DOCUMENT RESUME

ED 479 416 IR 022 093

AUTHOR Driscoll, Margaret, Ed.; Reeves, Thomas C., Ed.

TITLE E-Learn 2002 World Conference on E-Learning in Corporate, Government, Healthcare, & Higher Education. Proceedings (7th, Montreal, Quebec, Canada, October 15-19, 2002).

INSTITUTION Association for the Advancement of Computing in Education, Norfolk, VA.

ISBN ISBN-1-880094-46-0

PUB DATE 2002-10-00

NOTE 2850p.; For selected individual papers, see IR 022 094-242.

AVAILABLE FROM Association for the Advancement of Computing in Education (AACE), P.O. Box 3728, Norfolk, VA 23514. Tel: 757-623-7588; e-mail: info@aace.org; Web site: http://www.aace.org/DL/.

PUB TYPE Collected Works - Proceedings (021)

EDRS PRICE EDRS Price MF26 Plus Postage. PC Not Available from EDRS

DESCRIPTORS *Computer Assisted Instruction; *Computer Uses in Education; *Distance Education; Educational Media; Educational Resources; *Educational Technology; Elementary Secondary Education; Higher Education; Instructional Design; Instructional Innovation; Instructional Materials; Learning Activities; Material Development; Professional Development; Technology Integration

IDENTIFIERS Technology Role

ABSTRACT

The 7th annual E-Learn world conference on e-learning in corporate, government, healthcare, and higher education organized by the Association for the Advancement of Computing in Education (AACE) includes more than 600 papers. Papers from this proceedings come from contributors representing more than 50 countries, sharing their perspectives and experiences with electronic learning in elementary, secondary, and postsecondary education. Topics include: military training; course Web site creation; instructional design; new trends in health care and medicine; information and knowledge dissemination; knowledge management; learning repositories; instructional innovation and activities design; cognitive style; virtual communities; issues in e-government; success in distance education; computer system design; the Internet-connected classroom; teachers' and facilitators' roles; computer software development; professional development; distance education quality; usability tests and use studies; ethical issues; standards; student evaluation; collaboration; evaluation frameworks; theory and practice; instructional strategies; teleconferencing; search strategies; virtual reality; instructional effectiveness; instructional material design; computer simulation; gender equity; digital libraries; instruction for individuals with disabilities; technology integration; multimedia materials; and information skills development. (AEF)

Reproductions supplied by EDRS are the best that can be made
from the original document.

ED 479 416

E-Learn 2002

World Conference on E-Learning in Corporate, Government, Healthcare, & Higher Education

Edited by
Margaret Driscoll
Thomas C. Reeves

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL IN MICROFICHE ONLY HAS BEEN GRANTED BY

C.H. Marks

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

2B

Proceedings of E-Learn 2002

World Conference on E-Learning in Corporate, Government, Healthcare, & Higher Education

October 15-19, 2002; Montréal, Canada

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☑ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

- Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

IR022093

BEST COPY AVAILABLE

AACE
Association for the Advancement of Computing in Education
A CONFERENCE OF AACE
www.aace.org

E-Learn PROGRAM COMMITTEE

Program Co-chair: Thomas C. Reeves, Univ. of Georgia, USA
Program Co-chair: Margaret Driscoll, IBM Mindspan Solutions, USA
Panels Chair: Lou Stern, Baruch College, CUNY, USA

Marty Bray, Univ. of North Carolina at Charlotte, USA
Peter Brusilovsky, Univ. of Pittsburgh, USA
Dale Burnett, Univ. of Lethbridge, Canada
SeJin Chung, State of Michigan, USA
Gordon Davies, Open Univ., UK
Paul De Bra, Eindhoven Univ. of Technology, Netherlands
Abdulmotaleb El Saddik, Ottawa Univ., Canada
Allan Ellis, Southern Cross Univ., Australia
Alejandro Fernandez, Fraunhofer Inst. für Integrierte Pub.- und Info., Germany
Nuno Guimaraes, Univ. of Lisbon, Portugal
Joachim Hasebrook, efiport AG / Bank Academy, Germany
Trude Heift, Simon Fraser Univ., Canada
Colin Hensley, Toyota Motor Europe, Belgium
David Hicks, Aalborg Univ. Esbjerg, Denmark
Chuck Kacmar, Florida State Univ., USA
Tochtermann Klaus, Know-Center, Austria
Wendy Lawrence Fowler, Univ. of Texas-Pan American, USA
Chul-Hwan Lee, Inchon National Univ. of Education, Korea (South)
David Levine, St. Bonaventure Univ., USA
Jeni Li, Arizona State Univ., USA
Miltiadis Lytras, Athens Univ. of Economics and Business, Greece
Hermann Maurer, IICM, Graz Univ. of Technology, Austria
Erica Melis, DFKI GMBH, Germany
Tanja Mitrovic, Univ. of Canterbury, New Zealand
Maria Teresa Molfino, Consiglio Nazionale Ricerche - IMA, Italy
Wolfgang Nejdl, Learning Lab Lower Saxony, Germany
Charles Owen, Michigan State Univ., USA
H.-Ruediger Pfister, FH Nordostniedersachsen, Germany
Alfonso Quarati, IMATI - CNR Italy, Italy
Samuel Rebelsky, Grinnell College, USA
Vytautas Reklaitis, Univ. of Electro-Communications, Japan
Gunter Schlageter, Univ. of Hagen, Germany
Simeon Simoff, Univ. of Technology Sydney, Australia
Marcus Specht, Fraunhofer FIT, Germany
Ivan Tomek, Acadia Univ., Canada
Ellen Walker, Hiram College, USA
Martin Wessner, Fraunhofer IPSI, Germany

E-LEARN EXECUTIVE ADVISORY BOARD

William D. Aggen
CEO, Learnwright, LLC, USA
Judith V. Boettcher
Executive Director, Corp. for Research & Educational Networking (CREN), USA
Betty Collis
Shell Professor of Networked Learning, University of Twente, The Netherlands
Anthony R. Davidson
Director of Graduate Programs, Information Technologies Institute,
New York Univ., USA
Mary Jo Deering
Director, Health Communication & e-Health, Office of Disease Prevention and
Health Promotion, U.S. Department of Health and Human Services, USA
Margaret Driscoll
IBM Mindspan Solutions, USA
Erik Duval
Katholieke University Leuven, Belgium
Randy J. Hinrichs
Group Research Manager, Learning Sciences & Technology,
Microsoft Research, USA
Wayne Hodgins
Strategic Futurist, Director of Worldwide Learning Strategies , Autodesk Inc, USA
Cecelia M. Horwitz
Associate Director, Center for Future Health, University of Rochester, USA
Henry Kelly
President, Federation of American Scientists, USA
Ken McDonald
President, Collaborative Learning Network Inc, Canada
Jane Mahoney
Director, MasterCard University, USA
Alex Moulder
Corporate Learning Systems, Australia
Linda Neuhauser
Executive Director, Center for Community Wellness & e-Health,
University of California, Berkeley, USA
Ron Oliver
Professor of Interactive Multimedia, School of Communications and Multimedia
Edith Cowan University, Western Australia
Dee Olsen
Internal Revenue Service, USA
Roy Pea
Stanford Center for Innovations in Learning (SCIL), Stanford University, USA
Milt Petruk
University of Alberta, Canada
Sharon P. Pitt
Director of Learning Technology Service, North Carolina State University, USA
Rick Rabideau
Vice President , E-Learning Prudential Real Estate and Relocation Services, USA
Kirk Ramsey
Director of Learning Technologies, Scottish University for Industry, UK
Thomas C. Reeves
Professor, Dept. of Instructional Technology, College of Education
The University of Georgia, USA
Geoff Ring
Academic Director, ICUS, Singapore
Robby Robson
Eduworks Corporation, USA
Allison Rossett
Professor, San Diego State Univ., USA
Jan Willem Zd. Sedlarik
Cap Gemini Ernst & Young, Netherlands
Steven Teal
Director, Global Learning Solutions, Bristol Myers Squibb, USA
Jean A. Wooldridge
Strategic Advisor for Cancer Communication Technologies
Office of the Director, National Cancer Institute, USA

Copyright © 2002 by the Association for the Advancement of Computing in Education (AACE)

All rights reserved. No part of this book may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, without the prior written permission of the publisher.

AACE is not responsible for papers accidentally omitted from the conference proceedings due to late or errant submission by the author or proxy, or technical electronic anomalies during the time of submission.

The publisher is not responsible for the use which might be made of the information contained in this book.

From AACE, the Conference organizer: This is to confirm that all Conference paper submissions are peer-reviewed by at least 2 referees prior to acceptance in the Final Program and prior to publication in the Proceedings book and CD.

See AACE Review Policy: www.aace.org/reviewpolicy.htm

Published by
Association for the Advancement of Computing in Education (AACE)
P.O. Box 3728
Norfolk, VA 23514-3728 USA
www.aace.org

Printed in the USA

ISBN: 1-880094-46-0

Special thanks to – AACE Technical Coordinator: Jerry Price, University of Houston.

8TH ANNUAL

CALL FOR PARTICIPATION

E-Learn 2003

World Conference on E-Learning in Corporate, Government, Healthcare, & Higher Education

November 7-11, 2003
Phoenix, Arizona, USA
Proposals Due: April 30, 2003
www.aace.org/conf/elearn

- Keynote & Invited Speakers
- Full & Brief Papers
- Panels
- Roundtables
- Video Festival NEW
- Interactive Sessions NEW
- Tutorials & Workshops
- Posters/Demonstrations
- Corporate Posters/Showcases
- SIG (SPECIAL INTEREST GROUP) Discussions

Authors notified:
May 28, 2003
Proceedings file deadline:
September 15, 2003
Early registration deadline:
September 15, 2003
Advance registration deadline:
October 24, 2003

AACE *Estab. 1981*
Association for the Advancement of Computing in Education
Advancing Knowledge & Learning with Information Technology Worldwide

A CONFERENCE OF AACE • **www.aace.org**

CO-SPONSORED BY
International Journal on E-Learning
Corporate, Government, Healthcare, & Higher Education

BEST COPY AVAILABLE

INVITATION

E-Learn 2003 — World Conference on E-Learning in Corporate, Healthcare, Government, and Higher Education is an international conference organized by the Association for the Advancement of Computing in Education (AACE). This annual conference series serves as a multidisciplinary forum for the exchange of information on the research, development, and applications on all topics related to E-Learning.

Information for Presenters

Details of presentation formats are given on the following pages. The general principles applying to all are:

- All communication will be with the principal presenter who is responsible for communicating with co-presenters of that session.
- The conference will attempt to secure all equipment for presenters, with the exception of poster/demonstration presenters. However, where special equipment is needed, presenters may need to bring or rent equipment. The name of a rental firm can be provided.
- All presenters must register and pay the registration fee. Early registration fee will be approximately $395 (US) with a discount for AACE members.

Proceedings

Accepted papers will be published in the Proceedings (book and CD-ROM formats) as well as in the AACE Digital Library. These proceedings serve as major sources of information and reflect the current state of the art for the E-Learning community. In addition, selected papers may be invited for publication in AACE's respected journals especially in the *International Journal on E-Learning*. See: www.aace.org/pubs

Paper Awards

All presented papers will be considered by the Program Committee for Outstanding Paper Awards. There will also be an award for Outstanding Student Paper (therefore, please indicate if primary author is a full-time student).

Hotel & Travel Arrangements

Special hotel room rates will be available to conference attendees. Discount airfares will be available from a designated airline carrier.

Background

The E-Learn Conference series originated as the WebNet World Conference on the WWW and Internet which was held as a major international conference in San Francisco, CA (1996); Toronto, Canada (1997); Orlando, Florida (1998); Honolulu, HI (1999); San Antonio, TX (2000); Orlando, FL (2001); and Montréal, Canada (2002). E-Learn 2003 is the eighth in this series of internationally respected events.

Corporate Participation

A variety of opportunities are available to present research-oriented papers or to showcase and market your products and services.

E-Learn is Unique

The E-Learn Conference series is an international forum designed to facilitate the exchange of information and ideas on the research, issues, developments, and ap[illegible] of a broad range of E-Learning topics.

E-Learn is a[illegible] collaboration between E-Learning researchers and practitioners fr[illegible]porate, government, healthcare, and higher education sectors. All p[illegible]proposals are reviewed and selected by a respected international Pro[illegible]mmittee, based on merit and the perceived value for attendees.

Broad Range of Important Topics: Coverage of a wide range of interrelated topics is just one of the features that distinguishes the E-Learn conference series. Attendees are able to mix and match sessions to focus on the combination of topics that are of the most interest, concern and benefit to them.

Participatory Event: While there are Keynote and Invited talks delivered by internationally recognized technology experts, E-Learn is more of a participatory event. This means that all attendees play an important, interactive role, offering valuable feedback and insight gained from their own experiences. The atmosphere at E-Learn is exciting and energizing. A wealth of knowledge is gathered and exchanged, as professionals from disparate but related fields come from all over the world to meet one-on-one or in small groups and learn about new developments that impact their respective activities.

Not a Trade Show: While E-Learn does encourage commercial participation, it is not a trade show, and there is not an exhibition. Instead, the conference uniquely relates and displays commercial activities throughout the E-Learn program in the form of Corporate Showcases and Demonstrations and other presentations by companies.

900+ Participants
from 50 Countries

TOPICS

The scope of the conference includes, but is not limited to, the following topics as they relate to E-Learning in Corporate, Government, Healthcare, and Higher Education.

Application Domains

- General & Cross-Domain
- Corporate
- Government
- Health Care
- Higher Education
- Informal Learning (Museums, Communities, Homes)
- K-12
- Military Training
- Professional Associations & Non-Profits

Major Topics relating to or technologically supporting E-Learning

- Content Development
- Evaluation
- Implementation Examples and Issues
- Instructional Design
- Policy Issues
- Research
- Social and Cultural Issues
- Standards and Interoperability
- Tools and Systems
- Other

BEST COPY AVAILABLE

SUBMISSION INFORMATION

FULL PAPERS

Presentation time: 25 minutes
Submission length: 4-6 pages (2,500-3,750 words)
Proceedings length: 6 pages maximum
AV equipment provided: PC, Projector, Internet, VCR

Papers present reports of significant work or integrative reviews in research, development, applications, and societal issues related to all aspects of the conference topics.

Systems & Resources

Papers related to projects, technical developments, systems, and resources.

The paper should include:

- Whether this work is just beginning, on-going, or completed;
- The partners involved;
- The major goals and the basic approach - this includes the educational problem addressed or the new educational opportunity created;
- A brief review of previous work as a background;
- A clear description of what has been developed, including schematic overviews and screen dumps (if applicable);
- Any validation (usability testing, pilot testing, expert evaluation, etc.) that has taken place; and
- Future work and implications for others.

The reference list for this kind of paper should include URLs for the work, and at least a few literature references.

Conceptual & Empirical Studies

Reviews, conceptual overviews, evaluations, and empirical studies.

The paper should include:

- The topic;
- The motivation for the work;
- The major questions addressed;
- The general process and conceptual framework, with references to literature;
- The concrete method, with sufficient detail on instruments and procedures;
- Major points or results; and
- Implications.

This paper category requires a strong and up-to-date well synthesized literature review, with work from a variety of sources (not just the research team of the author), and also an appropriate writing and presentation style for a scholarly review or overview.

Case Studies

Papers related to local experiences (e.g., a course or a prototype tested in a local situation).

The paper should include:

- The most important features of the context;
- A description of the problem in both local and conceptual terms;
- A description of who, what, why, and how, including screen dumps if relevant;
- Implications for the local setting or the local prototype; and
- Implications for others outside the local setting.

This paper category should include a reference list with relevant URLs, and a few citations to papers related to the local problem, but from outside the local setting. The latter is to indicate that the author can see the local situation in a broader and more general context.

Other

For authors who do not feel they fit in any of the above. The Program Committee may request that the author revise the paper to relate to one of the above categories, or may accept it as submitted.

BRIEF PAPERS

Presentation time: 15 minutes
Submission length: 2-3 pages, 1,250-1,875 words
Proceedings length: 2 pages maximum
AV equipment provided: PC, Projector, Internet, VCR

These papers are brief, more condensed presentations or work-in-progress projects.

New Developments

Descriptions of new extensions to existing projects or newly initiated projects.

Project Opportunities

Descriptions of projects underway that include opportunities for additional project partners.

Demonstrations

Other

For authors who do not feel they fit in any of the above. The Program Committee may request that the author revise the paper to relate to one of the above categories, or may accept it as submitted.

The submission should include:

- What is going to be shown or demonstrated or offered;
- The major aspects;
- The context or motivation; and
- Relevant URLs or literature references.

PANELS

Presentation time: 1 hour
Submission length: 2-3 pages, 1,250-1,875 words
Proceedings length: 4 pages maximum
AV equipment provided: PC, Projector, Internet, VCR

A panel offers an opportunity for 3-5 people (including the chair) to present their views or results on a common theme, issue, or question and discuss them with the audience. Panels should cover timely topics related to the conference areas of interest. Panel selection will be based on the importance, originality, focus, and timeliness of the topic; expertise of proposed panelists; as well as the potential for informative (and even controversial) discussion.

Panels must allot at least 50% of the time for interaction and discussion with the audience.

The panel proposals should include:

- Description of the panel topic, including why this topic is important to Conference attendees; and
- Brief position statement and qualifications of each panelist.

ROUNDTABLES

Presentation time: 1 hour
Submission length: 2-3 pages, 1,250-1,875 words
Proceedings length: 150 words (to be published only in Abstract Book)
AV equipment provided: electricity

These sessions allow maximum interaction in informal, small-group discussions on a single topic. The format is appropriate for papers, projects, or works-in-progress that encourage discussion. Roundtables share a room with 2-3 other concurrently held Roundtables.

VIDEO FESTIVAL

Presentation time: 1 hour
Submission length: 2-3 pages, 1,250-1,875 words
Proceedings length: 2 pages
AV equipment provided: VCR, PC, Projector, Internet

The field has matured to the point that we have a growing number of video resources – cases, classroom/training video clips, and many other forms. Presenters should have a short handout on the video and use most of the time showing the video.

BEST COPY AVAILABLE

SUBMISSION INFORMATION

INTERACTIVE SESSIONS

Presentation time: 1 hour
Submission length: 2-3 pages, 1,250-1,875 words
Proceedings length: 3 pages
AV equipment provided: PC, Monitor, Internet

If you have mastered a new piece of software (or a new version) that others would be interested in learning about, submit a proposal for an Interactive Session. In this informal session, you will demonstrate the software, illustrate the process of using it, show participants some of the complexities and tricks about it, and give them an opportunity to try it themselves.

These sessions are also appropriate for instructional strategies, procedures, and evaluation procedures. The idea is not to give a definitive workshop on the topic, but to provide participants with enough information to help them decide whether their needs can be met with the program or procedure.

Include a description of the software to be used by participants, the objectives of the session, and the intended audience (experience level and prerequisites). These presentations share a room with 2-3 other concurrently held Interactive Sessions.

TUTORIALS / WORKSHOPS

Presentation time: 3.5 or 7 hours
Submission length: see information below
Proceedings length: no pages
AV equipment provided: PC, Projector, Internet (Tutorial);
PC, Projector, PC Lab, Internet (Workshop)

Tutorials and Workshops are intended to enhance the skills and broaden the perspective of their attendees. They should be designed to introduce a rigorous framework for learning a new area or to provide advanced technical training in an area. Submissions will be selected on the basis of the instructors' qualifications for teaching the proposed Tutorial or Workshop and their contribution to the overall conference program. Workshops differ from Tutorials by involving hands-on experience with hardware/software provided.

Note: Few Workshops are selected because a lab of equipment is required for each. If you submit a Workshop proposal, please indicate if your proposal is also appropriate for presentation as a non-hands on Tutorial.

Tutorial/Workshop proposals should include:

- Clear description of the objectives;
- Intended audience (experience level and prerequisites);
- Proposed length (3.5 hours or 7 hours);
- 200-word abstract;
- 1-page topical outline of the content; and
- Summary of the instructor's qualifications.

POSTER / DEMONSTRATIONS

Presentation time: 2 hours
Submission length: 2-3 pages, 1,250-1,875 words
Proceedings length: 2 pages
AV equipment provided: 4'x8' poster board, 6' table, 2 chairs, electricity, Internet if wireless card & PC brought

Poster/Demonstration sessions enable researchers and non-commercial developers to demonstrate and discuss their latest results and developments in progress in order to gain feedback and to establish contact with similar projects.

Poster/Demonstration proposals should include:

- Description of the planned Poster/Demonstration; should emphasize the problem, what was done, and why the work is important.

Poster/Demonstration presenters will be required to arrange for their own systems software and hardware.

CORPORATE DEMONSTRATIONS/ LITERATURE

Presentation time: 2 hours
Submission length: 1-2 paragraphs
Proceedings length: no pages
AV equipment provided: 4'x8' poster board, 6' table, 2 chairs, electricity, Internet if wireless card & PC brought

Demonstrate and discuss your company's products, services, developments, applications and research, inform the audience of your future directions, gain feedback, and establish contacts.

Scheduled with Poster/Demonstrations grouped together in open exhibition-style, usually all in one hall. This is an informal event with a circulating conference-wide audience. Sales are permitted. You may stock and sell your product at your table.

CORPORATE SHOWCASES

Presentation time: 30 minutes
Submission length: 1-2 paragraphs
Proceedings length: 150 words (to be published only in Abstract Book)
AV equipment provided: PC, Projector, Internet, VCR

Demonstrate and discuss your company's products, services, developments, applications and research, inform the audience of your future directions, gain feedback, and establish contacts.

Scheduled concurrently only with other Showcases. Presentation rooms generally accommodate 50-150 people, theatre-style. This is more of a formal presentation than the Corporate Demonstration.

SIG (SPECIAL INTEREST GROUP) DISCUSSIONS

Presentation time: 1 hour
Submission length: 1-3 pages (625-1,875 words)
Proceedings length: no pages
AV equipment provided: PC, Projector, Internet, VCR

To encourage informal interaction among individuals with common interests, SIG discussion groups will be formed based upon proposals accepted under the Call for Participation. Also, new SIG discussion groups may be formed either formally or on an impromptu basis when at the conference.

SIG Discussion proposals should include:

- Description of the discussion topic emphasizing the problem or issue and why the work is important; and
- Indication of whether you are willing to chair the discussion.

SUBMISSION REQUIREMENTS

Submit all proposals by completing the Web form at: http://www.aace.org/conf/elearn

All proposals must be submitted by uploading PDF, Word, RTF, or Postscript file using the Web form. No hard copy paper, faxed, or e-mail submissions will be accepted.

Please send your proposal only ONE time.

Questions? Contact AACE at:
Phone: 757-623-7588
Fax: 703-997-8760
E-mail: conf@aace.org
www.aace.org/conf/edmedia

Phoenix Arizona

Offering unique Southwest culture and a desirable climate, Phoenix is located along the banks of the Salt River, where early Hohokam Indians first settled. Phoenix, the state's capital, is saddled between dramatic mountain ranges.

Year-round sunshine and mild autumn temperatures make Phoenix an ideal location for E-Learn 2003. This premier desert city is located 1,117 feet above sea level and the weather is warm, sunny and usually dry.

ATTRACTIONS/NIGHTLIFE/PERFORMING ARTS: A variety of museums offer indigenous history and art, as well as imported works. The Heard Museum in downtown Phoenix is well known for its Native American art exhibits. The Phoenix Art Museum, host of the Cowboy Artists Show, has a permanent collection of 16,000 paintings, sculptures, costumes and other works of art from the 15th through 20th centuries. Other interesting and informative museums are the Arizona Science Center, the Phoenix Museum of History, the Hall of Flame Fire Fighting Museum, Scottsdale Center for the Arts and the Champlin Fighter Aircraft Museum.

With 20 theater groups in the area, there is no shortage of entertainment. Phoenix offers everything from Broadway plays to lyric opera. The Herberger Theater Center plays host to many fine performances, including Ballet Arizona, the Arizona Opera Company and the Arizona Theatre Company.

The Phoenix Symphony Orchestra has been performing for more than 35 years with a season that runs from fall through spring. There are many opportunities to enjoy other music as well, including rock, jazz, country and more.

SIGHTSEEING: Arizona is known for its contrasts. Visitors will see everything from northern Arizona's tall, cool pines to the cactus-filled scenery of the Sonoran Desert. And if there's a "must-see," it's Arizona's majestic Grand Canyon, one of the world's seven natural wonders. This breathtaking sight is open year-round and may be experienced through nature walks or mule rides into the Canyon, or by taking a leisurely drive along its outer edges. Before reaching the Grand Canyon, be sure to stop at Sedona, a cultural community providing a wide array of boutiques and art galleries selling everything from Native American and Southwestern arts and crafts to fine jewelry.

Arizona also is home to Lake Powell on the northern border. Lake Powell is 186 miles long and has more miles of shoreline than the entire Pacific coast of the United States. The lake, which extends into southern Utah. Located in eastern Arizona, the White Mountains stand at an elevation of some 9,000 feet. The White Mountains are rich in trout-stocked lakes. With temperatures about 30 degrees cooler than Phoenix.

Other scenic trips worth taking include venturing to: Prescott - site of the historic 1857 John C. Fremont House, the first territorial governor's mansion, and Whiskey Row; Apache Trail - a world-famous trail that twists through the Superstition Mountains and was once traveled by the Apache Indians; and Montezuma's Castle - a 12th-century Aztec-designed dwelling carved into a steep cliff, once inhabited by the Pueblo Indians.

These destinations can be reached in as a few hours by car from Phoenix.

ACTIVITIES: With so many sunshine-filled days, Phoenix is the perfect place to experience a range of outdoor activities. Horseback riding is a great way to see the spectacular Sonoran Desert, as is a rugged jeep ride. Spending an afternoon tubing or rafting the Verde or Salt rivers is another way to enjoy the outdoors. For the thrill seeker, a glider or hot-air balloon flight will take you high above the desert plateau and offer splendid views for miles.

Dependable sunshine and great weather make outdoor sports a way of life. Golf, tennis, hiking, mountain biking and in-line skating arepopular activities. Visitors can also choose from water skiing, sailing and fishing in the region's lakes and rivers.

DINING: Endless dining possibilities exist in Phoenix. With some of the world's best chefs, taste buds will be tantalized by indulging in a variety of foods including Fusion, Italian, Chinese, Mexican, Continental, Thai and Moroccan, just to name a few. It also is possible to taste a bit of the Old West by sampling a genuine cowboy mesquite-grilled steak at one of the many restaurants specializing in authentic Southwestern cuisine.

SHOPPING: When shopping you'll find a wonderful selection of upscale souvenirs such as beautifully handcrafted Native American turquoise jewelry and elegant leather goods. Everything from the latest in fashionable apparel to collectible artwork can be found at one of the many large shopping malls or tiny boutiques.

Sound like a great place for a conference? You bet! Plan to join us for E-Learn 2003, in Phoenix, Arizona, USA, November 7-11, 2003.

© GREATER PHOENIX CONVENTION & VISITORS BUREAU, ADAPTED FOR USE IN THIS CALL
ALL PHOTOS © GREATER PHOENIX CONVENTION & VISITORS BUREAU AND JESSEN ASSOCIATES, INC.

Explore Phoenix online at: www.phoenixcvb.com

BEST COPY AVAILABLE

Call for Participation

E-Learn 2003

World Conference on E-Learning in Corporate, Government, Healthcare, & Higher Education

AACE Estab. 1981

Association for the Advancement of Computing in Education

Advancing Knowledge & Learning with Information Technology Worldwide

P.O. Box 3728, Norfolk, VA 23514-3728 USA

Non-Profit Organization
U.S. Postage PAID
Charlottesville, VA
Permit #564

E-LEARN EXECUTIVE ADVISORY BOARD

William D. Aggen, CEO, Learnwright, LLC, USA

Judith V. Boettcher, Executive Director, Corp. for Research & Educational Networking (CREN), USA

Betty Collis, Shell Professor of Networked Learning, University of Twente, The Netherlands

Anthony R. Davidson, Director of Graduate Programs, Information Technologies Institute, New York Univ., USA

Mary Jo Deering, Director, Health Communication & e-Health, Office of Disease Prevention and Health Promotion, U.S. Department of Health and Human Services, USA

Margaret Driscoll, IBM Mindspan Solutions, USA

Erik Duval, Katholieke University Leuven, Belgium

Randy J. Hinrichs, Group Research Manager, Learning Sciences & Technology, Microsoft Research, USA

Wayne Hodgins, Strategic Futurist, Director of Worldwide Learning Strategies , Autodesk Inc, USA

Cecelia M. Horwitz, Associate Director, Center for Future Health, University of Rochester, USA

Henry Kelly, President, Federation of American Scientists, USA

Ken McDonald, President, Collaborative Learning Network Inc, Canada

Jane Mahoney, Director, MasterCard University, USA

Alex Moulder, Corporate Learning Systems, Australia

Linda Neuhauser, Executive Director, Center for Community Wellness & e-Health, University of California, Berkeley, USA

Ron Oliver, Professor of Interactive Multimedia, School of Communications and Multimedia, Edith Cowan University, Western Australia

Dee Olsen, Internal Revenue Service, USA

Roy Pea, Stanford Center for Innovations in Learning (SCIL), Stanford University, USA

Milt Petruk, University of Alberta, Canada

Sharon P. Pitt, Director of Learning Technology Service, North Carolina State University, USA

Rick Rabideau, Vice President , E-Learning Prudential Real Estate and Relocation Services, USA

Kirk Ramsey, Director of Learning Technologies, Scottish University for Industry, UK

Thomas C. Reeves, Professor, Dept. of Instructional Technology, College of Education, The University of Georgia, USA

Geoff Ring, Academic Director, ICUS, Singapore

Robby Robson, Eduworks Corporation, USA

Allison Rossett, Professor, San Diego State Univ., USA

Jan Willem Zd. Sedlarik, Cap Gemini Ernst & Young, Netherlands

Steven Teal, Directer, Global Learning Solutions, Bristol Myers Squibb, USA

Jean A. Wooldridge, Strategic Advisor for Cancer Communication Technologies, Office of the Director, National Cancer Institute, USA

BEST COPY AVAILABLE

Association for the Advancement of Computing in Education

Membership Information • Conferences • Publications

Invitation to Join

The Association for the Advancement of Computing in Education (AACE) is an international, non-profit educational organization. The Association's purpose is to advance the knowledge, theory, and quality of teaching and learning at all levels with information technology. This purpose is accomplished through the encouragement of scholarly inquiry related to technology in education and the dissemination of research results and their applications through AACE sponsored publications, conferences, and other opportunities for professional growth.

AACE members have the opportunity to participate in topical and regional divisions/societies/chapters, high quality peer-reviewed publications, and conferences.

Join with fellow professionals from around the world to share knowledge and ideas on research, development, and applications in information technology and education. AACE's membership includes researchers, developers, and practitioners in schools, colleges, and universities; administrators, policy decision-makers, professional trainers, adult educators, and other specialists in education, industry, and government with an interest in advancing knowledge and learning with information technology in education.

Membership Benefit Highlights

- *Gain professional recognition by participating in AACE sponsored international conferences*
- *Enhance your knowledge and professional skills through interaction with colleagues from around the world*
- *Learn from colleagues' research and studies by receiving AACE's well-respected journals and books*
- *Receive a subscription to the Professional Member periodical* Educational Technology Review [electronic]
- *Receive discounts on multiple journal subscriptions, conference registration fees, proceedings books & CD-ROMs*

AACE

Association for the Advancement of Computing in Education

www.aace.org

Advancing Knowledge and Learning with Information Technology

BEST COPY AVAILABLE

AACE Journals

Abstracts for all journal issues are available at **www.aace.org/pubs**

Educational Technology Review – Electronic Journal

Educational Technology Review International Forum on Educational Technology Issues & Applications

AACE's member journal is the focal point to exchange information between disciplines, educational levels, and information technologies. Its purpose is to stimulate the growth of ideas and practical solutions which can contribute toward the improvement of education through information technology.

CITE – Electronic Journal

CITE CONTEMPORARY ISSUES IN TECHNOLOGY & TEACHER EDUCATION

An electronic publication of the Society for Information Technology and Teacher Education (SITE), established as a multimedia, interactive electronic counterpart of the *Journal of Technology and Teacher Education*.

International Journal on E-Learning

(formerly WebNet Journal & International Journal of Educational Telecommunications)

(IJEL) ISSN# 1537-2456 Quarterly

IJEL serves as a forum to facilitate the international exchange of information on the current theory, research, development, and practice of E-Learning in education and training. This journal is designed for researchers, developers and practitioners in schools, colleges, and universities, administrators, policy decision-makers, professional trainers, adult educators, and other specialists in education, industry, and government.

Journal of Computers in Mathematics & Science Teaching

(JCMST) ISSN# 0731-9258 Quarterly

JCMST is the only periodical devoted specifically to using information technology in the teaching of mathematics and science. The *Journal* offers an in-depth forum for the exchange of information in the fields of science, mathematics, and computer science.

Journal of Educational Multimedia & Hypermedia

(JEMH) ISSN# 1055-8896 Quarterly

Designed to provide a multidisciplinary forum to present and discuss research, development and applications of multimedia and hypermedia in education. The main goal of the *Journal* is to contribute to the advancement of the theory and practice of learning and teaching using these powerful and promising technological tools that allow the integration of images, sound, text, and data.

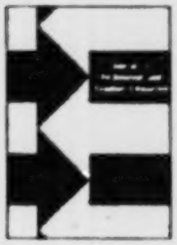
Journal of Interactive Learning Research

(JILR) ISSN# 1093-023X Quarterly

The *Journal's* published papers relate to the underlying theory, design, implementation, effectiveness, and impact on education and training of the following interactive learning environments: authoring systems, CALL, assessment systems, CBT, computer-mediated communications, collaborative learning, distributed learning environments, performance support systems, multimedia systems, simulations and games, intelligent agents on the Internet, intelligent tutoring systems, micro-worlds, and virtual reality-based learning systems.

Journal of Technology and Teacher Education

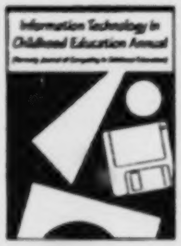
(JTATE) ISSN# 1059-7069 Quarterly



A forum for the exchange of knowledge about the use of information technology in teacher education. *Journal* content covers preservice and inservice teacher education, graduate programs in areas such as curriculum and instruction, educational administration, staff development, instructional technology, and educational computing.

Information Technology in Childhood Education Annual

(ITCE) ISSN# 1522-8185



A primary information source and forum to report the research and applications for using information technology in the education of children – early childhood, preschool, and elementary. The annual is a valuable resource for all educators who use computers with children.

BEST COPY AVAILABLE

AACE Conferences

Details for conferences are available at www.aace.org/conf

The exchange of ideas and experiences is essential to the advancement of the field and the professional growth of AACE members. AACE sponsors conferences each year where members learn about research, developments, and applications in their fields, have an opportunity to participate in papers, panels, poster/demonstrations and workshops, and meet invited speakers.

ED-MEDIA 2003

World Conference on
Educational Multimedia,
Hypermedia & Telecommunications

JUNE 23-28, 2003
HONOLULU,
HAWAII, USA

ED-MEDIA - World Conference on Educational Multimedia, Hypermedia & Telecommunications

This annual conference serves as a multidisciplinary forum for the discussion of the latest research, developments, and applications of multimedia, hypermedia, and telecommunications for all levels of education.

E-Learn 2003

World Conference on E-Learning in Corporate,
Government, Healthcare, & Higher Education

NOVEMBER 7-11, 2003
PHOENIX,
ARIZONA, USA

E-Learn 2003 - World Conference on E-Learning in Corporate, Government, Healthcare, & Higher Education

E-Learn is a respected, international conference enabling E-Learning researchers and practitioners in corporate, government, healthcare, and higher education to exchange information on research, development, and applications. This interdisciplinary dialogue is further supported by satellite events such as by the WebNet Symposium on the WWW and Internet.

SOCIETY FOR INFORMATION TECHNOLOGY & TEACHER EDUCATION 2003

14TH INTERNATIONAL CONFERENCE

MARCH 24-29, 2003
ALBUQUERQUE,
NEW MEXICO, USA

SITE - Society for Information Technology and Teacher Education International Conference

This conference, held annually, offers opportunities to share ideas and expertise on all topics related to the use of information technology in teacher education and instruction about information technology for all disciplines in preservice, inservice, and graduate teacher education.

Co-Sponsored Conferences

ICCE—International Conference on Computers in Education

ICCE is an annual event focusing on a broad spectrum of interdisciplinary research topics concerned with theories, technologies and practices of applying computers in education. It provides a forum for interchange among educators, cognitive and computer scientists, and practitioners throughout the world, especially from the Asia-Pacific region.

DECEMBER 3-6, 2002
AUCKLAND,
NEW ZEALAND

Membership Application

Join today and keep up-to-date on the latest research and applications!

Name: ______________________________

Address: ______________________________

City: ____________ State: ______ Code: ____________ Country: ____________

E-mail: ____________ ☐ New Member ☐ Renewal Membership ID # ____________

AACE Journals

Please check below the journal(s) you wish to receive:

- ☐ *International Journal on E-Learning (IJEL)*
  (formerly WebNet Journal & International Journal of Educational Telecommunications (IJET)
- ☐ *Jrl. of Educational Multimedia and Hypermedia (JEMH)*
- ☐ *Jrl. of Computers in Math and Science Teaching (JCMST)*
- ☐ *Jrl. of Interactive Learning Research (JILR)*
- ☐ *Jrl. of Technology and Teacher Education (JTATE)*
  Includes membership in Society for Information Technology and Teacher Education (SITE)
- ☐ *Information Technology in Childhood Education Annual (ITCE)*

Professional & Student Memberships

Annual membership includes a choice of AACE sponsored journals, subscriptions to *Educational Technology Review* and *CITE* (electronic journals), discounts for conferences, proceedings books & CD-Roms, and more.

Please check below the Journal(s)/membership(s) you wish to receive:

	Professional Membership	Student Membership*	
1 Journal	**$ 85**	**$ 45**	**$ ____**
2 Journals	**$140**	**$ 80**	**$ ____**
3 Journals	**$195**	**$ 115**	**$ ____**
4 Journals	**$250**	**$150**	**$ ____**
5 Journals	**$305**	**$185**	**$ ____**
All 6 Journals	**$360**	**$220**	**$ ____**

*If you selected a Student Membership rate above, you must be registered full-time in an accredited educational institution and you must provide the following information:

Expected graduation date: ____________

Educational institution: ____________

Non-U.S. postage: add $15 for shipping EACH Journal outside the U.S. **$ ______**

TOTAL $ ______

Library/Institutional Subscriptions

☐ *Int'l Jrl. on E-Learning (IJEL)*	$130
☐ *Jrl. of Educational Multimedia and Hypermedia (JEMH)*	$130
☐ *Jrl. of Computers in Math and Science Teaching (JCMST)*	$130
☐ *Jrl. of Interactive Learning Research (JILR)*	$130
☐ *Jrl. of Technology and Teacher Education (JTATE)*	$130
☐ *Information Technology in Childhood Education Annual (ITCE)*	$85
Non-U.S. postage: add $15 for shipping EACH Journal outside the U.S.	**$ ______**
TOTAL$	______

Method of Payment (US Dollars)

Membership extends for 1 year from the approximate date of application. Please allow 6-8 weeks for delivery.

Enclosed: ☐ **Check** (U.S. funds & bank, payable to AACE) ☐ **Purchase Order** (PO must be included)

Credit Card: ☐ **MasterCard** ☐ **VISA** ☐ **AMEX** ☐ **Discover**

Card # ________________

Card Exp. Date ___ / ___

Signature: ______________________________

Total: $ ____________

Return to: AACE, PO Box 3728, Norfolk, VA 23514-3728 USA
757-623-7588 Fax: 703-997-8760
E-mail: info@aace.org www.aace.org

AACE
Association for the Advancement of Computing in Education
PO Box 3728, Norfolk, VA 23514-3728 USA

Not-for-Profit Organization
U.S. Postage PAID
Charlottesville, VA
Permit #564

BEST COPY AVAILABLE

Current members:
Please give to a colleague

Preface

Welcome to E-Learn 2002 in exciting Montreal, Quebec, CANADA. The first E-Learn conference organized by the Association for the Advancement of Computing in Education (AACE) comes at an auspicious time. The past two years have been quite sobering for anyone interested in the topics encompassed in this inaugural E-Learn conference.

First, the downturn in the economy that began to affect North America two years ago (and even earlier in Asia and other parts of the world) has prompted many enterprises to take a hard look at their education and training initiatives, including those that might be described as e-learning, m-learning, virtual learning, Web-based learning, and so forth. As a result, these enterprises are, more than ever, looking to education and training programs as investments that must show a return.

Second, the shocking events of September 11, 2001, awoke many of us in North America and Europe to a vulnerability that others in less fortunate countries have lived with for decades. In the wake of these tragic events, managers and workers alike are considering e-learning in its many variants as an increasingly attractive alternative to traditional face-to-face education and training events that require people to travel great distances and/or be away from loved ones for long periods of time.

So what do the recent economic downturn and global terrorism have to do with E-Learn 2002? The answer is the importance of diverse professionals sharing research and development papers, tutorials, workshops, posters, demonstrations, panels, showcases and other events. E-Learn, like the other AACE conferences, is all about high quality research and development efforts. Unlike most commercial conferences, E-Learn presentations have been rigorously refereed by people who are the leaders in their respective fields. Thus, the quality of the sharing that goes on at this conference, and continues through the dissemination of these proceedings, becomes crucial to the realization of the return-on-investment we all seek, and the extension of learning and professional development opportunities beyond specific times and places.

In 2002, and in the wake of the aforementioned calamities, some might question the value of holding face-to-face conferences for which the submissions are due months in advance. After all, changes in technologies occur at an ever faster pace, and last month's cutting-edge development is sometimes this month's e-flop. Nevertheless, most of us recognize that as conference participants, we are not so much interested in technologies as ideas: ideas that are best shared, critiqued, and reshaped through personal dialogue and group discussion. While this could occur online, we recognize that many of the most important exchanges at conferences take place informally away from the formal sessions. Indeed, the face-to-face interactions are often the most valued and long-remembered aspects of any conference we attend, and we look forward to sharing these with you in Montreal.

E-Learn 2002 would not exist without the efforts of scores of volunteers, and so we would like to express our gratitude to the members of the Conference Steering and Program Committees as well as the local volunteers in Montreal who have made this event possible. Further appreciation is due to the highly professional staff at AACE who have worked tirelessly to ensure that this professional event is among the best of its kind. Finally, and most importantly, we wish to thank all of the researchers, developers, and others whose outstanding work is reported in these proceedings. Without you, there would be no quality to celebrate.

The more than 600 papers in this volume and on the accompanying CD-ROM come from contributors representing more than 50 countries. This is truly an international event. A year of preparation will soon be over, and E-Learn will be a pleasant memory. It is our hope that this memory will be refreshed each time you open this volume or access the conference CD-ROM, providing the wisdom and inspiration you seek. Further evidence of that living memory will be your continued participation in E-Learn conferences, and toward that end, we look forward to seeing you again next year at E-Learn 2003 in Phoenix, Arizona, USA; Nov. 7-11th (http://www.aace.org/conf/elearn).

E-Learn 2002 Program Chairs:
- Margaret Driscoll
IBM Mindspan Solutions, USA
- Thomas C. Reeves,
The University of Georgia, USA

TABLE OF CONTENTS

INVITED PAPERS

Be All That You Can Be—Again: E-Learning as a Means of Training Retiring Military to Become Teachers 2
Nancy Cassity Dunlap, Clemson University, USA
Creating and Maintaining Data-Driven Course Web Sites 9
Jesse M. Heines, University of Massachussetts Lowell, USA
Designing Authentic Activities for Web-based Courses 18
Jan Herrington, Edith Cowan University, Australia
E-Learning in Health Care - Policy, Practice, Evaluation, and Technical Implications - Emerging Trends 28
Penny Jennett, University of Calgary, Canada
eduSource: A Pan–Canadian Learning Object Repository 32
Rory McGreal, Athabasca University, Canada
Challenges in providing e-learning in the regulated pharmaceutical industry 41
James Vesper, Learnwright, Canada
The Open Source Movement, Publishing, and the Dissemination of Knowledge 47
Robert (Bob) F. Young, LuLu, Inc., USA

FULL PAPERS

Redesigning a Course Using an Analysis of Technical Problems Encountered in an Online Technology Training Course 53
Jason Abbitt, Mitchell Klett, Scott Graves, University of Idaho, USA
e-Learning and Knowledge Management: the MEMORAE project 61
Marie-Hélène Abel, Dominique Lenne, Omar Cissé, UMR CNRS 6599 Heudiasyc, France
Experimenting with Mobile Learning in a University Environment 67
Harri Alamaki, Radiolinja, Finland; Pauliina Seppala, Educational Centre for ICT, University of Helsinki, Finland
Instructional Models and Scenarios for an Open Learning Repository - Instructional Design and Metadata 75
Heidrun Allert, Learning Lab Lower Saxony, Germany; Hadhami Dhraief, Tobias Kunze, University of Hanover, Germany; Wolfgang Nejdl, Christoph Richter, Learning Lab Lower Saxony, Germany
Cognitive Styles and Medical Students' Learning 83
Zahra AlRawahi, Sultan Qaboos University, Oman
The Usability of the Virtual Hospital Round 91
Zahra AlRawahi, Saleh Shidhani, Sultan Qaboos University, Oman
Social Inclusion, Security and e-Democracy Issues in e-Government: the Role of e-Learning 98
Miguel Baptista Nunes, Maggie McPherson, Amy Whiteside, University of Sheffield, UK
Verifying Success in Distance Education 104
William Barber, Heather Clark, Elaine McIntyre, Appalachian State University, USA
Architecture of an E-Learning System with Embedded Authoring Support 110
Andreas Baudry, University of Hamburg, Dep. of Informatics, IMA Lab, Germany
Education Network of Ontario: Content/Curriculum Models for the Internet-connected Classroom 117
Mary Beam, Education Network of Ontario, Canada
The Changing Role of Instructors in Distance Education: Impact on Tool Support 123
Anke Biedebach, Birgit Bomsdorf, Gunter Schlageter, FernUniversität Hagen, Germany
Virtual University of Applied Sciences - German Flagship Projects in the Field of E-Learning in Higher Education 131
Michael Bischoff, Fachhochschule Lübeck, Germany

BEST COPY AVAILABLE

The New Paideia 138
Raj Boora, University of Alberta, Canada
Knowledge as Relationship and E-learning 144
Luca Botturi, USI-ICeF, Switzerland
A software tool for developing critical judgments about student writing 152
Roger Bruning, Mary Bodvarsson, Michael Dempsey, Christy Horn, University of Nebraska - Lincoln, USA
A Framework for Adaptive E-Learning Based on Distributed Re-usable Learning Activities.... 154
Peter Brusilovsky, Hemanta Nijhavan, University of Pittsburgh, USA
Perceived Organizational Climate and Internet Self-Efficacy: Identifying the Best Climate to Promote E-Learning 162
Dale Burnett, University of Lethbridge, Canada
Distance Education Quality: The Resources—Practices—Results Cycle and the Standards 168
Cathy Cavanaugh, University of North Florida, USA
Thinking Outside the Circle: the Design of Face-to-Face Collaborative Learning facilities 174
Robert Cavenagh, Dickinson College, USA
A Case and Implications of Implementing and Evaluating an Online Virtual Learning Community Environment 181
Chi-Cheng Chang, National Taipei University of Technology, Taiwan
Assessing the Usability of MOA Interface Designs 189
Yaowen Chang, Columbia University, USA
Ethical Issues in E-learning: Insights from the Application of Stakeholder Analysis in three e-Learning Cases 196
Nancy Pouloudi, Athens University of Economics & Business, Greece; Polyneikis Chozos, Athens University of Economics and Business, Greece, Greece; Miltiaidis Lytras, Athens University of Economics & Business, Greece
Science Education in the Web Era 204
Leon Combs, Kennesaw State Univesity, USA
Towards a Standards-based Approach to e-Learning Personalization using Reusable Learning Objects 210
Owen Conlan, Declan Dagger, Vincent Wade, Trinity College, Dublin, Ireland
A New Tool for Managing Students Self-Evaluations in Traditional and Distance Education Courses 218
Juan Contreras-Castillo, Arthur Edwards Block, Universidad de Colima, Mexico
Considerations for Building a Common Platform for Cooperative and Collaborative Authoring Environments 224
Alexandra Cristea, Technical University of Eindhoven, Netherlands
ODL Education Environments based on Adaptivity and Adaptability 232
Alexandra Cristea, Technical University Eindhoven, Netherlands
AHA! Version 2.0, More Adaptation Flexibility for Authors 240
Ad Aerts, David Smits, Natalia Stash, Paul De Bra, Eindhoven University of Technology, Netherlands
Group and Task Experience: Implications for Computer-Mediated Groupwork in the Workplace 247
Christina Dehler, Cal Poly Pomona, USA
Evaluation of a High-end Distance Delivery MBA Program 254
Dennis Dicks, Concordia University, Canada
Developing Online Emergency Room Case Study Role Play For Medical Students 262
Gilles Doiron, National University of Singapore, Singapore
Evaluating assessment using n-dimensional filtering 268
Jon Dron, Chris Boyne, University of Brighton, UK; Richard Mitchell, Inferdata Corp., USA
A Framework for Evaluation & Selection of E-Learning Solutions 275
Deniz Eseryel, Syracuse University / IDD&E, USA
Supporting E-Knowledge-building in teacher education: The use of computer-mediated-communication 283
Brian Ferry, University of Wollongong, Australia
The Lord Kelvin Project: Middle School Science for the 21st Century 291
Sebastian Foti, The Athena Group, USA

Aligning Theory and Web-based Instructional Design Practice with Design Patterns 298
Sherri Frizell, Roland Hubscher, Auburn University, USA
The Methodology for Reuse of E-Learning Resources 305
Takashi Fuji, Takeshi Tanigawa, Hokkaido Information University, Japan
Adaptive User Model for Web-Based Learning Environment 311
John Garofalakis, Research Academic Computer Technology Institute, Greece; Evangelos Sakkopoulos, University of Patras, Computer Engineering & Informatics Dept, Greece; Spiros Sirmakessis, Hellenic Open University, Greece; Athanasios Tsakalidis, University of Patras, Computer Engineering & Informatics Dept, Greece
A 3-D Interactive Environment for a Training within E-Learning Problem Based Activity 317
Laila Oubanaissa, Max Giardina-Associate Prof., University of Montreal, Canada
Playing Teacher 325
Juan E. Gilbert, Auburn University, USA
Mobile Lessons: Lessons Based on Geo-Referenced Information 331
Sylvain Giroux, Département de mathématiques et d'informatique, Canada; Claude Moulin, Raffaella Sanna, Antonio Pintus, CRS4, Italy
The VITAL Project (Virtual Instructional Training for the Advancement of Literacy) 339
Marc Glassman, Memorial University of Newfoundland, Canada
Using the Web to Teach Democracy 343
Ilia Goldfarb, Faculty of Education, UNB, Canada
Assessment and Technology: The National Assessment of Educational Progress Technology Initiatives 349
Madeline Goodman, Madeline Goodman, Hilary Persky, Hilary Persky, Educational Testing Service, USA
Modules and Information Retrieval Facilities of the Human Use Regulatory Affairs Advisor (HURAA) 353
Arthur Graesser, Xiangen Hu, University of Memphis, USA; Natalie Person, Rhodes College, USA; Tanner Jackson, University of Memphis, USA; Joe Toth, Institue for Defense Analysis, USA
Learning from Hypertext and the Analyst-Intuition Dimension of Cognitive Style 361
Martin Graff, University of Glamorgan, UK
Developing an Online Staff Development Program Using Instructional Technology for Supervisors and Administrators 369
Terry Daniels, St. John's University, USA; Robert Graham, Port Richmond High School, USA
An Analysis of Instructional Strategies Used in Synchronous Learning Environments 375
Melanie Greene, Sara Olin Zimmerman, John H. Tashner, Linda Pacifici, Appalachian State University, USA
Cognitive user profile and its involvement into adaptive interface 382
HABIEB MAMMAR Halima, HABIEB MAMMAR Halima, ICTT, France
Adapting Corporate Portal Technology for Management E-Learning 388
Michael Hamlin, Charla Griffy-Brown, Graziadio School of Business and Management, USA
International E-Learning Business: Strategies & Opportunities 404
Joachim Hasebrook, efiport AG / Bank Academy, Germany
Supporting Decentralized Education with Personal Technologies 412
Carl Johan Orre, Umea University, Sweden; Ulf Hedestig, Umea university, Sweden; Victor Kaptelinin, Umea University, Sweden
A Media Rich Interface vs. a Simple Interface for Interactive Television 420
Anders Hedman, Royal Institute of Technology, Sweden
Implementing Complex Web-Based Training Strategies with Virtual Classrooms 426
Denis Helic, IICM, TU Graz, Austria
How University Faculty Assess Scholarly Use of the Internet 433
Paul Henry, Program House, USA
Asynchronous conferencing with a twist of synchronicity: in search for tools for collaborative moderation in online discussions 441
Pentti Hietala, University of Tampere, Finland
A Fundamental Study for Grouping Formation Module based on Personality Information 449
Masateru HISHINA, Tokyo International University (JAPAN), Japan
Wearing Four Pairs of Shoes: The Roles of E-Learning Facilitators 457
Ed Hootstein, Intelligent Decision Systems Inc., USA

Development of An Internet Collaborative Learning Behavior Scale - Preliminary Results 463
Ti Hsu, Department of Business Administration, Tamkang University, Taiwan; Hsiu-Fei Wang, Da-Yeh University & New York University, Taiwan
EBOOK.EXE: A Desktop Authoring Tool for HURAA 471
Suresh Susarla, The University Memphis, USA; Xiangen Hu, Eric Mathews, Arthur Graesser, The University of Memphis, USA
MBA Students' Satisfaction with Technology Changes from Traditional to Online Courses 477
Shirley A Hudson, Ph.D., CPCM, Young H Kim, Ph.D., Clark Atlanta University, USA
A Preliminary Mapping of Web Queries Using Existing Image Query Schemes 485
Bernard Jansen, Penn State University, USA
Towards Implementing a Cognitive Model of Searching 493
Bernard Jansen, Penn State University, USA
Using Advanced Search Operators on Web Search Engines 501
Bernard Jansen, Penn State University, USA
Facing the Unknown: Distributed Project Team Guidelines 509
Eva Jansson, KTH (Royal Institute of Technology), Sweden; Carolyn Ybarra, Stanford University, USA
New Trends in Web Usage Patterns and Web Traffic 514
Jens F. Jensen, Aalborg University, Denmark
Virtual Reality: The Future Of Animated Virtual Instructor, The Technology And Its Emergence To A Productive E-Learning Environment 522
Juhanita Jiman, Multimedia University, Malaysia
An Instructional Strategy Framework for Online Learning Environments 529
Steven Aragon, Scott Johnson, University of Illinois at Urbana-Champaign, USA
ECO TECH LINK: PT3 Grant Builds Technology Circles in the K-18 Community 537
Katie Klinger, Jane Duckett, Maria Medrano, Nedra Crow, Gwen Stowers, National University, USA
The Instructional Instrument SL-EDGE:Student Library – Educational DiGital Environment .. 545
Antonia Kyriakopoulou, Theodore Kalamboukis, Athens University of Economics and Business, Greece
Means and Methods in Automatic Courseware Production: Experience and Technical Challenges 553
Tobias Lauer, Thomas Ottmann, University of Freiburg, Germany
Professional Skills Training for Social and Behavioral Competence:A Corporate Case Study in using a Fictional Video Script for interactive 561
Sylvie Leleu-Merviel, Nicolas Vieville, Michel Labour, University of Valenciennes (France), France
A Drag and Drop Editor for Interaction and Personalization of Web Pages 567
Jennifer Lennon, Richard Warburton, University of Auckland, New Zealand
HWONS: A Hyerwave Online Negotiation System 573
Hermann Maurer, IICM, Austria; Jennifer Lennon, University of Auckland, New Zealand
Diagnostic Cognitive Assessment and E-learning 578
kit leung, McGill University, Canada
The 3D Laokoon. Visual and Verbal in 3D Learning Environments 586
Gunnar Liestøl, University of Oslo, Norway
E-Learning: In Search of a Total Learning Experience (TLE) 593
Eric Lim, Ian Weber, Nanyang Technological University, Singapore
Designing ICT Training Material for Chinese Language Arts Teachers 601
Janet Mei-Chuen Lin, National Taiwan Normal University, Taiwan
Beyond the Current E-Learning paradigm: Applications of Role Play Simulations (RPS) - case studies 606
Roni Linser, Ausis P/L, Australia
Significant Features of Asynchronous Learning 612
Jose Llanes, University of Texas Pan American, USA
Improving Teacher Effectiveness In E-Classrooms 620
Jerome Eric Luczaj, Chia Y. Han, University of Cincinnati, USA
Semantics for E-learning: An advanced Knowledge Management oriented metadata schema for learning purposes 627
Miltiadis Lytras, Athens University of Economics and Business, Greece
Remote Internet Conferencing with Unique Populations in Diverse Settings 635
Douglas MacKenzie, James Mallory, Rochester Institute of Technology, USA

Voice vs Text-based Discussion Forums: an implementation of Wimba Voice Boards 640
Philip Marriott, University of South Australia, Australia
Developing Componentware for Education: A Programming Approach Providing Teachers More Creative Control of Course Design 647
Ryoji Matsuno, Prefectural University of Kumamoto, Japan; Yutaka Tsutsumi, Kumamoto Gakuen University, Japan; Richard Gilbert, Kumamoto University, Japan
Developing an Organisational E-Learning Strategy: A UK University Case Study 655
Robert McClelland, Liverpool John Moores University, UK
Evidence of the Need to Support the Development of On-line Collaborative Skills: An Action Research Study 661
Jennifer Sclater, Laura April McEwen, Concordia University, Canada
Community Building: Facilitating successfull online courses 669
Mae McSporran, Stuart Young, UNITEC Institute Of Technology, New Zealand
Enhancing Web-Based Materials with Video Clips 676
Susan Mehringer, Cornell Theory Center, USA
Self and Peer Assessment in an Online Collaborative Learning Environment 682
Marylu Menchaca, Carolyn Awalt, Paul Resta, University of Texas at Austin, Mexico
ELearn: A collaborative educational virtual environment 690
Anna Michailidou, University of Macedonia, Greece
Computer Support for Vicarious Learning 698
Rachada Monthienvichienchai, M. Angela Sasse, University College London, UK
A Model Driven Process for Web-based Instructional Content Development 706
sudhir mudur, concordia university, Canada; prachi gharpure, S. P. College of Engg., India; parvati rajan, SNDT University, India
Digital Lecture Halls Keep Teachers in the Mood and Learners in the Loop 714
Christoph Trompler, Computer Operating Group, Department of Computer Science, Darmstadt University of Technology, Germany; Max Muehlhaeuser, Telecooperation, Darmstadt University of Technology, Germany
A Campus Wide Project Of Web-Based Academic Instruction - A Research Framework And Priliminary Results 722
Rafi Nachmias, Tel-Aviv University, Israel
Using DVD Technology to Disseminate Classroom Teaching Practices 729
Richard O'Connor, University of Arkansas-Monticello, USA; Rhonda Richards, University of Arkansas at Monticello, USA
Hybrid e-Learning System for a Cooperative Linkage between University and Industry 732
Toshio Okamoto, Graduate School of Information Systems, University of Electro-Communications, Japan; Mizue Kayama, Senshu University, School of Information and Network, Japan; Hisashi Inoue, Joetsu University of Education, Japan
An Evaluation of Scaffolding for Virtual Interactive Tutorials 740
Claus Pahl, Dublin City University, Ireland
Data Mining Technology for the Evaluation of Web-based Teaching and Learning Systems ... 747
Claus Pahl, Dave Donnellan, Dublin City University, Ireland
Learner Relationship Management: Impacting the Top and Bottom Line 753
David Palumbo, Sapient Corporation, USA
Combining Cognitive, Affective, Social and Metacognitive Learner Attributes for Assistance in Distributed Learning Environments. 759
Anne Brisebois, LICEF Research Center, Télé-université; CEGEP André-Laurendeau, Canada; Diane Ruelland, LICEF Research Center, Télé-université, Canada; Gilbert Paquette, LICEF Research Centre, Télé-université, Canada
Minimizing the Gender Equity Gap in Science and Technology 767
María Victoria Pérez Cereijo, University of Texas at Arlington, USA; Tandra Tyler-Wood, Jon I. Young, University of North Texas, USA
Student Perceptions of Online Synchronous Courses 772
María Victoria Pérez Cereijo, University of Texas at Arlington, USA; Tandra Tyler-Wood, Jon I. Young, University of North Texas, USA
AutoTutor Passes the Bystander Turing Test 778
Natalie Person, Mary Erkel, Rhodes College, USA; Art Graesser, University of Memphis, USA

Reliable Assessment With CyberTutor, A Web-Based Homework Tutor 785
David Pritchard, Elsa-Sofia Morote, MIT, USA
Communities, communication and cognitive change: social processes and designing engaging e-learning discourse 792
Andrew Ravenscroft, Learning Technology Research Institute, UK
Learning Objects - Instructional Metadata and Sequencing 798
Giselher H.J. Redeker, Deloitte Consulting, Germany
Enhancing E-Learning Assessment and Evaluation Strategies 806
William Aggen, LearnWright, USA; Thomas Reeves, The University of Georgia, USA
Object Oriented Learning Objects in Online Education: A Framework and Example 812
Lilian Rincon, Drew Parker, Lilian Rincon, Drew Parker, Simon Fraser University, Canada
Impact Evaluations of Corporate eLearning 818
Geoff Ring, ICUS Pte Ltd, Singapore; Thomas Reeves, The University of Georgia, USA
MyLibrary: A Web personalized Digital Library 824
Geraldo Xexeo, Ana Regina Rocha, Catarina Rocha, Federal University of Rio de Janeiro, Brazil
An Agent Architecture for Asynchronous Learning 830
Stephen Rochefort, University of Calgary, Canada
Why web pages annotation tools are not killer applications? A new approach to an old problem 837
Marco Ronchetti, Università di Trento, Italy
A Conceptual Framework for the Development of WBT-Guidelines 842
Jörg Schellhase, Oliver Bohl, Udo Winand, University of Kassel, Germany
A Critical Discussion of Standards for Web-based Learning 850
Jörg Schellhase, Oliver Bohl, Udo Winand, University of Kassel, Germany
Anatomy of a Web-based Course: How Visualization Types & Techniques Can Impact Student Engagement & Learning Outcomes 856
Ann Shortridge, Jason Emmert, University of Arkansas, Fayetteville, USA
Elearning translates to experiential learning in a communication theory class - Higher Education 864
mukhbir singh, Buffalo State College, USA
Communication and Collaborative Learning at Work: Views Expressed in a Cross-Cultural E-Learning Course 870
Virpi Slotte, University of Helsinki, Finland
E-feedback to reflect legitimate peripheral participation; towards a redefinition of feedback in online learning environments 878
Marc Coenders, wdl learning architecture, Netherlands; John Smith, CPsquare, USA
Exploring Opportunities for Online Instruction for Individuals with Severe Disabilities 886
Nathan Sparks, Regent University, USA
The Use of the Electronic Portfolio in Allied Health 891
Dr. Jeff Stewart, Macon State College, USA; Dr. Ken Wright, Dr. Vivian Wright, The University of Alabama, USA
Localization vs. Internationalization: e-Learning Programs for the Aviation Industry 895
Judith Strother, Florida Institute of Technology, USA
Communities of Practice and On-Line Support for Dissemination and Implementation Of Innovation 901
Bronwyn Stuckey, Queensland University of Technology, Australia; Anna Buehring, Sally Fraser, Sowerby Centre for Health Informatics at Newcastle (SCHIN), UK
Accessing Distributed Learning Repositories through a Courseware Watchdog 909
Rudi Studer, Gerd Stumme, Julien Tane, Gerd Stumme, Steffen Staab, Learning Lab Lower Saxony, Germany
CoCoFolio: A Web-based Electronic Portfolio for Enriching Students Learning by Collaboration 916
Takeshi Sugiyama, Naoyuki Kakehi, Tsuneko Kura, Tokiichiro Takahashi, NTT, Japan, Japan
Students' Readiness For On-Line Distance Education In Slovenia 922
Viktorija Sulcic, Ekonomsko poslovna fakulteta Maribor, Slovenia; Dusan Lesjak, Ekonomsko-poslovna fakulteta Maribor, Slovenia

CMI Theory and Practice: Historical Roots of Learning Managment Systems ... **929**
Michael Szabo, University of Alberta, Canada

Students Develop Real-World Web and Pervasive Computing Systems ... **937**
Charles Tappert, Pace University, USA

Creating and assessing web-based learning environments: the relationship between knowledge type, pedagogy, and technology. ... **945**
David Tarcy, David Tarcy, University of Alaska Anchorage, USA; Chris Allen, Chris Allen, George Henik, George Henik, New York University, USA; Richard Satterfield, Richard Satterfield, University of Alaska Anchorage, USA

The effectiveness of educational technology: Will the Enhancing Education Through Technology Act of 2001 really expand our knowledge of teaching and learning with technology? ... **948**
Elaine Terrell, University of Arkansas, USA

Accessible Adult Learning in the Health Professions: Interactive Uses of Distance Technology ... **953**
Elizabeth Townsend, Dalhousie Univerisity, Occupaitonal Therapy, Canada; Janet Curran-Smith, Dalhousie University, Canada

Coaching the transition to e-learning: re-thinking instructional design ... **961**
Chris Trevitt, Centre for Educational Development and Academic Methods, Australia

Advanced Interactive Web Technologies in Industry Training ... **968**
Tania Vassileva, Dimitar Bojkov, Technical University, Bulgaria; Ilario Astinov, Ingenatic Company, Germany

An Evaluation Framework for the Development Process of an Online Curriculum ... **976**
Ron Wakkary, Karen Belfer, Simon Fraser University, Canada

Lessons from An Action Research on Project-based Learning in a Web-based Learning Environment ... **984**
Chien-hsing Wang, National Changhua University of Education, Taiwan

The Design of an Integrated System for Web-based Distance Education ... **992**
Hongxue Wang, Athabasca University, Canada

The Study of Learning Progress for Distance Education Students in Taiwan ... **999**
Sheng-mei (Jenny) Wang, The National Huiwei Institute of Technology, Taiwan

A Framework for Managing Personal Knowledge Activity in Education ... **1006**
Toyohide Watanabe, Nagoya University, Japan

Transcultural learning in Internet-based learning environments - European methods and experiences ... **1013**
Dr. Peter J. Weber, University of Hamburg, Germany

Presenting Complex e-Learning Content on the Web: A Didactical Reference Model ... **1018**
Franz Weitl, Institute of information systems and software engineering, Germany

Is eLearning Effective?: A Review of Literature from 1993-2001 ... **1026**
Robert Whelan, Jan Plass, New York University, USA

Tools of the Web-Based Learning Trade ... **1029**
Sumant Kailas, Koremax Consulting, Canada; Kay Wijekumar, The Pennsylvania State University Beaver, USA

Integration of e-Learning and Knowledge Management ... **1035**
Darrell Woelk, Elastic Knowledge, USA; Shailesh Agarwal, Ph.D, Docent Inc., USA

XML Based Course Websites ... **1043**
Michael Wollowski, Rose-Hulman Institute of Technology, USA

Factors Limiting the Proliferation of E-learning within Small to Medium Sized Enterprises ... **1049**
Dan Wood, NTP Information Solutions Limited, UK; Jason Watson, The University of Huddersfield, UK

On-line Learning Courses: A review and usability attributes ... **1056**
Panagiotis Zaharias, Athens University of Economics & Business, Greece

Accessible Multimedia for the Web ... **1063**
Nicholas Zaparyniuk, University of Alberta, Canada; Jillianne Code, Grant MacEwan College, Canada

PANELS

ELearning: Lessons Learned from Three Studies 1069
Sheila Cassidy, Selma Sax, Wexford Inc., USA; Deborah Jolly, Texas A&M University, USA
Portraying Yourself Online: A Discussion of Teaching Styles in Online Courses 1071
Sue Steinweg, Susan Colaric, Plummer (Al) Jones, Diane Kester, East Carolina University, USA
Advantages of the Various Online Course Designs 1079
Raymond Rose, Concord Consortium, USA; Zahrl Schoeny, Curry School, University of Virginia, USA; Alese Smith, Concord Consortium, USA
Supporting Learners for E-Learning 1081
Diane Ruelland, LICEF research center, Canada; Jane Pilling-Cormick, Professional Learning & Training, Canada; George Piskurich, Organizational Learning and Performance Consultant, USA; Donna Gabrielle, United States Military Academy, USA; Gail Derrick, School of Education at Regent University, USA
Panel Discussion: A Successful Online Education Program 1085
Paul Lakey, Raye Lakey, Abilene Christian University, USA; Kaye Shelton, Dallas Baptist University, USA; George Saltsman, Abilene Christian University, USA
Open Source Software Can Open Minds and Help Solve the U.S. Technical Education Problem 1089
Matthew Szulik, Chairman,CEO, President—Red Hat, USA
The New Generation Working Force: The Homo Zappiens 1093
Wim Veen, Willem van Valkenburg, EduTec, Faculty of Technology, Policy & Management, Delft University of Technology, Netherlands; Sicco Santema, Product Innovation & Management, Faculty of Design, Engineering and Production, Delft University of Technology, Netherlands; Ralph Genang, SCGroup, Netherlands
Communities of Practice for Improved Learning Systems in the Corporate, Government, Higher Education and Healthcare Sectors. 1096
Mary Lynn Benninger, Clarica, Canada; Céline Monette, Aventis Pharma, Canada; Roy Greenhalgh, Roy Greenhalgh Associates, UK; Etienne Wenger, CPSquare, USA; Thomas Ruhl,, Lewis and Clark College, USA

BRIEF PAPERS

Designing a Dynamic Course Outline System to Integrate Courseware Features 1100
Jason Abbitt, Michael Odell, Jason Graham, University of Idaho, USA
Classroom Observations through Distance Learning Technology 1103
Phyllis Adcock, University of Nebraska at Omaha, USA
Automating Evaluation and Assessment in a Technology Course 1106
Frank Akaiwa, Kelley School of Business-Indiana University, USA
Effect Of Language On E-Learning In The Arab World 1109
Adekunle Akinyemi, Sultan Qaboos University, Oman
E-Learning: A Reality In Sultan Qaboos University 1113
Adekunle Akinyemi, SULTAN QABOOS UNIVERSITY, Oman
Technology and Pedagogy : Changing Roles of Pedagogy in a Project-based Constructivist Environment 1116
Ahmed Ali, Ohio University, USA
(Re-)Designing an Educational Setting - Trails of Competency in an Open Learning Repository 1120
Heidrun Allert, Christoph Richter, Learning Lab Lower Saxony, Germany
Learning Objects on the Semantic Web. Explicitly Modelling Instructional Theories and Paradigms 1124
Heidrun Allert, Christoph Richter, Wolfgang Nejdl, Learning Lab Lower Saxony, Germany
Situated Citizen Photojournalism and a Look at Dilemmatic Thinking 1128
Mike Ananny, Carol Strohecker, Media Lab Europe, Ireland
The Nature of Electronic International Project Development 1132
betsy anderton, University of south Alabama, USA

BEST COPY AVAILABLE

A Framework for Developing and Managing Resource-Based Distance Learning Content in Higher Education **1136**
Carlos Araujo, University Cruzeiro do Sul, Brazil

Evaluation of web based communication and cooperation in a course in teacher education at a German University **1140**
Stefan Aufenanger, University of Hamburg, Germany

Evaluating distributed learning **1142**
Carlos Vaz de Carvalho, Instituto Superior de Engenharia do Porto (ISEP), Portugal; Lígia Maria Ribeiro, Faculdade de Engenharia da Universidade do Porto (FEUP), Portugal; Isabel Azevedo, Constantino Martins, Instituto Superior de Engenharia do Porto (ISEP), Portugal

How Can University Professors and Elementary School Teachers Work Together in Virtual Teams? **1146**
Mary Kay Bacallao, St. Thomas University, USA; Aldo Bacallao, Lloyd Estates Elementary, USA

Multi-disciplinary E-Learning for Future Educators **1148**
Mary Kay Bacallao, St. Thomas University/ Golden Glades Elementary, USA; Aldo Bacallao, Lloyd Estates Elementary, USA; Carol Wilson, Sandpiper Elementary, USA

Essential Strategies for Connecting with the E-Learner **1151**
Kathleen Bacer, Azusa Pacific University, USA

Evaluation of a Web-based Tutorial on the History of Technology in a University Science-Technology-Society Course **1155**
Patricia Backer, San Jose State University, USA

Blackboard and Beyond **1159**
Alan Bailin, Baruch College, City University of New York, USA

Factors Contributing to the Success of a Successful Distance Education Program **1163**
William Barber, Mary Bell, Appalachian State University, USA; Sherry Bell, Mitchell County Schools, USA; Tonya Patterson, Appalachian State University, USA; Kathy Taibo, Iredell County Schools, USA

Evaluation of the Q-matrix Method of Fault Tolerant Knowledge Assessment **1167**
Tiffany Barnes, Donald Bitzer, North Carolina State University, USA

Facilitation Considerations and Tips for Online Educators and Trainers **1171**
Julie Batovsky, Syrtis Technology-enhanced Instructional Solutions, USA

Online Course Design: An MBA Course Example **1175**
Darcy Becker, Univ of Wisconsin - Eau Claire, USA

Digital Literacy and Reflective Competencies **1179**
Claire Bélisle, LIRE-CNRS, France

Using XML In Elearning Courses **1183**
Amine BEKIRAN, EMI Rabat, Morocco; Youssef BELQASMI, ENSET Mohammedia, Morocco; Rachida AJHOUN, ENSIAS Rabat, Morocco

"Teleweb" For Distance Learning: The Evolution Of Televised Teaching Into Web Course **1187**
William Bercu, Arizona State University, USA

Cases of Multimedia Applications to Enhance Learning **1191**
Ian Bertie, Pontificia Universidad Catolica de Chile, Chile

Promoting the development of students' information literacy skills: Insights from a post-secondary classroom **1195**
Ty Binfet, Loyola Marymount University, USA

Taste the difference. Training and optimization of synchronous, audiovisual, cooperative telelearning. **1199**
Thomas Bliesener, University of Essen, Germany

Knowledge Management for Italian Public Administrations **1202**
Francesco Bolici, CeRSI, LUISS Guido Carli University, Italy

Component-based Content Development for E-Learning Systems **1206**
Roland Mittermeir, Roland Wohlfahrt, Andreas Bollin, University of Klagenfurt / Department of Informatics-Systems, Austria

A proposal for using visualisation to support collaborative learning **1210**
Luis Borges Gouveia, Universidade Fernando Pessoa, Portugal; Joaquim Borges Gouveia, University of Aveiro, Portugal

How an online survey was used to market, measure, and develop technical eLearning training for Cisco's Technical Assistance Center Customers 1214
Jashoda Bothra, Jashoda Bothra, Tina Francis, Tina Francis, Cisco Systems, Inc., USA

Virtual-Virtual-Barter For Sustaining And Developing Learning Communities; The Example Of 1218
Louise Sauve', Tele-Universite' Uiversite' du Quebec, Canada; Gary Boyd, Concordia University, Education Dept., Canada

Support for Mobile Learners in Distributed Space 1222
oliver brand, Learning Lab Lower Saxony, Germany

Software Architecture for the International Collaborative Environment (ICE) 1226
Robert Brazile, Robert Brazile, University of North Texas, USA

Knowledge Management Systems in Schools or How to Sort the Garbage Can? 1230
Dr Andreas Breiter, University of Bremen, Germany

Internationalising the interface for e-learning 1234
Ian Brown, Ian Brown, University of Wollongong, Australia

A Development Framework for Re-useable Learning Resources for Different Learning Styles and Requirements 1238
Catherine Bruen, Center for Learning Technology, Ireland

Online Communication: A Success Factor for Blended Learning 1242
Hans Georg Brunn, Universtiy of Paderborn, Germany; Christine Frank, University of Paderborn, Germany

Shifting the Unit of Analysis from the Individual to Action: Socio-cultural Approaches to Computer-mediated Communication 1246
Eva Bures, Steven Shaw, Education Department, Concordia University, Canada

Using Virtual Web-Enabled Technologies and Design at Accenture to Enhance Entry Level New Joiner Training. 1250
sandra burke, Melissa Noonan, Accenture, USA

Independent Study based on the Strategy of Online Workshops to Develop Professional Abilities (TDHP) of UNITEC 1251
Alfonso Bustos, Yolanda Jimenez, Jose Garcia-Santamarina, UNITEC, Mexico

The Impact of Learner Feedback on Program Redesign 1255
Jeanne Butler, Ph.D., Western Governors University, USA

Combining Classroom and Online Approaches for Maximum Learning 1258
Celina Byers, Oakland University, USA

Assessing Sense of Classroom Community in an Urban Community College Online Setting 1261
Cynthia Cadieux, Tidewater Community College, USA

Acquiring, Storing, and Sharing Research Datasets: Policies that Save Resources, Improve Collaboration and Research Activities using IT 1265
Kemal Cakici, Jodi Felberg, The George Washington University, USA

Intercampus: Administration and Teaching shared between eight Catalan universities through Internet 1269
Ramon Marti, Francisco Calvino, Univ. Politecnica de Catalunya, Spain

Web Portals: A Different View for Faculty Development 1273
Patricia Carlson, Rose-Hulman Institute of Technology, USA

Veterinary Multimedia Repository: An Example of a Web-Based Collaborative Tool for Organizing, Archiving and Retrieving Pedagogical Chunks. 1277
Eric Norman Carmel, Denis Harvey, André Desrochers, LITIEM - Faculté de médecine vétérinaire of Montreal University, Canada

Enduring Change 1280
Bruce Carter, Sheffield Hallam University, UK

Supporting The Development Of Students' Virtual Enterprises: An E-Learning Environment. 1284
Nunzio Casalino, CERSI - LUISS G. Carli University, Italy

Education Web Site Review and Redesign 1288
Cathy Cavanaugh, Terence Cavanaugh, University of North Florida, USA

College Website Review and Revision for Accessibility 1292
Terence Cavanaugh, University of North Florida, College of Education and Human Services, USA

Web/CD Hybrid model for the Distance Learning Environment 1296
Terence Cavanaugh, University of North Florida, College of Education and Human Services, USA
National Effort Goes to Support E-Learning: An Example In Taiwani¦s Academic Learning Paradigm 1300
Chiping Chan, National Center for High Performance Computing, Taiwan
Eclectic 1304
Ivy Chan, The University of Hong Kong, China; Naubahar Sharif, Cornell University, USA
An exploration of virtual community in Macau 1308
KAN KAN CHAN, University of Macau, Macau
Learning Systems Modeling with PDA,, a Case Study 1312
Tom Chan, Southern New Hampshire University, USA
Using e-learning to scaffold reflection and to support collaborative learning: A case study 1315
Christina C. Chao, Penn State University, USA
Measuring the Digital Divide: Liberal Arts Students' IT Skills 1317
Tracy Chao, Faculty of Arts Technologies for Learning Centre, University of Alberta, Canada
Computer-Assisted Collaborative Learning in Art Education: An Experimental Study 1321
Wei-Fan Chen, Chung-Pei Chuang, The Pennsylvania State University, USA
Quality Management Systems for Distance Learning 1325
William Chernish, University of Houston, USA
Communication Preferences and E-Learning 1327
Mark Chignell, Leonardo Ruppenthal, Mei Leung, Heather Parker, University of Toronto, Canada
Organizational Considerations for Designing Fully Online Learning Environments 1331
Elizabeth Childs, Tammy Dewar, Doug Hamilton, Dave Whittington, Royal Roads University, Canada
Harnessing IT for learner-centred self-directed music education 1335
Ying Hwee Chua, Indiana University - Bloomington, USA
Web screen design: background color impacts posttest performance 1339
Roy Clariana, Penn State University, USA
E-learning as a Teleworking Training Tool 1342
Nancy Clementino, UFSC, Brazil
The Virtual Poster Session in a Distance Education COurse 1346
Patrice Clemson, Pennsylvania State University, Canada
AMEE: Annotated, Multi-modal Electronic Evaluation for Dynamic Student Modeling 1349
John Coffey, Institute for Human and Machine Cognition, USA
Developing a Virtual Community of Learners 1353
Susan Colaric, East Carolina University, USA
How Does A Sales Organization Best Support A Distributed Sales Force From A Learning, Communication And Support Standpoint? 1356
David Connal, Maritz Canada, Canada
Accessibility and usability in complex web based learning applications: lessons from the PEARL project 1358
Telmo Amaral, Faculade de Engenharia da Univeersidade do Porto, Portugal; Chetz Colwell, Open University, UK; Martyn Cooper, Open Univeristy, UK
graW: A Web Interactive Environment to Support Undergraduate Courses ....,................ 1363
Cidorvan Leite, Marcello Junior, Rodrigo Paes, Evandro Costa, Universidade Federal de Alagoas, Brazil
Supporting Self-Regulation in Student-Centered Web-Based Learning Environments 1366
Nada Dabbagh, Anastasia Kitsantas, George Mason University, USA
REDI, on line educational resources for the development of professional multimedia skills 1370
Ricardo Dal Farra, INET - National Ministry of Education - Argentina, Argentina
QuikQuiz: Complementing WebCT Tools for More Learner Interaction 1374
Michael M. Danchak, Rensselaer Polytechnic Institute, USA; Joshua T. Pedersen, Rensselaer Ploytechnic Institute, USA
Using the Internet to Create an Integrated Thematic Unit Across the Curriculum 1378
Terry Daniels, St. John's University, USA
Applying Multi-Intelligent Adaptive Hypermedia to Online Learning 1382
Benay Dara-Abrams, University of San Francisco and BrainJolt, USA

Concept Relationship Types for AHA! 2.0 1386
Paul De Bra, Ad Aerts, Brendan Rousseau, Eindhoven University of Technology, Netherlands
Adaptation of the e-learning web application "Campus Virtual Teledomedia" to obtain an open and accessible information management system 1390
Antonio de Castro, Antonio de Castro, 1Departamento de Informatica y Análisis Numérico, Universidad de Cordoba, Spain
Modeling the Tutor-Learner Interaction in an E-Learning Environment: An Instructional Design Perspective 1392
Ileana de la Teja, LICEF Research Center, Tele-universite, Canada; Aytac Simsek, Syracuse University, IDD&E, USA
GWeb Enterprise Portal 1396
Francesco de Leo, Francesco de Leo, The George Washington University, USA
Issues in Rural Uptake of Online Learning: an Australian Perspective 1400
Ann Deden, Edith Cowan University, Australia
University Strategies in the Online Learning Marketplace 1403
Ann Deden, Jan Herrington, Edith Cowan University, Australia
A Distributed Learning Model For Problem Solving And Program Development 1407
Fadi Deek, New Jersey Institute of Technology, USA
Designing e-learning success: curriculum design that encourages student success 1411
Stephanie Delaney, Highline Community College, USA
E-Learning : The Design of Cognitive Crutches in the 21st Century 1415
Koen DePryck, Koen DePryck, Institute of Knowledge Management / CVO Antwerpen-Zuid, Belgium
Connecting the Dots: Uniting Education Around the World 1419
Laura Diggs, John Wedman, University of Missouri-Columbia, USA
Building and Accessing E-Learning Ressources 1420
Bich-Lien Doan, Yolaine Bourda, supelec, France
Implementing Higher Education Degrees Through Telecommunications and Collaborations 1424
Rita Dobbs, W. Clayton Allen, The University of Texas at Tyler, USA
Technology, Education and Knowledge: digital divide or knowledge leverage? - Some thought following a pilot project of the European Commission- 1428
Bourgeois Dominique, EJCM, France
CARA - A Constructivist Approach to E/C Resource Management and Administration 1432
Michael Draper, CERN, Switzerland
Effects of Social Interaction on Learning in a Hybrid Model of an Online Course, Child Abuse Detection and Reporting 1436
Brenda Dressler, New York Institute of Technology, USA
Estimating Development Time for E-Learning Programs 1439
Mark Eaton, Cerner Corporation, USA
Spider Tutoring System for Teaching Computer Programming Languages 1443
Mahmoud El-Khouly, Helwan University, Egypt, Egypt
Semi-online workshop for planning and developing online coursware 1447
Larisa Enriquez, National University of Mexico, Mexico
IQUIZ: A Tool Making Internet Quizzes easy to Develop and Use 1451
Hanna Farah, Univ. of Ottawa, Canada
A DISTRIBUTED WEB BASED K-12 MANAGEMENT SYSTEM 1455
Joao Ferreira, INESC - ISEL, Portugal
The challenges of implementing a university copyright policy in the digital world 1459
Donna Ferullo, Purdue University, USA
Interactive Video Content Supporting CSCL Environments 1462
Matthias Finke, Computer Graphic Center, Germany
Distance Learning At Secondary Levels: Contexts And Norms For The Learning Of Mathematics 1466
Josep M Fortuny, Josep M Fortuny, UAB, Spain

Distance Education At Secondary Levels: Contexts And Norms For The Learning Of Mathematics 1469
Philippe R. Richard, Université de Montréal, Canada; Joaquin Giménez, Universitat de Barcelona, Spain; Josep Maria Fortuny, Universitat Autònoma de Barcelona, Spain

Privacy and Anonymity: Perceptions and Expectations of Online Students 1473
Dannie Francis, University of Wyoming, USA

Blended Learning: What is it? How does it impact student retention and performance? 1477
Patricia Franks, Broome Community College, USA

The Effect of Interactive Applets in Mathematics Teaching 1481
George Gadanidis, University of Western Ontario, Canada

Interaction, Distributed Cognition and Web-based Learning 1485
Penny Ann Garcia, University of Wisconsin - Oshkosh, USA

Binding Virtual Molecules Sounds Good!: Exploring a Novel Way to Convey Molecular Bonding to Students. 1489
Miguel Garcia-Ruiz, University of Sussex, UK

Accessibility Implications for Multimedia 1493
Donna Gardner, University of Texas Health Science Center at San Antonio, USA; Deanie French, Southwest Texas State University, USA

Measurement Of Learner Attitudes Toward Internet Delivered Multi Media 1495
Donna Gardner, University of Texas Health Science Center, USA; Deanie French, Southwest Texas State University, USA

Electronic Portfolios: Effective Assessment Tools in Teacher Education Programs 1499
Constance Geier, Northern State University, USA

The Changing Role for Universities as Life Long Learner Centres 1501
Ralph Genang, Delft University of Technology / RaGeS Ltd., Netherlands

"Living in the Information Age": Writing Emphasis Goes Online 1505
David Gibbs, David Gibbs, University of Wisconsin Stevens Point, USA

Building Responsive Dissemination Systems for Education with the Semantic Web 1509
Michael Knapp, Green River Data, USA; Brandt Kurowski, BrandtKurowski.com, USA; David Gibson, National Institute for Community Innovations, USA

Functions of an Online Mentoring and Professional Learning Portal 1513
David Gibson, National Institute for Community Innovations, USA

Large-Scale Interaction Strategies for Web-Based Professional Development 1517
Paul Giguere, Education Development Center, Inc., USA; Scott Formica, Wayne Harding, Social Science Research & Evaluation, Inc., USA

Building a Knowledge Community among Higher Education Institutions 1521
Catherine Gihlstorf, Marycarmen Aguilar, UNC-CH, USA

Geographically Distributed International Student Team Collaboration 1525
Marycarmen Aguilar, UNC-Chapel Hill, USA; Catherine Gihlstorf, University of North Carolina - Chapel Hill, USA

DELOS (Developing a European eLearning Observation System) 1529
Cristina Girona, Universitat Oberta de Catalunya, Spain

Developing ICT-facilitators Competencies through a Blended Learning Approach 1530
Lisa Gjedde, Danish University of Education, Denmark

The Impact of Technology and Distance Learning on Higher Education 1532
Susan Goetz, The College of St. Catherine, USA

Io, Database Driven Web Art-Work 1537
Joseph Squier, nan goggin, Narrative Media, UIUC, USA

The collaborative study in the virtual classroom: some practices in distant learning carried out in a Mexican public university: Universidad Autónoma Metropolitana-Azcapotzalco (UAM-A), Mexico City 1541
MariaDolores González, Tatiana Sorókina, MiguelAngel Herrera, Universidad Autónoma Metropolitana, Mexico

Conquering the Digital Divide found in Attitudes in Higher Education 1544
Valerie Greenberg, University of the Incarnate Word, USA

Multimedia Instructional Design VS Learning Objects Development 1547
Lourdes Guardia, Albert Sangra, Universitat Oberta de Catalunya, Spain

Course Development for Distance Learning Using Alternative Software **1551**
George Guba, Anne Blakeslee, Broome Community College, USA
An evaluation of an on-line anatomy course by laboratory instructors: Building on instructional design **1552**
Larry Katz, The University of Calgary, Canada; Xiangpei Guo, University of Calgary, Canada; Murray Maitland, University of South Florida, USA
Using Technology to Aid in the Creation of High-Quality Corporate E-Learning **1555**
David Guralnick, Kaleidoscope Learning, USA
Establishing a pedagogical platform for blended e-learning **1559**
Andrew Hall, University of Manchester, UK
Development of a Web-based Learning System for Teaching Web Design and Development: A Problem-Based Progressive-Scaffolding Approach **1562**
Richard Hall, Aram Digenarro, University of Missouri - Rolla, USA; Jessica Ward, Nicholas Havens, University of Missouri-Rolla, USA; Joseph Ricca, University of Missouri - Rolla, USA
A return to education as usual: learning complexity in the design and evaluation of a university mathematics course **1566**
Tony Hall, Interaction Design Centre, University of Limerick, Ireland
An Assessment of Synchronous Online Audio Conferencing for English Language Instruction **1570**
Elizabeth Hanlis, Sandy McIntosh, University of Alberta, Canada
Web Access Evaluation and Repair Tools - Automation and Integration **1574**
Laurie Harrison, Adaptive Technology Resource Centre, University of Toronto, Canada
One World, One Ethics: Lessons Learned Designing an International E-learning Curriculum for Research Ethics **1578**
Robert Rice, Family Health International (FHI), USA; Mary Harvey, PriorityX Internet Services, USA
Introducing the Idea of Sustained Query Exposure in the Context of Language Vocabulary Learning **1582**
Daniel Heesch, Imperial College London, UK
E-Literacy for the Workforce: Designing Effective Instruction **1586**
Heather Hemming, Sonya Symons, Lisa Langille, Acadia University, Canada
Exploring the Effect of Visual Complexity on Music Interval Recognition Tasks Involving User-Generated Images **1590**
George Henik, Christopher Allen, New York University, USA
A Systematic Review of Technology to Support Adult Learning in Communities of Practice **1594**
Gyeong Mi Heo, McGill University, Canada
The Professional Development of Human Service Professionals in Rural and Remote Areas: Investigating the Affordances of the Internet **1598**
Anthony Herrington, Jan Herrington, Edith Cowan University, Australia
Computer Assisted Simulation and Role Playing **1602**
Donald Hetzner, State University College at Buffalo, USA
Computer Assisted Simulation and Role Playing **1605**
Donald Hetzner, State Unversity College at Buffalo, USA
Developing a Framework of Electronic Literacy for Post-Compulsory, Remote-Access, Virtual Learning Environments **1608**
Anne Hewling, The Open University, UK, UK
Differential Indexing: A Problem-Authoring Method for Computer-Based Problem Practice **1612**
Tsukasa Hirashima, Kyushu Institute of Technology, Japan
Problems and Perils for Digital Libraries in the K-12 Domain **1616**
Ellen Hoffman, Eastern Michigan University, USA; Marcia Mardis, Merit Network, Inc., USA
An Examination of the Elements and Principles of the Visual Design of Web Interfaces in the context of Improving Accessibility for Older Adult Users **1620**
Charlotte Holland, Dublin City University, Ireland
"Bringing Stars into the Classroom"- A unique model for virtual courses **1624**
Yona Holzman Benshalom, Tamid,Open University of Israel, Israel

An Empirical Study of the Learning Motivation, Satisfactionand Effectiveness among Web-based Learners in Taiwan **1628**
Ti Hsu, Department of Business Administration, Tamkang University, Taiwan; Chiuhua Wang, Industrial Technology Research Institute, Taiwan; Hsiu-Fei Wang, Da-Yeh University & New York University, Taiwan

Instructional Design, On-Line Classrooms, and Disability **1632**
Debbie Hu, Syracuse University, USA

The Value of Community Building in an Online Classroom **1635**
Debbie Hu, Syracuse University, USA; Phillip Fiorello, St. Leo University, USA

Web-Based Instruction—Its Impact on Higher Education **1639**
Yung-Hoh Sheu, Kung Shan University of Technology, Taiwan, Taiwan; Pei-Wen Nicole Huang, National Huwei Institute of Technology, Taiwan

On-line Simulations for Health Care Providers **1643**
Alicia Huckstadt, Karen Hayes, Wichita State University, USA

Breaking the unbreakable: addressing the need for cryptanalysis **1645**
William Hunter, The University of Ontario Institute of Technology, Canada

Online courses, teaching and development experiences **1648**
Alma Ibarra, National Univesity of Mexico, Mexico

Preservice Teachers Assess Credibility and Cognitive Load Associated with Websites **1652**
Marie Iding, Martha Crosby, E. Barbara Klemm, University of Hawaii, USA

Trust and the Internet: Findings from the HomeNetToo Project **1655**
Linda Jackson, Gretchen Barbatsis, Frank Biocca, von Eye Alex, Zhao Yong, Hirim Fitzgerald, Michigan State University, USA

mSupport — supporting the mobile student **1658**
Di James, Monash University, Australia

E-Learning Strategic Planning Utilising a Work Systems Framework **1661**
Sam Jebeile, Robert Reeve, Macquarie University, Australia

Strategies for the Diffusion of E-Learning in Traditional Teaching and Learning Contexts: A Study of Web Adoption in an Australian School **1665**
Sam Jebeile, Macquarie University, Australia; Mohamed Khadra, University of Canberra, Australia; Robert Reeve, Macquarie University, Australia

The Development of Computer-Based Simulation Laboratory for e-Learning : A Case Study of Non-Electrical Engineering Background at KMUTT in Thailand **1669**
Kalayanee Jitgarun, Department of Electrical Technology Education, Thailand

Modelling a Web-based Learning System using Wired and Wireless Technology **1673**
Jun Jo, Griffith University, Gold Coast Campus, Australia

Developing Web-Based Materials for Electronic Learning Environments: Lessons from a Study of Middle School Mathematics Teachers **1677**
Deborah Jolly, Texas A&M University, USA; Peggy Meathenia, Lufkin Independent School District, USA

Technology Mentor Leadership Initiative: A Study of Cross Generational Learning **1679**
Deborah Jolly, Texas A&M University, USA; Sheila Cassidy, Selma Sax, Wexford Inc., USA

Writing for the Web **1682**
David Juniper, Athabasca University, Canada

Teaching or Producing? Orientation and Motivation of Virtual University Team in the Development of Web Courses **1685**
Esko Kähkönen, University of Joensuu, Finland

A Pervasive Computing Solution to Asset, Problem and Knowledge Management **1689**
Suman Kalia, Chase Manhattan Bank, USA

WebKANEcts - Building on constructivism to create a learning-centred strategy for e-learning **1693**
Catherine Kane, CLT, Trinity College Dublin, Ireland

An Analysis of the Capabilities of a Self-study Support System for Network Education **1697**
Satoshi Kashihara, Waseda University, Japan

Just in Time Learning for School Superintendents **1701**
Cathy Kaufman, Indiana University of PA, USA

The Cost-Effectiveness of an Online Electric Circuits Course **1702**
Hans Kuehl, Lawrence Picus, Edward Kazlauskas, University of Southern California, USA

Blended Learning at a Leading Executive Education Institute: State of the Practice 1706
Alim Khan, Karen Lindquist, IMD International, Switzerland
Interest Required for Online Courses 1710
Caroline King, UNITEC Institute of Technology, New Zealand
Dialogic Enquiry in an Online Community 1714
Jayne Klenner-Moore, King's College & The Pennsylvania State University, USA
Building the Learning Community Through Teaming and Technology 1718
Cheryl Knight, Dianne Barber, Appalachian State University - Adult Basic Skills Professional Development Project, USA
Morph Chat: A Multimodal Instant Messaging System 1722
Nupura Kolwalkar, Juan E. Gilbert, Auburn University, USA
A unified content strategy for developing learning materials 1726
Pamela Kostur, The Rockley Group, Canada
Issues of Transclusions 1730
Harald Krottmaier, Denis Helic, Graz University of Technoloy, Austria
More than Passive Reading: Interactive Features in Digital Libraries 1734
Denis Helic, Graz University of Technology, Austria; Harald Krottmaier, Graz University of Technoloy, Austria
Use of Social Navigation Features in Collaborative E-Learning 1738
Jaakko Kurhila, University of Helsinki, Finland; Miikka Miettinen, Petri Nokelainen, Henry Tirri, Helsinki Institute for Information Technology, Finland
Obtaining Realistic Information on the Context of Use of E-learning System 1742
Masaaki Kurosu, National Institute of Multimedia Education, Japan
Managing Time Thresholds in Mixed-Initiative Learning Environments 1746
Anastasios Economides, Dimitris Lamboudis, University of Macedonia, Greece
Hard Choices: Selecting a Course Management System 1750
Bruce Landon, Douglas College and WCET, Canada
Developing, Delivering and Managing a Legal Compliance e-Learning courseware in a Corporate Environment 1754
teresa lau, sun microsystems, USA
Impatica for PowerPoint and Impatica OnCue — Empowering content specialists 1758
Alan Lawee, Impatica Inc., Canada
Diabetes and Your Eyes: A Pilot Study on Multimedia Education for Underserved Populations 1761
Kimberly Lawless, University of Illinois at Chicago, USA
A New Baseline for Faculty Knowledge of Educational Technologies 1766
Tracey Leacock, Simon Fraser University, Canada
Peer and Self-Evaluation for Improving Student Collaboration in Online Courses 1770
Lars Leader, Valdosta State University, USA
Academic Administration and Organization Model of Digital Distance Universities 1774
Yeonwook Im, Hanyang Cyber University, Korea (South); Insook Lee, Sejong University, Korea (South); Seyoung Chun, Chungnam National University, Korea (South); Heeok Heo, Sunchon National University, Korea (South)
Delphi Study on Competency Model of Online Instructor 1778
insook lee, sejong university, Korea (South)
Time and Resource Issues Pertaining to the Design and the Management of Course Materials for a WebCT-Based Project with Engineering Students 1780
Geneviève Légaré, Concordia University, Canada
Teaching about Mythic Kings: How Integrating Multi-Media Presentation Technology with Traditional Essay Writing Has Helped Students Learn More History 1784
David Leinweber, Oxford College of Emory University, USA
Reusable Learning Objects: Hazards, Hi-Performance, and a New Convergence 1788
Juan Leon, Intelli-media, USA
An empirical investigation of student satisfaction with Web-based courses 1792
Peter Leong, Curtis Ho, University of Hawaii at Manoa, USA; Barbara Saromines-Ganne, Leeward Community College, USA

Implementing Library Instruction for Freshman Composition on WebCT: the Oakland University Experience 1796
Frank Lepkowski, Oakland University Library, USA
From the Global to the Local: New Policies for New Technologies 1799
Brian Lewis, Simon Fraser University, Canada; Jennifer Jenson, York University, Canada; Richard Smith, Simon Fraser University, Canada
Enabling open network access during exams 1803
Jeff Wright, Michael Chiles, John Paul, Luby Liao, University of San Diego, USA
Development of Web Server Surveilance Software 1807
Janet Light, Dept of ASCS, Canada
The Effect of E-mail Project on Enhancing EFL Learners' Academic Writing Skills 1810
Huifen Lin, Penn State University, USA
A Structured Approach to Program Expansion From On-Campus to Distance Delivery 1814
Marilyn Lockhart, Richard Howard, Larry Baker, Montana State University, USA
A Feedback Model And Successful E-Learning 1818
Helena Dedic, Steven Rosenfield, Vanier College & Concordia University, Canada; Yiping Lou, Louisiana State Universtiy, USA
The Development of a Web-Based Continuing Education Course for Camp Nurses 1822
Jo Lynne Lundy, Doctoral student - Nova Southeastern University, USA
E-learning pedagogy: The reveal of value adding learning processes. Definitions and Implications for dynamic learning content delivery 1826
Miltiadis Lytras, Athens University of Economics and Business, Greece
Community Action/interaction Management System (A Course/Group Management System that Fosters Community) 1831
Brian Mackie, Norbert Ziemer, Northern Illinois University, USA
A Perception of Next Generation E-Learning in Australia. 1835
Anthony Kadi, VENKATESH MAHADEVAN, Robin Braun, University of Technology, Sydney, Australia
Talk and Chalk Digital 1839
carmem maia, university anhembi morumbi, Brazil
E-Learning for Distance Learners — Does it work? 1843
John Mak, The Open University of Hong Kong, China
The use of Internet in a PBL course at ITESM 1847
Maria Magdalena Maldonado Avalos, Maria Magdalena Maldonado Avalos, ITESM, Mexico
A Distributed E-Learning Tool Based on Learning Objects 1851
Mauro Marinilli, Università di Roma Tre, Italy
Theoretical Framework: Towards a Grid for the Pedagogical Analysis of online courses 1855
Chomienne Martine, Cégep@distance, Canada
Supporting Elearning in Engineering Education 1859
Constantino Martins, Isabel Azevedo, ISEP-Instituto Superior de Engenharia do Porto, Portugal; Lígia Maria Ribeiro, FEUP - Faculdade de Engenharia da Universidade do Porto, Portugal; Carlos Vaz de Carvalho, ISEP-Instituto Superior de Engenharia do Porto, Portugal
Teaching Argumentation in Secondary School Through Computer Based and Face-to-face Debate 1862
Miika Marttunen, University of Jyväskylä, Finland
LLC Lecture Capture and Editing Tool for Online Course Delivery 1866
Masood Masoodian, Mark Apperley, Bill Rogers, University of Waikato, New Zealand
Supporting Online Meetings between Research Students and Supervisors 1870
Saturnino Luz, University of Dublin, Ireland; Masood Masoodian, University of Waikato, New Zealand
On-Demand Learning:Infrastructure Design and Managment 1874
Enid McCauley, Open Learning Agency, Canada
Technological Collaborations: Pairing Pre-service Teachers and Mentors 1876
Lillian McEnery, University of Houston- Clear Lake, USA
The Canadian Design Website: An Evaluation of Process and Product 1880
Laura April McEwen, Concordia University, Canada
Personality as a theoretical construct for the development of effective school leaders 1884
Michael McFrazier, Pamela Freeman, Prairie View A & M University, USA

Distance learning supports: The intentionality of pre-assessment surveys 1887
Patricia McGee, The University of Texas at San Antonio, USA
The Calibrated Course: Considering the Limits of Standards and Standardization 1891
Sylvia McLaurin, Georgia Center for Continuing Education, USA
Mobile what? The educational potential of mobile technologies. 1895
Thomas McManus, Saginaw Valley State University, USA
The Simulation Game: Discussing the educational potential of online multiplayer games. 1899
Thomas McManus, Saginaw Valley State University, USA
The Psychological Dimensions of Communities of Practice and their Relation to Online Learning 1903
Donald McMurray, Southern Cross University, Australia
WebQuests: Instructional and Design Techniques 1907
Donna McNierney, Youngstown State University, USA
Sustaining Instructional Design Strategies to Enhance e-Learning Among Learners 1911
Mustafa Md. Hanafiah, Open University Malaysia, Malaysia; Abtar Kaur, Open UNiversity Malaysia, Malaysia
A New Paradigm For OnLine Science Laboratory Learning Environments 1915
Gerald Meisner, LAAPhysics, USA
The Use of Course Mentoring Websites for Collaborative Curriculum Design and to Support Adjunct Faculty Teaching For Lesley University 1918
Dr. Linda Mensing Triplett, Lesley University, USA
Learning Cubes: A Model for Online Education 1921
William Messier, University of Macau, Macau
Public Relations Writing Moves From the Classroom On-Line: An Experience Report 1925
Alton Miller, Columbia College Chicago, USA
"Virtualizing": A Brazilian Initiative for Upgrading Media Knowledge of K-12 Public School Teachers 1929
Nilson Modro, LED UFSC, Brazil
Technological Applications in a Graduate Special Education Program 1933
Maribeth Montgomery Kasik, Governors State University, USA
CardioResearch: Supporting Knowledge Management in an Academic Cardiology Environment. 1936
Mariella Montoni, Catarina Rocha, COPPE Sistemas - Federal University of Rio de Janeiro, Brazil; Kathia Oliveira, Catholic University of Brasília, Brazil; Álvaro Rabelo Jr., Beatriz Salvador, Fundação Bahiana de Cardiologia (FBC), Brazil; Marcus Vinicius Souza, Ana Regina Rocha, COPPE Sistemas - Federal University of Rio de Janeiro, Brazil; Lisia Rabelo, Fundação Bahiana de Cardiologia (FBC), Brazil
Developing a 'WICeD' Team 1940
Peter Moodie, WICeD - The University of Waikato, New Zealand
Increasing Teacher Certification through a Multicampus(Blackboard) Praxis Network 1944
William Moore, Southern University, USA
Developing and Integrating Resources in a Virtual Learning Environment 1948
Raul Morales Salcedo, Tokushima University, Japan
The use of Virtual Learning Environments in UK Higher Education - Are VLEs supporting student-centred learning? 1952
Sue Moron-Garcia, Open University, UK
E-Learning & the Global Interface 1956
Michael R. (Mike) Mosher, Saginaw Valley State University, USA
Collaboration as a Response To Individualism in Distance Learning 1957
Robert Muffoletto, Appalachian State University, USA
E-Learning: "Self Service" Does Not Equal "Self-Directed" 1961
Felicity Mulgan, Content Alive Inc., Canada
Analysis of Students• f Eye Movement in Relation to Contents of Multimedia Lecture.........1965
Masayuki MURAKAMI, Kyoto University of Foreign Studies, Japan; Koh KAKUSHO, KyotoUniversity, Japan; Michihiko MINOH, Kyoto University, Japan
ON-LINE STUDENT SUPPORT SERVICES (OSSS) - A Pre-Testing Opinion Survey of Distance Learners on OSSS 1969
Kantayapalem Murali Manohar, Kakatiya University, India

Internet-based Distance Learning in Slovakia 1973
Julius Bajcsy, Slovak Technical University, Slovakia (Slovak Republic); Klara Nahrstedt, University of Illinois at Urbana-Champaign, USA
Putting the E to work in E-teaching 1977
J C Nash, University of Ottawa, Canada
Faculty Institute: A Model For Online Success 1981
Susan Nealy, Northwestern State University of Louisiana, USA; Kathy Autrey, Darlene Williams, Northwestern State University, USA
The issues faced by traditional classroom teaching staff when converting courses from face to face to online. 1984
Jenny Newby-Fraser, Waikato Institute of Technology, New Zealand
Single-click Interactive Java Programming Tutorials on the Web 1988
jan newmarch, monash university, Australia
Building a Hybrid Learning Community 1992
Thanh Nguyen, Bridgewater State College, USA
Technology Leadership Academy: Inter-Institutional Collaboration for Technology Infusion in Teacher Preparation 1994
Coral Noonan, Technology Leadership Academy, USA; Paul Resta, The University of Texas, USA
Online Learning 'Assumes' Online Delivery Skills 1997
John O'Donoghue, National ICT Research Centre for Education, Training and Employment, UK
A model for an open, flexible website to aid classes at university: the student interface 2001
Lia Oliveira, University of Minho, Portugal
What are faculty's thoughts on asynchronous teaching? A case study of one community college in Upstate, New York. 2005
Carol Oliver, The Graduate Center - CUNY, New York, USA
Doctorate at a Distance (D@D): In Search of Serendipity 2009
Nadine Ozkan, Jacqueline Bourdeau, France Henri, Tele-University, Canada
A Model LAN to Mimic the Networking Environment in Hong Kong Primary and Secondary Schools for Teaching and Learning 2013
Ka-man Pang, Simon So, Hong Kong Institute of Education, Hong Kong
Adaptation Architecture for Adaptive Educational Hypermedia Systems 2017
Jose M Parente de Oliveira, Computer Science Division, Technological Institute of Aeronautics, Brazil
Every Word A Click: The Hypertext Being Smart 2021
Young Park, Teachers College, Columbia University, USA
Generic simulator model for training and learning in virtual laboratory environments 2023
Pierric Permezel, ENSEITH, France
A District in Transition: Information and Decision-Making in a California Community College 2027
Lisa Petrides, Sara McClelland, Columbia University, Teachers College, USA
CORE Solutions: A Trifecta for Education 2031
Mem Stahley, Jennifer Platt, University of Central Florida, USA
Online Learning Forum: An RPInteractive Professional Development Model 2035
Linda Polhemus, The Center for Initiatives in Pre-College Education, USA; Karen Swan, University at Albany, USA; Michael Danchak, Rensselaer Polytechnic Institute, USA; Lester Rubenfeld, Center for Initiatives in Pre-College Education, USA
Student Roles in Online Learning Communities: Navigating Threaded Discussions 2039
Linda Polhemus, Karen Swan, University at Albany, USA
Community and constructivism: implicit pedagogical models in virtual learning 2043
Richard Pountney, Liz Aspden, Sheffield Hallam University, UK
An Efficiency Improvement Scheme For Content-Based Image Retrieval Systems 2047
Seinosuke Narita, School of Science and Engineering, Waseda University, Japan; Wichian Premchaiswadi, Faculty of Information Technology, King Mongkut's Institute of Technology Ladkrabang, Thailand; Nucharee Premchaiswadi, Faculty of Information Technology, Dhurakitpundit university, Thailand; Sutasinee Chimlek, Faculty of Information Technology, King Mongkut's Institute of Technology Ladkrabang, Thailand; Wichai Premchaiswadi, Faculty of Engineering, Khon Kaen University, Thailand

Selecting a Course Management System 2051
Robert Price, Texas Tech University, USA
Building Worldwide Mentoring Tools: Content Analysis of Visited Web Page and Matching 2055
Jared Luxenberg, Curtiss Priest, Center for Information, Technology & Society, USA
Using Animated Pedagogical Agents to Teach Entomology 2059
Haiyu Qi, University of Maryland, USA; Juan E. Gilbert, J. Wayne Brewer, Auburn University, USA
Open Goal-Based Scenarios: An Architecture for Hybrid Learning Environments 2063
Lin Qiu, Christopher Riesbeck, Northwestern University, USA
Making your Online Learning Environment a Success - Clemson University's Approach 2067
Carla Rathbone, Clemson University, USA
The magic of making e-learning work in Africa 2070
Jena Raubenheimer, eDegree, South Africa
Life on the Bleeding Edge: How Emerging Technologies Can Help New Teachers 2074
Pamela Redmond, University of San Francisco, USA; David Georgi, California State University, Bakersfield, USA
Diversify, diversify, diversify ! Why Gender Mainstreaming in educational media does not mean one size fits all. 2076
Bernd Remmele, Bernhard Nett, Frank Roehr, Britta Schinzel, Benjamin Stingl, Tanja Walloschke, Institute for Computer Science and Social Studies, University of Freiburg, Germany
Faculty Rewards and Incentives for E-Learning 2080
Judi Repman, Randy Carlson, Elizabeth Downs, Georgia Southern University, USA
Empowerment Through Equitable Access: Middle School Students Developing Strategic Skills 2084
Thomas Reynolds, Peter Serdyukov, National University, USA
A Multi-Disciplinary Framework for the Design and Evaluation of Computer Supported Learning-Environments 2086
Christoph Richter, Heidrun Allert, Learning Lab Lower Saxony, Germany
INCLUSIVE WORKFORCE DEVELOPMENT IN AN E-LEARNING WORLD 2090
Robert Robert, Western Michigan University, USA
A Multi Dimensional Project to Assess Student Information Competence Skills 2094
Gordon Smith, Ilene Rockman, The California State University, USA
Virtual Community of Teachers in Switzerland – Are Teachers Ready to Share Online? 2098
Andreas Röllinghoff, University of Applied Science - HTA-BE, Switzerland
The Concord E-Learning Model 2104
Raymond Rose, Concord Consortium, USA
A Framework for Analyzing Online Learning in Post-secondary Education 2107
Leona Rousseau, Lethbridge College, Canada
Asynchronous learning environment for language, communication and culture study 2111
Irina Rozina, Institute Of Management, Business and Law, Russian Federation
Home Workstation Ergonomics for the Online Learner 2115
Carolyn Rude-Parkins, University of Louisville, USA
Educational Technology in the Classroom: Emphasizing Process Before Training 2119
Linda Runyon, George Semich, Robert Morris University, USA
A custom fit 2122
John Ruttner, John Ruttner, CSUSB, USA
The Internet in Education: Two Different Examples 2125
Nicoletta Sala, University of Italian Switzerland, Switzerland
MISTRAL: an intelligent platform for distance education incorporating teaching strategies which adapt to students' learning styles 2129
Pedro Salcedo, Universidad de Concepción, Chile
Integration of Cognitive Theories into the Instructional Design of Educational Technologies 2133
Danielle Salomone, Teachers College, Columbia Universtiy, USA
Evaluation of a Website with Learning Objects for Cell Biology 2137
Christian Floto, Thomas Huk, Technische Universität Braunschweig, Germany; Uwe Sander, IWF Wissen und Medien gGmbH, Germany

Workplace Environments Are Evolving: Is Adult E-Learning Keeping Pace? **2140**
Michael Scheuermann, Drexel University, USA
E-Commerce Privacy and Security: Degree of Awareness Among College Students **2142**
Maria Canabal, Klaus Schmidt, Illinois State University, USA
A Dose of Reality in the Classroom **2146**
Diane Schuch-Miller, Marie Lee, Greenfield Coalition, USA
Color Coding Reduces Medical Error: e-Learning and the Blended Approach **2150**
Terry Seelinger, MHA, Duke Univ. Health System, Corp. Info. Services, USA; Karen Frush, MD, Medical Director Children's Services, Duke University Medical Center, USA
Reusable Learning Objects: Critique & Future Directions **2154**
Steven Shaw, Concordia University, Canada; Sarah Sniderman, Silverspaces Co., Canada
The Design of Interactive Applets for Mathematics Education **2158**
David Sher, Mat/Sta/CMP dept., Nassau Community College, USA
An Evaluative Study of a Distance Education Degree Program Using Focus Groups **2161**
Ching-Chun Shih, Dan Dobill, Ann Thompson, Iowa State University, USA
First Encounters: Using Educational Multimedia as a Learning Tool In the Traditional Classroom **2165**
Ann Shortridge, George Sabo, University of Arkansas, Fayetteville, USA
Enhancing Instructional Development Processes for E-Learning **2171**
Deborah Jones, RMIT University, Australia; Rod Sims, Deakin University, Australia
Disaster Medicine Online: An Internet Based Modular Curriculum For Health Care Professionals **2175**
Bryan Singleton, University of Alberta, Division of Emergency Medicine and City of Edmonton Emergency Response Department, Canada
Interactive Graphic Organizers **2178**
Thilla Sivakumaran, William Wishart, University of Tennessee, USA
Teaching Creativity in Computer Science to the Playstation Generation **2180**
Stephen Skelton, UNITEC, New Zealand
Forming Community with Technology: The Degree Program Planner **2184**
Deborah Smith, Empire State College, USA
Web-based support for "Teaching for Learning" **2187**
Denise Chalmers, University of Queensland, Australia; Ronald Smith, Paul Lam, City University of Hong Kong, Hong Kong
The Links Project: A USDE Initiative **2191**
Nancy Gotcher, Sharla Snider, Texas Woman's University, USA
Could We Smell the Cooking over the Internet? An Interactive E-Learning Solution for Home Economics Using Synchronized Multimedia **2195**
Theresa Lai, Simon So, Hong Kong Institute of Education, Hong Kong
LessonML: A Markup Language to Facilitate the Exchange and Presentation of Lesson Plans **2199**
Simon So, Hong Kong Institute of Education, Hong Kong
Designing Attractive Virtual Spaces for E-Learning **2203**
Yuki Sogabe, Asahi University, Japan
Web based Training on Radiographic Testing **2207**
Suwanna Sombunsukho, King Mongkut's University, Thailand
Multimode Virtual Consulting (MVC) Environment as an Alternative to Faculty Office Hours: A Work-in-Progress Report **2210**
Peter Soreanu, ORT Braude Academic Engineering College, Israel
LABORARY: A Library of Lab Set-ups **2214**
Laurent VAN HAVERBEKE, RUCA-University of Antwerp, Belgium; Hugo Bohets, Tor-Björn Johansson, Herbert Peremans, UFSIA-University of Antwerp, Belgium; Karel SOUDAN, UFSIA - University of Antwerp, Belgium
EduBITE: Educating Business and Information Technologies **2218**
Claudia Steinberger, University Klagenfurt, Austria; Judit Bajnai, University Vienna, Austria; Wolfgang Ortner, FH Joanneum, Austria; Michael Schuh, FH Wiener Neustadt, Austria; Manfred Vogt, FH Vorarlberg, Austria

A user-oriented information system for Teleservice in trouble shooting of mobile construction machines 2222
Klaus Henning, Arne Simon, Achim Streit, Department of Computer Science in Mechanical Engineering, Germany

Automatic Videoing a Normal Classroom for a Distant Lecture with a Recording Function of a Blackboard 2226
Akira Suganuma, Shuichiro Nishigori, Kyushu University, Japan

Linux and the Rise of Open Source Software: the Indian Perspective 2230
Yogesh Suman, NISTADS, India

Exploring Tools and Methods for Work-Integrated Learning 2234
Lars Svensson, Ulrika Snis, Kerstin Grunden, Tomas Lindroth, Stefan Nilsson, Pia Stahl-Falck, Christian Östlund, Laboratorium for Interaction Technology, HTU, Sweden; Carsten Sorensen, Laboratorium for Interaction Technology, HTU and LSE, UK

Facilitating on iTV: A Call for Broadcast Communication Style & Voice Management 2238
Sharifah NurAnthasha Syed Ahmad, Multimedia University, Malaysia

The Use of Style Guides in the Development of Online Documentation and Computer-Based Training: A Survey 2242
Michael Szabo, University of Alberta, Canada

Teaching in An e-Classroom: How To Be An Effective Teacher to E-Learners 2246
Fataneh Taghaboni-Dutta, Betty Velthouse, University of Michigan - Flint, USA

Web-based Supplementary Material to Complement Classroom Teaching - A Case Study 2250
Toshitaka Tamura, Waseda University, Japan

Bridging Theory and Practice Through IT: The case of On-Line Trading in Corporate Finance 2254
Ivy Tan, Centre for Instructional Technology, Singapore; Dr Yew Kee Ho, National University of Singapore, School of Business, Singapore

The selection and implementation of computer mediated communication software for virtual peer collaboration. Lessons learnt. 2258
Sharin Bin Mohamad Sani, Melvyn Song, Ivy Tan, National University of Singapore, Singapore

Effects of Collaborative and e-Learning on Skill Acquisition and Retention for Computer-based Cognitive Tasks 2261
Kuo-Hao Tang, Feng Chia University, Taiwan

Using the Knowledge Modeling Approach to Assess Effectiveness of Electronic Learning 2265
Stephen Gilbert Taylor, Champlain Regional College, Canada

Standard Assesment Components for e-Learning Materials 2268
Dimitar Tenev, Technical University, Department of Computer Science, Bulgaria; Vasil Vasilev, Technical University, Department of Electronics, Bulgaria; Tania Vassileva, Technical University, Bulgaria; Vassiliy Tchoumatchenko, Technical; University, Department of Electronics, Bulgaria

Key Steps for Developing E-learning Events - interactive courseware development 2272
Tenku Norishah Tenku Shariman, Multimedia University, Malaysia

Towards a total learning environment for the distanced adult learner 2276
sarah teo, ICUS Pte Ltd, Singapore

CD-ROM Enabled Web Sites 2280
Thane Terrill, Teachers College, Columbia University, USA

Extending Distance Learning Courses with CD-ROM Media 2282
Thane Terrill, Teachers College, Columbia University, USA

The University of London eUniversity project: collaboration and cultural change in a complex institution 2285
Cate Thomas, University of London External Programme, UK

Smart E-Classrooms, Traditional Classrooms and Critical Thinking 2288
Jennifer Thomas, Pace University, USA

Using Web-Based Software in Teacher Education Courses 2292
Kelli Thomas, University of Kansas, USA; Thomas Matthew, Central Missouri State University, USA; David Hofmeister, Indiana State University, USA

Introducing Blended Learning to the South West of England 2296
Dafydd Thorne, Exeter College, UK

The Potential of Virtual Reality to Improve Education on Psychosis 2299
Jennifer Tichon, The University of Queensland, Australia
E-Learning that Adapts to the Learner 2303
Jutta Treviranus, RCAT, University of Toronto, Canada
Using Electronic Portfolios in Teacher Performance Assessment 2307
Burcu Tunca, George Washington University, USA
New Roles for Teachers and Learners in Higher Education 2309
JoAnn Ullery, South Dakota State University, USA
The Poor Man's Eyetracker Tool of ActiveMath 2313
Carsten Ullrich, Erica Melis, German Research Center for Artifical Intelligence, Germany
Health Sciences Students' Perceptions of Online Problem-Based Learning 2317
Ruta Valaitis, Wendy Sword, McMaster University, Canada; Bob Jones, Sheridan College, Canada; Andrea Hodges, Hamilton Social and Public Health Services, Canada
How To Debit Their Scores? An ICT Solution To Assess Accountancy Students 2321
Dirk Vanderbist, Jan Vanthienen, Katholieke Universiteit Leuven, Belgium
An Infrastructure of Possibilities: Distance Learning at the University of the Sacred Heart 2325
Antonio Vantaggiato, University of the Sacred Heart, USA
A Generic Platform for Presenting Learning Material: Praktix Presentation Viewer. 2329
Jan Vanthienen, Dirk Vanderbist, Katholieke Universiteit Leuven, Belgium
The use of open and distance education in facilitating changes in managerial development: the Mexico experience 2333
José G Vargas-Hernández, Centro Universitario del Sur, Universidad de Guadalajara, Mexico
Integration of Hardware Experiments in e-Learning Systems 2337
Vasil Vasilev, Technical University, Bulgaria; Ivan Furnadziev, Technical University, Department of Electronics, Bulgaria
Utilizing WebCT to Monitor Pre-Service Teachers' Professional Development 2341
Paul Vellom, University of Western Michigan, USA; John Mascazine, Ohio Dominican University, USA
Aggregation and Reduction:Two design approaches for reusable instructional materials 2345
Ranga Venkatachary, KnowledgeWindow Asia Pacific Pte Ltd, Singapore; J. Anton Ravindran, Genovate Solutions Pte Ltd, Singapore
Online Virtual Tutorials: Increasing Access To Peer To Peer Tutoring 2349
Ray Walshe, Department of Computing,Dublin City University, Ireland
Student Perceptions Toward Using Instant Messenger to Facilitate eLearning Online Interaction in Conventional Versus Virtual Graduate Classrooms 2353
Lih-Ching Chen Wang, Cleveland State University, USA
Electronic Cognitive Apprenticeships: Building Students' Understanding of ID 2356
Ling Wang, Hua Bai, SungHee Park, Purdue University, USA
Impact of Vicarious Learning Experiences and Goal Setting on Preservice Teachers' Self-Efficacy for Technology Integration 2360
Ling Wang, Purdue University, USA
Gender, Discourse Style, and Equal Participation in Online Learning 2364
Minjuan Wang, Christina Sierra, San Diego State University, USA
Virtual Projects in Distributed Learning Environments 2368
J. Michael Spector, Xuemei Wang, Syracuse University, USA
New Global Initiatives in ELearning from MIT 2372
Janet Wasserstein, MIT Center for Advanced Educational Services, USA
A Development of Multi-lingual Web-Based E-Mail Client Developed by JavaServet Technologies 2376
Kenzi Watanabe, Saga University, Japan
A Knowledge Handling Model in Educational Activity 2380
Toyohide Watanabe, Nagoya University, Japan
Missouri/Taiwan High Tech-High Touch Excursion 2384
John Wedman, Laura Diggs, University of Missouri, USA
A Mobile Augmented Reality Environment for Collaborative Learning and Training 2386
Reiner Wichert, Computer Graphics Center (ZGDV), Germany

The Effect of Hypertext Structure on Recall 2390
Kay Wijekumar, Brooks Canavesi, The Pennsylvania State University Beaver, USA
Information Technology's Role in Biochemical Systematics 2393
James D. Willett, George Mason University, USA; David D. Keefe, SRI International, USA
Web-Assisted Projects: Collaborative Learning in an Electronic Environment 2397
Vicki Williams, Barry Williams, Penn State, USA
Adult Learners, Juvenile Behaviors: Constructive and disruptive ad hoc communities in higher education distance education. An analysis of synchronous and asynchronous settings 2400
Dee Anna Willis, Northwestern State University, USA
Cheating an Online Test: Methods and Reduction Strategies 2404
Joe Winslow, Coastal Carolina University, USA
Harborough Community Learning Network - a Model for Community E-Learning 2408
David Wortley, Mass Mitec, UK
Web-based Learning from the Student's Perspective 2410
Linda Wright-Smith, Cameron University, USA
Teaching Resources for Fetal Echocardiography 2414
Piotr Wroblewski, Wroblewski Consulting, USA; Krzysztof Wroblewski, University of Pennsylvania, USA; Zhi Yun Tian, Children's Hospital of Philadelphia, USA
Implementing SCORM real issues and resolutions 2418
Vincent Wu, Cerner Corporation, USA
A Trust Model for Distributed E-Learning Service Control 2419
Yuefei Xu, Larry Korba, National Research Council of Canada, Canada
Evaluation and Implementation of a Networked Multiple-Choice Question-Posing and Peer Assessment Learning System 2427
Fu-Yun Yu, National Cheng-Kung University, Taiwan
Impacts of the Anonymity Feature of Networked Synchronized Competition on Motivation and Interpersonal Relationships 2431
Fu-Yun Yu, National Cheng-Kung University, Taiwan; Yu-Hsin Liu, National Chi-Nan University, Taiwan; Chialing Han, National Cheng-Kung University, Taiwan; Tak-Wai Chan, National Central University, Taiwan
Developing Adaptive Hypermedia using an Extended Hierarchical Mixtures of Experts Approach 2435
JeongSu Yu, Dept. of Computer Education, Jeonju National university of Education, Korea (South)
Multimedia Application In Higher Education: Political Science 2439
YING YU, YU SISTERS MULTIMEDIA STUDIO, Canada; LUC DUHAMEL, UNIVERSITÉ DE MONTRÉAL, Canada
Handheld Computing in Education 2442
Steve Yuen, The University of Southern Mississippi, USA; Patrivan Yuen, William Carey College, USA
Museum Satellites: Web Spaces for Learning 2445
Laura Zadoff, Danielle Kaplan, Stacey Hagreen, Teachers College, USA
Non-Linear Web Based (Nlwb) For Teaching 3d Computer Modelling 2448
Mohd Izani Zainal Abidin, Multimedia University, Malaysia; Aishah A.Razak, FCM, Malaysia
The Interactivity Issues in Using Blackboard 2452
Chenfeng Zhang, University of Massachusetts Boston, USA
Axes to classify learning Content Units 2454
Annett Zobel, Matthias Hupfer, Bauhaus-University Weimar, CogVis/ MMC, Germany
Evaluation of a Homegrown LCMS : All Work and No Play? 2457
Nanette Zorn, Terry Taylor, DePaul University Library, USA
A Web-Accessible Lab Equipment for Training Courses on Chip Design 2461
Peter Roessler, Vienna University of Technology, Austria

INTERACTIVE SESSIONS

Technologies to Support Communities of Practice: Web Crossing for CpSquare Communities of Practice Workshop 2465
Bronwyn Stuckey, Queensland University of Technology, Australia; John D. Smith, Learning Alliance, USA

Technologies to Support Communities of Practice: A Community Information and Knowledge Exchange Tool to Support Organizational Readiness in the Public Sector 2468
Thomas McKegney, Public Sector Communities of Practice Platform, Canada
Technologies to Support Communities of Practice: Dgroups 2471
Shady Kanfi, Bellanet, Canada
Technologies to Support Communities of Practice: US Army: CompanyCommand.com AND PlatoonLeader.org 2473
Maj. Peter Kilner, United States Military Academy West Point, USA
Technologies to Support Communities of Practice: Network Analysis with I-know 2474
Noshir Contractor, Andy Swarbrick, University of Illinois, USA
Online Media Juke-Box 2475
Luca Botturi, USI-ICeF, Switzerland
Professional Development + Instruction + Minerals = A DVD that Rocks! 2477
Renee M. Eggers, Salvatore A. Sanders, Donna J. McNierney, Raymond E. Beiersdorfer, Youngstown State University, USA
Developing Online Courses using Robohelp 2480
Daniel Farkas, Pace U niversity, USA; Narayan Murthy, Pace University, USA
Designing Web-based Collaborative Tools for Teachers 2481
Yitna Firdyiwek, University of Virginia, USA
Developing and Authoring Multimedia Presentations using Trivantis 2482
Ted Fowler, Ted Fowler, University of Cincinnati, USA
The Challenge of Turning Professional Development into Professional Practice 2484
Sharon Friesen, Pat Clifford, Galileo Educational Network, Canada
SNOW Project: A Web-based resource for educators of learners with special needs 2487
Craig Hegins, Adaptive Technology Resource Centre, Canada
Motivate Learners to Change 2489
Peter Hess, CHANGE Partners, Inc., USA
Best Practices in Blended eLearning 2491
Gregory Dunkling, The University of Vermont, USA; Jennifer Hofmann, InSync Training Synergy, USA
Online Professional Development in Educational Technology: Star-Online 2494
Patty LeBlanc, Stetson University, USA; Angelique Nasah, Bethune Cookman College, USA
Teaching the Rule of Thirds for Photography Interactively through Flash 2497
Susan Lister, Higher Colleges of Technology, Canada
Convergent Media in a Standards Based Mathematics Program for Middle School 2500
Peggy Meathenia, Lufkin Independent School District, USA; Deborah Jolly, Texas A&M University, USA
Community Capacity Building with an E-Learning Strategy 2502
Alan Norman, Connect New Brunswick, Canada
E-learning in Spanish: a language and culture course and a placement test 2505
Jessica Payeras, Evelyne Diabaté, Université du Québec à Montréal, Canada
Exploring Science Education Using Handheld Computers and Data Collection Tools 2508
Raymond Rose, Concord Consortium, USA
Information Brokering for the Adaptive Learning Environment 2510
Marcus Specht, Marcus Specht, Fraunhofer FIT, Germany
Social Justice: A Portal for Educators 2513
Sharon Tettegah, University of Illinois, Urbana Champaign, USA
Higher Education's Challenge for Academic Excellence in the 21st Century: Can Old Profs Be Taught New Tricks? 2514
Renee Wallace, Florida A&M University, USA

VIDEO FESTIVAL

A demonstration of exemplary pedagogies designed for low-budget producers and low-tech learners 2518
Lisa Holstrom, University of Cincinnati, USA
Virtual Field Experiences for Pre-Service Teachers 2520
Patty LeBlanc, Elizabeth Heins, Stetson University, USA

An Online Digital Video Library to Use as a Knowledge Base for Teacher Education 2522
Paul Skiera, Deborah Stirling, Chris Lamont, Arizona State University, USA
Creating a computerized multimedia Chinese language lesson from authentic web text, using the KEY 4.0 software (for both PC and Mac) 2524
Sheri Zhang, University of Ottawa, Canada

POSTER/DEMONSTRATION PAPERS

Promoting Web-Enhanced and Web-Based Courses by Focusing on Technology Integration in Higher Education 2527
Jason Abbitt, John Davis, Michael Odell, University of Idaho, USA
Using Discovery-Based Online Learning in the Teaching of Computing 2529
Ken Abernethy, Furman University, USA
Cost Effective Real-Time Video Conferencing for Instructionand Collaborative Learning in Music and the Performing Arts Via Next Generation Internet powered virtual laboratory environment 2531
Sterlin Adams, Florida A&M University, USA
Is the Integration of CALL into Language Curriculum affected by the environments surrounding it? 2533
Ibrahim Ahmed, Intenational.I.University-Malaysia, Malaysia
Information Technology And Medical Students At Sultan Qaboos University 2535
Adekunle Akinyemi, SULTAN QABOOS UNIVERSITY, Oman
Faculty Adoption of Technology: The End User as the Determinant 2537
ahmed ali, St cloud state university, USA
A Pilot Methodology for Teaching the Course "Introduction to the Information Society" at the University of Cyprus 2539
Panagiotes Anastasiades, Panagiotes Anastasiades, University of Cyprus, Cyprus
Assessment of understanding: a case study 2542
Vytautas Reklaitis, Graduate Scool of Information Systems, the University of Electro-Communications, Tokyo, Japan; Kazys Baniulis, Kaunas University of Technology, Lithuania
Online Writing as a Form of Electronic Communication in a Second Year Biology Course 2544
Michael Barbour, Michael Collins, Memorial University of Newfoundland, Canada
Does web-enhanced instruction increase student satisfaction with curriculum? 2546
Sherry Batson, Connie Ruiz, Amy Pemberton-Shows, Department of Family & Consumer Sciences, USA; Paula Nichols, Education Technology Center for Distance Learning & Professional Development, USA
From Campus to Cyberspace: The Transistion of Classroom Faculty to Distance Education 2548
Michael Beaudoin, University of New England, USA
Collaborating to ensure online offerings and on campus courses have content agreement 2549
Timothy Blum, University of Wyoming Lab School Albany County Public Schools, USA; Dr. Barbara Chatton, Dr. D.J. Yocom, University of Wyoming, USA
Evaluation of the VR-project in Helsingborg, Sweden 2551
Lennart Bolin, Förvaltning för Gymnasie- och Vuxenutbildning, Sweden
Designing and redesigning the WebCT part of the undergraduate course "Teaching and Learning with Music Technology 2553
Marie-Michele Boulet, Faculté de musique - Université Laval, Canada
Implementation of java applet solution for e-learning in physics 2555
Said Boutiche, Bechar University, Algeria
Switching Sides of the Desk: Two Instructional Designers Discuss Their Teaching Experiences 2557
Barbara Brazon, Penn State Hazleton Campus, USA; Mary Lynn Brannon, Penn State Worthinton Scranton Campus, USA
A Real-Life Paradigm Example of Designing and Delivering a Successful Hands-on Online Learning Experience for Members of a University Task Force on Technology-Assisted Education 2559
Anne-Marie Brinsmead, University of Toronto, Canada

The Impact of an E-Learning Environment on Students' Self and Peer Assessment 2561
Herman Callaert, Transnationale Universiteit Limburg, Belgium
Revitalizing Native American Cultures through Virtual Museum Projects 2563
Mark Christal, Paul Resta, Loriene Roy, University of Texas at Austin, USA; Marty Kreipe de Montaño, Smithsonian National Museum of the American Indian, USA
Light Bridge: Employing Internet2 in Support of Preservice Teacher Education 2565
Brett Christie, Sonoma State University, USA
Assessing The Processes of Online Teaching and Learning: A True Measure of Assessment 2567
Patricia Comeaux, University of North Carolina-Wilmington, USA
eLMS: KMI Inc.'s hosted eLearning solution 2569
Joel Copeland, KMi Inc., USA
Delivering video-streamed library orientation on the Web: technology for the educational setting 2571
Karmen Crowther, Alan Wallace, University of Tennessee Libraries, USA
Does Personality Type Effect Online versus In Class Course Satisfaction? 2572
Richard Daughenbaugh, University of South Alabama, USA
E-Learning for choral music ensembles: Evaluation of a contextual approach for enabling pre-service teachers to design and implement online learning experiences for choirs 2573
James Daugherty, University of Kansas, USA
HAMTUTOR: Author tool to develop adaptive multimedia courses 2575
Carlos de Castro, Carlos de Castro, Universidad de Cordoba, Spain
The activating learning experience supported by ICT 2577
Toby De Loght, Peter Van Petegem, UA (University of Antwerp), Belgium
Web-learning: aspects of a new paradigm. 2579
Orlando de Pietro, Francesco Appratto, University of Calabria, Italy
An On-line Undergraduate Medical Genetics Laboratory 2581
Theresa Logan-Phelan, Centre For Learning Technology Trinity College Dublin, Ireland; Miguel DeArce, Dept. Genetics Trinity College Dublin, Ireland; Ruaidhri Power, Computer Science Dept. Trinity College Dublin, Ireland
Thesis and Dissertation Propagation Utilizing PDF and the WWW: A Versatile Tool for Research and Higher Education 2583
Phillip Diol, The Ohio State University, USA
Building Bridges: An experiment in Informal Education and Technology 2585
Jorge Domingos, LNCC, Brazil
Java-based telecollaborative environment 2587
Abdulmotaleb El Saddik, University of Ottawa, Canada
Accessibility Challenge to U.S. Government's Information Technology Initiatives 2589
Ugur Yeliz Eseryel, Syracuse University, USA
Making the World a Softer Place: The Development of a Health Education Website Using Netscape Composer 2591
Joan Fleitas, Fairfield University School of Nursing, USA
Interactive Simulation of Patients – An advanced tool for student activating learning in medicine 2593
Uno Fors, Rolf Bergin, Karolinska Institutet, Sweden
Learning materials for German as a foreign language, with an emphasis on integrating with classroom contents 2595
Shinichi Fujita, Waseda University, Japan
The intellectual indicating of the question in WBT 2597
Makio Fukuda, Osaka Internationa University, Japan
E-Learning Challenge: Digital Literacy and creativity 2599
Marilene Garcia, Inter-Activa Educational Projects, Brazil
Webstorming: Brainstorming in the Web 2601
Susane Garrido, UNISINOS, Brazil
From turnstiles to cyberspace: Perceptions of librarians in an era of transformation 2603
Ariel Gil, St. Thomas University, USA

Next Generation Courseware: Custom Learning Environments Integrating Research and Collaboration 2605

Glenn Golden, et. al., Media Union/ School of Information, USA

Online supplemental instruction and assessment of OOP (object-oriented programming) concepts 2607

Kenton Graviss, Kenton Graviss, Indiana University Southeast, USA

Developing Reusable Learning Design Resources 2609

Barry Harper, University of Wollongong, Australia; Ron Oliver, Edith Cowan University, Australia; John Hedberg, Sandra Wills, Shirley Agostinho, University of Wollongong, Australia

Development of Chinese language multimedia teaching material with a partial perception system utilizing 3D virtual space 2611

Hiroaki Hashiguchi, Waseda University, Japan

Building a Community of Learners and Encouraging Discussions in a Purely On-Line Course That is Quantitative in Nature 2613

Jay Holmen, University of Wisconsin—Eau Claire, USA

The Effect of Speech and Pointing Conditions on the Comprehension and Recall Performance in a Multimedia Presentation 2615

Cholyeun Hongpaisanwiwat, Department of Computer Science, Thammasat University, Thailand; Michael Lewis, School of Information Sciences, University of Pittsburgh, USA

Ocean View and River Run: New Internet Tools For Facilitating Scientific Inquiry 2617

Richard Huber, University of North Carolina Wilmington, USA

A Visual Tool to Support Personal Management of Information on WWW 2618

Akiko Inaba, Takanori Yamamoto, ISIR, Osaka University, Japan

The formation of experts in the handling of the TIC. The case of the Mexican librarians 2620

Maribeth Johnson, Instituto Mexicano de la Administración del Conocimiento A.C., Mexico

Successful Strategies: Collaborative Learning for Blended Courses 2622

Claudine Keenan, The Graduate Center of Marlboro College, USA

Developing a Virtual Master of Engineering at UTS: A case study 2623

Tom Anderson, Homa Koosha, Jafar Madadnia, University of Technology, Sydney (UTS), Australia

Developing of Assessment Techniques in Learner-Focused Online Subjects 2625

Jafar Madadnia, Homa Koosha, University of Technology, Sydney (UTS), Australia

Educators Experiences And Lessons In E-Learning 2627

Hasan Akpolat, Homa Koosha, Tom Anderson, Jafar Madadnia, University of Technology, Sydney (UTS), Australia

Data driven inquiry practices 2629

Ravinder Koul, Penn State University-Great Valley, USA

Professional Development for Mentoring Interns and Teaching English Language Learning Students in the Mainstream Classrooms through the Use of a Website 2630

Nathalie Lahire, The George Washington University, USA

Automatic Problem Generation for the Pilot Training 2632

Soldatova Larisa, Vladivostok State University of Economy and Service, Russian Federation

Adaptive Virtual Learning Environments And Mediated Learning Experience 2634

Raija Latva-Karjanmaa, University of Helsinki, Finland

Alternative Communication Methods in Online Settings: A Study of Demands and Effects 2637

Matthew Leavitt, Michael Spector, Peter Gray, Noorazah Reduan, Radha Ganesan, Syracuse University, USA

Using Multi-Media Technology to Teach Foundational Courses in Western Civilization 2639

David Leinweber, Oxford College of Emory University, USA

A WYSIWYG editor for a web writing course 2641

Ting-Wen Liang, Wenzao Ursuline Collage of Languages, Taiwan

Networked portfolio system and students' learning effect 2643

Eric Zhi-Feng Liu, Ming Hsin University of Science and Technology, Taiwan

To propose an algorithm for team forming: Simulated annealing K team-forming algorithm for heterogeneous grouping 2645

Eric Zhi-Feng Liu, Ming Hsin University of Science and Technology, Taiwan

Designing digital data-gathering techniques in a busy hospital environment 2647
Chris Livermore, The University of Melbourne, Australia
Students Perception on Skills Needed for Successful On-Line Collaborative Projects 2649
Dina Loebl, Ziva Levy, Tel Aviv University, Israel
Learning To Protect The Natural Voice - The Dublin University Voice Care Programme 2650
Theresa Logan-Phelan, Trinity College Dublin, Ireland; Pauline Sloane, Trinity College, Ireland
Depressed? Go online! (or: how to get counseling via the internet) 2652
George Lotter, Potchefstroom University for Christian Higher Education, South Africa
EduKBr Portal: an Environment Concerned with Quality of Information in the Brazilian World-Wide Web 2654
Marisa Lucena, KBr Project - Padre Leonel Franca Foundation - PUC-Rio, Brazil
Applying qualitative research in e-learning. Discussion and findings from three case studies. Setting the base for a knowledge management oriented metadata schema 2656
Miltiadis Lytras, Athens University of Economics and Business, Greece
E-Learn is about business: A business model for the digital economy 2658
Miltiadis Lytras, Athens University of Economics and Business, Greece
CAMS - Community/Course Management System 2660
Brian Mackie, Northern Illinois University, USA
Parallel Computing Performance Monitoring Tool for a Cluster of Computers 2661
Mahshid Madani, Ruth Shaw, Janet Light, University of New Brunswick, Saint John, Canada
An Introduction to the Text-To-Speech XML-Driven e-Lecture Delivery System 2663
Wai Keong Mak, Ngee Ann Polytechnic, Singapore
The Assesment in an online Learning Model of Marketing in a University 2665
Maria Magdalena Maldonado Avalos, ITESM -CEM, Mexico
The WWW, ADDIE, and the ADL Guidelines 2667
Patricia McGee, The University of Texas at San Antonio, USA; Leah Wickersham, Texas A&M University at Commerce, USA
E-Learning: Courseware Development Among University Students 2669
Sharihan Md Khalid, Sharihan Md Khalid, Universiti Malaysia Sabah, Labuan International Campus, Malaysia
Shaping The Delivery of Middle School Mathematics through Production of Original Video 2671
Peggy Meathenia, Lufkin Independent School District, USA; Deborah Jolly, Texas A&M University, USA
The Development of a Web-based Teaching System for Traffic Engineering Education 2673
Luis Geraldo Meloni, Leonimer Melo, UNICAMP, Brazil
Regents Online Degree Programs 2675
Robbie Melton, Tennessee Board of Regents, USA
The Use of Relational Blocks Demonstrated 2677
Anne Daugherty, Linda Merillat, Washburn University, USA
Creating Virtual Experiments within a Web Adventure 2679
Leslie Miller, Rice University, USA
Distance Education as a Discursive Practice: Voice, Discourse and Pedagogy 2683
Ananda Mitra, Wake Forest University, USA; Amelia Hall, Department of Communication, USA
Creating a Distributed Learning Network: Forging Partnerships, Forging Ahead 2685
James Monaghan, California State University, San Bernardino, USA
CNCplus telelearning - A cooperative distant learning approach integrating University and Production with IT-technologies 2687
Klaus Mueller, Robert Bosch, Software Engineering, Germany; Klaus Henning, Achim Streit, Department of Computer Science in Mechanical Engineering, Germany
Considering Tehnology Use in Education: A Pre-service Education Course Model 2689
Sharon Murray, Sharon Murray, St Thomas University, Canada
The simulation program and chat in the e-Learning course in physics (mechanics) 2690
Yasushi Nakajima, Advanced Research Institute For Science And Engineering, Japan
A Multimedia Storyboard Tool 2692
Helmut NIEGEMANN, Technische Universitaet Ilmenau, Institute for Media and Communication Studies, Germany
Emerging Perspectives on Teaching, Learning and Technology: An E-Book 2694
Michael Orey, University of Georgia, USA

Building a Model of Collaborative Learning Environment 2696
Thereza Padilha, CEULP-ULBRA, Brazil
Management Of The Educational Process 2698
Pedro Paraiso, UCP-Centro Regional das Beiras, Portugal; Paulo Ribeiro, UCP- Centro Regional das Beiras, Portugal; Ciro Martins, Werner Schneider, UCP-Centro Regional das Beiras, Portugal
Designing for a moving target 2700
Beverly Pasian, Bodec Corp., Canada; Sandi Barber, Northern Alberta Institute of Technology, Canada; Kathy Siedlaczek, Seneca College, Canada
eInstruction: A Gateway to Effective eLearn 2702
Kalpeshkumar Pathak, Secondary Teachers Training College, India
Blended WBI: A Meteorology Mixture 2703
David Pedersen, Embry Riddle Aeronautical University, USA
Empowering Learners Through Digital Education In Urban Environments: Using Internet-Based Teacher Education Portals 2705
Joyce Pittman, The University of Cincinnati, USA
Region-based Image Retrieval System using Color Spatial Relationship 2707
Seinosuke Narita, School of Science and Engineering, Waseda University, Japan; Nucharee Premchaiswadi, Faculty of Information Technology, Dhurakijpundit University, Thailand; Wichian Premchaiswadi, Surangkana Rawongyot, Faculty of Information Technology, King Mongkut's Institute of Technology Ladkrabang, Thailand; Wichai Premchaiswadi, Faculty of Engineering, Khon Kaen University, Thailand; Worapot Keesuradet, Faculty of Information Technology, King Mongkut's Institute of Technology Ladkrabang, Thailand
Text-to-Speech in Learning Thai Language for Foreigners 2709
Seinosuke Narita, School of Science and Engineering, Waseda University, Japan; Wichian Premchaiswadi, Faculty of Information Technology, King Mongkut's Institute of Technology Ladkrabang, Thailand; Nucharee Premchaiswadi, Faculty of Information Technology, Dhurakijpundit university, Thailand; Wanida Chawangwongsanugul, Prachuab Vanitchatchavan, Faculty of Information Technology, King Mongkut's Institute of Technology Ladkrabang, Thailand; Wichai Premchaiswadi, Faculty of Engineering, Khon Kaen University, Thailand
CyberTutor, a Socratic Web-based Homework Tutor 2711
David Kokorowski, David Pritchard, Elsa-Sofia Morote, MIT, USA
Technology Driven Course Redesign in the Humanities 2713
Craig Rademacher, Jim Wohlpart, Florida Gulf Coast University, USA
Using WebQuest in project-based learning 2715
Jorge Joel Reyes-Méndez, Universidad Autónoma Metropolitana campus Xochimilco, Mexico
Issues in the development of online teacher education 2717
George Gadanidis, Sharon Rich, University of Western Ontario, Canada
Creating an Effective Training Model: One Size Does Not Fit All 2719
Chris Roberts, Wright State University, USA
Using Knowledge Levels with AHA! for Discovering Interesting Relationship 2721
Cristobal Romero, Carlos de Castro, Sebastian Ventura, Universidad de Cordoba, Spain; Paul De Bra, Eindhoven University of Technology, Netherlands
Essential Elements: Prepare, Design, and Teach Your Online Course 2723
Raymond Rose, Alese Smith, Concord Consortium, USA
Online Education for Adults: An Andragogic Approach 2725
Mark Ryan, National Univertsity, USA; Peter Serdyukov, National University, USA
Corporate Education - A new vision of training and development. 2727
Juarez Sagebin Correa, Carlos Eduardo Sabrito, Brasil Telecom, Brazil
Student Performance Analysis Using Bivariate Correlation For Higher Academic Success In Electronics Engineering Program 2729
Guven Sagdic, Dokuz Eylul University, Turkey
The Use of The Internet in High School and University 2731
Nicoletta Sala, University of Italian Switzerland, Switzerland
Using CMC to Build Middle School Communities Among Peers with Mild/Moderate Disabilities 2733
Hannah Sellers, Eastern CT State University, USA

Technology, Teachers, and PT3 2734
John Sfondilias, University of Illinois, USA
Using Speech to Enhance a Math Education Applet 2735
David Sher, Nassau Community College, USA
Development of Computer-Based Instructional System on Introductory Statistics 2737
Minsuk Shim, University of Rhode Island, USA; Sunguk Shim, South Kingstown High School, USA
A Blended Learning Approach To Faculty Development: Using The Or-Cat Model For The I3 Training Series 2739
Bernadette Sibuma, Teachers College, Columbia University, USA
MathThread: Mathematics formulas and diagrams in Distance Learning threaded discussions 2741
Glenn Smith, David Ferguson, State University of New York at Stony Brook, USA
Automated Study Questions for Medical Students Using the Web 2743
Ross Smith, Virginia Black, NYU School of Medicine, USA
The Links Project: Development, Implementation, And Institutionalization 2745
Nancy Gotcher, Sharla Snider, Texas Woman's University, USA
Competencies for Classroom and Online Teaching: Development and Validation 2747
Roderick Sims, Deakin University, Australia; Michael Spector, Syracuse University, USA; James Klein, Arizona State University, USA; Dennis Fields, St. Cloud State University, USA; Barbara Grabowski, Penn State University, USA
The Konstanz Internet Solar Cell Experiment 2749
Martin Stachel, Univerity of Konstanz, Germany
Redefining Web Design Education: An Interdisciplinary Convergence to Optimally Prepare Web Authors and Designer 2751
R. Brian Stone, The Ohio State University, USA
E-Learning and International Education: Fulfilling the Promise of the Virtual Classroom 2753
Florence Sullivan, Teachers College, Columbia University, USA
EVA_pm: Towards Project-Based e-Learning 2755
Paraskevi Synteta, Daniel Schneider, TECFA, FAPSE, University of Geneva, Switzerland, Switzerland
The Memphis Educational Computer Connectivity Alliance (MECCA) Young Scholars Program (MYS): Using e-learning tools to export best practices of high school summer enrichment programs to other institutions 2757
Larry Tague, Arthur Geller, University of Tennessee Health Science Center, USA; Ann Lambros, Wake Forest University School of Medicine, USA
Algorithm to Evaluate Educational Effectiveness of Teacher's Advice in Multi-Media Assisted Education System with Individual Advance 2759
Tsuneo Kuwabara, Kouichi Yamada, Toshinao Kokubun, Motonori Tamaki, Nippon Telegraph and Telephone Corporation, Japan
Teaching for Social Justice: A Portal for Educators 2761
Sharon Tettegah, University of Illinois, Urbana Champaign, USA
Facilitating Critical Reflection and Discourse in Online Master's Degree Programs 2762
Deanna Nisbet, Evie Tindall, Regent University, USA
Integrating Virtual and Face-to-Face Education in Computer Programming Learning: an experience using high technology classroom 2764
Alberto Araujo Lopes, faculdade Sumare, Brazil; Romero Tori, USP / Faculdade Sumare, Brazil
Virtual Spaces of Cooperative Experimentation: Virtual Laboratory of Kinematics 2766
Gonzalo Alberto Torres Samperio, Gustavo Nuñez Esquer, Universidad Autónoma del Estado de Hidalgo, Mexico
Higher education in an era of a digital competition: Gist and boundaries 2768
kiran Trivedi, Shantilal Shah Engineering College, India
Applications of Reusable Learning Objects and Atoms in e-Learning 2770
Vladimir Uskov, Bradley University (USA), USA
National Science Foundation Project on e-Learning in Information Technology 2772
Vladimir Uskov, Bradley University (USA), USA
Engaging Students in Web-Based Self-Development 2774
Diane Wagoner, Indiana University of Pennsylvania, USA; Kay Wijekumar, The Pennsylvania State University Beaver, USA

A Blended Learning Approach to Business in Manufacturing 2776
Michael Wood, Walsh College, USA; Marie Lee, Greenfield Coalition, USA
Seeing is Believing! Can Students Learn Culture using Distance Education? 2778
Ching-Mei Hsiao, The University of South Daktoa, USA; Fei Yang, The University of South Dakota, USA
International Issues in Using Web Technologies in Higher Education 2780
Bibi Eshrat Zamani, Isfahan University, Iran (Islamic Republic Of)
An interactive multimedia tool for learning Chinese: the KEY 4.0 software for PC and Macintosh 2781
Sheri Zhang, University of Ottawa, Canada
Mathematics Education Markup Language 2783
Yi Zhou, Yi Zhou, Kent State University, USA
Happenings: A Foray into e-Learning 2785
Judith Zorfass, Education Development Center, Inc. (EDC), USA
The personalized Courseware Authoring Tool 2787
YANHUA CAO, National Laboratory of Machine Perception and Center for Information Science, China

OTHER PAPERS

Meeting Students Expectations and Realizing Pedagogical Goals within the Development of a Virtual Learning Environment 2790
Christine Frank, Stephan Kassanke & Leena Suhl, University of Paderborn, Germany
Visiting heritage landscapes: creating and using an E-media fieldtrip as an educational resource 2796
D. Craig Whitehead, Lesley A. Gardner & Simon J. Holdaway, University of Auckland, New Zealand

BEST COPY AVAILABLE

Invited Papers

"Be All That You Can Be"--Again
South Carolina Troops-to-Teachers Coalition Alternative Route to Teacher Certification ("T^3 ARC")

Nancy Cassity Dunlap
Associate Director, School of Education
Clemson University
USA
Ndunlap@clemson.edu

Abstract: The South Carolina T^3 Coalition has designed this alternative to provide requisite training and credentialing for retiring military personnel to become teachers in the schools most in need. Incorporating a unique blend of on-line instruction and hands-on practical experiences, the program is accessible around the clock and around the world. Participants may begin training within two years of retirement, and, through special Proviso by the state legislature, they will be classified as resident students at the four partner universities. The curriculum, grounded in a documentable knowledge base, reflects what a new, second-career professional needs to know and be able to do to become a successful teacher. Featuring a robust curriculum, a powerful e-learning delivery mode, a strong research/evaluation component, a year-long paid internship, and two years of follow-up with skilled mentor teachers, this program has the capacity for ameliorating the teacher shortage in South Carolina and elsewhere.

"What teachers know and can do is the most important influence on what students learn," *What Matters Most*, a report of the National Commission on Teaching and America's Future, 1996.

Introduction

Master Sergeant Virginia Dukes grew up in Newark, the only child of a single parent living in the inner city. The Army offered her an escape from her bleak surroundings and promises of opportunity, which she took. She completed her education, had an illustrious career in training and data management, and is retiring, but at 39, she is a vital, energetic, bright, and motivated woman who feels that teaching might be a viable option for her. She also wants to locate in the Sunbelt, and has chosen to live in South Carolina.

Lt. Col. Raoul Hernandez and Maj. Donna Hansen met while both were stationed at the Beaufort Air Station. They married, raised a family, and after successful careers in the Marine Corps (she in public information, he a Provost Marshal), have decided to return to the Beaufort area. She has her degree in Journalism from the University of Montana; he received his JD degree from George Washington University. They have a desire to give back to the community, and are considering teaching as a second career.

Commander Mercer Jamison was born and raised in Pocataligo, SC, a small crossroads in the South Carolina Lowcountry. A young African-American with few local prospects, he couldn't wait to get away, and when a Navy recruiter offered him a chance to see the world and complete his education, he jumped at the chance. Now, 25 years later, with a bachelor's degree in engineering from Old Dominion University and 15 years as a nuclear engineer, he is preparing to retire and is anxious to return home, where he hopes to make a difference for rural youth. He wants to become a teacher.

The players in these three fictitious scenarios have several things in common: all have had successful careers as military commissioned or non-commissioned officers; all want to come to South Carolina; all want to teach; all are attempting to begin a new chapter of their lives; and all bring a abundance of talents and skills and a world view to an area and a career field that desperately needs them.

BEST COPY AVAILABLE

However, traditional programs would require up to two years to complete after the service member leaves active duty, and they would forego a paycheck during training. Also, if they were in traditional teacher-preparation programs, their maturity, experience, expertise, and training would not necessarily be valued. Or, as in some alternative-certification programs, they would be placed in the classroom with no preparation or supervision and left to their own devices to survive (or not) in the school setting.

To be successful, aspiring teachers need more than a textbook and a handshake. They need training--not a traditional undergraduate teacher-training program (although those options continue to be available), but one tailored specifically for them, to provide necessary knowledge and skills, to provide options for demonstration of proficiency, to avail them of what they need to be successful in this social structure called "school," while acknowledging the talents, experience, and expertise that they bring with them. The training also needs to be readily accessible, and it should enable military personnel to assume a teaching position immediately upon exiting their military careers, but with continued follow up, training, mentors, and supervision—all focused upon the new teachers' success.

The South Carolina Troops-to-Teachers (T^3) Coalition has developed a program using "blended learning" (e-learning and practical, hands-on field experiences) to enable these folks to realize their dreams while concurrently ameliorating the teacher-shortage needs in South Carolina--the needs for specific content areas, in grade levels, in small, rural, or inner-city schools, for minority representation, and for male teachers.

The South Carolina Troops-to-Teachers Coalition consists of four institutions, five agencies, and a corporate partner: Clemson University, the University of South Carolina, the Citadel, and South Carolina State University have come together with five agencies (the Governor's Office, the South Carolina Center for Teacher Recruitment, the Commission on Higher Education, the Employment Security Commission, and the State Department of Education) and IBM/Lotus to craft an initiative to enable commissioned and non-commissioned officers with college degrees to secure the requisite training and credentialing to become teachers.

The target group consists of members of the armed forces, commissioned or non-commissioned officers, who possess a bachelor's degree or higher.

The reasons to tap this talented pool are numerous:

1. The military began downsizing in 1994, sending well-qualified personnel into the civilian work force.
2. Military personnel often have strong content skills, particularly in math and science.
3. Commissioned and non-commissioned officers possess high levels of training and education; indeed, many have master's degrees.
4. The potential pool is great; while the military is not presently downsizing, many active-duty personnel are making plans for retirement–often wanting to return "home."
5. Within the ranks exists a high ethnic minority ratio; this will enable us to recruit, train, and place heretofore under-represented minorities.
6. Likewise, there is a high ratio of males; this cadre can provide more men for the classrooms.
7. Their military experience as trainers; provides them with a solid foundation for a teaching career; all commissioned and non-commissioned officers have served in various training capacities during their careers.
8. They have the added benefit of being trained in providing safe and secure environments; this is an added benefit for school safety and violence prevention.
9. In their military careers, they have gained organizational, interpersonal, technical, technology, and leadership skills.
10. They are great role models for kids--mature, drug-free, and physically fit.
11. Finally, they bring a wealth of personal and professional experiences and a world view heretofore missing in our schools.

Because of their high degree of training and education acquired during their military service, because the number of teachers who can be trained from this pool is potentially much greater than many sources, and because of the high ethnic minority and gender ratios which could significantly ameliorate under-representation of ethnic minorities and men in these critical-needs areas of education, this group would be a benefit to and a resource for South Carolina's schools and our young people.

Evolution of T^3 ARC

The T^3 ARC began in August 1999; the first year was dedicated to planning. With a small grant, the Coalition has undergone a rigorous process to design an alternative certification program to allow participants to complete their requisite course work while still on active duty using e-learning and blended-learning strategies.

The Coalition reviewed the existing literature on alternative certification, best practice, and research, to examine the programs of other states, teacher education programs, and other entities. While most states have developed or are developing routes for alternative licensure, none possesses the uniqueness of the proposed South Carolina model.

Based on the premise posited in *What Matters Most*, a report of the National Commission on Teaching and America's Future, *"What teachers know and can do is the most important influence on what students learn,"* the Coalition began by processing ten essential questions:

1. What do mature, new, second-career teachers need to know? Can we defend this through a scientifically documentable knowledge base?
2. What do mature, new, second-career teachers need to be able to do? Can we defend this through a scientifically documentable knowledge base?
3. What specific competencies do they need?
4. What specific competencies do they possess and can they demonstrate?
5. How do we identify these competencies?
6. How do we identify gaps?
7. Can we develop a training model based on this gap analysis?
8. What will it include?
9. How can we deliver it? Can we deliver via the Internet?
10. What resources (human, material, technological) do we need to do this?

Upon completion of this analysis, the Coalition then reviewed standards, best practice, knowledge bases, and research from the following agencies and organizations:

National Board for Professional Teaching Standards (NBPTS)
National Association for Accreditation of Teacher Education (NCATE)
Council of Chief State School Officers (CCSSO)
Interstate New Teacher Assessment and Support Consortium (INTASC)
Key Competencies (Australia)
Teachers College, Columbia University
National Commission on Teaching and America's Future (*What Matters Most*)
Renaissance Group
University of Arkansas Profile of a Beginning Teacher
American Association of State Colleges and Universities (AASCU)
Educational Testing Service (PRAXIS)
American Association of Colleges of Teacher Education (AACTE)
Holmes Partnership
National Network for Educational Renewal (NNER)
Carnegie Foundation for the Advancement of Teaching
South Carolina's Assisting, Developing, and Evaluating Professional Teaching (ADEPT)
Good Teaching Matters; a Report of The Education Trust
Conceptual Frameworks of the partner universities
American Council on Education

The Coalition also adopted the following "touchstones" to guide the process and to keep the group on-track and on-target:

> "Develop high-quality pathways to teaching for recent graduates, mid-career changers, paraprofessionals already in the classroom, and military and government retirees." –National Commission on Teaching & America's Future, *What Matters Most*, Recommendation 3
>
> "The fundamental differences between an alternative and traditional program are the target audience, the training design, and the length of training, not the program content, rigor, or expected outcomes." --AACTE, *Alternative Preparation for Licensure: Policy Statement*

BEST COPY AVAILABLE

"To do and perform all things necessary to encourage, uphold, and dignify the profession of teaching." --*Carnegie Foundation for the Advancement of Teaching and Learning*
The Coalition would return to these touchstones often.

The Curriculum

Upon examination of the standards and evidence, the Coalition developed two documents: (1) What teachers need to know and (2) what teachers need to be able to do. To achieve the necessary validation, these lists were widely circulated within and without South Carolina; teachers, teacher educators, parents, business people, community leaders, and the Military Assistance Council, the advisory group for the Coalition, had the opportunity for input. It was important that this be as comprehensive, as valid, and as reliable as possible.

The result is a rich, valid, robust curriculum, grounded in best practice and research, based upon what career-changing professionals need to know and be able to do to become successful teachers, (acknowledging that pedagogy for a 40-year-old professional should differ from that for a 20-year-old college sophomore AND recognizing the vast expertise and experience that military professionals bring to the profession) in nine discrete modules divided into three blocks, from the more general and theoretical to the more specific and concrete:

Block One
- ☐ Psychological Foundations of Adolescent Learning and Development
- ☐ Technology in the Classroom
- ☐ Cultural Distinctions and Diversity

Block Two
- ☐ Community Resources
- ☐ Application of Research
- ☐ Student Assessment and Evaluation

Block Three
- ☐ Methods and Strategies (content-specific in mathematics, sciences, and English/language arts)
- ☐ Classroom Organization and Management
- ☐ The Culture that is School

The Technology

The group then, upon returning to the "Ten Questions," determined that we could, indeed, take this list of what teachers need to know and, using a "gap analysis," could tailor an individualized, performance-based, open-entry program based upon the client's documented experiences and expertise, over the World-wide Web, using state-of-the-art technology and synchronous and asynchronous delivery of modules rather than traditional graduate-level courses.

From this point, we turned to the technology experts; upon reflection, it was determined that we needed a vehicle not only of getting the courses on-line, but also a means of managing variable credit, generating student transcripts, providing means of interactivity between faculty and participants, among other significant issues, and an in-depth review of technological potential yielded two likely candidates: IKON Technologies and IBM/Lotus. IBM/Lotus remains as a partner in crafting the technological methodology for on-line delivery and management of this complex project. (Due to corporate redirection, IKON is no longer a partner). The support and engagement of IBM/Lotus has been exemplary; not only is their LearningSpace a robust system, but their technical support has been exceptional.

The Academic Program

Military personnel may access the program during their last two years of active duty through the T^3 ARC Website (http://www.hehd.clemson.edu/TTT/). Since all of these folks will have bachelor's degrees (and many will come with master's degrees), content expertise is presumed; however, prior to admission into the program, the candidate must provide passing scores from the Praxis II subject-area examination to validate currency of content knowledge. The candidate's program will be determined based upon what experiences he/she can validate from the military. University faculty will provide the personalization.

The participant will have the modules available around the clock; the professors will maintain maximum availability. Options will be available, also, for real-time discussions, chat rooms, white boards, and the like.

Additionally, since teacher education cannot occur in a vacuum, field experiences and practical applications of skills are built into each module. The experiences are as varied as the curriculum, but are a requisite part of the training, hence the "blended-learning" methodology that complements e-learning.

Also, the Coalition has designed a schedule to allow the participant to work on as many as three modules in an eleven-week period. If deployed to a combat zone, however, the "clock stops," and he or she may resume the module at the point at which he/she left it. The academic schedule of courses is presently designed through 2008, and it takes into account holidays and other pertinent issues; the university Registrar has incorporated the [essentially quarter] schedule into its semester-based calendar, thus allowing for acceleration of participants through the program. All of the support mechanisms are in place.

Upon completion of the modules, the participant will be placed in a one-year internship, during which he/she will not only undergo induction, as does any first-year teacher, but he/she will have to demonstrate the knowledge gained through the modules–the "What teachers need to be able to do" list. Resources will be made available to provide for mentor teachers and other resources necessary to assure candidate success. Accompanying this internship is a year-long seminar (also carrying academic credit), bringing together participants from the four regions with university faculty, school district and school personnel, and other pertinent, relevant resources.

The Placements

The Coalition determined four criteria for placements as critical:

1. Districts "in greatest need of technical assistance;"
2. Geographic critical teaching needs, based on criteria and annual determination of the State Board of Education;
3. Top 12% in the State for high school dropouts;
4. Proximity to military installation; must be either inner-city or rural and must meet federal poverty guidelines for "high need LEAs"

Based upon recent information from the State Board of Education regarding geographic critical needs, the Coalition has identified 78 schools throughout the state that meet one or more of the above criteria; this will likely change as new data become available.

The Coalition has determined four areas of the state; each of the partner universities will have responsibility for monitoring the internship and two subsequent years of follow up. Subsequent monitoring and support for this three-year program will be provided in partnership among the Coalition, the LEA, and the partner university. Additionally, we will gather data on successful program completion, internship, and ultimate placement within the schools and districts most in need.

Project Uniqueness

The program is unique in many ways; following is a compendium of reasons:

Participants may begin within two years of separation from military service;

Participants may participate at their duty station, anywhere in the world;

Program uses state-of-the-art technology;

Participants are provided a waiver of out-of-state tuition (Section 5A.32 of the 2002 Budget Bill, SC General Assembly);

Participants partake of a robust curriculum designed to prepare them for the realities of the classroom;

Coordination among 4 universities and 5 agencies, school districts, and a corporate partner; over 90 people have been involved in the genesis of this project, including university faculty, corporate officers, technicians, university administrators, school district personnel, military representatives, and agency staff;

Field experiences and practical application of skills are incorporated into every course;
Curriculum developed by university faculty based on what teachers need to know and be able to do;
Graduate-credit modules via Internet delivery with synchronous and asynchronous options;
One-year paid internship with skilled mentor teacher; participants will not miss a paycheck;
Placement in districts with greatest need;
Strong research/evaluation component;
Focus on retiring military with bachelor's degree or higher;
Program availability year-round, with course rotation;
Flexibility:
  Participant may "stop the clock" and resume at a later date;
  Program will be available around the clock, seven days per week;
The result is a program that is research-based, facile to use and to navigate, easy to access, is valid, is reliable, and is grounded in reality and a scientifically documentable knowledge base.

Lessons Learned

Throughout the development and implementation activities, the Coalition learned many lessons as we blazed new trails through the *Terra Incognito* of e-learning and blended learning. One of the most compelling was to identify, analyze, and document our processes as we proceeded. Following is a listing of some of the processes and some samples within each; of course, different projects will render differing processes.

Table 1: PROCESS ANALYSIS

Conceptual processes
Idea, needs assessments, literature searches

Analytical processes
Data, resources, best practice, research

Academic processes
Curriculum development, committees, materials selection

Political processes
Funding, support, consensus, residency

Marketing processes
Advertising, web site, monitoring, print media

Documentation processes
Data collection/analysis, participation, support

Fiscal processes
Grants, finances, resources

Implementation processes
Hardware, software, enrollments, fees

Continuous Improvement processes
Growth plans, adjustments, evaluation, realignment

Suggestions from the Trenches

Determine needs--yours and "theirs," whoever "they" happen to be. Nurturing partnerships is critical to the success of any collaboration. In every case, the partners have institutional goals and needs to meet; likewise the representatives of the partnership may have personal and/or professional goals for his/her participation (research, publications, *et alia*). Partnerships like the Coalition require nurturing to maintain a high level of effectiveness.

Review the literature--research, best practice, state-of-the-art, et alia. Scholars begin their work with an in-depth review of what is happening in the field they are researching; they read, review, analyze, and reflect on the work that has been done and in the areas that they are studying. Likewise, with this project, we located, through traditional and non-traditional means, the scope of the body of work in the field. What we discovered was interesting; while there was an abundance of descriptive pieces ("what we did;" "how we did it"), for example, there were very few research studies looking at the long-range efficacy of alternative programs. This provided us with another unique niche; we will be gathering and analyzing data for a long-term study of our program compared to other non-traditional as well as traditional teacher-preparation programs. This exercise also established the uniqueness of our project. There was clearly nothing else like it.

Build and nurture coalitions. It is critical to bring the appropriate parties to the table early in the process so that they have ownership within their organizations. Coalitions do not happen by accident; they are carefully nurtured and evolved. Care must be exercised, however, to avoid the evolution of factions; one way to avoid this is to work toward achieving consensus rather than majority votes.

Determine and analyze data. "Prove it," the naysayers will demand; "show me the data," potential funders will insist. You must be able to determine what kinds of data to collect and what you plan to do with the data. For example, we will want to know how our T^3 ARC participants compare to other first-year and fifth-year teachers from other alternative programs, so we must determine whether to use standardized test scores--how many pass on the first attempt, for example--in keeping with our research and evaluation design.

Continually review and adjust. Sometimes, something just will not work; do not fret over it or mourn it; adjust and learn from it. There will be divergences; there always are for pioneers. Lewis and Clark knew where they were going, but they were continually surprised along the way. Likewise, program developers need to enjoy the sights along the trail as they blaze it, but they need to be able to retrack and change direction when they hit the big water.

Engage stakeholders in processes. Who are your stakeholders? Are they policy makers? Are they private business/industry leaders? The determination of where and when a project needs outside support may mean the difference between success and failure. Bring them to the table early and enlist their endorsement; letters of support are always helpful. And make sure that they receive periodic updates of progress.

Build capacity. The intent is to create synergy—to create an effect that no partner can achieve alone; therefore, the whole becomes greater than the sum of the individual parts. But the results can be thrilling!

Document! Document! Document! Enough said.

Finally, enjoy the adventure of discovery! According to Lester Thurow (1996), "With similar persistence [to Lewis and Clark] and willingness to attempt the unknown, let our journey begin!"

Finis

Military personnel represent a wealth of talent, experience, diversity, knowledge, expertise, skills, and world views; they are grounded in the content areas, and many have extensive training experience. What opportunities exist to install this leadership and talent in the inner-city and rural schools most in need! And our new cadre of teachers can "be all that they can be," yet again.

References:

Thurow, L. C. (1996). *The future of capitalism: How today's economic forces shape tomorrow's world.* New York: Wm. Morrow & Co.

Creating and Maintaining Data-Driven Course Web Sites

Jesse M. Heines
Department of Computer Science
University of Massachusetts Lowell
United States
heines@cs.uml.edu

Abstract: This paper deals with techniques for reducing the amount of work that needs to be redone each semester when one prepares an existing course Web site for a new class. The key concept is algorithmic generation of common page elements while still allowing full control over page content via WYSIWYG tools like Microsoft FrontPage and Macromedia Dreamweaver. The paper explores both client- and server-side techniques and discusses their advantages and disadvantages. The most advanced techniques are those that encode control information in XML rather than HTML or JavaScript and apply that information on the server side using XSL and JavaServer Pages. The paper also touches on course organization techniques that might involve students in the creation and maintenance of course Web sites, thereby fostering more student-centered learning.

Itsa Lotta Work!

Numerous student and faculty surveys have shown that parties on both sides of the podium consistently laud the instructional benefits of course Web sites. For example, when 62 students in a Web site-supported course were asked to react to the statement "I wish other professors maintained course Web sites like this one," 82.3% "strongly agreed" and another 16.1% "agreed" (Heines 2000). On the faculty side, 68.0% of the 25 respondents to a survey on course Web site development who did *not* have a course Web site (out of 150 total responses) indicated that they would like to have one (Grankovska & Heines 2002). Gehringer (2002) found that while only 7.6% of 250 survey respondents reported that their universities have a policy on making course materials publicly available on the Web, 85.2% at least posted their syllabi, 68.8% posted their assignments, and 53.2% posted their lecture notes.

There is also ample evidence that the amount of work it takes to post material on the Web is considerable. David Jordan (1997) estimated that "creating and maintaining the site roughly doubles the work involved in teaching the course." Even with the availability of commercial tools, 81.3% of the 150 professors who responded to the Grankovska and Heines survey (2002) cited time as the most "serious obstacle to making their course Web site everything they want it to be" or the most "significant part of the reason why they did not have a course Web site."

Even with commercial tools – general-purpose as well as those designed for instructional use – course Web site development is time-consuming at best and daunting at worst. But as difficult as *creating* a rich course Web site may be, *maintaining* it – keeping its content and links current and updating the site when the course is revised – is even more arduous. Even for those of us who are highly dedicated and have the best of intentions, the amount of work that seems to need to be redone each semester is so frustrating that we often give up and leave things the way they were. The focus of this research is therefore to explore techniques for reducing the amount of work needed not only to create course Web sites, but to maintain them as well.

Moving to Data-Driven Course Web Sites

There are two basic ways to build most computer applications. First, you can embed data within program code, a technique referred to as "hard-coding." On a Web site, this is analogous to creating pages in HTML, either directly using a text editor and entering HTML tags and attributes yourself, or indirectly using a

WYSIWYG editor like Microsoft FrontPage or Macromedia Dreamweaver that creates those tags and attributes for you. Pages can be built from templates to achieve consistency in their look and feel, but, for the most part, once a hard-coded page is created it remains independent of all other pages on the site.

The second approach is to separate content data from code logic and thereby make the application "data driven." On a Web site, this is analogous to creating pages where what is displayed is stored in some sort of data file, while how that content is displayed is controlled by some sort of scripting technique such as JavaScript on the client side or JavaServer Pages on the server side. Overall look-and-feel or deployment of a new feature across the entire site can then be modified or added by manipulating a small set of control files.

Data-driven techniques are used by virtually all commercial course Web site "engines" such as Blackboard (http://www.blackboard.com), WebCT (http://www.webct.com), and IntraLearn (http://www.intralearn. com). Such tools are excellent for courses that fit their models and instructors who are satisfied with their facilities, but it is typically difficult to break out of their paradigms to add new course models or interaction capabilities. While this restriction is frustrating to experienced Web developers, the data-driven characteristics of these engines use techniques that all serious developers embrace.

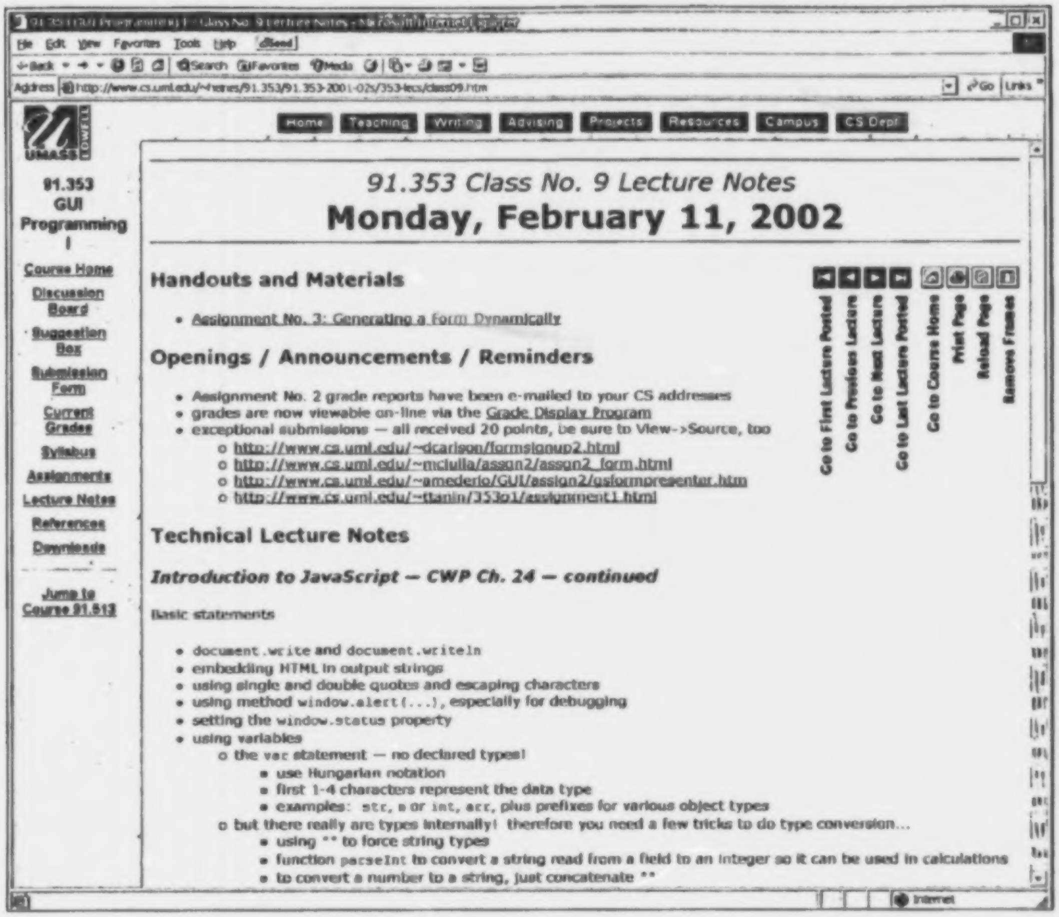
Consider, for example, the elements in the typical lecture notes posting for shown in Figure 1. Focusing solely on the notes themselves inside the navigation frames, you can see that there are numerous common elements here that will be formatted identically on all lecture notes pages: the course number, class number, and date in the header, as well as the eight control buttons to the right of the "Handouts and Materials" heading. From left to right, the four arrow buttons jump to the first, previous, next, and last posted lecture notes. Likewise, the four control buttons jump to the course home page, print and reload the current frame, and remove (or restore) the navigation frames. It is probably obvious that you wouldn't want to include the code needed for each of these elements on every lecture notes page. It is more subtle, however, to appreciate that the "previous" and "next" page is different for every page and therefore requires that link to be generated algorithmically rather than hard-coded. If you have the dates of each class stored in some sort of data structure, you can not only write code to format the header information consistently across all similar pages, but you can also automatically generate the links from one page to the next.

Using JavaScript on the Client Side

There are two basic choices for implementing data-driven course Web sites on the client side: Java applets and Dynamic HTML. The use of Java applets and similar plug-ins (like Macromedia Flash) involves a dramatic shift away from the basic programming paradigm based on HTML that is used in most WYSIWYG editors. This is not inherently bad, and many would argue that it's high time we retired HTML anyway. However, use of Java applets obviously requires knowledge of those languages and their facilities that is considerably beyond the scope of this paper.

Dynamic HTML, on the other hand, is easily integrated into standard Web pages in the form of JavaScript or VBScript. There is no need to throw away HTML that you've already generated. Instead, you can simply augment it by inserting scripting code into the same file. VBScript is a Microsoft product and is more closely integrated with Internet Explorer than JavaScript (or even Jscript, Microsoft's version of JavaScript), but I prefer to work in JavaScript because it is more universal. There are differences in the way JavaScript works on the major browsers, but those differences tend to be small and easy to rectify.

The common elements in Figure 1 pointed out in the previous paragraph are all implemented on my Web site using JavaScript. I use a couple of simple conventions to make the job easier, which help me organize the site as well as make it data driven. First, I name all related files sequentially, like class01.htm, class 02.htm, etc. Thus the file name indicates which class it is, and I can move content between files at will without affecting the links between them. (I do this all the time, because no class ever goes exactly as planned.) This simple convention makes it possible to determine the class number dynamically using the JavaScript code shown in Listing 1. When this code is included in an HTML page – or, as I implement it, in a common file that is included via a link in almost every HTML page on my site – it sets variables that can be used to generate the page header and to control navigation between related pages "on the fly." For example, the page shown in Figure 1 has a URL of http://www.cs.uml.edu/~heines/91.353/91.353-2001-02s/353-lecs/class09.htm. Executing the routine in Listing 1 from this page sets variable `intClassNo` to 9 and `strPrefix` to `"class"`.


91.353 GUI Programming I - Class No. 9 Lecture Notes - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites Media
Address http://www.cs.uml.edu/~heines/91.353/91.353-2001-02s/353lecs/class09.htm
Go Links
UMASS LOWELL
Home
Teaching
Writing
Advising
Projects
Resources
Campus
CS Dept
Go to First Lecture Posted
Go to Previous Lecture
Go to Next Lecture
Go to Last Lecture Posted
Go to Course Home
Print Page
Reload Page
Remove Frames
Internet

91.353 GUI Programming I

Course Home
Discussion Board
Suggestion Box
Submission Form
Current Grades
Syllabus
Assignments
Lecture Notes
References
Downloads

Jump to Course 91.513

91.353 Class No. 9 Lecture Notes

Monday, February 11, 2002

Handouts and Materials

- Assignment No. 3: Generating a Form Dynamically

Openings / Announcements / Reminders

- Assignment No. 2 grade reports have been e-mailed to your CS addresses
- grades are now viewable on-line via the Grade Display Program
- exceptional submissions — all received 20 points, be sure to View->Source, too
    - http://www.cs.uml.edu/~dcarlson/formsignup2.html
    - http://www.cs.uml.edu/~mciulla/assgn2/assgn2_form.html
    - http://www.cs.uml.edu/~amederio/GUI/assign2/gsformpresenter.htm
    - http://www.cs.uml.edu/~ttanin/353p1/assignment1.html

Technical Lecture Notes

Introduction to JavaScript — CWP Ch. 24 — continued

Basic statements

- `document.write` and `document.writeln`
- embedding HTML in output strings
- using single and double quotes and escaping characters
- using method `window.alert(...)`, especially for debugging
- setting the `window.status` property
- using variables
    - the `var` statement — no declared types!
        - use Hungarian notation
        - first 1-4 characters represent the data type
        - examples: `str`, `n` or `int`, `arr`, plus prefixes for various object types
    - but there really are types internally! therefore you need a few tricks to do type conversion...
        - using "" to force string types
        - function `parseInt` to convert a string read from a field to an integer so it can be used in calculations
        - to convert a number to a string, just concatenate ""

Figure 1: A typical Web posting of lecture notes with numerous common page elements.
The vertical button labels were added for clarity; they do not appear on the actual Web page.

Listing 1: JavaScript code to extract the 2-digit lecture number and its prefix from a file name.

```
// determine the file name from the current page's URL
var strURL = "" + document.location ;         // full URL of current page as a string
var intSlashPos = strURL.lastIndexOf( "/" ) ; // position of last forward slash in URL
var strFile =                                 // name of lecture notes file
        strURL.substr( intSlashPos+1, strURL.length ) ;

// extract the class number and its string prefix
var intDotPos = strFile.lastIndexOf( "." ) ;  // position of dot in filename.extension
var strClassNo =                              // 2-digit class number as a string
        strFile.substring( intDotPos-2, intDotPos ) ;
if ( strClassNo.substring( 0, 1 ) == "0" )    // remove leading 0 if it exists
  strClassNo = strClassNo.substring( 1, 2 ) ;
var intClassNo = parseInt( strClassNo ) ;     // class number as an integer
var strPrefix =                               // characters in file name that precede
        strFile.substring( 0, intDotPos-2 ) ; //    the class number
```

BEST COPY AVAILABLE

Next, I use a simple JavaScript array data structure to hold the dates of all classes. The second convention involves the format in which those dates are stored: YYYY-MM-DD, known as "ISO 8601" format because it is an official standard of the International Organization for Standardization. The advantage of ISO 8601 over the more common M/D/YY format used in the United States is not only that it is Y2K compliant, but, more important, that it allows dates to be sorted alphanumerically. Thus my array looks like this:

```
// class days for the Spring 2002 semester
var arrClassDate = new Array(
        "2003-01-23" ,  //  1
        "2003-01-30" ,  //  2
        "2003-02-06" ,  //  3
           . . . and so on . . .
        // "2003-05-01" ,  // 13
        // "2003-05-08" ,  // 14
        null ) ;
```

If the lecture notes for a certain date have not yet been posted, or if I simply don't want to make them available to students yet, I comment out the corresponding dates in the array as you see for May 1 and 8 above.

Given a series of lecture notes files that follow the naming convention discussed above and their corresponding dates in an array data structure, I use the built-in JavaScript Date object along with a few small routines of my own convert the ISO 8601 string to the "Weekday, Month Day, Year" format you saw in Figure 1. (All of these routines are available from the author on request.) In addition, I use the same data to dynamically create the links for the four arrow buttons. Part of the code accomplishes this is shown in Listing 2 to give you a feel for what's involved. Data-driven creation of these links insures that they will never be "broken," and that, for example, the "Next" and "Last" buttons are automatically disabled when students are viewing the last page in the sequence.

Listing 2: JavaScript code to generate the previous and next page buttons.

```
/** output links to first, previous, next, and last pages
 *  @param intClassNo an integer specifying the current page number
 */
function setPrevNextLinks( intClassNo )
{
  // last and next buttons
  if ( arrClassDate[intClassNo] != null )
  {   // enabled versions
    document.writeln(      // strImagesLoc is the relative path to the images directory
      '<a href="' + strPrefix +
      ( arrClassDate.length-1 < 10 ? '0' + (arrClassDate.length-1)
                                   : (arrClassDate.length-1) ) + '.htm">' +
      '<img src="' + strImagesLoc + '/blue_last.gif" alt="Go to Last Lecture Posted" '+
      'align="right" border="1" hspace="2" width="24" height="24" ' +
      'onMouseDown="this.src=\'' + strImagesLoc + '/blue_last_down.gif\'" ' +
      'onMouseOut="this.src=\'' + strImagesLoc + '/blue_last.gif\'"></a>' ) ;
    document.writeln(
      '<a href="' + strPrefix +
      ( intClassNo+1 < 10 ? '0' + (intClassNo+1) : (intClassNo+1) ) + '.htm">' +
      '<img src="' + strImagesLoc + '/blue_next.gif" alt="Go to Next Lecture" ' +
      'align="right" border="1" hspace="2" width="24" height="24" ' +
      'onMouseDown="this.src=\'' + strImagesLoc + '/blue_next_down.gif\'" ' +
      'onMouseOut="this.src=\'' + strImagesLoc + '/blue_next.gif\'"></a>' ) ;
  }
  else
  {   // disabled versions
    document.writeln(
      '<img src="' + strImagesLoc + '/blue_last_disabled.gif" ' +
      'align="right" border="1" hspace="2" width="24" height="24">' ) ;
    document.writeln(
      '<img src="' + strImagesLoc + '/blue_next_disabled.gif" ' +
      'align="right" border="1" hspace="2" width="24" height="24">' ) ;
  }
  . . . code for the first and previous buttons is analogous to what appears above . . .
}
```

BEST COPY AVAILABLE

Moving to XML

The use of JavaScript and its built-in structures work very well for simple data-driven routines that use Dynamic HTML. Development is straightforward, code size is small, testing is easy, and client-side execution is fast. When the data gets more complex, however, arrays and JavaScript's simplified class structure (some would call it a "pseudo class structure") are insufficient to encapsulate the relationships between various data elements and make them available throughout the Web site. A better alternative is to encode data in XML, the eXtensible Mark-up Language, and access it using one of the various techniques specifically developed to allow XML data to be used on Web pages.

For readers unfamiliar with XML, one can describe it in a nutshell as a data-encoding scheme in which HTML-like tags are used to label individual data items. Those items can then be arranged into a hierarchy that structures the entire data set and adds further meaning (semantic content) to its components. The simple, self-explanatory example shown in Listing 3 should suffice to give a feel for how data is encoded in XML. Given such data, it is not difficult to imagine using this information in a variety of displays, such as:

- a listing of all sessions sorted by the primary presenter's last name
- a listing grouped by the various application domains, technologies, or strategic-focuses
- an APA-formatted bibliographic reference or one in any other standard format

Listing 3: Sample XML file to show basic syntax and structure.

```
<?xml version="1.0" ?>
<conferences>
  <conference name="E-Learn 2002" location="Montreal, Canada" startdate="2002-10-15">
    <session number="1234">
      <title>Creating and Maintaining Data-Driven Course Web Sites</title>
      <presenter>
        <name>
          <first>Jesse</first>
          <middle>M</middle>
          <last>Heines</last>
        </name>
        <affiliation>University of Massachusetts Lowell</affiliation>
        <e-mail>heines@cs.uml.edu</e-mail>
      </presenter>
      <categorization>
        <application-domain>Higher Education</application-domain>
        <technology>Web Technologies</technology>
        <strategic-focus>Blended Learning</strategic-focus>
      </categorization>
    </session>
  </conference>
</conferences>
```

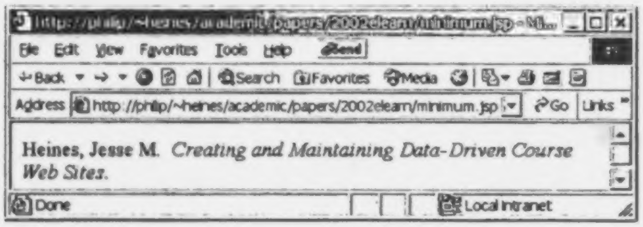
A full discussion of XML is, of course, beyond the scope of this paper, but many books are available that address its syntax, capabilities, and related technologies (of which there are many). My favorite remains Martin (2000), even though it is now two years old (ancient in this field!).

There are several ways to work with XML data, the easiest of which may be via client-side extensions to HTML provided by Microsoft in Internet Explorer 6.0 and available as a plug-in to Internet Exploror 5.5. This client-side technique is unique to Internet Explorer, however, and therefore is not truly usable in course Web sites that may be accessed via other browsers or even versions of Internet Explorer older than 5.5. Thus the preferred way to use XML is on the server side.

XML parsers come in various flavors, many of which are freely available (a list of reasonable size is available at http://www.w3.org/XML/#software, W3C 2002a). Most XML parsers can be seamlessly integrated with other server-side techniques, although the effort to do so can be substantial due to inadequate and sometimes even incorrect documentation. Parsers exist that work with CGI programs written in C++ or Perl, as well as Java programs implemented as JavaServer Pages or Java Servlets. Some parsers, such as *Xerces* from the Apache Software Foundation (2002), load entire XML documents into memory and allow them to be manipulated using a Document Object Model (DOM). Others, such as the *Simple Application Programmer Interface (API) for XML* (SAX), read XML data as a stream and process each data node in turn (Meggison 2002). I prefer to process XML data using XSL – the *XML Stylesheet Language* – which has a built-in parser and capabilities specifically designed to translate XML data into a variety of formats, including HTML (W3C 2002b, Heines 2003). Listing 4 shows an XSL file that generates the output shown in Figure 2 from the XML data in Listing 3.

Listing 4: XSL file to generate the output in Figure 2 from the XML data in Listing 3.

```
<?xml version="1.0" ?>
<xsl:stylesheet version="1.0" xmlns:xsl="http://www.w3.org/1999/XSL/Transform">

  <!-- processing begins here -->
  <xsl:template match="/">
    <html>
    <body>
      <xsl:apply-templates select="conferences/conference" />
    </body>
    </html>
  </xsl:template>

  <!-- this template is executed for each conference -->
  <xsl:template match="conference">
    <xsl:apply-templates select="session" />
  </xsl:template>

  <!-- this template is executed for each session -->
  <xsl:template match="session">
    <xsl:apply-templates select="presenter/name" mode="last-name-first"/>.&#160;
    <i><xsl:value-of select="title" /></i>.
  </xsl:template>

  <!-- this template generates a presenter name in last-name-first format -->
  <xsl:template match="name" mode="last-name-first">
    <xsl:value-of select="last" />, <null />
    <xsl:value-of select="first" />&#160;<null />
    <xsl:value-of select="middle" />
  </xsl:template>

</xsl:stylesheet>
```


http://philip/~heines/academic/papers/2002elearn/minimum.jsp - Mi...
File Edit View Favorites Tools Help Send
Back Search Favorites Media
Address http://philip/~heines/academic/papers/2002elearn/minimum.jsp Go Links
Done
Local intranet

Heines, Jesse M. *Creating and Maintaining Data-Driven Course Web Sites.*

Figure 2: Output generated by applying the XSL file in Listing 4 to the XML data in Listing 3.
minimum.jsp is a JavaServer Page that applies XSL to XML and is available from the author on request.

The advantage of using these techniques on the server side is that it is possible to know exactly what software is installed on the server and thus not have to deal with browser differences on the client side. XSL stylesheets (as well as programs that process XML using the DOM or SAX) use the XML data to generate straight HTML with is then "sent down the pipe" to the client. That HTML can be as simple or as sophisticated

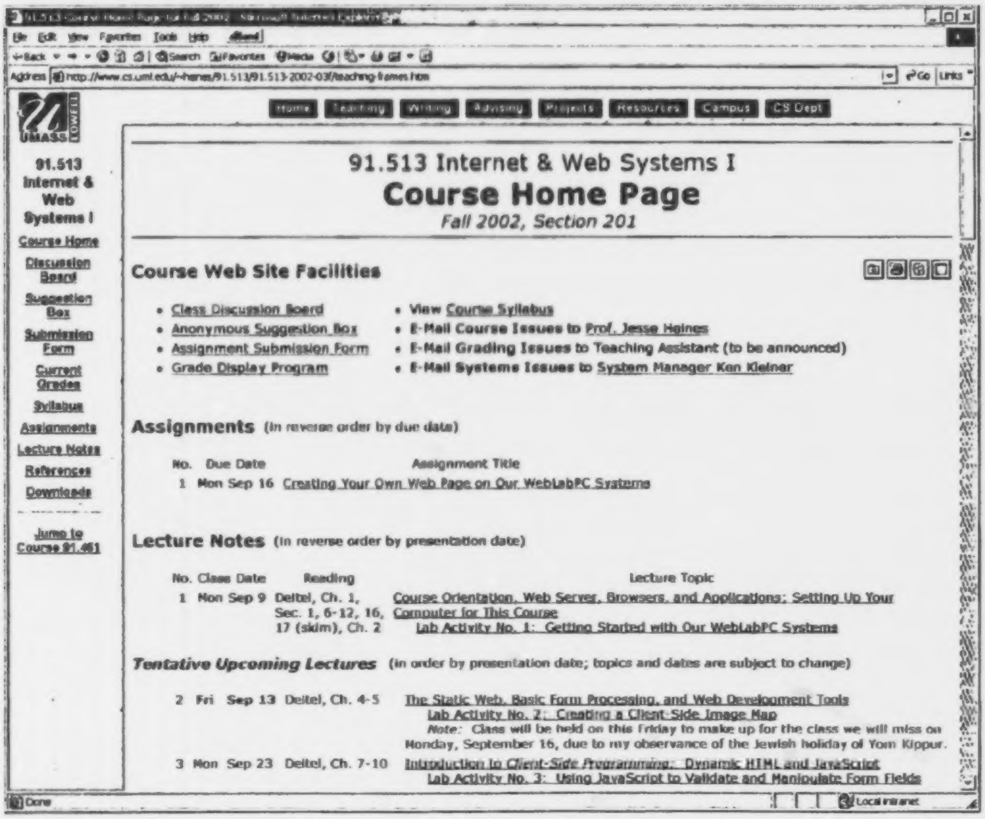
BEST COPY AVAILABLE

as you like, including embedded code that detects and compensates for the minor differences between browsers at the HTML level. Luckily, as of this writing those differences are small.

Note that all of these techniques require some degree of server-side programming support, something that is not always enabled on university servers. In the UMass Lowell Computer Science Department, for example, we do not allow server-side scripts of any sort on our main server that hosts student and faculty Web pages due to the high probability that such scripts will crash the server. As an alternative, we make space available to all students and faculty who request it on lower-capacity, non-production, CGI- and Java-enabled servers.

Using XML on the Server Side

To understand the contribution XML can make to data-driven course Web sites, consider the list of assignments and lecture notes on the course home page in Figure 3. Setting up and maintaining the assignments table with a standard WYSIWYG editor is not too bad, but doing likewise for the lecture notes table with the number and date of each class, the related reading, the lecture topics to be covered, complementary lab activity, and correct URL for each linked element is error-prone even with FrontPage or Dreamweaver. In addition, after you've gone to the trouble to encode the information in `<table>`, `<tr>`, and `<td>` tags, there is nothing else you can do with it. That is, you can't include it on the lecture notes pages themselves and you can't use it to control navigation between related pages as discussed at the beginning of this paper.


Address http://www.cs.uml.edu/~heines/91.513/91.513-2002-03f/teaching-frames.htm
Go
Links
Home
Teaching
Writing
Advising
Projects
Resources
Campus
CS Dept
UMASS LOWELL
91.513 Internet & Web Systems I
Course Home
Discussion Board
Suggestion Box
Submission Form
Current Grades
Syllabus
Assignments
Lecture Notes
References
Downloads
Jump to Course 91.461
Done
Local intranet

91.513 Internet & Web Systems I

Course Home Page

Fall 2002, Section 201

Course Web Site Facilities

- Class Discussion Board
- Anonymous Suggestion Box
- Assignment Submission Form
- Grade Display Program
- View Course Syllabus
- **E-Mail Course Issues** to Prof. Jesse Heines
- **E-Mail Grading Issues** to Teaching Assistant (to be announced)
- **E-Mail Systems Issues** to System Manager Ken Kleiner

Assignments (in reverse order by due date)

No.	Due Date	Assignment Title
1	Mon Sep 16	Creating Your Own Web Page on Our WebLabPC Systems

Lecture Notes (in reverse order by presentation date)

No.	Class Date	Reading	Lecture Topic
1	Mon Sep 9	Deitel, Ch. 1, Sec. 1, 6-12, 16, 17 (skim), Ch. 2	Course Orientation, Web Server, Browsers, and Applications; Setting Up Your Computer for This Course Lab Activity No. 1: Getting Started with Our WebLabPC Systems

Tentative Upcoming Lectures (in order by presentation date; topics and dates are subject to change)

2	Fri Sep 13	Deitel, Ch. 4-5	The Static Web, Basic Form Processing, and Web Development Tools Lab Activity No. 2: Creating a Client-Side Image Map *Note:* Class will be held on this Friday to make up for the class we will miss on Monday, September 16, due to my observance of the Jewish holiday of Yom Kippur.
3	Mon Sep 23	Deitel, Ch. 7-10	Introduction to Client-Side Programming: Dynamic HTML and JavaScript Lab Activity No. 3: Using JavaScript to Validate and Manipulate Form Fields

Figure 3. A typical course home page.

BEST COPY AVAILABLE

Storing the data in XML as shown in Listing 5, however, yields not only the ability to use the data elsewhere, but also the ability to manipulate it easily and use it in a variety of other ways. For example, instead of cutting and pasting table rows as each class moves from "upcoming" to current or passed – a tricky maneuver even in WYSIWYG editors – you simply delete the `status="upcoming"` attribute of the XML file's corresponding `class` element or changes its value to an empty string (`""`). Once the lecture notes and activity for a class are finalized, all you have to do is delete the `suppresslinks="true"` attribute or change its value to `"false"` and the appropriate links will be generated automatically. As before, automatic link generation assures that those links will never be "broken" as long as you follow the appropriate file naming conventions.

Listing 5: XML data used to generate the listing of lecture notes in Figure 3.

```
<?xml version="1.0" ?>
<!--
  513-lecs.xml
  Jesse M. Heines, UMass Lowell Computer Science, heines@cs.uml.edu
  updated by JMH on August 19, 2002 at 11:48 AM
-->
<classes>
  <class number="1">
    <date>2002-09-09</date>
    <reading>
      <![CDATA[Deitel, Ch. 1,<br />Sec. 1. 6-12, 16,<br />17 (skim), Ch. 2]]>
    </reading>
    <lecture>
      Course Orientation, Web Server, Browsers, and Applications; Setting Up Your
      Computer for This Course
    </lecture>
    <activity>Getting Started with Our WebLabPC Systems</activity>
  </class>
  <class number="2" status="upcoming" suppresslinks="false">
    <date format="bold" color="red">2002-09-13</date>
    <note>
      Class will be held on this Friday to make up for the class we will miss on
      Monday, September 16, due to my observance of the Jewish holiday of Yom Kippur.
    </note>
    <reading>Deitel, Ch. 4-5</reading>
    <lecture>
      <![CDATA[The Static Web, Basic Form Processing, and Web Development Tools]]>
    </lecture>
    <activity>Creating a Client-Side Image Map</activity>
  </class>
  ... code for the other classes is analogous to what appears above ...
</classes>
```

You can also extract data from the XML file to add to the lecture notes shown in Figure 1. For example, you might want to indicate the topics covered in the lecture and the list of related readings, information which currently only exists in the index on my course Web site. Pulling this data from the XML file would once again guarantee that the two places in which this information appears always agree with each other, eliminating inconsistencies and "out-of-synch" problems. As you might suspect, you can also use the data in this file to address the page navigation issues discussed above.

Thus, the encoding data in XML files and using that to drive the Web site rather than straight HTML provides a wealth of functionality and levels of consistency and integrity much more difficult to achieve in non-data-driven course Web sites. In all fairness, however, I must recognize that some will object to the code-centric view one must adopt to work with XML and will see that as a step backward from today's sophisticated WYSIWYG HTML editors. I concede that this is a legitimate concern today, but some XML editors with well-engineered graphical user interfaces to exist today, and we at UMass Lowell are exploring techniques that will allow the required XML data to be specified via Web forms.

Moving to Student-Centered Course Web Sites

When course Web sites are data-driven and their formatting code is independent of their content, one can begin to explore alternative ways to generate their content, knowing that the display format will remain consistent regardless of who serves as the content author. Using this approach we are beginning to explore a model of course Web site development and maintenance that puts students in the center of the process as *course scribes*. In addition to providing a way to get timely information on-line without burdening professors with yet another responsibility, this approach will hopefully get students more actively involved with the subject matter and its treatment in the course. Such involvement would undoubtedly enrich the individual scribes' learning as well as that of their fellow students following the classic adage: "If you really want to learn something, teach [or explain] it to someone else."

We also expect that when students rather than professors put material on-line, there will be more discussion among peers about the accuracy of the Web site content. It would be ideal if this activity fostered an environment in which students learn from and critique each other's work in the same way that journalism students do when putting together a campus newspaper or literature students do when editing submissions to a literary magazine. Students readily accept that they and their peers make mistakes, while they implicitly – although, of course, erroneously – assume that whatever their professors post is correct. Such discussions are one of the fundamental tenets of cooperative learning, which has been shown to produce significant positive effects on student achievement (Slavin, 1996).

References

Apache Software Foundation (2002). Apache XML Project. http://xml.apache.org

Gehringer, E.F. (2002). To see or not to see: access restriction on course Web sites. *Proceedings of the 2002 American Society for Engineering Education Annual Conference and Exposition*, Montreal, Quebec, Session 1520, June 16-19, 2002.

Grankovska, S. & Heines, J.M. (2003). Course Web sites: state-of-the-art. Paper submitted to the *ACM SIG CSE 34th Technical Symposium on Computer Science Education*, Reno, Nevada, February 19-23, 2003. http://teaching.cs.uml.edu/~heines/techrpts/papers/GrankovskaHeines_SIGCSE2003_online.pdf

Heines, J.M. (2000). Evaluating the effect of a course Web site on student performance. *Journal of Computing in Higher Education* (Fall 2000) 12(1):57-83. http://www.cs.uml.edu/~heines/academic/papers/2000jche

Heines, J.M. (2003). XSL. In H. Bidgoli (Ed.), *The Internet Encyclopedia*. To be published by John Wiley & Sons.

Jordan, DK. (1997). *Evaluation of a Web site as a teaching tool in MMW-1 (track C)*. Unpublished manuscript. University of California, San Diego.

Martin, Didier, and twelve other authors (2000). *Professional XML*. Birmingham, UK: Wrox Press, Ltd.

Meggison, David (2002). SAX. http://www.saxproject.org

Slavin, R.E. (1996). Research for the future: research on cooperative learning and achievement: what we know, what we need to know. *Contemporary Educational Psychology* 21(1):43-69. http://www.success-forall.net/ resource/research/cooplearn.htm

World Wide Web Consortium (2002a). XML Software. http://www.w3.org/XML/#software

World Wide Web Consortium (2002b). What is XSL? http://www.w3.org/Style/XSL/WhatIsXSL.html

Designing Authentic Activities in Web-based Courses

Jan Herrington
School of Communications and Multimedia
Edith Cowan University
Australia
j.herrington@ecu.edu.au

Abstract: Influenced by constructivist philosophy and advances in technology, there is increasing interest in authentic activities as a basis for learning in both face-to-face and web-based courses. Whereas traditionally, activities have primarily served as vehicles for practice of skills or processes, a more radical approach is to build a whole course of study around authentic activities and tasks. This presentation will put the case that the value of authentic activity is not constrained to learning in real-life locations and practice, but can be analysed for the critical characteristics that help to enhance learning in online contexts. It will continue with a description of the theory, research, and development initiatives that provide the foundations for this approach. Finally, guidelines for the design of complex authentic activities for online learning and examples will be presented, together with the implications of this approach for teachers, students and designers.

Introduction

Teachers have long recognised the advantages of learning in authentic situations. The apprenticeship system was once the primary method for education and training in skills and processes relevant to the workplace. Professional practice, where students spend days or weeks performing in the workplace, is an authentic method for learning the practices of a profession. In higher education and schools, teachers facilitate groups of students performing authentic practices with real consequences and outcomes: students are assisted to form fully operational businesses, to diagnose illnesses in real patients, to form video and multimedia production teams with real clients, and to conduct scientific experiments and data collection on the Internet.

The merits of such engaging and authentic learning environments have been well documented, particularly in reference to situated learning (e.g., Honebein, Duffy, & Fishman, 1993; Brown, Collins, & Duguid, 1989; McLellan, 1996; Duffy, Lowyck, & Jonassen, 1993; Wilson, 1996; McLellan, 1997; Bennett, Harper, & Hedberg, 2001; Luca & Oliver, 2001). Nevertheless, the evidence for real-life experiences is not always positive. For example, in discussing apprenticeships in relation to situated cognition, Wineburg (1989) noted: 'No doubt some apprentices find their apprenticeship absolutely authentic, but I can imagine others who find it absolutely tedious, inefficient, repressive, servile, tradition-bound, and in some cases, downright mean' (p. 9). Lave and Wenger (1991) also noted that the quality and consistency of apprenticeships vary enormously. They argued that apprenticeships do not inevitably result in learning in practice. Included in a series of case studies, they give the example of apprentice butchers who were used in ways more consistent with profit-making than incorporating them into the practice of meat-cutting. For example, a new apprentice might be assigned to the automatic wrapping machine and stay on that single task for years until a new apprentice comes along. Lave and Wenger argued that the apprenticeship itself is not the issue. There can be apprenticeships where 'masters prevent learning by acting in effect as pedagogical authoritarians' (p. 76). The critical issue for them, and the real value of these experiences, is the 'legitimate peripheral participation' the apprenticeship allows. Even when real experience works well, it is not always possible for teachers to organise these authentic learning experiences in real life settings for reasons such as the limitations of the subject matter, practical constraints such as physically moving students to locations of practice, and precautions against risk of danger to students.

The argument advanced in this paper is that the value of authentic activity is not constrained to learning in real-life locations and practice, but can be analysed for the critical characteristics that help to enhance learning. Lave and Wenger (1991) cautioned that the conception of situated learning was substantially 'more encompassing in intent than conventional notions of "learning in situ" or "learning by doing" for which it was used as a rough equivalent' (p. 31). The challenge they put to researchers was to identify the critical aspects of situated learning to enable it to translate into teaching methods that could be applied in the classroom. Together with my colleagues, the purpose of my current research is to distil those elements that contribute to the success of authentic learning environments, to analyse the antecedents and mediating variables, and to provide guidelines for the design of activities to embody those characteristics. Such characteristics can then be applied in a variety of learning contexts, such as simulations, case studies, role-plays, and scenarios, in the classroom and in online learning situations.

Authentic Activities

Activities, investigations and problems have always been at the heart of student involvement in meaningful learning contexts. Teachers provide such activities to enable students to interact with the learning environment, and to learn, apply and practice newly acquired skills. Activities have been defined by Brophy and Alleman (1991) as: 'Anything students are expected to do, beyond getting input through reading or listening, in order to learn, practice, apply, evaluate, or in any other way respond to curricular content' (p. 9).

However, a well-designed activity can be so much more than an opportunity for students to practice and apply their learning. In this paper, it is proposed that the activity students perform as they complete a course of study is the single most important element in the design of the learning environment. A complex and sustained activity can motivate students to learn. It can provide meaning and relevance to complex content, enable collaborative problem solving, justify the creation of polished products, and provide integrated assessment of achievement. It can be the central organising element of an entire course of study.

There is no lack of research and literature written on the use of authentic activities over the past decade or more. There has been a great deal written about the differences between the kinds of activities and problems we face in real-world situations and those typically designed into courses of study. For example, Sternberg, Wagner and Okagaki (1993) differentiated between the kinds of problems learners face in academic situations and practical, real-world applications. They contended that academic problems tend to be: formulated by others, well-defined, complete in the information they provide, characterised by having only one correct answer, characterised by having only one method of obtaining the correct answer, disembedded from ordinary experience, and of little or no intrinsic interest. For example, it is unlikely that the following typical mathematics textbook exercise would ever be encountered in this form in any real context, or that students would necessary know when to apply it in appropriate circumstances:

$2x + 1 = 7$. Solve for x

Similarly word problems, while attempting to provide a real-world context, fail to replicate the essential elements of a meaningful and realistic problem. For example:

> Jenny and her friend left Strasbourg to visit a winery. They bought 3 one-litre bottles of wine, 5 bottles each containing 750 millilitres and two half-litre bottles of wine. What was the total quantity of wine bought?

Why does the student need to know how much wine Jenny bought? If the total was needed to write on a customs declaration, or Jenny needed to calculate her likely blood alcohol level after consuming this wine, this is important contextual information that is missing from the problem description. As it stands, the problem remains a simple and pointless algorithm dressed up with a few words. Bottge and Hasselbring (1993) have pointed out that such word problems are inadequate because: they describe situations in a textual rather than a contextual form; they typically include key words such as 'in all' or 'how many more' that can trigger a specific number operation—unlike real problems that offer no such clues; and there is usually only a single correct answer, which takes only a few minutes to solve (p. 36). Such activities often lead only to an enculturation into the practices of classrooms rather than the real-world transfer teachers expect. Clayden, Desforges, Mills and Rawson (1994) noted that students' efforts to make sense of classroom activities generally lead them to focus on working practices rather than abstract ideas. 'What they learn ... is how to do work, how to be neat, how to finish on time' (p. 164).

In direct contrast to the academic approach, practical problems tend to be characterised by: the key roles of problem recognition and definition, the ill-defined nature of the problem, substantial information seeking, multiple correct solutions, multiple methods of obtaining solutions, the availability of relevant prior experience, and often highly motivating and emotionally involving contingencies (Sternberg et al., 1993, p. 206). Key differences between the school-based approach and real life approach have also been developed and summarised by Lebow and Wager (1994) (Table 1).

Table 1: Real-life versus in-school problem solving (Lebow & Wager, 1994)

Real-life	In-school
1. Involves ill formulated problems and ill structured conditions.	1. Involves 'textbook' examples and well structured conditions.

67

2.	Problems are embedded in a specific and meaningful context.	2.	Problems are largely abstract and decontextualized.
3.	Problems have depth, complexity and duration.	3.	Problems lack depth, complexity, and duration.
4.	Involves cooperative relations and shared consequences.	4.	Involves competitive relations and individual assessment.
5.	Problems are perceived as real and worth solving.	5.	Problems typically seem artificial with low relevance for students.

While the differentiation between the two approaches is largely within the context of school (and to some extent university) classrooms, the same distinctions may be drawn for the design of online learning environments. In completing activities and solving problems, students frequently learn to invoke 'sub-optimal' schemes to enable them to proceed, rather than deal with the content in a way that promotes true understanding. Many of these online programs are so 'well designed', they fail to account for the nature of real-world problem solving, where the solution is rarely neat and the salient facts are rarely the only ones at students' disposal.

In contrast, a number of authors suggest that authentic activities should be ill-defined—students *find* as well as *solve* the problems. Learners need to have the opportunity to: explore a situation with all the complexity and uncertainty of the real world, have a role in determining the task and how it might be broken up into smaller tasks, select relevant information, and find solutions that suit their needs. For instance, Myers (1993) developed three criteria for measuring the authenticity of an activity: (1) the activity provides opportunities for the students to achieve something that they perceive as real or genuine; (2) the activity challenges, inspires and empowers learners to take risks and exceed personal limitations; and (3) the activity makes some difference in the lives of the learners (p. 72). Others have also discussed the importance of providing an authentic context to the task. Jonassen (1991) noted that authentic activities have real-world relevance and utility, and integrate those tasks across the curriculum (p. 29). Similarly, Bransford, Vye, Kinzer and Risko (1990b) described the following criteria of authentic activities that maximise the effectiveness of the approach:

- A single complex problem should be investigated by the students
- Students identify and define their own questions
- Students must have the opportunity to experience the problem from a number of different perspectives
- Students work on the problem over a 'reasonably long period of time' (p. 394), that is weeks rather than days
- Activities are logically related to the problem.

Young (1993) has also listed the attributes of real-life problems which need, where possible, to be replicated in authentic activities. The problem must provide:

- Ill structured complex goals
- Opportunity for the detection of relevant versus irrelevant information
- Active/generative engagement in defining problems as well as solving them
- Involvement of the student's beliefs and values
- An opportunity to engage in collaborative interpersonal activities (p. 45).

Many other theorists and researchers (e.g., Gordon, 1998; Lebow & Wager, 1994) have also emphasised the importance of designing collaborative, rather than independent, learning activities, and others such as Duchastel (1997) have pointed out the importance of diversity, rather than uniformity, of outcome. The Cognition and Technology Group at Vanderbilt (1990b) have stressed the importance of complexity and the necessity to provide an environment capable of sustained examination.

Some argue that it is impossible to design truly 'authentic' learning experiences. Petraglia (1998) argued that authenticity can be neither 'predetermined nor preordained', and such attempts often result in little more than 'preauthentication', that is, 'the attempt to make learning materials and environments correspond to the real world prior to the learner's interaction with them' (p. 53). In supporting this view, Barab, Squire and Dueber (2000) argued that authenticity occurs 'not in the learner, the task, or the environment, but in the dynamic interactions among these various components … authenticity is manifest in the flow itself, and is not an objective feature of any one component in isolation' (p. 38). Petraglia (1998) contended that learners need to be *persuaded* that they are participating in an authentic learning environment. This theme is also adopted by Kantor, Waddington and Osgood (2000) who, when referring to the kinds of goal-based scenarios they designed for Anderson Consulting, argued that: 'It is a simulation of a client engagement in which the participants tacitly agree to go along with an interpretation of job reality which we have crafted' (p. 212).

According to Cronin (1993), the message for designers and teachers of online learning environments is a simple one: in designing authentic activities, 'students' experiences … should more closely resemble the experiences they encounter in real life' (p. 80).

10 Characteristics of Authentic Activities

As described above, many writers and theorists have suggested quite specific design criteria of activities which, if implemented, might enhance students' learning as they engage in tasks that reflect the critical characteristics of genuine roles and activities of professionals in real world settings. In reflecting on the characteristics of authentic activities described by researchers, we have derived ten design characteristics of more authentic activities (c.f., Reeves, Herrington, & Oliver, 2002):

1. *Authentic activities have real-world relevance*
   Activities match as nearly as possible the real-world tasks of professionals in practice rather than decontextualised or classroom-based tasks (e.g., Lebow & Wager, 1994; Cronin, 1993; Oliver & Omari, 1999; Brown et al., 1989; Cognition and Technology Group at Vanderbilt, 1990a; Jonassen, 1991; Resnick, 1987; Winn, 1993)
2. *Authentic activities are ill-defined, requiring students to define the tasks and sub-tasks needed to complete the activity*
   Problems inherent in the activities are ill-defined and open to multiple interpretations rather than easily solved by the application of existing algorithms. Learners must identify their own unique tasks and sub-tasks in order to complete the major task (e.g., Sternberg et al., 1993; Lebow & Wager, 1994; Bransford et al., 1990b; Brown et al., 1989; Cognition and Technology Group at Vanderbilt, 1990a; Winn, 1993)
3. *Authentic activities comprise complex tasks to be investigated by students over a sustained period of time*
   Activities are completed in days, weeks and months rather than minutes or hours, requiring significant investment of time and intellectual resources (e.g., Lebow & Wager, 1994; Bransford et al., 1990b; Cognition and Technology Group at Vanderbilt, 1990b; Bransford et al., 1990b; Cognition and Technology Group at Vanderbilt, 1990b; Jonassen, 1991)
4. *Authentic activities provide the opportunity for students to examine the task from different perspectives, using a variety of resources*
   The task affords learners the opportunity to examine the problem from a variety of theoretical and practical perspectives, rather than a single perspective that learners must imitate to be successful. The use of a variety of resources rather than a limited number of preselected references requires students to detect relevant from irrelevant information (e.g., Sternberg et al., 1993; Bransford et al., 1990b; Young, 1993; Cognition and Technology Group at Vanderbilt, 1990b)
5. *Authentic activities provide the opportunity to collaborate*
   Collaboration is integral to the task, both within the course and the real world, rather than achievable by an individual learner (e.g., Lebow & Wager, 1994; Young, 1993; Gordon, 1998)
6. *Authentic activities provide the opportunity to reflect*
   Activities need to enable learners to make choices and reflect on their learning both individually and socially (e.g., Young, 1993; Myers, 1993; Gordon, 1998)
7. *Authentic activities can be integrated and applied across different subject areas and lead beyond domain-specific outcomes*
   Activities encourage interdisciplinary perspectives and enable diverse roles and expertise rather than a single well-defined field or domain (e.g., Bransford, Sherwood, Hasselbring, Kinzer, & Williams, 1990a; Bransford et al., 1990b; Jonassen, 1991)
8. *Authentic activities are seamlessly integrated with assessment*
   Assessment of activities is seamlessly integrated with the major task in a manner that reflects real world assessment, rather than separate artificial assessment removed from the nature of the task (e.g., Reeves & Okey, 1996; Young, 1995; Herrington & Herrington, 1998)
9. *Authentic activities create polished products valuable in their own right rather than as preparation for something else*
   Activities culminate in the creation of a whole product rather than an exercise or sub-step in preparation for something else (e.g., Barab et al., 2000; Gordon, 1998; Duchastel, 1997)
10. *Authentic activities allow competing solutions and diversity of outcome*
    Activities allow a range and diversity of outcomes open to multiple solutions of an original nature, rather than a single correct response obtained by the application of rules and procedures (e.g., Duchastel, 1997; Bottge & Hasselbring, 1993; Young & McNeese, 1993; Bransford et al., 1990a; Bransford et al., 1990b).

Investigating Authentic Activities Online

As stated by Lebow and Wager (1994): 'When authentic activity is the model for appropriate learning activity, the perceptions of the learner and the affordances of the environment represent an integral and inseparable context of learner/environment' (p. 241). The Cognition and Technology Group at Vanderbilt (1990b) describe authentic activities as 'generative' because the completion of the task requires the students to generate other problems to be solved. They draw a distinction between these authentic tasks and simple word problems which already define the problem, such as: 'If you travel 150 kilometres at 90 kph, how long will the journey take?' Compare this simple problem with one described by Reeves and Laffey (1999) in an undergraduate engineering course where the students' task is to plan a mission to Mars, and to design a research station including a renewable power source to sustain life once a station is established.

Such activities guide learning in entire courses of study. They are not provided simply to enable students to practice skills taught in more didactic, content-focussed ways. They are integral to the way students approach and study the course, and provide meaning to complex curricula.

At Edith Cowan University, a *Graduate Certificate in Online Teaching and Learning* has been developed according to the guidelines of authentic activity described above. The aim of the course is to assist teachers to have the confidence to design and plan effective online learning environments. The course consists of four units: *Online Teaching and Learning, Resources for Teaching and Learning Online, Designing Effective Online Learning Environments,* and an *Online Learning Project Unit*. The design of the units is characterised by strongly student-centred environments, with authentic and contextualised learning tasks in collaborative settings, using integrated assessment strategies and learning scaffolded by teacher support. The units are designed to be delivered online and to embody a variety of online teaching and learning strategies.

The first unit entitled *Online Teaching and Learning* (Figure 1a) was designed to explore issues associated with the creation of effective learning environments, and draws heavily on recent theory and research. The unit is based upon a task (Figure 1b) where the student takes on a role in a scenario set in a fictitious university. The student is required to evaluate a website that has been set up as an exemplar for a consortium of universities planning to develop a joint online course. The students then, in collaboration with other students ('representatives from the other universities') recommend a set of guidelines for website development, and then redesign the original website (or one of their own choosing) according to those guidelines. While comprising a single sustained task, the activity can be evaluated at three points.

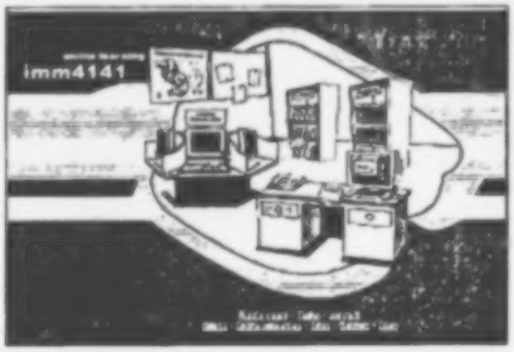


Figure 1a: The main interface for *Online Teaching and Learning*

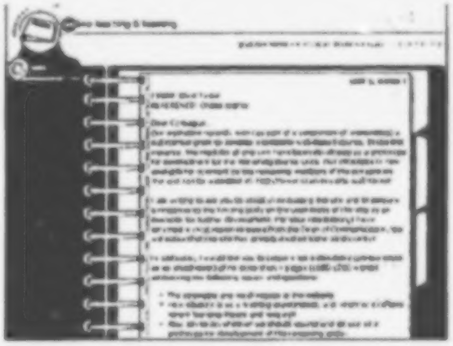


Figure 1b: The task is presented as a memo

Our current research funded by the Australian Research Council, entitled *Authentic activity as a model for web-based learning* has sought to investigate examples of courses or units that embody the critical elements described above. Using these characteristics as criteria for the selection of appropriate courses to study, our research has sought to investigate the characteristics of authentic activity that facilitate a whole course unit of study being encapsulated within complex tasks, and to determine the factors that contribute to the successful adoption and implementation of activity-based online course units. We have used the criteria listed above to select courses or units of study that use authentic activities as a central core of their presentation. The units must have a major online component, not simply comprise supplementary material to on-campus delivery. Examples of the types of online courses that use authentic activities are given below.

In a post-graduate unit entitled *Research Preparation: Research Methods*, students do not learn research methods by studying texts describing research methodologies and appropriate applications. Instead they work virtually in a graduate research center (Figure 2a) where they are given the task of investigating the closure of a rural school. They do this using both qualitative and quantitative methods, and they are assisted by two virtual researchers who have collected data from the community and assembled it in a raw form in the center. The students can examine school records, population data, interviews with teachers, parents and community members, newspaper reports and other documents (e.g., Figure 2b). Students produce a report that analyses the impact of the closure of the school on the rural community.

BEST COPY AVAILABLE

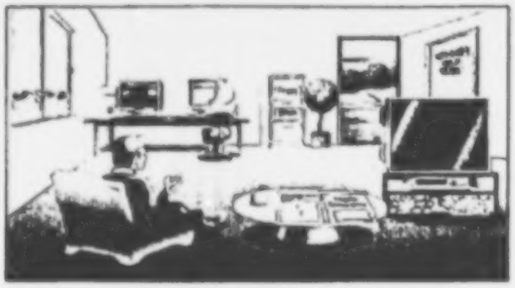


Figure 2a: The graduate research center

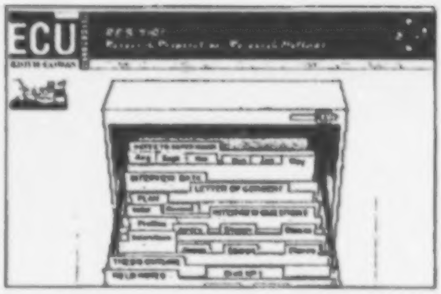


Figure 2b: Qualitative data in the filing cabinet

In a semester course entitled *North American Fiction and Film*, (Figure 3a) students study novels written by North American writers such as Melville, Hemingway, DeLillo, Vonnegut, Atwood, and Esquival, and they view film versions of the same works (if appropriate). In the course, they are given the role of Editorial Board Members of an online scholarly journal (Figure 3b), to which they submit book reviews and articles based on their study of the literature. The students collaboratively design a guide for novice reviewers on how to write a book review. The teacher of the course is the journal editor, and an edition of the journal is published online at the end of the semester. A range of literary resources, articles and reviews are accessible from the website. The theoretical and design framework of the course is described in Fitzsimmons (2001).

TASKS
LIBRARY
ONLINE
LIST
SUPPORT

Figure 3a: Main interface of North American Fiction and Film

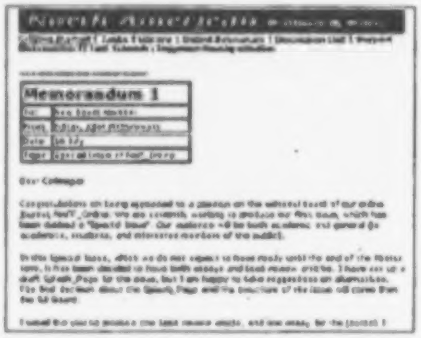


Figure 3b: Memo inviting students to be part of the Editorial Board

Coastal and Marine Systems is a post-graduate unit where activities are specifically designed to mirror the typical problems that a coastal manager or an environmental consultant might encounter. For example, in one major task (Figure 4a), it is proposed that a marina has been developed, and as part of the approval, annual monitoring of water quality is required. The monitoring encompasses water inside the marina as well as a site several hundred meters outside the marina, in well-flushed ocean conditions. The students are provided with a set of real data collected by the course teachers from inside and outside the marina, and they are required to understand, analyse and interpret the data and draw conclusions as to whether the water quality within the marina is different to that outside, and if so explain the possible causes. The evaluation is presented as a report within the context of the renewal of the marina license. The course is constrained, to a degree, to the requirements of the proprietary software, Blackboard (originally the plan included a more realistic interface with clickable visual links and metaphors) (Figure 4b) but nevertheless, the task incorporates the characteristics of authentic activities described earlier.

BEST COPY AVAILABLE

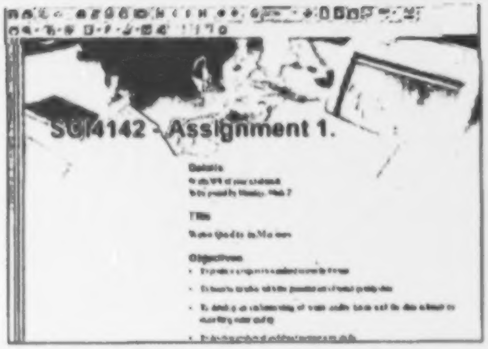


Figure 4a: Major activity on marina development and water quality

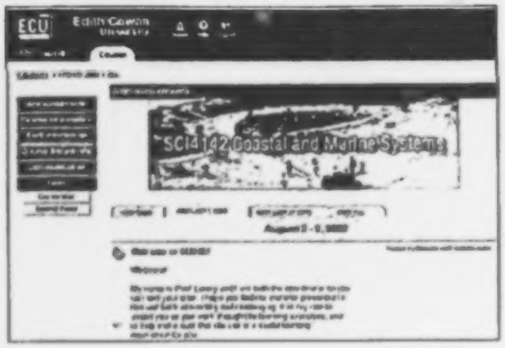


Figure 4b: Main interface of Coastal and Marine Systems in Blackboard

In another example of complex activity, Pennell, Durham, Orzog and Spark (1997) described a web-based environment, *Writing in Organisations*, part of the third-year curriculum for Bachelor of Arts (Communication Studies) where students learn business communication skills by accepting temporary employment in a virtual recording company (Figure 5a). They are given a complex task to complete, where they need to prepare a report on whether the company would benefit from the introduction of an internal newsletter. In order to complete this activity, they make appointments, keep a diary, 'interview' the director and other employees (Figure 5b), and write letters, and memos as required.

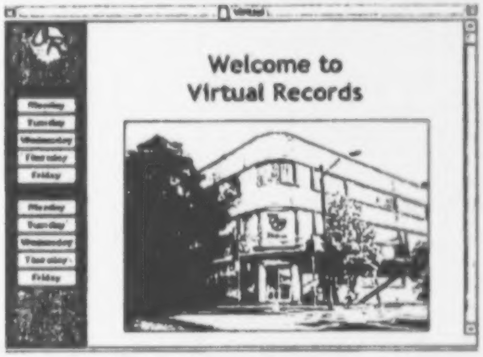


Figure 5a: Main interface of Virtual Records

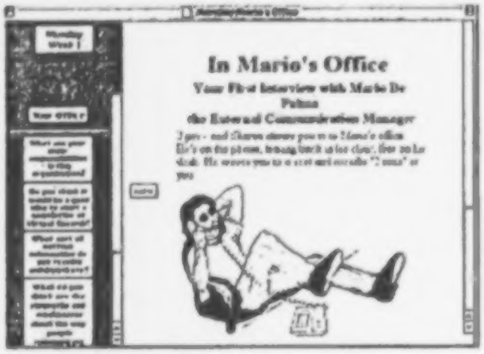


Figure 5b: Interviewing one of the employees

While most of the learning environments studied have involved the creation of simulated work places and often incorporate extensive resources such as graphics, video, and sound files, other examples studied are less resource intensive while still retaining fidelity to the authentic characteristics described. For example, in an introductory biology course for online delivery (described in Koenders, 2002) students investigate a simulation of the discovery of new life forms, and are introduced to the interpretation of microscopic images of cellular structures. In the scenario, students are given a role as biologist—one member of an expedition to a remote lake in Siberia where several microorganisms are found that cannot be classified. They 'collect' the specimens and return to the university to analyse them. On the website, they are provided with images of unicellular organisms apparently unknown to science. Students are assigned to groups of four where they analyse the specimens and prepare a report. The scenario is not drawn in an elaborate, resource intensive manner, but built up through the creation of an interesting and engaging idea.

The learning environments described have varying degrees of fidelity to the characteristics of authentic activities defined earlier, but all have strong linkage to real-world professional practice. Teachers, authors, instructional designers, tutors and other associated with the design and delivery of the courses are being interviewed, and the websites analysed. Student responses are being gained through online questionnaires. The research is ongoing, and analysis is focusing on the identification of conceptual

BEST COPY AVAILABLE

themes and issues emerging from the data, using techniques such as clustering, and making contrasts and comparisons (Miles & Huberman, 1994).

Some Issues Arising from the Research

While analysis is preliminary at this stage, several trends have emerged, and there are implications not only for the design of online learning environment, but also for the teaching and learning of such courses, and further research efforts .

Generally, the teachers involved in units and courses featuring complex, authentic activities (as described above) are enthusiastic and positive about their teaching and about the quality of student learning in the course. All have found the experience of designing and teaching the course to be professionally enhancing, through their own learning of recent educational research and pedagogy, through the experience of teaching in new and innovative ways, and in many cases through publications and conference presentations about the course and other professional activities.

One theme which has emerged strongly from a number of different sources in our research is the nature of authenticity, and how 'authentic' environments are often the creation of the teachers', authors' and instructional designers' imaginations, and are thus inevitably someone's *view* of what is authentic. Petraglia (1998) has been critical of this shortcoming, calling it 'the real world on a short leash' (p. 53). There is nevertheless, much evidence to suggest that these learning environments can provide a great deal of meaning to otherwise decontextualised facts and skills, and can enhance the transfer of deep and lifelong learning (Barab & Landa, 1997). At what point do students become engaged, if ever, in these scenarios? Is there a pattern to their acceptance of the terms of the authenticity, and how important is the suspension of disbelief? (Herrington, Oliver, & Reeves, 2002).

Another recurring theme is time, in terms of both the teachers' and the students' commitment to authentic activities. Many of the teachers interviewed to date have mentioned the inordinate amount of time involved in both the preparation of the authentic tasks and environments, and the teaching of the online course. Teachers also reported that students were likely to spend much more time on the tasks, some complaining of the demands, others appreciative of the sense of deep engagement they experienced with the learning context. The time commitment problem has also been noted in many other authentic learning environments, some of which have reverted to more traditional modes despite strong evidence of effectiveness, including the Mission to Mars engineering course described earlier (Reeves & Laffey, 1999). If the large time commitment is a 'labor of love', willingly given by the intellectual owners of the course, it is also likely that this commitment is not sustainable over the long term, and courses based on authentic tasks will be abandoned for more manageable—and more traditional—lecture/tutorial modes of instruction.

Proponents of authentic activities as described here are generally enthusiastic and committed teachers who willingly provide time and effort beyond the usual expectations. Further research may help to identify authentic activities in online units that are offered to large student cohorts. Investigation of large scale, successful initiatives will possibly yield a great deal of information on how these environments can be sustained with standard resources and faculty allocations, rather than an abundance of goodwill and generosity on the part of teachers. Longer term studies may also reveal the kinds of support that host institutions can develop to facilitate course units employing authentic and complex activities.

It is hoped that analysis of our own and further research data will help to suggest those characteristics of authentic activity that facilitate a whole course unit of study being encapsulated successfully within complex tasks, and to determine the factors that contribute to the successful and sustainable adoption and implementation of activity-based online course units.

References

Barab, S.A., & Landa, A. (1997). Designing effective interdisciplinary anchors. *Educational Leadership, 54*, 52-55.

Barab, S.A., Squire, K.D., & Dueber, W. (2000). A co-evolutionary model for supporting the emergence of authenticity. *Educational Technology Research and Development, 48*(2), 37-62.

Bennett, S., Harper, B., & Hedberg, J. (2001). Designing real-life cases to support authentic design activities. In G. Kennedy, M. Keppell, C. McNaught , & T. Petrovic (Eds.), *Meeting at the Crossroads. Proceedings of the 18th Annual Conference of the Australian Society for Computers in Learning in Tertiary Education* (pp. 73-81). Melbourne: Biomedical Multimedia Unit, The University of Melbourne.

Bottge, B.A., & Hasselbring, T.S. (1993). Taking word problems off the page. *Educational Leadership, 50*(7), 36-38.

Bransford, J.D., Sherwood, R.D., Hasselbring, T.S., Kinzer, C.K., & Williams, S.M. (1990a). Anchored instruction: Why we need it and how technology can help. In D. Nix & R. Spiro (Eds.), *Cognition, education and multimedia: Exploring ideas in high technology* (pp. 115-141). Hillsdale, NJ: Lawrence Erlbaum.

Bransford, J.D., Vye, N., Kinzer, C., & Risko, V. (1990b). Teaching thinking and content knowledge: Toward an integrated approach. In B.F. Jones & L. Idol (Eds.), *Dimensions of thinking and cognitive instruction* (pp. 381-413). Hillsdale, NJ: Lawrence Erlbaum Associates.

Brophy, J., & Alleman, J. (1991). Activities as instructional tools: A framework for analysis and evaluation. *Educational Researcher, 20*(4), 9-23.

Brown, J.S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher, 18*(1), 32-42.

Clayden, E., Desforges, C., Mills, C., & Rawson, W. (1994). Authentic activity and learning. *British Journal of Educational Studies, 42*(2), 163-173.

Cognition and Technology Group at Vanderbilt. (1990a). Anchored instruction and its relationship to situated cognition. *Educational Researcher, 19*(6), 2-10.

Cognition and Technology Group at Vanderbilt. (1990b). Technology and the design of generative learning environments. *Educational Technology, 31*(5), 34-40.

Cronin, J.C. (1993). Four misconceptions about authentic learning. *Educational Leadership, 50*(7), 78-80.

Duchastel, P.C. (1997). A Web-based model for for university instruction. *Journal of educational technology systems, 25*(3), 221-228.

Duffy, T.M., Lowyck, J., & Jonassen, D.H. (Eds.). (1993). *Designing environments for constructive learning*. Heidelberg: Springer-Verlag.

Fitzsimmons, J. (2001). *Designing an effective online unit: Theory and practice.* Paper presented at the Teaching Online in Higher Education Online Conference, Indiana University-Purdue University Fort Wayne, Indiana. Available: http://www.ipfw.edu/as/tohe/2001/abstracts/fitzsimmons.htm.

Gordon, R. (1998). Balancing real-world problems with real-world results. *Phi Delta Kappan, 79*, 390-393.

Herrington, J., & Herrington, A. (1998). Authentic assessment and multimedia: How university students respond to a model of authentic assessment. *Higher Education Research and Development, 17*(3), 305-322.

Herrington, J., Oliver, R., & Reeves, T.C. (2002). The suspension of disbelief in authentic online learning environments, *Conference paper submitted for publication.*

Honebein, P.C., Duffy, T.M., & Fishman, B.J. (1993). Constructivism and the design of learning environments: Context and authentic activities for learning. In T.M. Duffy, J. Lowyck , & D.H. Jonassen (Eds.), *Designing environments for constructive learning* (pp. 87-108). Heidelberg: Springer-Verlag.

Jonassen, D. (1991). Evaluating constructivistic learning. *Educational Technology, 31*(9), 28-33.

Kantor, R.J., Waddington, T., & Osgood, R.E. (2000). Fostering the suspension of disbelief: The role of authenticity in goal-based scenarios. *Interactive Learning Environments, 8*(3), 211-227.

Koenders, A. (2002). Creating opportunities from challenges in on-line introductory biology. In A. Goody, J. Herrington , & M. Northcote (Eds.), *Quality conversations: Research and Development in Higher Education, Volume 25* (pp. 393-400). Jamison, ACT: HERDSA.

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge: Cambridge University Press.

Lebow, D., & Wager, W.W. (1994). Authentic activity as a model for appropriate learning activity: Implications for emerging instructional technologies. *Canadian Journal of Educational Communication, 23*(3), 231-144.

Luca, J., & Oliver, R. (2001). Developing generic skills through on-line courses. In C. Montgomerie & J. Viteli (Eds.), *Proceedings of Ed-Media 2001* (Vol. 2, pp. 1163-1164). Tampere, Finland: Association for the Advancement of Computing in Education.

McLellan, H. (1997). Creating virtual communities via the web. In B.H. Khan (Ed.), *Web-based instruction* (pp. 185-190). Englewood Cliffs, New Jersey: Educational Technology Publications.

McLellan, H. (Ed.). (1996). *Situated learning perspectives*. Englewood Cliffs, NJ: Educational Technology Publications.

Miles, M.B., & Huberman, A.M. (1994). *Qualitative data analysis: An expanded sourcebook* (2nd. ed.). Thousand Oaks, CA: Sage.

Myers, S. (1993). A trial for Dmitri Karamazov. *Educational Leadership, 50*(7).

Oliver, R., & Omari, A. (1999). Using online technologies to support problem based learning: Learners responses and perceptions. *Australian Journal of Educational Technology, 15*(158-79).

Pennell, R., Durham, M., Ozog, M., & Spark, A. (1997). Writing in context: Situated learning on the web. In R. Kevill, R. Oliver , & R. Phillips (Eds.), *What works and why: Proceedings of the 14th Annual Conference of the Australian Society for Computers in Learning in Tertiary Education* (pp. 463-469). Perth, WA: Curtin University.

Petraglia, J. (1998). The real world on a short leash: The (mis)application of constructivism to the design of educational technology. *Educational Technology Research and Development, 46*(3), 53-65.

Reeves, T.C., Herrington, J., & Oliver, R. (2002). Authentic activities and online learning. In A. Goody, J. Herrington, & M. Northcote (Eds.), *Quality conversations: Research and Development in Higher Education, Volume 25* (pp. 562-567). Jamison, ACT: HERDSA.

Reeves, T.C., & Laffey, J.M. (1999). Design, assessment, and evaluation of a problem-based learning environment in undergraduate engineering. *Higher Education Research and Development Journal, 18*(2), 219-232.

Reeves, T.C., & Okey, J.R. (1996). Alternative assessment for constructivist learning environments. In B.G. Wilson (Ed.), *Constructivist learning environments: Case studies in instructional design* (pp. 191-202). Englewood Cliffs, NJ: Educational Technology Publications.

Resnick, L. (1987). Learning in school and out. *Educational Researcher, 16*(9), 13-20.

Sternberg, R.J., Wagner, R.K., & Okagaki, L. (1993). Practical intelligence: The nature and role of tacit knowledge in work and at school. In J.M. Puckett & H.W. Reese (Eds.), *Mechanisms of everyday cognition* (pp. 205-227). Hillsdale, NJ: Lawrence Erlbaum Associates.

Wilson, B.G. (Ed.). (1996). *Constructivist learning environments: Case studies in instructional design*. Englewood Cliffs, NJ: Educational Technology Publications.

Wineburg, S.S. (1989). Remembrance of theories past. *Educational Researcher, 18*(5), 7-10.

Winn, W. (1993). Instructional design and situated learning: Paradox or partnership. *Educational Technology, 33*(3), 16-21.

Young, M.F. (1993). Instructional design for situated learning. *Educational Technology Research and Development, 41*(1), 43-58.

Young, M.F. (1995). Assessment of situated learning using computer environments. *Journal of Science Education and Technology, 4*(1), 89-96.

Young, M.F., & McNeese, M. (1993). A situated cognition approach to problem solving with implications for computer-based learning and assessment. In G. Salvendy & M.J. Smith (Eds.), *Human-computer interaction: Software and hardware interfaces*. New York: Elsevier Science Publishers.

Acknowledgements

Thanks to my co-researchers Professor Tom Reeves and Professor Ron Oliver, to the Australian Research Council for funding the research, and to the teachers authors and instructional designers of the courses described, for their thoughtful and considerate participation, and for permission to reproduce pictures of their websites: Trevor Bennett, Clare Brook, Marsha Durham, John Fitzsimmons, Jan Gray, Annette Koenders, Paul Lavery, Maria Northcote, Russ Pennell, Heather Sparrow; and the University of Western Sydney, Central Queensland University, and Edith Cowan University.

E-LEARNING IN HEALTH CARE
EMERGING TRENDS
(Policy, Practice, Evaluation, and Technical Implications)

Dr.Penny Jennett
Professor, Faculty of Medicine
Head, Health Telematics Program
University of Calgary
Canada
jennett@ucalgary.ca
(adapted from other presentations, sources and papers)

Introduction

Important ingredients to selecting appropriate e-learning tools for this electronic age are: 1) a clear understanding of the changing nature of practice and professional learning and 2) an awareness of recent e-learning frameworks to assist in making choices. This presentation will review current directions in professional workplace learning, address related implications for e-learning, outline guidelines that can be used when making choices specific to e-learning tools, and suggest new ways for assessing the impact of using such tools. The discussion will close with reference to change and accountability. Two concrete examples of e-learning projects will be referenced.

Body

Wenger (1998) in his reference to communities of practice (Tab. 1) invites us to consider learning within the health renewal process. Professionals in the workplace are faced with new ways of learning and practice. A re-definition of knowledge is core to this change. Knowledge, driven by workplace learning, now includes tacit knowledge, explicit (evidence-based, empirical) knowledge, knowledge of relationships, and knowledge created from collaboration. Quality of care and learning are tied together through team performance and health outcomes (Frankford, et al., 2000, Cervero, 2000). As a consequence, workplace learning environments invite cooperative interdisciplinary learning at points of care. They also facilitate "capability" - the ability to adapt to change, generate new knowledge, and continuously improve performance (Fraser & Greenhalge, 2001).

Progressive pedagogies, (including e-learning), erase barriers within the continuum, encourage lifelong learning through practice reflection, as well as the sharing of knowledge across organizational and hierarchical boundaries. The development of communities of learning, within and between organizations, is fostered (Wenger, 1998). Given this context, a number of guidelines can be used when selecting e-learning tools.

First, it is helpful to appreciate the ways that e-learning tools can be categorized. Definitions and examples of categories are outlined in Table 2. Before choosing or purchasing specific tools, health professionals can reflect on which type(s) of tools are required to achieve and optimize the task at hand

When choosing electronic aids, it is also important to consider both the characteristics and the capabilities of the chosen tools (Tables 3 & 4). Table 3 outlines 13 characteristics to be considered before purchase and implementation. Table 4 outlines a number of functions that may be required to support and achieve a learning task. Optimal learning will be achieved when users review such guidelines, and decide which characteristic/function, or combination of characteristics/functions, is optimal. By being aware of the characteristics and capabilities of an e-tool, the user can recognize the strengths and limitations of it, and consequently better apply and use it within the workplace.

Further, new frameworks are now evolving specific to research and evaluation. For example, Action Research, (Stringer, 1996), Design Experiment Methodologies, (Brown, 1992), Collins, Brown, & Newman, 1989), Return on Investment models, (Stacey, 2002), and Information literacy research approaches (Cheuk, 2000) are being applied.

Change and areas of accountability are shifting, given these evolving concepts, definitions, and assessment approaches. This change impacts workplace learning settings, health organizations, as well as the health and learning systems. The culture of learning is now such that stakeholders become communities that learn collectively, health professionalism becomes a continuum of education and practice, and learning with technology transects traditional organizational boundaries. Technology is not only a medium, but also a catalyst for human development and change (cultural, organizational, system, and economic). For example, standards, accreditation, certification, and licensing issues arise, as do confidentiality/privacy/security, partnership, and intellectual challenges.

Conclusion

As the nature of practice and workplace learning evolves, so must the expectations of e-learning tools within this context. Decision-making frameworks are helpful as the electronic age emerges. Changes and areas of accountability within the workplace culture, the communities of learners, the organization, and the system are issues to be articulated and understood. The paper has been written to facilitate this process.

References

The ABC Alliance For Building Capacity. (2000). The ABC rural/remote alliance bringing technology, health, and people together. A submission to the Canada Health Infostructure Partnership Program.

Brown, A. L. (1992). Design experiments: Theoretical and methodological challenges in creating complex interventions in classroom settings. *Journal of the Learning Sciences*, 2(2). 141-178.

Cevero, R. (2000). Trends and issues in continuing professional education. Charting a course for continuing professional education: reframing professional practice. V. Mott & B Daley (eds.) San Francisco: Jossey-Bass.

Cheuk, B.W. (2000) Exploring information literacy in the workplace: a process approach in C Bruce and P Candy (Ed.) Information Literacy around the world. *Advances in programs and research* published by Charles Sturt University. 177-191.

Collins, A., Brown, J. S., & Newman, S. (1989). Cognitive apprenticeship: Teaching the crafts of reading, writing, and mathematics. In L. Resnick (Ed.). *Knowing, learning, and instruction* (pp. 453-494). Englewood Cliffs, NJ: Erlbaum.

Frankford, D.M., Patterson, M.A., & Konrad, R.T. (2000). Transforming Practice Organizations to Foster Lifelong Learning and Commitment to Medical Professionalism. *Academic Medicine* 175. July (7): 708-717.

Fraser, S., & Greenhalgh, T. (2001). Complexity science: Coping with complexity: educating for capability. *British Medical Journal*. 323:799-803.

Office of Learning Technologies (OLT). (2001). *Evaluating technologies for team learning in health sector workers: a review and synthesis of the literature and recommendations for future research*. Contract No.: 21001R.

Stacey, P. (2002). *E-Learning Return on Investment (ROI)*: May 31st, [online] Available: http://www.bctechnology.com/index.html

Stringer, E. (1996). *Action Research: A handbook for Practitioners Thousand Oaks*: Sage.

Wenger, E. (1998). *Communities of Practice. Learning, meaning and identity*. Cambridge University Press.

77

TABLE 1: E-Learning within the Health Renewal Process

> *"...once education is understood in terms of identity, it may no longer seem such a good idea to front-load 'education' ... Identity formation is a lifelong process whose phases and rhythms change as the world changes. From this perspective, we need to think about education not merely in terms of an initial period of socialization into a culture, but more fundamentally in terms of rhythms by which communities and individuals continually renew themselves."* (Wenger, 1998)

TABLE 2: Classifications for Technologies

Practice Support Systems
Technology applications that can assist practitioners to integrate knowledge and learning into practice (point of care)
Examples:

- Expert Systems, Decision Support systems
- Error-detection or flagging mechanisms
- Personal Digital Assistants (example – clinical practice guidelines)

Health Information Systems
Searchable databases of medical information that practitioners can use at the point of care
Examples:

- Electronic health records
- Electronic prescription systems
- Network-based databases – e.g. exchange of radiology images and laboratory data
- Online knowledge services

Communication Facilitation Technologies
Technologies that support and enhance communication between team members
Examples:

- E-mail and listservs
- Chat groups
- IP based videoconferencing and date sharing
- Visualization technologies (digitalization, virtual whiteboards, etc.)
- Virtual reality environments

Collaborative Learning & Knowledge Building Environments
Technology that facilitates the advancement of knowledge and improvement in practice
Examples:

- Learning environments that deliver a best practice module in pain management
- On-line collective learning sessions

Adapted from the Office of Learning Technologies (OLT) report (2001)

TABLE 3: Characteristics of e-Health Tools

- Simplicity
- User Friendly
- Interoperable
- Affordable
- Sustainable
- Open Standards
- Portable
- Scalable
- Robust and Reliable
- Networked
- In keeping with Privacy, Confidentiality, and Security guidelines
- Computable with diverse transmission modes (i.e. wireless, wired, satellite

TABLE 4: Functionalities for E-Health Tools

Tools which will:

- Serve the learning continuum- undergraduate, graduate clinical, graduate science, continuing professional development
- Enable multi-disciplinary, inter-professional collective team performance
- Enhance health and health care outcome (tying quality of care, patient safety, and learning together)
- Facilitate learning in practice
- Support learning across organizational/hierarchical jurisdictional boundaries.
- Serve as a medium, but also a catalyst, for Continuing Professional Development and change
- Support continuous improvement
- Provide point of care, jut in time learning; as well as reflective intended learning

Adapted from the Office of Learning Technologies (OLT) report (2001)

eduSource: A pan –Canadian learning object repository

Rory McGreal, T. Anderson, N. Friesen, M. Sosteric: Athabasca University
Ken Hewitt, Janelle Ring, Douglas MacLeod: Netera Alliance
Griff Richards, Marek Hatala, Tom Calvert: IMEC/Simon Fraser University
Margot Chiasson, Toni Roberts: TeleEducation NB
Tom Carey, Kevin Harrigan: University of Waterloo
Gilbert Paquette: Technologies Cogigraph Inc.
Stephen Downes: National Research Council
Email: rory@athabascau.ca

Abstract: As more and more institutions and companies in Canada develop online learning content, the importance of learning objects and the metadata used to describe them becomes clear. EduSource has brought together Canada's leading experts, researchers and practitioners in the field of E-Learning for the purpose of defining and testing a world-class infrastructure for learning object repositories (LOR) and to produce a Repository in a Box prototype that will include metadata guidelines, software tools, hardware specifications, best practices and methods for generating communities of use that would allow any organization to build and connect their own repositories.

Summary

The eduSource project is a pan-Canadian collaborative project to create a testbed of linked and interoperable learning object repositories. The project is providing leadership in the ongoing development of the associated tools, systems, protocols and practices that will support such an infrastructure. The primary delivery mechanism for this testbed will be the broadband Internet, and in particular CA*Net 3/4. This project is based on national and international standards; it is fully bilingual; it will be accessible to all Canadian including those with disabilities; and it will share and disseminate its findings across Canada and internationally. Each of the partners and their associates are bringing considerable resources to the project. Collectively the contributions of the partners amount to $5,280,000 of the total project value of $9,830,000, CANARIE is contributing up to $4,500,000.

To simplify its activities, eduSource has six designated primary partners who will lead this work – Athabasca University, the Netera Alliance, (New Brunswick Distance Education Network (NBDEN), the New Media Innovation Centre, Téléuniversité du Québec, and the University of Waterloo – with the Netera Alliance serving as the lead contractor. In addition it will include a host of associates in the private and public sector representing learning institutions from across the country.

EduSource takes advantage of, and enhances, the capabilities of each of its members in building a comprehensive LOR implementation infrastructure. NBDEN will work with the NewMIC Foundation to explore the development of Repository Content. NBDEN will also work with TeleEducation NB, the National Research Council, and private sector partners such as RightsMarket Inc. to investigate Digital Rights Management for LOR's. Télé-université with le Centre de recherche LICEF and the Advanced Technologies for Learning Unit of the University of Alberta will provide a testing and evaluation framework for the project. Athabasca University will lead in the ongoing development of the CanCore metadata application profile. Télé-université will coordinate the integration and development of software packages such as Explor@ - II, CAREO (Campus Alberta Repository of Educational Objects), ALOHA (from the Learning Commons at the University of Calgary) and SPLASH (from the POOL project) and lead the development of new software packages. Netera and NewMIC will continue their work in hardware and network integration. The University of Waterloo will contribute its knowledge of and international collaborations in community building, as well as its expertise developed in the CANARIE Learning

Program's PLIANT (**Partnerships for Learning, Innovation and Technology**) project. Netera will provide project management, coordination and communications for the project as well as examining new Business and Management Models.

Project Objectives

The primary objective of the project will be the design and testing of a prototypical but functional, national learning object repository infrastructure and the development of specifications and tools for a "Repository in a Box" that can be shared with organizations across the country. This will be accomplished by bringing together Canada's leading experts, researchers and practitioners in the field to share best practices for the large-scale, country-wide deployment of a network of learning object repositories.

In this context, the project team has identified four broad goals for the project:

1. Tto promote and refine a repository metadata framework through the ongoing development of the CanCore protocol;

2. To support experimental research in key areas such as pedagogy, accessibility, protocols, network engineering, hardware integration, quality of service, security, rights management, content development and software applications;

3. To implement a national testbed to investigate processes such as peer review, content repurposing, user support, professional development and content transactions; and

4. To communicate and disseminate its findings through cooperation and partnership with other federal and provincial agencies, institutions and the private sector.

To meet these goals, the eduSource project has identified a number of specific objectives:

1. *It will address and examine issues of interoperability by connecting a critical , mass of learning objects housed in repositories across the country.*
   Specifically, it will first link together existing collections of learning objects such as BELLE's Alexandria Repository and the Math Resources website at Simon Fraser University and secondly it will provide the tools for other communities, such as SavoirNet and CIRTA (Centre interuniversitaire de recherche sur le téléapprentissage) in Quebec to create and connect their own content and repositories to this pan-Canadian network. In this manner a sufficient number of learning objects of various types can be created, adapted, packaged and tested.

2. *It will play a leadership role in developing and promoting national and international standards.*

   Already eduSource members participate in a variety of IMS, IEEE and other international working groups. Members are part of an international network working to develop and implement the Educational Modeling Language. This new project will provide a framework for these experts to continue to contribute to the ongoing development of internationally recognized metadata specifications.

3. *It will develop a blueprint for the rights management of learning objects.*
   The objective here is to design a rights management structure, built on internationally recognized standards, for use by the repositories participating in this national initiative and to integrate this work with the project's software tools.

4. *It will link and integrate the development of repository software programs.*
   In the first phase of the CANARIE E-Learning Program eduSource partners and associates produced a host of valuable software tools for building repositories. These include Explor@ - II for managing resources and repositories and integrating learning objects within courses and learning events; CAREO for searching and building centralized repositories; ALOHA for metatagging objects in CanCore; and SPLASH for creating peer-to-peer repository networks. The

objective of this phase of the work is to integrate and extend those packages to provide a comprehensive suite of tools to build, link and use repositories.

5. *It will create a physical testbed of servers linked together through CA*net 4.*
   As in Software Development, the focus of this objective will be in integrating existing testbeds. The BELLE, POOL, CanLOM, APCCC (Atlantic Provinces Community College Consortium) and SavoirNet projects are some of the existing or proposed repositories that will be molded into a single, shared network for the creation, management and distribution of learning objects using both client-server and peer-to-peer applications..

6. *It will build a bilingual pan-Canadian community of practice.*
   Under the leadership of Tom Carey at the University of Waterloo, the BELLE, PLIANT, POOL and SavoirNet communities of use are being linked together to form a critical mass of instructors, teachers, technology coordinators, instructional designers and content producers. All partners have made a commitment to provide materials in both official languages. Canada can and should play a pivotal role in ensuring that multilingual capabilities are an inherent part of LOR development.

7. *It will examine new business and management models for object repositories.*
   EduSource is developing models for the ongoing sustainability and commercialization of its testbed. In particular, the leadership role that Canada is playing in this area will be investigated for its potential to generate international export opportunities.

8. *It will develop a communications plan for the dissemination of these results.*
   A comprehensive plan will be designed to speed the flow of information between eduSource partners and associates as well as raising awareness throughout the country about the importance and value of this work.

9. *It will accomplish these goals within the context of a comprehensive program of evaluation and feedback.*
   Evaluating the effectiveness of learning objects in educational environments is critical to the success of this repository project. Based on the experiences of the LICEF's LORIT Laboratory at Télé-université and the Advanced Technologies for Learning Unit of the University of Alberta, the project will ensure consultation and input from a broad spectrum of educators and learners from across Canada.

10. *It will make certain that that these repositories will be accessible to all Canadians and particularly to those learners with disabilities.*
    Through an alliance with Jutta the Adaptive Technology Resource Centre, at the University of Toronto (ATRC), eduSource will be linked to and compliant with the Centre's guidelines for accessibility. EduSource will work with them through their Barrierfree On-line Learning Exchange or BOLE project in order to make our network of repositories accessible.

Project Description

Canada's recently announced Innovation Strategy is predicated on an ever-increasing supply of well-educated and skilled workers in all parts of the economy and in all parts of the country. Learning object repositories are the first step in ensuring that this demand can be met. Individual provinces. learning institutions and even the private sector are all capable of developing their own separate and discrete repositories but the value of these projects grows exponentially when they are connected together.

EduSource will be designed around a series of complementary and interwoven work packages. What holds these pieces together is the idea of developing and testing a shared prototypical "Repository in a Box." Each package has been designed to support this concept and taken together they provide much more than just a testbed for a network of linked repositories – in effect, they provide the blueprint for others all across Canada to create a proliferation of repositories that can all work and communicate together. Each of these packages is described in detail below.

Repository Content Development

Package Managers: NBDEN and NewMIC Foundation
Key Participating Partners: University of Waterloo; Télé-université

The key to this package is to develop a critical mass of content to test the capabilities of the proposed network. This will be accomplished by a multi-part strategy. The package managers will develop and provide the interfaces, templates and protocols necessary to connect existing and developing learning object repositories across Canada and internationally and ensure interoperability.

Secondly, content from all the project partners and associates will be repurposed. In association with the Community Building partners, learning objects will be authored by diverse communities and institutions from across Canada.

Thirdly, using the content developed in stages one and two, learning objects of various types will be created, adapted, and tested. This includes the storage, indexing and segmentation of media types ranging from text to Java Applets; the development of archival standards for digital masters; and an evaluation of the effectiveness of the delivery of these objects through a variety of means including broadband, medium band and satellite networks.

NBDEN and its partners will use the CanCore specification to build the next generation of CanLOM – the pan-Canadian Learning Object Metadata directory, which will be based on the TeleCampus. CanLOM is not a learning object repository, but rather a database containing the metadata necessary for the exchange and interoperability of learning objects housed in repositories across Canada and in other countries. Partners are working together to present a comprehensive strategy for the widespread adoption and implementation of the CanCore metadata profile through CanLOM and through repository projects across Canada.

Digital Rights Management
Package Managers: NBDEN with NRC

Based on the explorations and research of the National Research Council, a digital rights management (DRM) approach will be developed for the project. This package will begin with a comprehensive survey of the literature in the fields of commerce and information management on the current state of DRM theory and technology and will look at emerging international standards such as the Open Digital Rights Language (ODRL).

Based on this research a series of recommendations regarding DRM will be prepared and presented. These will include an XML (Extensible Markup Language) DRM schema which can be used as a standard complement to the CanCore profile. These components will be used to design a rights management structure for repositories participating in this national initiative. Mechanisms for using this specification will be integrated into the project's suite of software tools.

Testing and Evaluation
Package Managers: Netera and Télé-université

Partners will implement a project evaluation strategy designed to maximize learning, knowledge accumulation and dissemination and knowledge transfer. This work will be accomplished through well-established stages such as Outcome Definitions, Needs Assessment, Formative Evaluation, Summative Evaluation and Learning from the Collaborative Process. A summative evaluation will assess the impact of the project on practice within the participating organizations. It will also assess the project's success at meeting the initial project goals. Data will be gathered through extensive interviews with key partners, associates, funders, surveys of end users and functional review of products produced during the project.

Despite the popularity and potential of collaborative funding models with government agencies, there has been little systematic study of their efficacy and little awareness of potential problems and solutions that will better ensure successful innovation. EduSource will develop both theoretical and practical models to inform future projects. Using constant comparative analysis of interview transcript data, minutes of meetings, project documentation and investigator observation, the researchers will build theory that identifies the most effective type of collaborative organization, barriers and motivators for collaboration and types of organizational structure most conducive to effective collaboration both within the partnering organizations and of the collaborative organization.

Metadata Development

Package Managers: Athabasca University and NBDEN
Key Participating Partners: Télé-université

Metadata is what separates repositories from the chaos of the World Wide Web. In this respect, the development of the CanCore metadata profile is one of the most important deliverables of the entire E-Learning Program. EduSource will build on this success and further Canada's leadership in this area. The partners are developing, extending and reinforcing the CanCore, including the development of a French language version.

Partners will work on extensions to the specifications to integrate distance learning ontologies derived. The actual LOM relational database implementation within the Explor@-II system will complement and directly aid in the implementation of the CanLOM learning objects metadata directory.

EduSource is not merely conforming to internationally recognized metadata specifications, but its members are actively engaged in setting those standards. This project acts as a springboard for Canada to play a prominent role in this area.

Software Development

Package Manager: Télé-université
Key Participating Partners: Athabasca University; NBDEN; NewMIC Foundation; Learning Commons, University of Calgary (in association with Netera)

The partners are developing an integrated suite of software tools for the implementation and management of learning object repositories. These software tools will form the foundation of the pan-Canadian repository network and their development will be coordinated across various institutions. Wherever possible the project will use open source solutions to ensure the adoption and use of these tools across a full spectrum of Canadian and international educational organizations.

A crucial dimension of this work will be the integration of existing software tools developed during the first phases of the E-Learning Program. These include the POOL project's SPLASH for the creation of peer-to-peer networks of repositories; Explor@ II for the management of repositories and resource integration into courses; CAREO for the searching and creation of centralized repositories; and ALOHA from the Learning Commons at the University of Calgary for the metatagging of learning objects. By making these tools work together and augmenting them with some strategic software 'bridges', eduSource will provide a complete set of repository building tools.

But eduSource will also move into new areas of research and development and in particular it will try to harness the emerging capacity of the Semantic Web and Web Services to facilitate teaching and learning. CANARIE projects to date have focused on the formal description, tagging and distribution of educational objects. While this is an important first step, it is well known that successful learning experiences are dependent upon many other factors besides availability of content. Recognizing this limitation a number of researchers have developed educational modeling languages (EML) that formally describe other critical components of the educational transaction. Most importantly EML from the Dutch Open University is expressed in formalized notation (using XML) to facilitate search, retrieval and automatic application of this knowledge on the semantic web by both humans and autonomous agents. The ADISA implementation of the MISA instructional methodology, built by Télé-université's Cogigraph also provides an educational modeling language as a set of XML descriptions that will be compared with EML and possibly combined through an international collaboration with the Dutch Open University

In this context, the software team will develop tools for Repository Interoperability and Development, Knowledge and Information Management, and Facilitating Teaching and Learning.

Hardware Integration

Package Managers: Netera and NewMIC Foundation

Partners will work together to develop a hardware specification for learning object repositories and to create a physical testbed for a large-scale, cross-country implementation trial of learning object repositories using Ca*net 3/4. This work will build on, enhance and integrate existing servers established through CANARIE projects.

The national testbed will be designed to accommodate servers from various vendors and of various sizes, capacities and operating systems as well as exploring different architectures including both peer-to-peer and centralized server models. In all cases this package will be informed by the principles of open systems and interoperability.

The primary delivery mechanism for this network will be the broadband Internet and in particular CA*net3/4 but it will also investigate the delivery of learning objects by other means as well. This will include the commercial Internet and wireless and satellite systems and the use of caching servers and other devices to enhance delivery and performance.

Business and Management Models

Package Manager: Netera

Key Participating Partners: NBDEN; Télé-université; University of Waterloo

During the course of this project, a business and management strategy will be advanced. To this end a variety of funding models will be developed and assessed. These would include memberships, subscriptions, support and service contracts, licences and pay-per-use. This work will be closely coupled with the Digital Rights Management Package.

This work-package will also explore the sustainability of LOR infrastructures between and within educational institutions. Investigations will be made into how learning organizations independently and separately coordinate resources (labour, equipment) to support the creation of educational objects, what challenges exist, and how to redesign organizational processes to engender the long-term sustainability of LORs in education.

The long-term viability of these networks depends on communicating their value and importance to educational institutions, government agencies and the general public. Learning organizations need to understand that repositories are the foundation of online learning and that lessons, modules and courses cannot be delivered through the Internet without a robust repository architecture. The success of eduSource's business model depends on both its testbed and the effectiveness of its communications plan in disseminating its results.

Community Building

Package Manager: University of Waterloo
Key Participating Partner: Netera

The partners will develop networks of exemplary Canadian communities for the design, development, evaluation and exchange of learning objects and these will be informed by the communities of use established by other collaborative projects. In the post-secondary domain, these networks of communities will demonstrate the scalability of online subject area communities to achieve the following objectives:

- Foster collaborations across Canada among community members
- Extend the quality and quantity of learning objects that are developed and re-used
- Enhance understanding and expertise about the design, implementation and use of learning objects
- Establish a distinctive Canadian area of expertise in the international learning object realm.

- Faculty members at universities and colleges are critical to the development of robust networks of communities. Project partners will develop exemplary proto-type networks of discipline-specific online communities to integrate local collaborations within their larger communities of use and link them to eduSource's pan-Canadian network of repositories.

Project Management, Co-ordination and Communications

Package Manager: Netera
Key Participating Partners: All

In consultation with all its partners, the Netera Alliance Inc. is providing project management, accounting and administration for the project as well as fulfilling the reporting requirements as stipulated by CANARIE. cannot be over-emphasized that the success of large-scale projects with multiple partners spread across the country depends on a strong management team.

Project Team

The eduSource team is built on the foundation of the CRAG (Canadian Repository Action Group) which was formed in the summer of 2001 to provide a forum for ongoing collaboration between Learning Object Repository projects.
The members presently include the following:

- Athabasca University (Alberta)
    - Campus Alberta Repository of Educational Objects
    - Distance Education Projects and Technological Help

- New Brunswick Distance Education Network Inc. (NBDEN)
    - TeleEducation NB
    - Atlantic Provinces Community College Consortium
    - Université de Moncton
    - E-com inc.

  - The National Research Council of Canada (NRC)

- Netera Alliance (Alberta)
  - Learning Commons (University of Calgary)
  - Advanced Technologies for Learning (University of Alberta)
  - Callisto
  - Telesat
  - RightsMarket
  - Antarcti.ca.

- New Mic Foundation (New Media Innovation Centre) (BC)
  - Simon Fraser University (Surrey)
  - TelesTraining Inc.
  - C2T2 (Centre for Curriculum Transfer and Technology)
  - BC Institute of Technology

- Téléuniversité du Québec
  - CIRTA
  - LICEF
  - Technologies Cogigraph Inc (TCI)
  - Canal Savoir
  - ETI (Ecole de technologie de l'information)
  - Bell-Technomedia
  - Ecole Polytechnique,

- University of Waterloo

Summary

EduSource is a comprehensive project that ties together various work packages and creates synergies between its partners and associates. All of the partners are Canadian organizations and meaningful work will be carried out in every region of the country. Moreover each partner brings unique skills to the project and the work packages have been organized to ensure that those skills bolster and complement one another. For example, CanCore guidelines are developed in Alberta through Athabasca University but implemented in the CanLOM metadata repository in New Brunswick and in Explor@ in Quebec. In fact, the wide-scale adoption of CanCore demonstrates how the principles of interoperability and open systems have guided our previous projects and are the foundation of our present work together.

Because the project builds on and integrates pre-existing repository work by experienced project teams, eduSource can ensure the soundness of its methods and the feasibility of the technologies involved. In addition not only are eduSource members aware of the best national and international standards, such as CanCore, they are helping to create those standards. All of the partners are connected to CA*net 3 and have helped develop the applications such as videoserving and videoconferencing that exploit its unique strengths. The project addresses issues of accessibility through its partnership with the Adaptive Technology Resource Centre and its Barrierfree On-line Learning Exchange or BOLE project.

The expertise of the team and the members' experience in collaborative product development are powerful indicators that eduSource will be beneficial to the future of the Canadian economy not only through the exporting and commercialization of its results, products and expertise to a growing global market, but also through the significant competitive advantage it will impart to Canada and Canadians through the effective exploitation of broadband networks for the delivery of education and training.

Web References

Alexandria	alexandria.netera.ca/
ATRC	www.utoronto.ca/atrc/
BELLE	belle.netera.ca/
BOLE	www.barrierfree.ca/
CANARIE	www.canarie.ca/
CanCore	www.cancore.ca
CAREO	www.careo.org/
CIRTA	www.cirta.org
Cogigraph (TCI)	www.cogigraph.com
DEPTH	depth.athabascau.ca/
EML	eml.ou.nl/
Explor@	www.licef.teluq.uquebec.ca/exploredemo/
IMS	imsproject.com
IEEE LOM	ltsc.ieee.org/wg12/
Learning Commons, U. of Calgary	www.ucalgary.ca/commons/
LICEF	www.licef.teluq.uquebec.ca/
Merlot	merlot.com
Netera	www.netera.org
NewMic	www.newmic.com/
NRC Elearning	www.lit.nrc.ca/e-learning.html
Open Digital Rights Language	odrl.net/
SavoirNet	www.canal.qc.ca/corporation/savoirnet/
TCI	www.cogigraph.com/eng/dirigeants.htm
TeleCampus	telecampus.edu
TeleEducation NB	teleeducation.nb.ca
TelUQ	www.teluq.uquebec.ca
UWaterloo	www.uwaterloo.ca
PLIANT	pliant.ca
POOL	www.newmic.com/pool/
University of Alberta	ualberta.ca

Acknowledgements

The authors would like to thank CANARIE (The Canadian Network for Advanced Research in Education) for their support for this project.

Challenges in Providing e-Learning Solutions in the Regulated Pharmaceutical Industry

James L. Vesper, Learnwright, Inc., Rockville, MD, USA jvesper@learnwright.com

Abstract: Regulatory agencies around the world require that those involved in producing pharmaceutical products be adequately trained. E-learning can accomplish this, providing consistent delivery and learner assessment. However, there are some unique expectations that regulators and the pharmaceutical industry have of e-learning solutions. These include approved electronic records and signatures that have reliability and integrity, system and application validation, and assessment of learning. While these expectations are a challenge to e-learning courseware producers, they contribute to the production of high-quality, robust courseware.

The pharmaceutical industry includes those firms that manufacture prescription and over-the-counter drug products, active pharmaceutical intermediates, biotech pharmaceuticals, and those products derived from human blood and plasma. Manufacturers in this sector must provide knowledge and skill training to personnel who develop, manufacture, and test pharmaceutical products making this sector a prime candidate for using web-based e-learning solutions. At the same time, this heavily regulated industry has some unique requirements that must be met in order for e-learning to be used.

We're familiar with the features of e-learning. Some of these are of particular interest in the pharmaceutical industry because of the resulting benefits that include:

- Consistency of content and delivery;
- Availability 24/7;
- Availability from any location with a suitable inter-/intra-net access;
- Completing the program at the learner's own pace;
- Inclusion of text, audio, graphical, and video elements; and
- Rapid updates.

Examples of where e-learning is currently being used or implemented include providing:

- Basic regulatory training for personnel working in blood collection centers across the U.S. including large cities as well as very small/remote communities.
- Initial training to temporary workers or contractors.
- Intermediate-level training on how regulations apply in particular jobs.
- Basic and intermediate-level training to clinical investigators and institutional review boards on how to protect people who volunteer to participate in clinical research.

Regulations, requirements, and expectations

Most industries or sectors consider themselves "special" or "unique". Those of us in the pharmaceutical industry certainly do – in part because we are the most heavily regulated in the world along with the aviation and nuclear power industries. Drug agency inspectors, like those from the Canadian Health Products and Food Branch and the US' Food and Drug Administration, conduct periodic inspections, evaluating the quality systems, buildings and facilities, and manufacturing and laboratory operations. Training is a key element in each of these areas. The set of knowledge and skills these personnel need to know and apply is called, "Good Manufacturing Practice" or GMP.

Most countries or regions have their own set of these GMP requirements; most of the principles of GMP are the same from country to country, however there are some small differences.

Regulatory requirements are derived not only from what is published as regulations, but also from guidance documents, and best of industry practices that are "feasible and valuable" – a phrase of particular importance with the US FDA. Sometimes these requirements are referred to as "expectations" – which is what the regulatory agencies expect to see implemented by drug manufacturers.

Currently, there are three important expectations related to training of personnel using e-learning solutions:

1. Use of electronic records and electronic signatures that are at least as reliable and trustworthy as their traditional paper or hand-written counterparts.
2. Validation of computerized systems and applications to ensure they function as intended.
3. Assessment of personnel to ensure they have the required knowledge and can (and are) performing their assigned tasks as required.

The first two expectations must be considered as part of the design, development, and implementation of any learning management system or LMS and the e-learning "engine"; the second and third expectations must be considered in the design, development, and implementation of the specific training course applications. These expectations apply to e-learning projects done by contractors/vendors or by pharmaceutical firms themselves.

Electronic records and electronic signatures

In March 1997, the US FDA published a regulation, "21 CFR Part 11" (FDA 1997) that mandates that whenever electronic documents or an electronic signatures are generated or used to meet an FDA requirement, that they be created, stored, and retrieved in a way that assures their veracity – i.e., their truthfulness and reliability. The FDA had, in isolated but significant situations, discovered firms that had prepared and submitted fraudulent paper documents. The agency was concerned that by using computer technology, those firms intent on committing fraud could do illegal things, faster.

Regulatory agencies in other countries and regions have similar concerns but have not yet established such detailed requirements.

We all saw – or participated in – the work required to make computer systems Y-2-K compliant. For firms regulated by the FDA, Y-2-K was, without exaggeration, a fraction of the effort and expense to achieve "Part 11" compliance. Terms like audit trails, biometric and non-biometric signatures, certifications, and metadata are now part of our lexicon.

Neither the FDA nor the industry had a clear understanding of enormous impact of the regulation when it was published. We are still in a dynamic situation with the FDA as their expectations evolve.

Related to e-learning, Part 11 impacts learning management systems and any e-learning application that creates or stores records or requires someone to "sign" that they have completed a specified action. For example, if an LMS collects and retains assessment results from a learner's session and retains a record of this, an FDA investigator (or an in-house regulatory compliance auditor) could ask simple questions, such as: *"How do you know that this training record for Mr. G. Brown hasn't been modified in any way? How do you know that this is the actual data or record that was generated during the training session? Prove it to me."* Providing suitable – compliant – answers to these questions is the essence of Part 11.

Validation

Another question that regulatory investigators (and auditors) ask is, *"How do you know that this computer system or web-based training program is doing what it is supposed to do?"* That is the basic question answered through the process of validation. Validation is simply defined as having documented evidence that a computerized system is consistently performing as it was intended.

For new systems or applications that are being created, hardware and software designers utilize the "system life cycle" with defined actions and responsibilities that apply to both the system owner and the developer (or supplier). This approach is not unique to the pharmaceutical industry; the expectations are consistent with ISO standard ISO 9000-3 and recommended practices by the IEEE.

The nine phases are not necessarily a linear path; some are predicated on others being completed while at other times, there may be a re-iterative loop or branch that is appropriate to take. The phases consist of:

1. System idea (including a needs analysis report and a request for proposal [RFP])
2. System plan (defining user requirements specifications [URS] and system requirements specifications [SRS])
3. Design (producing the system design description)
4. Build
5. Test (verifying compliance to the system design)
6. Commission (system acceptance, validation to URS and SRS)
7. Operate
8. Maintain
9. Retire (decommissioning and retiring)

In other words, you:

- Define what must be achieved
- Produce a solution that achieves the goal
- Prove that the goal is being achieved
- Maintain control to ensure that the goal is achieved

Throughout this process, records become the evidence that the activities were done. Pharmaceutical client firms conduct audits of vendors to review the records and assure that procedures are written and are being followed to adequately control the entire process.

Accomplishing some of these activities is consistent with good instructional systems design or ISD practice, while other activities can be a challenge to control. For example, at Learnwright, as we have created web-based GMP training courses, we have been challenged to initiate and follow new rules of practice to comply with validation and change control when developing new programs or making fixes or changes. Key in this is having the proposed change approved, documenting what we are doing, and then adequately testing to assure ourselves and our clients that there have not been any unintended surprises. For creative software developers and ISD professionals, achieving this needed level of control is a discipline that must be developed.

Does this control take more time and energy? Yes. Does it cost more money upfront in the design and development process? Yes. Are there benefits to our clients and to us? Yes – it helps them meet regulatory requirements and helps us have a higher level of comfort that our courseware will work. It is an investment that we can make that builds quality and excellence into what we do.

Is all of this really necessary? Read the article in the July/August 2002 issue *of Technology Review*, entitled "Why Software is So Bad" (Mann 2002). You'll see how inadequate control during design, programming, and testing can result in serious problems.

Am I saying that learning management systems and e-learning courseware have to be developed and validated to the same degree that an implantable pacemaker must be? No. The key is that what we do must ensure that the e-learning solutions we provide are fit for their intended use – a basic definition of quality.

The third regulatory expectation that we mentioned earlier, *Assessment of personnel to ensure they have the required knowledge and can (and are) performing their assigned tasks as required,* is where e-learning technologies can have a unique impact. This is where we, as designers and producers of e-learning can leverage our creativity and engineering skills.

Assessing the learners

Those who have studied the theory of learning and assessment have confirmed a rather intuitive fact: The closer the design of an assessment exercise is to how the job is actually performed, the more confidence we can have that if a person does well on the assessment, the higher the probability that a person can transfer the knowledge and skill into the job. Yes, there are any number of factors that can block transfer, but with that said, the closer the assessment tool is to the job, the better.

A simple example: You are teaching me how to put on a sterile gown – we call them "bunny suits" – so I can working in an aseptic facility making injectable drugs like antibiotics or insulin. You give me a pen and paper test about the sequence of what part of the gown to put on first, second, third, and so on – I'll probably pass. I'm good at that type of fact recall. But my passing that assessment isn't going to tell you much about how I put on that gown – can I put it on in the correct sequence without contaminating it. For that, you want an assessment that is more of a simulation of how the task is actually performed in as close to the "natural" setting as possible.

With that in mind, I would like to show you three examples of how we at Learnwright have attempted to make our assessment strategy as close as possible to how a person in a pharmaceutical or blood products organization would apply certain GMP principles. These are what we call:

- Audit document
- Audit cam
- Audit conversation

The basic premise is that we assign the learner to examine something that they would have familiarity with in their jobs: they are to review documents, watch a person perform a task, and observe a conversation. It each situation, they identify deficiencies (based on other information and content provided or that they should know) and then determine the impact of the problem, state why it is a problem, or select the corrective action that is appropriate. These skills are similar to what an auditor would do during a GMP compliance audit. Hence the term, "audit cam".

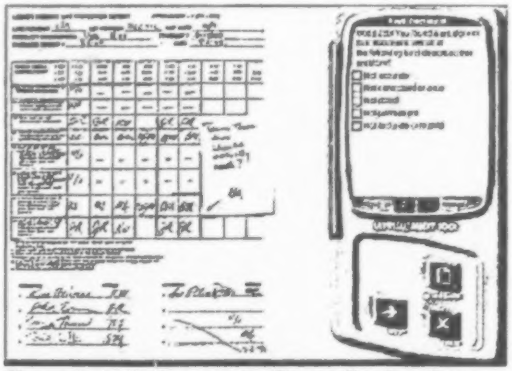


Figure 1. Audit Document – Data collection sheet.

BEST COPY AVAILABLE

An audit document is shown in Figure 1. The learner can roll over the document and see that different areas are highlighted. Some are real problems, others are distractors. The system deducts points for incorrect selections. So, if you know the information and select the correct hot spots and answer the follow-up questions correctly, you will keep a high score. If you guess, you will be loosing points, reducing the score.

In this audit document, you can see that a simple horizontal line is used to show that data is not present. In our industry, that is a problem – it should have an "NA" or a "not applicable" marking and include the writer's initials and date written. Clicking on that highlighted zone, I get feedback that I have found a valid problem and then a follow-up question that I need to respond to.

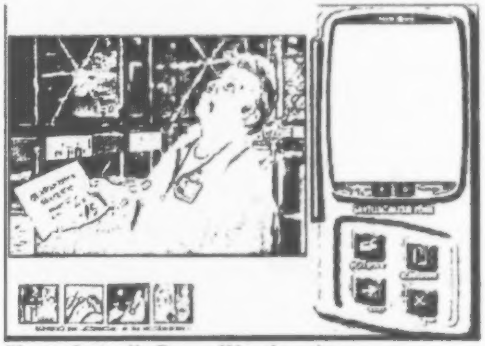


Figure 2. Audit Cam – Warehousing.

An audit cam is shown in Figure 2. The learner first reads a description of a video scenario that they will view – in this case, someone who finds a special "quarantine" label on the floor of the warehouse. Then they will view a 45 to 75 second video of the person doing the task, similar to what they do in their job. A voice-over presents what the person in the video is thinking as he or she performs the job. After completing the video sequence (which they can review without penalty), still-frames from the video are presented that include the problems visually depicted in the video. Here the learner plays the game, 'what's wrong with this picture' – identifying problems and determining their impact. Some of these video segments are "over the top" – most experienced personnel seeing these are on the floor laughing about the poor practices. That's fine – it opens up a part of their mind to the learning process and allows them, through the follow-up questions, to demonstrate that they understand *why* it is a problem or *how* they should properly respond.

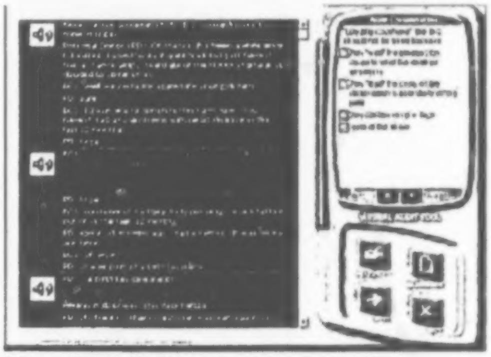


Figure 3. Audit Conversation – Transcript.

An audit conversation is shown in Figure 3. This was first developed because of the needs in the blood industry. If you donate blood, a screener must ask certain questions, in a particular way, in a proper setting. Using audit conversation, the learner will watch and listen to a videotaped conversation and then examine a transcript of that

BEST COPY AVAILABLE

conversation. The transcript has sections that are "hot" – again with the distractors and true problems – that the learner can click on. If a problem is found, feedback is given and a follow-up question is asked.

Since all of the scenarios used in the audit documents, audit cams, and audit conversations are based on real-life situations and problems that a person working in that area could reasonably encounter, these are almost simulations that assess the learner's ability to apply GMP knowledge and decision-making skills.

Conclusion

There are some special requirements in providing e-learning solutions to the pharmaceutical industry: electronic records and signatures, validation, and the need for assessment. Our experience has been that by embracing these requirements, our end product is more stable, controlled, robust, and focused on the true learning and compliance needs of our clients.

References

FDA (1997) Part 11 – Electronic Records; Electronic Signatures, *Federal Register*, 62 (54), 13429-13466.

Mann, C.C. (2002) Why Software is so Bad, *Technology Review* 105 (6), 33-38.

All images shown are Copyright © 2000-2002, Learnwright, Inc. All rights reserved. Used by permission.

The Open Source Movement, Publishing, and the Dissemination of Knowledge

Bob Young, CEO – Lulu, Inc.

Summary

Content…. movies, music, books – it all falls under the rubric of "intellectual property". Indeed, this is only a subset of IP, but for our purposes it is a representative example. Here is the key issue to ponder: A series of changes in intellectual property law over the last 30 years has made it more difficult for researchers, scientists, authors, and artists to cooperate and collaborate on critically important projects. At the same time the advance of communications technologies, specifically the Internet, promises to foster an explosion in creativity, cooperation, and collaboration never before thought possible. How can the restrictive environment of today's intellectual property laws, often exemplified by copyright, co-exist with society's overarching interest in this burgeoning advancement? Remember, society's interest is both crassly commercial and sympathetically benevolent.

These interests reflect pretty grand, yet seemingly contradictory goals. This discussion considers how new tools and strategies will enable content owners, whether authors or publishers, to control their works and retain the benefits provided by "scratching the self-interest itch" that often provides primary motivation. At the same time users of these works are enabled to derive maximum value from pre-existing art and knowledge by building on these advances. They can, as Newton put it, "stand on the shoulders of giants".

Copyright: Yesterday, Today, and Tomorrow

What is copyright? How did it come into being? Quite simply, copyright began in the 16th century as a means for one group of printers to protect their printed works from being pirated by other printers. You see, that first group of printers had acquired permission from an "author" to reproduce a work, in this case, a book. Copyright was established as a protection for the work of that "permissioned" group of printers. In the United States, the genesis of copyright law is found in the Constitution, article 1, section 8, which states:

[The Congress shall have power] "To promote the progress of science and useful arts, by securing for limited times to authors and inventors the exclusive right to their respective writings and discoveries;"

The original period of copyright protection was 14 years with "privilege of renewal" for an additional 14 years. Over the years copyright term has been extended repeatedly as the "fair use" rights have been diminished. While a smaller and smaller group may have benefited, an ever increasingly larger group has suffered. That group can easily be described as "society as a whole".

Copyright did not attempt to stop users from reselling a book, teaching from a book, quoting portions of the book, or using the book as the basis for satire or inspiration. Attempts to prevent a work like "The Wind Done Gone" from being published would have been laughed out of court. Today copyright lawyers would have you believe that it is almost no longer permissible to base any work on a prior work or on "that which has come before". For example, Walt Disney's practice of basing stories or characters on those that can be traced back to the Brothers Grimm (Snow White, for example) can now be interpreted as expressly prohibited. If we believe the lawyers, certain historical figures are, or will soon be, off limits to almost anyone creating works of art or fiction. Examples of this include Pocahontas and even Dr. Martin Luther King. This begs the question, "How does this benefit anybody"? Does Disney really have a claim to the Pocahontas legacy? Who owns the history of and the ideals personified by Dr. King?

Let me go out on a limb and predict that the pendulum has swung as far as it can on the issue of extending copyright regulations in favor of the big corporate content empires. There is a pending Supreme Court case called Eldred v. Ashcroft that is attempting to return a modicum of sanity to portions of the intellectual property arena. If not the Eldred case (www.eldred.cc) then some other, stronger case will likely begin to roll back these over-extended corporate rights. The crazy part about this entire scenario is that content companies like publishers, movie studios, and record companies ultimately have such significant prospects for gain. Fear of change, however, seems to keep them blinded to this new world of opportunity.

What does this actually mean to an industry like publishing? It means significantly less than many of the conglomerates fear. First of all, most publishers do not make any money on content that is over 90 years old. Most earn the vast majority of their revenues on content created in the last five years. Indeed, an ability to use their marketing and editorial engines to leverage an enhanced public domain would become a powerful tool in their business toolbox.

At any rate, it will serve to focus the concentration of the leaders of this industry on the recognition that they earn their money not by forcing their customers to buy their products, but by delivering such high value goods and services that customers are pleased to buy them.

The Future of the Internet and Why We Can't Count Out eBooks

Despite all the dire predictions for the Internet and how it would certainly fall prey to one evil monopoly or another, the future is going to look much like its recent past. It will continue its rapid growth in both access and speed. The Internet is becoming as ubiquitous as television. That will not stop. It is also well on its way towards becoming more ubiquitous than the telephone is today. For businesses like the publishing industry, the meaning of this ascent will either be terrifying or thrilling, depending on its state of readiness. Rapid change in technology is wonderful....especially if the real users of that technology think so.

Many of us, myself included, have had great fun pointing out fatal flaws with eBook technologies. This was even more fun given the fanfare that accompanied eBooks and their proponents. In direct opposition to the initial hoopla, one might now assume it is a given that the average pleasure reader will never read electronically displayed text. We are becoming convinced that humans prefer the tactile sense of holding an organic material like paper and the "always-on" convenience of the printed page.

Don't kid yourselves! The ridiculously creative, competitive, and wealthy technology sector prides itself on making its own technology offerings obsolete every 18 months or so. It may take them 20 more years than they predicted. However, they will get the technology application right. When that happens the electronic sharing and collaborative development of content will become more commonplace than email. The benefits, commercially and societally, will be astonishing.

Remember the paperless office predicted in the '70s? Well it is almost here, admittedly 30 years late, but for many firms it will soon be their reality. Remember the Apple Newton personal organizer of 1990? It failed spectacularly, only to reappear as the hugely successful Palm Pilot. This is a prime example of better engineering and better technology that was "based on what had come before".

Every eBook I've tried to read has been....how can I say this nicely....a challenge. What the heck, they've all been duds. It may take three years or it may take 20, but someday the eBook, or some of its progeny, will build the business that obsolesces the companies who currently make their living putting ink on dead trees.

As the Internet becomes more "everywhere, all the time", at even lower cost, most consumers will prefer to "read" or "experience" content electronically. All of us – business people, educators, and learners – better be ready or we will look like the proverbial buggy whip manufacturer, the horse and buggy driver, or the uncomfortable horse and buggy passenger when Henry Ford came along and put a Model "T" in every garage.

Future Partnerships between Authors, Publishers, and Consumers

How do all the players take those first small steps into this brave new world? There are a few "watch words"; let me suggest just a couple and then propose a couple of additional "rules". First, we should all consider the concept of trust. As in, "I trust you to do what you said you would....and what I said you could." This "one on one" relationship will become even more critical as technology advances. The "barter" relationship of the Open Source movement depends on this type of trust. Again, the opportunities for existing, large, commercial entities to benefit from their existing positions could be huge. All they have to do is secure (or retain) our trust. Second, we should all consider the benefits from the word "extend" – like "I extend to you the right to....(fill in the blank). Better yet, how about, "I extend to you the right to improve on my work."? Just don't forget to "cut me in" – monetarily or recognition-wise.

Here are two rules that I would suggest hold true for large commercial enterprises as well as research-oriented organizations and institutions:

1. Experiment, experiment, experiment. Many small inexpensive initiatives will beat a very large well-funded R&D project every time. Play to your strengths. In business and in education it is essential to partner with good partners. While this seems self-evident it is often simple truths such as these that are ignored. This is where an Open Source perspective comes in. The ability to benefit from your partner's work and experimentation is critical to moving forward both your initiatives and your partner's goals. As an aside, many of you may have been waiting for me to insist that "a key to the intellectual property business castle" can be had by giving away copyright-protected content (whether on your own or on your author's behalf). I hate to disappoint but that would seem like a clueless thing to do unless you can find good commercial reasons for doing so. Of course one reason to "give away" content is to receive something that you want in return – the barter analogy.

These reasons might include, for example, trying to build a readership of related materials that your enterprise sells, or trying to build a reputation of or a following for a particular author, artist, or project. In general, Open Sourcing (or giving away) previously copyright protected content may not earn you direct revenue but it certainly could serve to reduce marketing or other costs associated with development or generating revenue on related materials.

But this is somewhat of a digression. The real importance of Open Source is your selection of partners, especially technology partners. What Open Source can mean to you is that you actually gain control over the technology you will use to distribute content in this new world just described. This potentially puts one in the position of controlling how content can be used (from a publishing perspective, for example) while becoming unshackled from any dictates a particular technology provider might want to impose. Open Source strategies ultimately put those controls in the hands of the full range of users. Exploring this from an integrated technology and content perspective could lead to a content owner establishing relatively non-restrictive licenses on how the content can be used in other publications while imposing no restrictions with regard to delivery mechanisms.

Open Source software is simply a real, verifiable, and guaranteed commitment on the part of your technology supplier to treat you like a partner with regard to the use of that technology. This is critical because when technology is used to reach your customers, you or your organization retain control over customer access and you do not become a victim of that supplier.

2. Don't fear your customer. Your customers may not always be right, but they are always your customers. Your customers want a level of control, they need this control, and they will pay for control. This is especially true if you are a content provider. It can easily be deduced that the record industry, based on their public pronouncements, apparently must fear their customers. They are seemingly convinced that most of their

customers are crooks and draconian new laws are needed to protect this industry from these "customers". What a sad way to live you life! What a stupid way to serve your customers! You can treat customers badly for a while, sometimes even for years, but it always comes back to haunt you. Either the customers will find a way to avoid your product or service altogether (think using email rather than going to the post office), or they will migrate en mass to a new supplier who treats them like....well....customers (think Wal-Mart versus Kmart).

Don't let the public relations barrage from lawyers representing large "content conglomerates" fool you either. Extracting never-ending and ever increasing revenues on existing content libraries without offering similarly increasing benefits to customers just will not happen. Ok, it may happen for a few, well-developed consumer icons like a mouse with big ears....but for the rest of us....and them, the old rules still apply. Content businesses will make most of their revenues the old-fashioned way. They will earn them by providing better, more useful and valuable content to their customers than their competitors. Best of all, this can be provided in formats that make content more useful, accessible, and/or entertaining.

Try new things. Get close to your "consumer". Trust this brave new world and extend opportunities for others to enhance your work. As we move forward I hope that control of intellectual property remains in the hands of its owners and developers. However, I truly believe we all benefit if a full array of rights and permissions are granted so that others can build on the pre-existing base of knowledge. I think this will lead to more flexible, learner-centered customizations in the education arena. Best of all I feel that we all can benefit from the lower costs of an electronic delivery model and the added value of dynamic content.

Full Papers

Redesigning a Course Using an Analysis of Technical Problems Encountered in an Online Technology Training Course

Jason T. Abbitt
University of Idaho, College of Education, USA
jtabbitt@uidaho.edu

Mitchell D. Klett, PhD
University of Idaho, College of Education, USA
jtabbitt@uidaho.edu

Scott M. Graves, PhD
University of Idaho, College of Education, USA
jtabbitt@uidaho.edu

Abstract: This study sought to analyze the technical problems encountered by students in a technology training course for educators. The results of the study then informed the redesign of the course for its next offering. The study collected data by both qualitative and quantitative means with the overall purpose of determining in which course modules the students encountered the most technical problems. Further data collected from the survey following the course indicated that occurrence of technical problems did not negatively impact the students' rating of the value of each module or the perceptions of the value of the course.

Introduction

This paper reviews the results of a web-based course intended to teach technology skills to practicing K-12 educators. While computer-based training has long been used for training technology, new systems being developed for online courses will benefit from continued research into the practice and application of Internet technology in distance education situations. The American Federation of Teachers recommends "as we encourage experimentation in distance education, we must conduct much more rigorous evaluation of distance education programs" (p.15).

The purpose of this study was to begin an evaluation process to meet those needs. The development of this course follows a four stage process of (a) Design, (b) Development, (c) Evaluation, and (d) Revision (Willis, 1992). At the point that this paper was written, the course was undergoing the evaluation stage of the course development process. The results from the data gathered will serve to inform the course designers during the revision stage of the process.

Relevant Literature

In 1995, the Office of Technology Assessment identified technical problems as one of several barriers to technology integration in the K-12 educational practices. The Institute for Higher Education Policy (2000) identifies reliability of distance delivery system is also a benchmark for quality online education.

Technical problems while using computer technology are certainly not an uncommon occurrence. Harmes (2001) notes that in a case study on a internet based course, "the most frustrating portions of the distance learning course were reported to be problems with software (e.g. using AOL's browser), trouble communicating with other students, and long download times" (p. 2854). Other studies have indicated that only 20.9% of course websites have technical help functions available (Mioduser, et al., 2000).

It is possible, however, to alleviate some of the technical problems that might be encountered in online courses. The development of a course website is very similar to the development of other software. In this study, the "software" being developed was the course website, tutorial modules, and assignments. Mishra (1999) proposes that the design of software "is an ongoing conversation" (p. 231). This conversation includes the initial design of software, testing the software, presenting to clients, and other reiterative processes used to develop and refine software to meet the specified need. In terms of online courses, the clients include both the instructor and the students, thus consideration must be made for the usability needs of both the instructors and the students

Even with careful planning, testing, etc., there is still a high likelihood that inconsistencies in web browser software will impact a web-based course (Horton, p.115). Because of such things as browser inconsistencies and the multitude of differing computer configurations, it is nearly impossible to test a web site for a course in every possible configuration, it is even less possible to test software to be used in a course for every possible situation that might be encountered.

Undoubtedly, there are some technical problems expected when teaching a course on technology with technology. It is the ultimate goal of internet-based educational systems to be as free from technical problems as can be reasonably expected and to provide timely and appropriate assistance when a problem occurs.

Course Description

The topics covered in the course were a concepts relating to computer operating systems, the Internet, digital image manipulation, digital cameras, QuickTime Virtual Reality authoring, and the introduction of a custom-built website for sharing electronic images and files. There were a total of six major course topics, each with a tutorial module and an assignment to be completed by the participants after working through the tutorial module.

The course was taught by the first and second author of this paper, both of whom had previous experience designing and teaching educational technology courses at the university level in a classroom setting, at a distance via the Internet, and also in training workshops with practicing educators on the topics presented in the course.

During the course, the primary means of communication between the students and the instructors was through of email. The course website featured a form that would send email to both instructors and also the email addresses of both instructors was given on the course website. Students were encouraged to contact the instructors via email if they had any questions, problems, or other needed other assistance.

Assignments in the course were submitted via web-based forms, or alternatively as an attachment to an email message. Of the six assignments that were required in the course, two were primarily text-based information, three assignments required uploading one or more files that were then delivered to the instructors, and the final assignment was to based on the students' ability to successfully use an web-based application for media and file sharing (hereafter referred to as the "Artifact Archive").

Participants

This course was part of a series of online courses and workshops for the teachers involved in a Technology Innovation Challenge Grant program funded by the US Department of Education. Prior to this course, the participants had taken two online courses which used a similar interface and similar course features and attended one three-day workshop, and one two-week workshop involving technology training. There were a total of 51 participants representing 17 school districts in 9 states in the course for the eight week session.

Methodology

The evaluation of this course used two primary sources of information. First, because email was the primary means of communication between students and the instructors, all email communication between students and the instructors was collected. After the course was completed, participants then completed a 67-item course survey that covered multiple aspects of the course. For the purpose of this study, items relating to technical problems encountered and the core content of the course were extracted from the survey data for analysis.

Analysis of Survey Data

The 67-item survey administered following the completion of the course provided information on different aspects of the course, including technical problems encountered. Other information on the survey was not relevant to this study, but will inform other aspects of the course development. The primary items analyzed were the items pertaining to the course tutorial modules and the general course evaluation questions. The tutorial module items asked the participants to rate themselves on their proficiency with the topic before and after the course. The participants were also asked to rate the level of difficulty of each tutorial module and associated assignment, the amount of help needed to complete the module and assignment, and the possibility of using these modules in their classroom. In a following section of the survey, the participants were asked to indicate which modules they found most valuable, least valuable, and which modules they would suggest included in future versions of this course.

From the available survey data, the ratings of "level of difficulty" and "help required" were selected as primary indicators of possible modules where technical problems factored into the success of the course. Also, the indication of which course topics were most valuable, least valuable, and should be included in future version of the course were also examined to further indicate which course topics were most problematic because of technical difficulties. These data would provide initial findings to be confirmed by the analysis of the electronic communications from the course. Additional information was also provided by the survey in the form of comments from the participants. This information was reviewed and used to gauge the overall response of the participants to the course.

Analysis of Email

A coding scheme was developed after the completion of the course to analyze the content of the email messages. Table 1 lists the three levels of coding that were used in the analysis of email messages.

Table 1

Coding Scheme for Participant Email Messages		
Level 1: Message Type	Level 2: Course Topic	Level 3: Detail
▪ Problem ▪ Question ▪ Comment ▪ Other	▪ Operating Systems module ▪ Internet Module ▪ Digital Camera Module ▪ Graphics/Image manipulation module ▪ QuickTime VR module ▪ Artifact Archive module ▪ Multiple modules ▪ General/Other	▪ Submitting Assignment ▪ Using/Installing software ▪ Course administrative ▪ Regarding assignment ▪ Regarding ▪ grade/completion ▪ Website Issue ▪ Other

Following the coding of the electronic communication, the analysis was conducted to examine the messages according to the Level 1 groupings. After determining the total number of problems, the messages were then further sorted by the course topic to which they messages were related. This provided information about which course topics seemed to cause the most problems and which course topics caused the fewest. Following the second level categories, the messages were further sorted according to the details of the type of problem encountered. This information provided insight into how the problem might be avoided or corrected in future iterations of the web-based course.

Findings

Level of Difficulty

In assessing the level of difficulty of the course topics, the survey data indicated that the Operating Systems, Internet, and Digital Camera course topics were rated at a low level of difficulty. For each of those course topics, nearly 60% or more of the course participants rated those topics as a 1 or 2 level of difficulty on a 5 point scale, with 1 being not difficult at all and 5 being very difficult. Specifically, for the operating systems, Internet, and Digital Camera modules, 59.5%, 63.6%, and 67.4% respectively rated those modules as a 1 or 2 level of difficulty.

Conversely, the graphics/image manipulation (Mean = 2.36) and the QuickTime VR (Mean = 2.95) course topics had higher ratings for difficulty. Though none of the mean ratings appear drastically higher or lower than the others, the data indicated that none of the participants rated the Internet, Digital Camera, and Artifact Archive topics at the "very difficult" level. The QuickTimeVR topic had the highest percentage of "very difficult" ratings with 11.4% of the participants and also the highest percentage of ratings of a 4 (25.0%).

Help required

In analyzing the data regarding the amount of help required to complete each course topic, the survey data indicated that the QuickTime VR (Mean = 2.93) and the Graphics/Image Manipulation (Mean = 2.37) course topics ranked highest on a five point rating and the Operating Systems (Mean = 1.86) and Internet/Web Browsing (Mean = 1.69) topics ranked lowest.

Most/Least Valuable topics and Suggestions for future revisions

The third area that was selected as a possible indicator for technical problems was the survey data concerning the most and least valuable course topics and the suggestion for topics to be included in future versions of the course. From the data collected, the QuickTime VR topic ranked highest as the most valuable course topic, followed by the Graphics/Image manipulation and the digital camera topics. The data indicates that the Operating systems topic was the least valuable, followed by the Internet topic. Also, the QuickTime VR, Graphics/Image manipulation, and digital camera topics all were suggested for inclusion in future versions of the course by more than 90% of the respondents.

Results of Analysis of Electronic Communications

During the course, a total of 121 email messages were received that were communication from the course participants to the instructors regarding the course. Since email was also an alternative delivery method for the assignments, those email messages were not considered communication, but rather assignment submissions. Of those messages received, 49 (40.5%) were reporting an instance of a problem encountered while completing the course topics or assignments.

Fifty-one percent of the problems occurred either installing or using the software being taught in the course topics. Also of note is the 28.5% of the problems reported were encountered while submitting an assignment. In looking at those two types of problems that accounted for 79.6% of the total problems reported, it can be seen that 68% of the software installation or use problems were encountered when completing the QuickTime VR topic while the problems while submitting assignments were encountered most with the digital cameras (28.6%) and the artifact archive (42.9%).

Discussion of Results

Perhaps one of the most interesting comparisons of results is that of the number of technical problems reported seemed to have a less significant impact on the suggestions for inclusion in future versions of the course than expected. For example, the number of technical problems with the Operating Systems and Internet course topics were low; the operating systems tutorial and assignment had only two reported technical problems, while the Internet tutorial and assignment had no problems reported. However, the Operating Systems topic ranked lowest on the suggestion for inclusion in future versions of the course and highest as the least valuable course topic. The Internet topic ranked 4 out of 6 on inclusion in future versions of the course and second as the least valuable topic. The QuickTime VR topic had the most problems reported, but ranked highest for inclusion in future versions of the course.

Other results of interest include the relatively high number of problems while submitting assignments via the course website. Since assignments in this course were primarily submitted via the course website, the problems encountered are a point to be carefully considered.

Conclusions

From the data collected, the overall response to the course topics was positive. Many of the surveys included positive comments regarding the course and no negative comments regarding the course overall were encountered. With regard to technical problems encountered, some conclusions can be made regarding which modules were most problematic and the types of problems that were most common.

The data indicate that the QuickTime VR topic had significant problems with the software used and made available to the participants. Most of the problems encountered in the QuickTime VR topic were related to the software not working properly in some fashion. In many cases reported, this problem was a result of compatibility issues with various computer systems on which it base being used.

The Artifact Archive topic also had significant problems, though no strong common link between the problems seemed apparent. Most of the problems were unable to be replicated or only occurred once. Given that the artifact archive is a web-based file sharing application, it is likely that problems were due to communication issues between the users' computers and the server on which the application was hosted.

A third problem area was in submitting assignments via the course website. Problems reported, other than those in the Artifact Archive, were mostly in completing the digital camera assignment and were reported as uploading errors. The most likely cause of this problem is that the assignment required an upload of several files, some of which were larger files that required a longer time to upload, which can often exceed the time limit for uploading files to the server due to low bandwidth connections.

Implications

This study indicates that there are several improvements that can be made to the course itself to alleviate some of the technical problems encountered. These improvements include procedural improvements for submitting assignments, the choice of software for particular topics, the inclusion or exclusion of some topics in future versions of the course, as well as adjustments to be made to the course to accommodate the various levels of competency in technology encountered.

Procedural improvements to the course will primarily impact the submission of assignments. Over the duration of the course, several problems were encountered submitting assignments. This was most often remedied by asking the participants to submit the assignment files as an attachment to an email message to the instructor. The most likely solution to the problem of assignment submissions is to have all assignments submitted in this fashion where file uploading is necessary. No problems were reported that indicate a problem submitting an assignment as an attachment to an email message. In one case, the email message that was reporting the problem also included the files that were being submitted. To that participant, attaching the files to an email message seemed the best solution without any suggestion from the instructors. In all other cases, attaching the files to an email message was a successful remedy to the problem when suggested by one of the instructors. For that reason, assignments in future versions of the course will be submitted as an attachment to an email message, with the submission via the website remaining available as a backup option for students who might not have access to their email. In cases where uploading via the website is required, the web pages that manage the upload will be arranged to limit the number and size of files that can be uploaded to more appropriate limits to alleviate the problems such as upload script timeouts.

In choosing software to be used in the course for the completion of the tutorials and the assignments, careful consideration must be made to ensure that software is available to all participants and that it is reliable. Clearly there were some pieces of software used that did not meet the essential requirements of stability and availability to be included in future versions of the course.

The survey data provides some compelling information when considering which topics in this version of the course should be included in future versions. According to the survey data, a large number of the participants recommend that the Operating systems and Internet sections be removed from the course. One of the follow-up questionnaires, however, mentions that the Operating Systems topic was necessary. Judging from additional information provided on the survey, it seems that the central issue with the Operating Systems topic and the Internet topic is that these covered basic skills that were already very familiar to the participants. The data concerning level of difficulty from the survey also seem to support that statement. From the instructor's perspective, however, and also supported by the ISTE Technology Standards for Teachers, these two topics are essential and must be available to those who do not have these skills and knowledge. Some of the subtopics in the Operating Systems topic in particular are seen by this author as ultimately valuable for any computer user. With all things considered, it is apparent that the participants in the course should ultimately have some choices in what topics they need to complete, based on their self-assessment of their skills and knowledge.

In general, the implications of the data collected are that the course needs revision to address some of the technical problems. Given the relatively low occurrence of technical problems, only 48 reports of problems, and the indications of the value of the topics covered, it would seem that the course met its overall goals of providing applicable and productive training in specific areas of technology despite the occurrence of some technical problems. Future versions of the course should clearly seek to avoid the technical problems that did occur while maintaining relevant topics and the ability to address the various skill levels of the participants.

References

Teacher & Technology: Making the Connection. (1995). Washington, D.C.: Office of Technology Assessment. Retrieved, from the World Wide Web: http://www.wws.princeton.edu/cgi-bin/byteserv.prl/~ota/disk1/1995/9541/9541.PDF

Harmes, J. C. (2001). Assessing Distance Learning Tools and Techniques: A Case Study. Paper presented at the Society for Information Technology & Teacher Education 2001, Orlando, Florida.

Horton, S. (2000). Web Teaching Guide. New Haven, CT: Yale University Press.

Matthew, K. I., & Varagoor, G. (2001). Student Responses to Online Course Materials. Journal of Research on Technology in Education, 33(5).

Mioduser, D., Nachmias, R., Lahav, O., & Oren, A. (2000). Web-Bade Learning Environments: Current Pedagogical and Technological State. Journal of Research on Computing in Education, 33(1), 55-77.

Mishra, P., Zhao, Y., & Tan, S. (1999). From Concept to Software: Developing a Frameworkfor Understanding the Process of Software Design. Journal of Research on Computing in Education, 32(2), 221-238.

National Educational Technology Standards for Students: Connecting Curriculum and Technology. (2000). International Society for Technology in Education.

Quality on the Line: Benchmarks for Success in Internet-Based Distance Education. (2000). Washington, D.C.: The Institute for Higher Education Policy. Retrieved, from the World Wide Web: http://interact.hpcnet.org/webcommission/index.htm

Teachers, A. F. o. (2000). Distance Education, Guideline for Good Practice. Washington, D.C.

Willis, B. (1992). Instructional Development for Distance Education. ERIC Digest. Retrieved, from the World Wide Web: http://www.ed.gov/databases/ERIC_Digests/ed351007.html

E-Learning and Knowledge Management: the MEMORAe Project

Marie-Hélène Abel, Dominique Lenne, Omar Cissé

UMR CNRS 6599 Heudiasyc
Université de Technologie de Compiègne
France
{mhabel, dominique.lenne, omar.cisse}@hds.utc.fr

Abstract: e-learning leads to evolutions in the way of conceiving a course. Diffused through the web, the course content cannot be the pure transcription of a "classical" course. The students need to personalize it and to access it when they need it (just-in-time). Therefore the course content is often divided into knowledge grains. The MEMORAe project aims at applying knowledge management techniques to improve the structure of the content and its access in e-learning solutions. We propose to build an ontology based "learning organizational memory" and to give the users a direct access to this memory by using "knowledge books". The pilot application we chose is a course on algorithms and programming attended by beginner students in our technological university.

Introduction

Information Technology has already transformed the way we work and has a growing impact on the way we learn. New approaches mainly based on the utilization of web technologies are proposed. These approaches are often grouped under the concept of "e-learning", which is still unclear but often put forward as a key-solution to professional training difficulties. Indeed, e-learning allows on-site training and can contribute to a closer integration between working and learning situations. However it raises also many problems and its progression is slower than one could at first think.

A key point in building an e-learning solution is to give the users an easy access to the contents and to the resources they can use. To this end, knowledge is often cut up into grains (Boullier, 2001), joining in that knowledge management techniques. More generally our goal in the MEMORAe project is to study the possibility to apply knowledge management techniques to the construction of e-learning solutions. We propose to build an ontology based learning organizational memory and to make it available to students in an e-learning context.

As a pilot application, we chose a course on Algorithms and Programming, which is taught at the Technological University of Compiègne (France), in face-to-face as well as in distance education. Before describing this project in details, we first clarify our conception of e-learning and we argue for making the link between knowledge management and e-learning.

From Training to E-Learning

E-learning brings some new characteristics regarding to classical training situations. First of all, using the term e-learning rather than e-teaching sets the focus on the learner. In e-learning situations, the learner has to be more active than in classical training applications. Knowledge is not presented linearly as in a course. It is often divided into grains and the user has to choose the grains he considers as being useful for him. He can be helped in this task by a tutor. Teachers and learners roles are deeply modified: learners have to be more active and can cooperate with other learners, teachers play the role of tutor and have rather to assist students than to deliver their knowledge. The tutor pedagogy is based on the personal work of the student.

To sum up, we consider an e-learning application as being a distance learning application

- Using a network approach,
- Giving access to contents divided into grains and not to a linear course,

- In which students are active and can work in a collaborative way,
- In which teachers role is rather to assist students than to deliver their knowledge.

This definition puts the emphasis on the contents provided to students. It presupposes pedagogical resources to be precisely described in order to allow the students to easily access them, with the help of the tutor if needed. The contents elaboration is a quite complex and time-consuming operation that can rarely be realised by the only tutor. Moreover an e-learning application has to allow the management of all the relations, contents and technologies. It implies to identify the expertise in the course organisation itself.

Knowledge Management and E-Learning

In an e-learning application we find people (learners, teachers, administrators, etc.) who need to communicate and to access knowledge and information when they need it ("just in time"). This kind of situation has some similarities with a knowledge management situation.

Knowledge management aims at formalizing knowledge in order to share it and to reuse it. The process of knowledge management involves the following actions (Benjamins et al., 1998):

- gathering the knowledge to be managed,
- organizing and structuring the knowledge,
- maintaining knowledge,
- bringing the knowledge to the persons who need it.

A way to fulfill these requirements is to conceive a corporate memory or more widely an organisational memory. Following (Barthès et al., 1999) an organizational memory is an explicit and persistent representation of knowledge and information in an organization, in order to facilitate their access and re-utilization by adequate members of the organization.

The implementation of an organizational memory may vary according to its expected utilization. It often uses a database, a knowledge base or a document indexing system. The design methods vary according to the available sources: human experts, paper or digital documents etc. A frequently adopted solution to design and manage an organizational memory is to use ontologies.

In knowledge engineering a commonly used definition of an ontology is the one of Grüber (1993): "an ontology is an explicit specification of a conceptualization". By "explicit specification", Gruber means that the ontology is coded with a language. This language can either be the natural language or a logical language.

Roughly an ontology can be represented as a hierarchy of concepts augmented by a definition of the relations between the concepts and by rules and constraints (Fortier, 2001).

In our project, the elaboration of an ontology will be useful to structure the learning contents and to define a shared vocabulary. The ontology will allow to add a context to the requests and to facilitate the access to the information thanks to the semantics associated to the concepts.

Learning Contents Management: the MEMORAe Project

The MEMORAe project focuses on the contents management in an e-learning application. We consider this issue as a knowledge management issue involving acquisition, gathering, organization, maintenance and distribution of the learning knowledge. We are building what we call a "learning organizational memory" (Fig. 1). Users (learners, teachers, tutors, etc.) have access to any capitalized information related to the course they have chosen: pedagogical objects (Bourda & Hélier, 2000), learning objects (Boullier, 2001), users descriptions, etc. Moreover they can communicate and collaborate through the memory. The memory is built and structured by the way of ontologies.

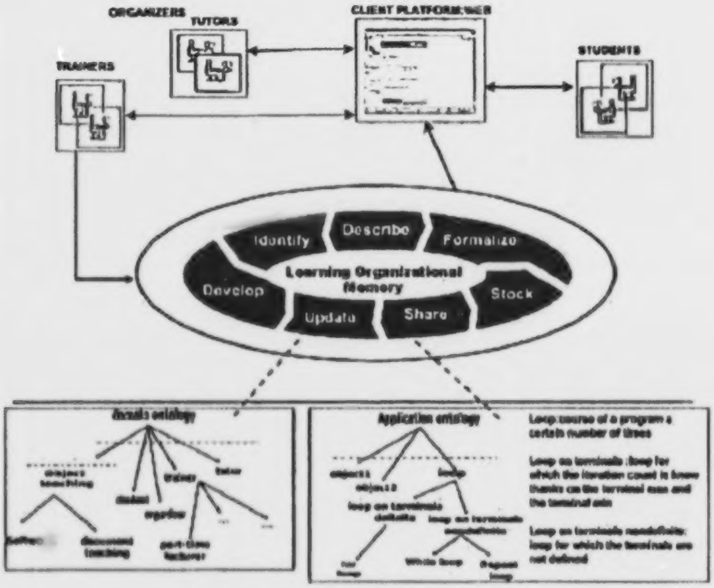


Figure 1: the MEMORAe Project.

We present below the course that we have chosen as a pilot application. We precise the distinction between learning objects and learning contents. Then we describe the learning organizational memory contents and structure. Finally, we explain how we materialize and diffuse this memory.

Choice of an Application : NF01

In the MEMORAe project, we consider scientific teaching at university. The pilot application we have chosen is a course attended by young students (first year at the technological university of Compiègne). This course, which is often referred to by its code NF01, is a course on "Algorithms and Programming", delivered in face-to-face education (250 students) as well as in distance education (25 students). This course combines theoretical and practical teaching. Its goal is not to learn Pascal programming but to learn programming itself. The Pascal language is only introduced to practice notions on algorithms.

Learning Objects and Learning Contents

Developing a course diffused through the internet implies to set the pedagogical focus on the student. The goal is to make him/her active, to give him/her a clear view of the available resources, and to learn him/her how to seek and use them. The articulation of a course around learning objects offers many learning individualization possibilities. According to Boullier (2001), such a division of the "knowledge world" is a preliminary act, needed in any teaching process. Boullier sees this division as materialized by the supports. Learning objects are the result of a delimitation of texts, a semantic marking up (Bachimont & Charlet, 1998). Contrary to this work, we do not consider a learning object as being a piece of a linear course text, but as a notion to be learnt. Thus, it is not necessary to build any support materializing such a delimitation. Authors remain free concerning the creation of their learning support, for example they do not have to follow any graphic charter. Learning objects (notions to be learnt) index documents related to them.

Within the framework of the MEMORAe project, we represent not only learning objects but also other types of knowledge such as documents and information related to these objects. Our choice of representing learning objects as notions (concepts) that allow to index documents related to them gives more flexibility to the writing of documents and allow the reuse of various types of documents. The fact that a learning object references many documents allows many ways to get it.

BEST COPY AVAILABLE

The course manager is responsible for the quality of the teaching content, he defines learning objects and selects documents to be indexed. Among learning objects, we can also find problem-situations (what to do in such situation ?). The tutor is in charge of the construction of the teaching scenario.

Content of a Learning Organizational Memory

A learning organizational memory allows to capitalize not only learning objects but also any knowledge, documents, information related to them. The organizational memory we build does not capitalize the whole documents and knowledge related to the NF01 learning objects but a pertinent part according to the course manager.

Beyond the pedagogical content, the memory capitalizes:

- Any information related to the learning environment that can be useful to users: trainers, staffs, entry form, learners, etc.
- Users knowledge.

Within the framework of e-learning, the student has to be active and to access to different types of information. The need of a shared vocabulary between the actors of the educational process is thus reinforced. In order to define this shared vocabulary within the memory, we propose to develop an ontology, more exactly several ontologies:

- A domain ontology of learning: it defines concepts of the learning domain, concepts which remain generic for this domain. In such an ontology we find for example concepts like: coach, tutor, secretary, as persons, or book, learning device as documents.
- An application ontology: it defines concepts of a particular application, and contains concepts definitions more specific than those of the domain ontology. For example, concerning an ontology about algorithms, concepts such as loop or array are defined. An application ontology has to be defined for each course considered. It's through this ontology that the learning objects are determined.

These ontologies are part of the organizational memory, in other words they structure it. In addition to them, the memory contains various documents related to the course. These documents are at least represented in the organizational memory, some of them are directly stored in the memory.

Materialization of a Learning Organizational Memory

Starting from the necessity to exploit the web to realize an e-learning application, we made the choice of materializing our organizational memory by the way of computing structures:

- a knowledge base to represent knowledge and receive ontologies,
- a documents base to store various electronic documents indexed by knowledge.

Diffusion of the Organizational Memory

The organizational memory we build consists in ontologies and electronic documents. The memory user has to interrogate concept representations to reach the needed information. In order to give him this possibility, we chose to use the concept of knowledge book (Ermine et al. 1996, Kassel et al. 2000, Abel et al. 2000) which represents a knowledge base consulting environment.

Navigating through a knowledge portal that is unknown is often a difficult task. If the portal is well structured, it is usually more helpful for the user to explore it by browsing (Staab & Maedche 2001).

The knowledge book is a document which allows to consult knowledge represented in a knowledge base. This book differs in several points from classical portals. On one hand, its content and its presentation are generated starting from the knowledge base. On the other hand, its structure is still the one of a classical book augmented of IT functionalities. According to Boullier (2001), the stability of the workspace constitute a cognitive framework, particularly useful when there is no interaction allowing to adapt one by one common marks like in a face-to-face teaching.

The knowledge book is an hypertextual document: links allow to navigate within different representations and to make actions relying on these representations, for example, reaching electronic documents of the memory or sending an email to a person.

The knowledge book consists in two frames (Fig. 2). The static left frame presents different parts of the book to the user. These parts concern the learning contents and are chosen by the course manager. The dynamic right frame displays the content of the selected part. These two frames allow to read the knowledge book in two ways: a "predefined way" and a "free way", with the possibility to shift from one to the other at any time.

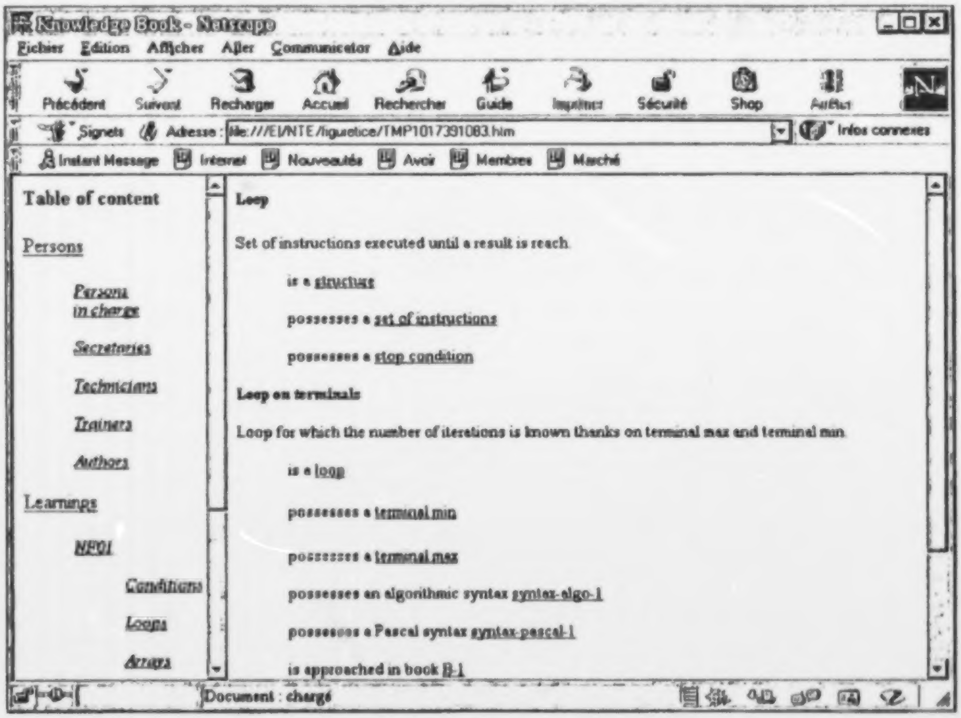

Knowledge Book - Netscape
Fichier
Edition
Afficher
Aller
Communicator
Aide
Précédent
Suivant
Recharger
Accueil
Rechercher
Guide
Imprimer
Sécurité
Shop
Arrêter
Signets
Adresse : file:///E|/NTE/figuetice/TMP1017391083.htm
Infos connexes
Instant Message
Internet
Nouveautés
Avoir
Membres
Marché
Document : chargé

Table of content

Persons

Persons in charge

Secretaries

Technicians

Trainers

Authors

Learnings

NF01

Conditions

Loops

Arrays

Loop

Set of instructions executed until a result is reach

is a structure

possesses a set of instructions

possesses a stop condition

Loop on terminals

Loop for which the number of iterations is known thanks on terminal max and terminal min

is a loop

possesses a terminal min

possesses a terminal max

possesses an algorithmic syntax syntax-algo-1

possesses a Pascal syntax syntax-pascal-1

is approached in book B-1

Figure 2: a Knowledge Book.

The "predefined way" is made possible by the way of the left frame. Indeed, as in a traditional book, the user is guided by the structure of the book. The only difference is in the possibility to directly access the different parts of the book by using the mouse.

The "free way" consists in browsing through the ontology presented in the right frame. It gives the possibility to reach a given knowledge piece in different ways: by browsing through the hierarchy of concepts or by browsing through links between knowledge pieces in the memory (e. g. "Loop is approached in Book B1").

Electronic documents of the organizational memory are represented in the knowledge base as object models representing instances of concepts defined in the sub-ontology of documents. They are stored in a documents base. The knowledge book allows to diffuse objects models of the knowledge base (Fig. 2). Starting from the representation of these models, the users can reach stored electronic objects. Indeed, if the user wants to reach a document itself and not its representation, (s)he can do that by the way of a contextual menu that allows him/her to execute different actions on the knowledge representation, for example "reach an electronic document".

Thus, whatever the knowledge is, its access and presentation are always done in the same way. So, we obtain a coherence in knowledge presentation formats and users can find new handling ways.

BEST COPY AVAILABLE

Conclusion

We focused in this paper on content management in e-learning applications. We consider that it is a knowledge management issue involving acquisition, gathering, organization, maintenance and distribution of learning knowledge. We propose to design an ontology-based "learning organizational memory" that will be made available to the actors of the educational process. This memory capitalizes the notions students have to learn and all the needed related information. The knowledge grains representation relies on an ontology. These grains are used as an index to access various related documents and information.

By using ontologies, our goal is also to define a vocabulary common to all the actors involved in the learning process. This common vocabulary is particularly needed in a distance context. In the evaluation of the learning organizational memory we plan to make we will particularly examine to what extent this vocabulary can be shared by learners and tutors. Furthermore through our pilot application we will evaluate how the memory can help a student to build its own personalized course.

References

Abel, M.-H, Barry, C., Boulitreau, P., Cisse, O., Irastorza, C., Kassel, G., Perpette, S. (2000). Livre de connaissances et accès aux documents électroniques. Troisième Colloque International sur le Document Electronique : CIDE'2000, Lyon, juillet 2000, 263-274.

Bachimont, B. , Charlet, J. (1998). PolyTeX : un environnement pour l'édition structurée de polycopiés multisupports, *EuroTeX'98*, Saint Malo, 1-16.

Barthès, J.P., Dieng, R., Kassel, G. (1999). Dossier Mémoire d'Entreprise, *Bulletin de l'AFIA*, no 36, janvier 1999.

Bellier S. (2001). *Le e-learning*, Editions Liaisons, Cegos.

Benjamins R., Fensel D, Gomez Pérez A. (1998). Knowledge Management through Ontologies. *2nd International Conference on Practical Aspects of Knowledge Management (PAKM98)*, Basel, Switzerland.

Bourda Y, Hélier M. (2000). Métadonnées et XML: applications aux «objets pédagogiques ». *Conférence TICE'2000*, Troyes.

Boullier, D. (2001). Les choix techniques sont des choix pédagogiques : les dimensions multiples d'une expérience de formation à distance, *Sciences et Techniques Educatives*, vol. 8, n° 3-4 /2001, 275-299.

Ermine, J.-L., Chaillot, M., Bigeon, P., Charreton, B. et Malavieille, D. (1996). MKSM, méthode pour la gestion des connaissances. *Ingénierie des systèmes d'information, AFCET-Hermès* , Vol 4, n°4, 541-575.

Fernandez, M. (1999). Overview Of Methodologies For Building Ontologies. *Proceedings of the IJCAI-99 workshop on Ontologies and Problem-Solving Methods (KRR5)*, Stockholm.

Fortier J.-Y. (2001) Construction d'une ontologie pour gérer la documentation d'un centre de recherche ; application au Centre Commun de Recherche d'EADS, *LaRIA report*, University of Picardie Jules Verne.

Grüber, T.R. (1993). A translation approach to portable ontology specifications, *Knowledge Acquisition* 5, 199-220.

Kassel, G., Abel, M-H., Barry, C., Boulitreau, P., Iraztorza, C., Perpette, S. (2000). Construction et exploitation d'une ontologie pour la gestion des connaissances d'une équipe de recherche, *IC'2000 : Journées francophones d'Ingénierie des Connaissances*, Toulouse, 10-12 may 2000, 251-259.

Kassel, G., Perpette, S. (1999). Co-operative ontology construction needs to carefully articulate terms, notions and objects. *International workshop : Ontological Engineering on the Global information Infrastructure*, Dagstuhl Castle (Allemagne), 57-70.

O'Leary, D.E. (1998). Using AI in Knowledge Management: Knowledge Bases and Ontologies. *IEEE Intelligent Systems*, May/June 1998, 3-15.

Staab, S., Maedche, A. (2001). Knowledge Portals Ontologies at Work, *AI Magazine*, summer 2001, 63-75.

Experimenting with Mobile Learning in a University Environment

Mr. Harri Alamäki
Oy Radiolinja Ab
Finland
Harri.Alamaki@radiolinja.fi

Ms. Pauliina Seppälä
Educational Centre for ICT, University of Helsinki
Finland
Pauliina.O.Seppala@helsinki.fi

Abstract: This article describes a mobile learning project, where mobile devices are used for educational activities. The article defines the word "mobility" from the educational point of view. We present experiences recorded while using mobile technology in teacher training and among students of forest resource. Two pilots were carried out at the Department of Home Economics and Craft Science and the Department of Forest Resource Management of the University of Helsinki. The idea of the pilot in home economics teacher training was that supervising teachers and trainee students should discuss and share their ideas about teaching methods etc. through mobile devices and also using SMS-messaging and digital pictures as part of the supervising process. The use of digital pictures which were delivered via the mobile device was surprisingly successful. The students of forest resources used mobile technology to deliver textual and pictorial material from forests. The goal of these innovative pilot projects is to create flexible teaching solutions, which will enable users of all kinds of devices to access of information, and to support learning in a variety of situations.

Introduction

According to Clark Quinn (Quinn 2000) "Mobile learning is learning through mobile computational devices". So mobile learning refers to situations in which students use mobile technology in their studies. Characteristic of mobile learning is the opportunity to break away from the teaching that takes place in a classroom, and to move to another location while communicating over information networks. Another distinctive feature of mobile learning is that it enables learners to enter an information network at the precise moment when it is necessary by using a portable learning device and a wireless network. Mobile learning may be considered as an extreme form of flexible learning. The mobile environment integrates studies that take place on campuses, at homes or outside university facilities into one shared, flexible learning environment (Sariola 2001).

The university of Helsinki has had a special interest in trying to benefit from the use of mobile technology in learning and teaching. One of the reasons is that the university itself is changing from a traditional monolithic, integrated unit to one with four different university campus areas, which are physically located in different places. This brings a need for mobility and flexibility. This in turn often means solutions which use mobile technology. At present, Finland has about 5 million inhabitants, over 70% of whom have mobile phones. Approximately 98% of university students have a mobile phone, so we can assume that university students are highly experienced users of mobile technology (Tuononen & Helin 2001).

Since the middle of the 90's several teachers and researches at the University of Helsinki have experimented mobile technology in teaching and studying. The first project was the LIVE –project (Learning in a Virtual Environment) in 1997-1999 (see Nummi et al. 1998, Sariola et a. 2001). The UniWap project was begun in June 2000 as a joint venture between The Educational Centre for ICT in the University of Helsinki and the software company Fujitsu Invia. In this project a WAP-based project environment which utilized a shared database was developed In practice, this meant that if teachers came up with a good idea, they could immediately use a WAP phone to enter the idea in the database. This first Uniwap pilot was tested by 25 university teachers in connection with personnel training in 2001.

Based on the Uniwap -project the Educational Centre for ICT with its partners, Fujitsu Invia, Oy Radiolinja Ab, The Hypermedia laboratory at the University of Tampere and R5Vision, established "the Mobile Learning -project". The aim of this project is to develop the production of digital learning materials and construct models for teaching, studying and learning in mobile learning environments. The Uniwap environment has been improved, for example, the addition of SMS services and the transfer of digital pictures to the environment. These additions have now been tested in two pilots in the University of Helsinki. The first pilot was carried out on trainee teachers in the Department of Home Economics and Craft Science and the second one on students in the Department of Forest Resource Management. These two educational fields were chosen mainly because of two reasons. First, in both cases there was an instant need to diversify the way in which teaching was organised and to experiment with alternative pedagogical approaches. Second, in both disciplines there were personnel who had participated in the mobile pioneer group for personnel training. Both these groups of teachers were both skilled and eager to try to benefit from mobility in their own fields.

At the end of both projects, there was a group interview in which both the teachers and students participated. One of the researchers took notes during the interviews. It was also taped and transcribed. In the case of the forest students, a questionnaire, based on the issues that emerged in the interview was also completed by the students.

Mobility

We will start by defining the word "mobility" from the educational point of view. Kynäslahti (Kynäslahti 2002) claims that mobility has the following three elements:

1. convenience
2. expediency
3. immediacy

Kynäslahti arrived at these elements by asking the following questions which deal with mobility of teaching and learning.

Who/what is mobile?
Why is that person mobile?
Who is on the move?
Why is that person is on the move?

When we think of the question, who/what is mobile, we can obtain at least four different outcomes: 1) a teacher, 2) a learner, 3) some external specialist, 4) content (learning content, an animal etc.)

When we think of question why someone is mobile or on the move while he is teaching or learning, we can obtain the following answers: 1) The reason for moving is irrelevant to learning and teaching. The person happens to be moving while conducting educational activities. It has to do with convenience, rational time management etc. 2) Secondly the person just are on the move in some particular place or in places which are relevant regarding the subject that is being studied. This would be called the perspective of expediency. 3) The third essential aspect of mobility is immediacy. Users are able to perform an educational act immediately, even if it requires access to the Internet or a connection to other kinds of electronic environments, regardless of where they are. (Kynäslahti et al. 2002)

The word mobility can be defined also from a technical point of view. What devices which can used while we are learning in mobile situations?

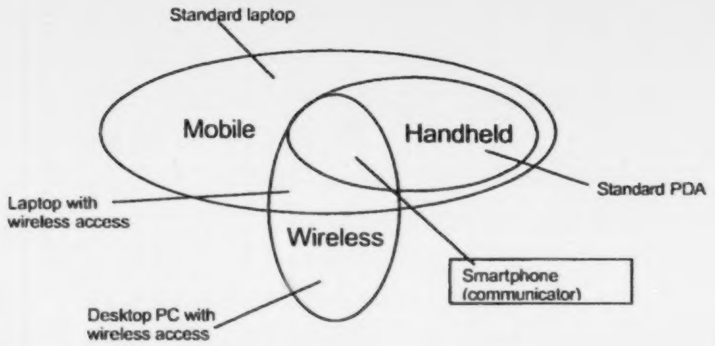

Standard laptop
Mobile
Handheld
Standard PDA
Laptop with wireless access
Wireless
Smartphone (communicator)
Desktop PC with wireless access

Figure 1: Defining the mobile device (adapted from Siilasmaa 2002).

This figure defines the requirements for the mobile device which was to be used in this pilot project. First of all we can think of its mobile features. The traditional example of a mobile device is a standard laptop computer. It is portable and can be taken to many places. By adding the hand held feature to the mobile feature we can get a standard PDA (personal digital assistant) device. These devices (laptops and PDAs) do not yet offer the capabilities required to carry out tasks which were needed in this project. We also needed wireless access to a network. A wirelessly connected device can also be a desktop computer which is connected to a wireless local area network. By adding the mobile feature to the wireless feature we can obtain a laptop computer with WLAN access. But in this pilot we needed a device which is mobile, hand held and has wireless access to a network.

The device which meets all these requirements is a smartphone (Nokia Communicator 9210). In this project it was also important that the device has a www-browser. The browser enabled the user to upload digital pictures to appropriate locations in the learning materials.

Technical implementation

We set up a mobile learning environment for testing and evaluating purposes. We needed a device which can use existing wireless phone networks and is capable of data transfer and presentation. We also wanted to use a device which has features found both in PDAs and cellular phones. We came up with the Nokia 9210 Communicator because of its full feature keyboard and midsize colour screen. This device can handle common HTML-pages, WAP-pages, email and naturally SMS-messages. All of these techniques were to be used in this project. The learning materials were located in a web-based environment, and it was possible to have multichannel access to this environment. The database was accessible by PC www-browsers, smartphone www-browsers and wap-browsers. We also tested the transfer of digital pictures. We used infrared connections to transfer the pictures from digital cameras to the phone. We had to use quite a barebones user interface version of the phone so we could simultaneously transfer pictures and text material to the server. We could thus operate within the bandwidth limitations of GSM-networks. The figure below illustrates the technical implementation of the pilot project.

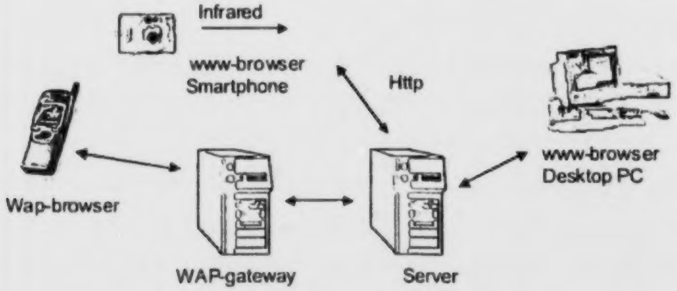


Figure 2. Technical implementation of the pilot project

BEST COPY AVAILABLE

Case: Mobile learning in teacher education at the Department of Home Economics

In spring 2002 we started the Uniwap -pilot for trainee teachers at the Department of Home Economics and Craft Science. There were eleven students and five teachers in this "mobile pilot". The Educational Centre for ICT lent the teachers and students 10 Nokia Communicator 9210s and two digital cameras (Casio QV-3000EX/Ir). We will take a closer look at this case in this section

Teacher education and mobility in teacher training

In Finland, prospective teachers are educated in departments of teacher education or other similar university departments. Successful trainee teachers obtain a Master of Education degree. The course work for the degree requires 160 study credits. One credit is equivalent to 40 hours of study. The teachers' pedagogical studies include educational studies, didactics and teacher training. The purpose of teacher training is to train students to plan and organize their teaching duties. For many students, the teacher training course is their first practical contact with the everyday life of a teacher. Students have the opportunity to use their own knowledge, experiences and personal characteristics and grow into a capable teacher. The development of a professional identity and skills are supported by supervising teacher.

In this case we used the virtual teacher training instruction model (Tuononen & Kurola 2002). This means that the students are instructed in three different ways: 1) face-to-face instruction, 2) instruction via a network based learning environment and 3) instruction via a mobile device. Face-to-face instruction is the traditional method where student and supervisor discuss practice teaching sessions. Network-based-instruction means that supervisor uses a learning management system to interact with the students. The supervisor can deliver training material by various methods including the Internet. The third method is the use of mobile devices for instruction. The main idea of the virtual teacher training instruction model is that the student has the possibility to document all aspects of his/her teacher training. Face-to-face instruction is nowadays more or less the prescriptive way to instruct trainees. The trainee always has the opportunity to ask questions and to go back to the network based or mobile instruction documents for more details. The supervisor can for example use a mobile device to have real time conference calls with his/her students. When this is done the supervisor is able to reach all his/her students even if they are physically in different places. There are many other examples of how a supervisor can support the instruction of trainees using mobile devices.

How the pilot was carried out

The mean aim of pilot was to enable teacher and students to discuss teaching methods, through mobile devices and also to use SMS-messages and digital pictures as a part of the course. The pilot also enabled supervisors to take digital pictures of various teacher training occasions, the learners' throughput and different teaching techniques. The trainees themselves could also make their wishes concerning what pictures the supervisor should take. The pictures could be downloaded from the phone to the camera via an infrared connection. The pictures could then be uploaded using a www-browser to the trainee's material bank in a Uniwap-database even before the training session had finished. Moreover, the supervisor may write down ideas and feedback related to the training session and send them to the trainees. The trainees then put together a digital portfolio on the basis of the photographs and a network discussion.

Case: Mobile learning at the Department of Forest Resource Management

The other case study was made at the Department of Forest Resource Management. Fifteen students and three teachers took part in the pilot. This pilot was part of a course called "The forest planning and inventory project". The participants used the same equipment as the students of home economics. So, the technical infrastructure and other functions were exactly as those used in the home economic pilot. The use context was different, as the users used their mobile devices for different purposes.

Studying at the Department of Forest Resource Management

Forest Mensuration and Management is an applied science that relies on informatics, forest economics and biological sciences as applied to forests. This subject helps the student to obtain the knowledge and skills needed for measuring the qualitative and quantitative characteristics of trees, forest stands and any larger forest area. Students majoring in this field learn to apply remote sensing, statistical sampling techniques and GIS to forest inventory and monitoring and they obtain knowledge essential for building and applying models that describe the development and states of forests. The management planning of forests resources with multiple objectives is an important part of this field. The teaching is based on lectures with exercises, field courses, problem-based learning, the literature of the field and seminars. (Student's Guide 2002)

How the pilot was carried out

The substantial themes of the course were acquisition of spatial data (geoinformatics) and planning methods, especially multi-criteria decision analysis. The stimulated situation for the student groups was to act as advisers for landscape planning for the Viikki campus area. The students were divided into two groups. One group worked in the forests and the other group of students, the analyzing group, were in the classroom . To complete the task, the forest group, needed to walk all over the campus, choose different kinds of scenery, take digital photographs and determine the GPS-coordinates of the corresponding points. After the pictures and metadata had been wirelessly transferred to the database using mobile devices, the analysis phase took place in the computer classroom. GIS-software was utilised in order to place the GPS-points on the map. Furthermore, web-based decision support software was used to complete the scenery comparison.

Results

We looked at the three different elements for mobility (according to Kynäslahti) and compared them to the feedback, which we collected from the students and teachers. The elements were convenience, expediency and immediacy.

First we examined aspects of convenience The students felt that the reason they were mobile was that they wanted to use their idle moments for educational activities. For example, they, wrote notes or memos to be shared with other students on the bus or train. They uploaded pictures from their phones to the material bank. All of these examples deal with convenience. The university students had the opportunity to use their time rationally even when they were on the move.

The second element is expediency. The students moved between various locations. Trainee teachers worked in a classroom environment and they also conducted activities in many other places while they were on the move. From the expediency point of view teacher trainees pointed out that they had to work at home and they did not have any other access to the Internet apart from their phones. Trainees also mentioned that they used the phones in stores when they had to check if there were particular foodstuff at school which they needed in their trainee home economics lessons. In these cases they mostly used audio calls and SMS-messaging. The trainees wanted to move pictures from the camera to the phone right away and most of the time this was possible in the classroom. They felt that without mobility the working method with the camera would not have been appropriate. The forest management students also had to send pictures and coordinates right away to the analyzing group.

The third element is immediacy. This element was most meaningful for the trainee teachers. They liked the fact that they were able to act immediately. They wrote memos and took pictures while they were observing other trainees' lessons. The trainees had an immediate need to write down their thoughts and ideas to be shared with other trainees. One trainee said that she got a great idea on the way to university very early in the morning and was happy to be able to share this idea with other class members right away. A mobile device is a great tool for giving feedback at the same time as observing other trainees. We found that there was a difference in the way feedback was given between supervisors and trainees. Trainees gave immediate feedback to other trainees while they were observing. They acted spontaneously. The supervisors were more careful and did not give spontaneous feedback, they thought more deeply about what to write. For example they read through their message text before they sent it and corrected any typos that might be present, while the trainees typed the text and send it without checking.

Forest management students thought that from the immediacy point of view the idea that the user could send pictures and coordinates immediately was great. They often had to make long trips to the forests and they had to be able to share information and material with analyzers or with their supervisors in working life. However, some students criticised the way the course was assessed. The main reason for these criticisms was possibly a failure to appreciate the immediacy aspect of mobility. Some of the students remarked sarcastically that the process of transferring pictures from a digital camera to the Communicator and, their counterparts in the computer room took so much time that it would have been easier to walk to the room and transmit the information directly to PC. This can be seen as a severe disadvantage of the project. However, the immediacy aspect was important for the teachers who guided the process and for students as well when they needed instant help.

The teachers' opinions about mobility and the use of mobile devices were also mostly positive. During teacher training supervising teachers need to work long hours and for that reason they felt that the use of mobile devices helped their work a lot. Teachers need to go from one school to another many times during the day, and while they were travelling they were able to connect to the shared database. Also, teachers felt that mobile devices brought more flexibility to their time usage planning.

The massive use of Uniwap was surprising. During these two pilots there were all together 528 SMS-messages or digital pictures in the Uniwap database. The students of home economics were more active than students of forest resource, they sent a total of 388 messages while the students of forest resource sent 144 messages.

The reason for this difference could be the observation that the trainee teachers used the mobile device and Uniwap as a photo gallery of funny pictures which they had taken during classes. The students of forest resource used the Uniwap strictly for their studies.

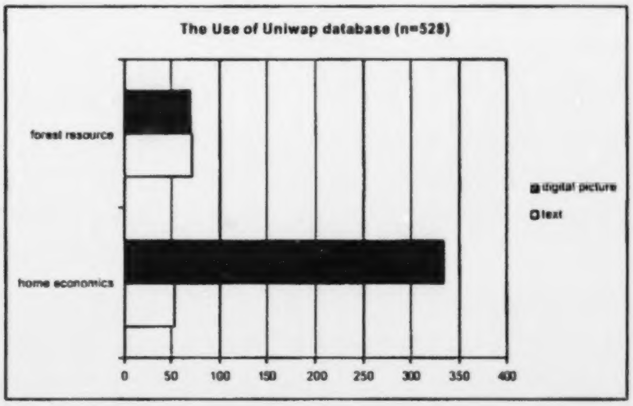


Figure 3. The number of messages and digital pictures in the Uniwap-database.

There were some differences in Uniwap usage times between these two pilots. In the home economics pilot the use of Uniwap was most active at the end of the working week, because most of the trainee lessons were held then. Uniwap was actively used almost round the clock, messages were sent by SMS between 9.39 am and midnight to 12.11 am. The supervising teachers especially sent SMS-messages quite late at night. The main reason for using SMS-messaging was give students feedback after a supervisor had read a trainee student's plan for a lesson. This component of the supervisors' work usually took place at home late in the evening. One supervising teacher said that when she have the possibility to get in touch with her students by using a mobile device and the Uniwap database at any time of the day, it helped her supervising process.

The teachers in the forest resource pilot mainly had the same opinion about freedom to contact students around the clock, but they didn't use that possibility so much. Most messages in this second pilot were sent between 8 am and 6 pm.

When analysing the contents of SMSmessages, we found three kind of situations, in which SMS was used: giving information, supervising and feedback. Mostly SMS-messages were used to send general information. Teachers sent information about the next class meetings or notified students that their feedbacks or assessments were now available. Also students notified other students and teachers of their plans or GPS-coordinates with digital pictures were ready and if they needed feedback.

The most interesting aspect of these pilots was however the number of digital pictures which were taken and uploaded to the Uniwap-database (see Figure 3), especially in the home economics pilot. The reasons for this huge number of digital pictures were that teachers and students found the possibility so much fun that they wanted to take many pictures of every trainee lesson and situation. Because you could upload the picture and notes right away to the database, everybody was able to comment and give feedback instantly. This immediacy, the third element of mobility, was very important and without this "right-away -possibility" the transfer of digital pictures would not have been used so much.

Students thought that the digital pictures helped to grow their professional identity as teachers of home economics. They saw, in so cases for the first time, how they looked in front of an elementary school class and how they taught them. The use of still-pictures helped students and supervisors to see things that they did not notice in the actual situations. This was very helpful in discussions between the students and their supervisors when the students analyzed their own teaching methods and made notes in their portfolios.

Koskinen (Koskinen et al. 2001) points out in their research that digital pictures without text are not interesting. With text you can clarify the situation in picture, why it was important to take or what happened afterwards. In our pilot the text was added to digital pictures during or after they had been uploaded to the Uniwap-database. The students changed the titles of the pictures and wrote little messages describing what was happening in the pictures. Supervising teachers expanded the picture message by giving feedback or asking questions about the situations in the classroom. This way the digital pictures came alive also to people who were not present in the actual teaching situations, such as other trainee students and researchers.

Conclusion

The project brought together Finnish mobile learning innovators in a networked organization. On the national level it made a great contribution to the development and research into mobility in educational use.
Both mobile pilots, i.e., at the Department of Home Economics and Craft Science and ate Department of Forest Resource Management showed that the educational use of mobile device and pedagogical opportunities of mobile learning are worth further research and testing. The Educational Centre for ICT continues to use education and testing pilots to spread these innovative methods to other units at the University of Helsinki and possibly to the Finnish Virtual University. The long-term goal is to create flexible teaching solutions, which will enable access to information with all kinds of devices, and to produce materials flexibly in a variety of situations.

Mobile technology is only beginning to take its first steps in academic teaching and studying. The opportunities it creates have been recognised and the idea of a wireless campus is spreading to universities. The integration of the Internet and mobile solutions will transform the use of ICT in teaching and take it in the direction of open teaching, provided that mobile technology is seen as a candidate for the development of academic teaching and education. The core characteristic of mobile learning is that it enables learners to be in the right place at the right time, that is, to be where they are able to experience the authentic joy of learning.

The mission of Radiolinja is to create and facilitate a wireless lifestyle – a Mobile Society. The role of the Technology Center of Radiolinja is to participate in innovative research and development projects. The main aim of those projects is to explore future wireless lifestyles. Radiolinja sees the support of learning and teaching with mobile devices as one of its future possibilities. By taking part in, and supporting these innovative research studies Radiolinja can be certain that it is also promoting the direction that wireless lifestyles will take in the future.

References

Quinn, C. (2000). mLearning: Mobile, Wireless and In-Your-Pocket Learning. Line Zine Magazine. http://www.linezine.com/2.1/features/cqmmwiyp.htm

Sariola, J. (2001). What are the limits of academic teaching? - In search of the opportunities of mobile learning. In Telelearning 2001, 10.-13.11.2001, Vancouver. Canada.

Tuononen, K. & Helin, E. (2001). Research raport of using information technology and mobile phones among students in Department of Pharmatology. (not published)

Nummi, T., Rönkä, A. & Sariola, J. (1998). Virtuality and Digital Nomadism: An Introduction to the LIVE Project (1997-2000). University of Helsinki. Department of Teacher Education. Media Education Centre. Media Education Publications 6.

Sariola, J., Rönkä, A., Tella, S. & Kynäslahti, H. (2001). From Weak Signals to the Concept of mLearning: The LIVE Project Revisited. In Loveless, A. & Dore, B. (Eds.) ICT in the Primary School: Changes and Challenges. Miltoin Keynes: Open University Press. (In press)

Kynäslahti, H. (2002). Mobiilisuus liikkumisena – Helsingin yliopisto liikkeessä (*Mobility as moving –The University of Helsinki on move.*) In publication Seppälä, P. (ed.) 2002. Mobile learning – Flexibility in moving. (in Finnish) Helsinki: University of Helsinki. The Educational Centre for ICT.

Kynäslahti, H., Sariola, J. Tuononen, K., Seppälä, P. & Hujala, T. (2002). The UniWap Experimenting with mobile teaching and studying. Paper in EERA-conference. The Educational Centre for ICT University of Helsinki

Siilasmaa, R. (2002). Securing the Mobile Enterprise. Presentation in TecIT Forum 23.2.2002. Helsinki.

Tuononen, K. & Kurola, J. (2002). Verkko-ohjaus ja mobiilisuus korkea-asteen opiskelussa (*Net-mentoring and Mobility in Higher Education*). In publication Seppälä, P. (ed.) 2002. Mobile learning – Flexibility in moving. (in Finnish) Helsinki: University of Helsinki. The Educational Centre for ICT.

Student's Guide. (2002). Faculty of Agriculture and Forestry 2002-2003.
http://honeybee.helsinki.fi/mmvar/ENGLISH/formensandman/index.htm

Koskinen, I., Kurvinen, E. & Lehtonen, T-K. (2001). Mobile Image. Edita. IT Press. Helsinki.

Instructional Models and Scenarios for an Open Learning Repository - Instructional Design and Metadata

Heidrun Allert, Hadhami Dhraief, Tobias Kunze, Wolfgang Nejdl, Christoph Richter
{allert, richter, nejdl}@learninglab.de
{dhraief, kunze}@kbs.uni-hannover.de
Learning Lab Lower Saxony, University of Hanover, Germany

Abstract: We present and discuss the evolution of a metadata-based course portal, the Open Learning Repository. Different instructional models and learning principles are integrated in order to meet different learning and teaching strategies: different metadata models (domain model, instructional model, cooperative and structural model) are designed and mapped. A scenario-based evaluation of a former version of OLR revealed that the use which was intended by designers and teachers can differ from actual use by learners. In the current version we do not only implement different instructional principles and theories but also help-files which address the learners reflection of their own learning strategies. In the design process, different learning theories as well as the organizational framework serve as relevant context which is addressed by scenarios written by all stakeholders. Scenarios serve as medium for communication between instructional designers, computer scientists, and teaching staff.

Motivation

Our Open Learning Repositories (OLR for short) are metadata-based course portals, which structure and connect modularised course materials, which can be distributed all over the Web. The modular content is integrated by explicit metadata information in order to build courses and connected sets of learning materials. Modular content can be reused for other courses and in other contexts, leading to a course portal which integrates learning objects from different sources and authors. Semantic annotation is necessary for authors to help them choose Learning Objects and to connect them into course structures. We use a relational database to store all metadata. We don't store content in the database itself, but reference it by URLs. We are currently using the OLR system in the context of two courses, one in Artificial Intelligence and one in Software Engineering.

The focus in the first and second generation of our Open Learning Repositories (Dhraief et al., 2001) was the technical infrastructure. The main questions were, how to store the metadata, whether to use O-Telos (Mylopoulos et al., 1990), XML or RDF (World Wide Web Consortium, 1999) etc. We also implemented different navigation interfaces. Different views on a given course are offered to students, realized by different queries and page designs. A user has the choice between a hierarchical tree-like navigation, a trail navigation, where he can move forward and backward on a trail, and semantic (context) net navigation.

However, there was a lack of pedagogical background in the first and second generation of OLRs. Therefore we decided to design and implement a new generation of OLR, which we call OLR3. In a team of computer scientists and educational researchers we focused explicitly on the goal to use such an open learning repository to enhance teaching and learning. We have implemented different instructional models and extended the Learning Object Metadata Standard LOM (IEEE Learning Technology Standards Committee, 2002) to incorporate our strong focus on educational theories. Also, as the results of the evaluation of the second generation of the Open Learning Repository revealed that the system did not meet the students needs, we addressed the entire educational setting which is supported by technology instead of focussing on the technology in an isolated way. For this, we developed a scenario-based approach to guide the design process of OLR3 in order to address both the technology as well as the educational setting, which influences the use of an e-Learning system. The multi-disciplinarity of the project team required a medium for communication that allows to communicate ideas and theories beyond the different areas of expertise. The scenario-based approach helped to handle this task.

The Open Learning Repository (OLR3): Technological Aspects

In this chapter, we will give an overview on the architecture of the 3rd generation of OLR, its current functionalities, and its web interface.

Architecture and Technology

The 3rd generation of our Open Learning Repository, OLR3, is implemented in Java and works as a JavaServlet, running on an Enhydra (Madl et al., 2002) Application Server (which has been developed as open source). It is connected to an Oracle Database via JDBC, which is used to store the metadata entered by course authors and students. There are two types of metadata: structure-metadata and annotation-metadata. The structure metadata represent information about the structure of a given course or course unit, the navigation path within this course or course unit and the relations between different learning objects. Annotation metadata represent the information about the content itself. We are using (a subset of) the LOM metadata standard to annotate the learning objects. All metadata are represented in RDF and RDFS (World Wide Web Consortium, 2002). The RDF schemes, needed for either the annotation or the structure of learning, can resided anywhere on the Web, as do the learning objects. The database does only hold the metadata, and assembles the course from these data., which

The system works on a "StatementPool",which holds all metadata known to the system at runtime, relevant for a given course. When an author starts working on a course, the pool is filled with the already existing data about that course from the database, and all statements from the used RDF schemes. Any referenced RDF schema will be parsed using the SiRPAC RDF parser (Melnik, 2001), whereas imported RDF files are parsed by a VRP RDF parser (Tolle, 2001), which provides semantical checks against given RDF schema rules.

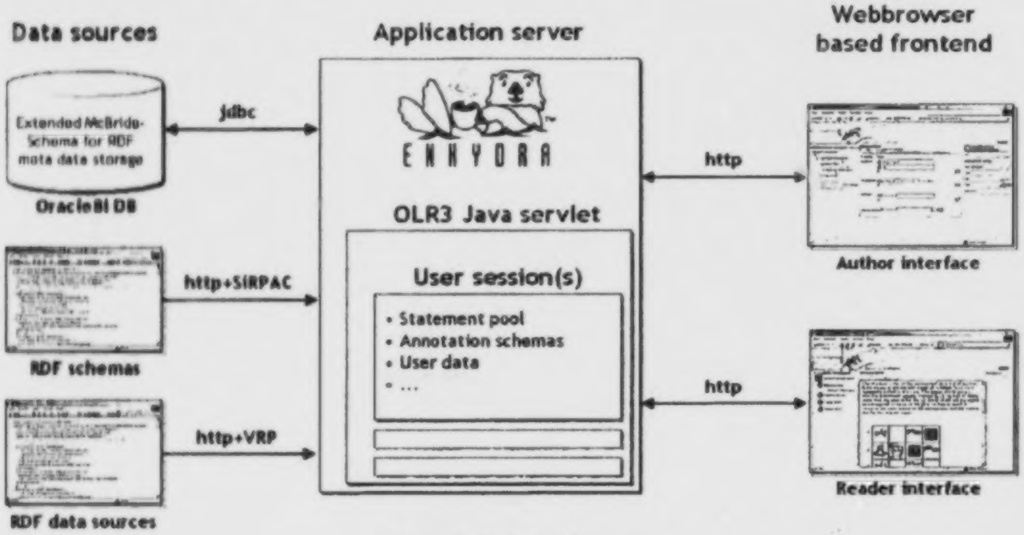

Data sources
Application server
Webbrowser based frontend
Extended McBride-Schema for RDF meta data storage
Oracle8i DB
jdbc
ENHYDRA
http
OLR3 Java servlet
Author interface
RDF schemas
http+SiRPAC
User session(s)
• Statement pool
• Annotation schemas
• User data
• ...
http
http+VRP
Reader interface
RDF data sources

Figure 1: OLR Architecture

Web Interface

OLR3 provides a web-browser based metadata editor/viewer and two major user interfaces: The first one is used for readers preferring a more graphically oriented view and only minor functions for manipulation of the underlying metadata. The second one is designed for authors to provide a schema-driven and browser-based metadata editor with flexible binding to different RDF schemes.

BEST COPY AVAILABL

Learner Web Interface

Learners of a given course can navigate through an existing course structure, displayed as a tree and extended by additional, metadata-defined images for better understanding. As we will see in the second part of this paper we implemented two instructional models in our OLR3 prototype for the course "Introduction to Artificial Intelligence". Within that tree the user may select course elements, whose content will be displayed in the center of the screen. A specific engine prepares and filters the content, and displays it based on a stored layout. The reader interface also offers the reader the possibility of making minor additions to the metadata of a selected course element by providing functions like "add comment", "add bookmark", "add keyword to metadata" etc. All those additions can be made private or public to other course readers.

Author Web Interface

The second interface provides the actual metadata editor which is intended for course authors, who can navigate through the structure tree of a course and select any sub-element. All existing editable metadata for this element are shown in the center of the screen, and the user can choose from a set of existing RDF properties, to add to the metadata, or to modify the existing data. The author can also bind RDF schemes (e.g. DC, DCQ, LOM) stored on the Web to extend the set of available properties for annotation, or unbind RDF schemes, that are not needed anymore. A "toolbar" holds those bound RDF schemes and offers the possibility of navigating through their structure by displaying an expandable tree view of any available property.

Different Views on Learning Material: Three Models

Learning management systems and learning environments as well as standards for metadata in the field of learning often implement or address only specific learning and teaching principles, theories and models. These learning theories are addressed either implicitly or (sometimes) explicitly. This means that neither teachers nor learners can choose a way of learning suited best to their preferred learning strategy or learning style. In a life long learning context, however, learners have to be able to decide on learning needs themselves and should be able to choose a preferred way of learning themselves. This requires reflection on ones own strategies of learning and teaching. Rautenstrauch (2001) explains: *Life-long learning will be a learners own decision (...) the learner is mature (...) he will identify and define his own needs and prefered ways of learning (...) he will learn to learn self-organized, self-determined, and independent from predetermined curricula and institutional forms of organization.*

We therefore designed the Open Learning Repository (OLR3) open to different learning and teaching strategies. In order to be able to implement diverse learning models we separated different metadata-models: the *Domain Model* and the *Instructional Model*. Furthermore, we offer different navigational structures: guiding sequences (supporting learning processes) as well as links to related learning objects (supporting exploration and elaboration), in order to face the different needs of novices and experts. We implemented two different learning models which can be assigned to different paradigms/epistemologies: a learning sequence designed along Ausubel's theory of Expository Teaching (Ausubel, 1968), which is assigned to cognitivistic theory, and a PBL model (Problem-Based Learning) (Wiesenfarth, 1992) which is associated with situated approaches.

Modeling different spaces or metadata-models in OLR is a means of representing different views on learning material. In the OLR we have three main spaces to model different aspects/views: *Domain Model*, *Instructional Model*, *Structural and Cooperative Model*. These different models can be structured by different experts in the different fields (experts in the subject domain may structure the *Domain Model* whereas instructional designers may extend the *Instructional Model*)

Domain Model

In the *Domain Model* domain and subject specific ontologies are specified, mainly including MatterOfFactRelations, both hierarchical and associative (cp. Meder, 2000). This knowledge space includes structuring of subject specific knowledge, subject specific skills and competencies.

Instructional Model

There is no unique instructional ontology but different approaches, theories and models. In the Instructional Model instructional phases and relations are specified. They are derived from different instructional models and learning theories. Furthermore learning processes are modelled along different instructional principles (PBL, Case-based etc.). Trying to represent these aspects in learning object metadata, we realized that existing metadata standards do not address learning processes (Allert et al., 2002), an issue also discussed by Meder, who stresses, that learning objects should be defined in six dimensions (Meder, 2000), where one of these dimensions defines the position of an learning object within the process of knowledge acquisition: *A learning object must be defined in the dimension of logic-operative modes of processes, i.e. there are methods which determine the process of acquisition of knowledge. („Ein didaktisches Objekt muss bestimmt sein (...) in der Dimension logisch-operativer Verlaufsformen, d.h. es gibt Methoden – im definierten Sinne – die den Verlauf der Aneignung von Wissen bestimmen können")* (Meder, 2000)

Up to now we implemented two different instructional models derived from different principles and paradigms: Expository Teaching by Ausubel (cognistivism) and a Problem-based model (situated approach) (see Tab. 1).

Phases we modelled along the Expository Teaching by Ausubel (1968):	Phases we modelled along the PBL model of Wiesenfarth (1992):
Phases	**Phases**
Advance Organizer (orientation)	Set Goal
Progressive Differentiation (conceptualization)	Specify Criteria
Practice	Acquire Knowledge
Integrating and Connecting	Generate Ideas
Relations between them are „followed by".	Realize Implementation
	Reflect
	Generalize

Table 1: Phases modelled in OLR3

These different guiding structures (learning processes and phases), specified in the *Instructional Model*, serve as threads and address the problem of linking decontextualized objects to stringent learning sequences and coherent structures. We defined instructional roles of learning objects within each phase. The Expository model as well as the PBL model work as guidance to authors presenting learning material as well as to students navigating through the material. The PBL model also guides students structuring their own project work. The phases which are modeled in the *Instructional Model* represent the structure at the interface. The learner can choose from two views on the learning material: "learning sequence" (Expository model) and "problem solving path" (PBL model).

Structural and Cooperative Model

Whereas in the *Instructional Model* learning models and processes are specified in order to support guidance, in the *Structural and Cooperative Model* relations are specified in order to support exploration and elaboration. Course authors may use the Relations to integrate further material and learning objects, beyond the thread of guidance. There are different kinds of relations:

- Methodical and Structural Relations
- Cooperation-Supporting Relations
- Learner Activities.

Examples for methodical and structural relations are:

- Theory generalizes example.

- Exercise applies theory.

Entity	Relation	Entity
theory	generalizes	example
exercise	applies	theory
...		

Table 1: Methodical Relations specified in the *Structural and Cooperative Model*, expressed as Triple

In order to model these relations, each learning object must be categorized methodically. In this *Structural and Cooperative Model* learner activities are modelled, too. Examples for learner activities are:

- Add keyword to metadata
- Add relation
- Add comment

Cooperative relations are modelled to guide students cooperative work. Next to the "problem solving path" relations are offered which motivate students to compare the progression of their project with others' or to compare the organization and coordination of projects within teams. These relations are planned to be implemented in the OLR3.

Based on these models the new interface of the OLR3 will look as shown in Fig. 2. This new interface is based on results of the scenario-based-evaluation of the former version of OLR (OLR2).

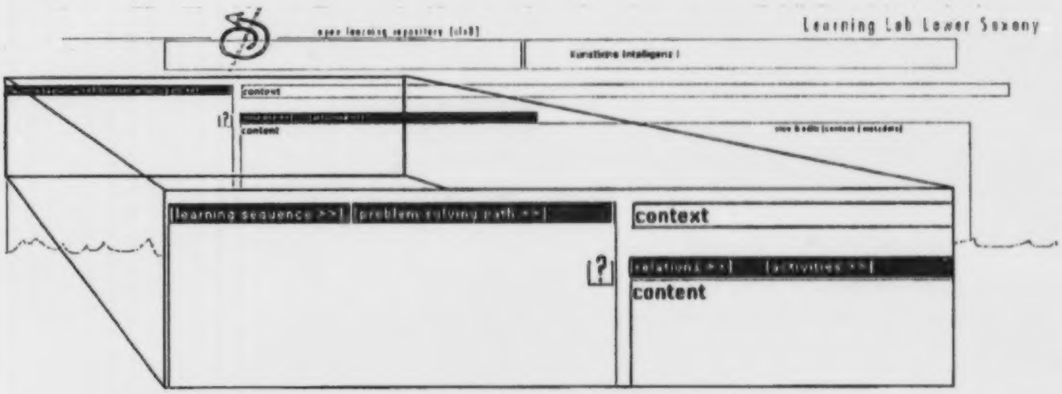

open learning repository [olr3]
Learning Lab Lower Saxony
Kunstliche Intelligenz I
context
content
[learning sequence >>] [problem solving path >>]
context
?
[relations >>] [activities >>]
content

Figure 2: new interface of the OLR3

Scenario-Based Evaluation and Design

In this section different aspects of the scenario-based evaluation and design of the OLR will be highlighted. First the evaluation of the previous version of the OLR is briefly described. Then the impact of organizational and educational context for the design of a computer supported learning environment like the OLR3 is discussed. Furthermore the relevance of scenarios as a medium for communication will be stressed.

Evaluation of a Former Version of the OLR

The scenario-based[1] evaluation of the previous version of the OLR has been an important starting point for the design of our current version. In an evaluation survey 20 students, which had attended an introductory

---

[1] We use the term scenario to refer to a narrative description of a situation of use. (Carroll, 2000) states that a scenario is characterized by a setting, includes agents and actors with individual goals or objectives and describes in contrast to

BEST COPY AVAILABLE

course on Artificial Intelligence, participated in semi-structured interviews. The lecture notes of this course on Artificial Intelligence had been provided to the students via the OLR. The aim of this survey was to explore how the OLR could be improved. On the basis of these interviews a scenario-of-actual-use was written. In addition the designers, teachers, and developers of the OLR were asked to write scenarios-of-intended-use in order to express their ideas of how the OLR should be used by the students. The comparison of the scenario-of-actual-use and the scenarios-of-intended-use revealed that the OLR had been used in a very restricted way by the students. Much of the functionality implemented in the OLR had not been used, or had been judged as not useful/necessary for reaching the course objectives. The survey is described in more detail in a technical report (Richter & Allert, 2002).

We are convinced that the mismatch between the use made by the students and the functionality implemented in the OLR can be assigned at least partly to the characteristics of the educational context in which the OLR was embedded. The students concentrated on objectives determined by the course and its embedding in the organizational structure (the course was held in a rather conventional way). These objectives contradicted main ideas underlying the design of the OLR. For example, while the OLR tries to provide a broad range of diverse material on a topic, this feature was at least unnecessary or sometimes even counterproductive to prepare for the exams which focused on the core material. As a consequence (besides changing the course structure and focus in the next semester) we suggest not only to implement different learning principles and modules but also help-files, which address the learners' reflection of learning strategies, acknowledging the fact that choosing from different learn ing modules requires reflection on ones own activities of learning. We are going to create the help-files on the basis of scenarios that describe the different underlying educational ideas on the level of concrete human activities.

The Meaning of Contextual Conditions for the Design of the OLR3

The evaluation revealed that it is crucial to address the educational context as well as characteristics of the learners more carefully in the design of the OLR3. The most important aspect of the educational context that influences the use of learning materiasl are the (often implicit) learning objectives. While in many educational settings some learning objectives as the acquisition of domain specific knowledge are named explicitly, other possible learning objectives stay more or less implicit., for example the acquisition of social competencies.

A precise description of implicit and explicit learning objectives within a given educational setting and their possible impact on students activities are therefore very important to make comprehensible design decisions. Only if conflicts between the learning objectives within a given educational setting and the learning objectives of the eLearning system are anticipated, it will be possible to decide if the system should be adapted to the educational setting or vice versa. This problem will be even more important if the learning system is constructed on a special educational model with explicit learning objectives and a certain conception of the learner. We assume that focussed changes in learning can only be fruitful in interaction with organizational changes (lecture and exams etc.) – nothing will not change if we simply offer a new e-Learning system to the students. The use of a learning environment such as the OLR3 has therefore to be understood as a part of more complex and longer lasting students' learning activity.

The educational setting with its implicit and explicit learning objectives and their possible impacts on students activities will constitute the context, which is addressed by scenarios written by all stakeholders. Scenarios of use appear to be an adequate way to describe the possible impacts of the context, because they force the writer to think about the specific behaviour of the user.

Scenarios as a Medium for Communication

Beside the fact that scenarios seem to be an adequate way of describing the use of a certain artefact on different levels of abstraction and can serve to highlight different perspectives on one task they additionally serve as a medium for communication between all involved stakeholders. A collective base for communication is of great importance because of the multidisciplinary design team involved in the design of the OLR3, consisting of instructional designers, computer scientists and teachers. In the development of any kind of educational material many different variables like the learning content, the underlying instructional models, characteristics of

---

conventional Use-Cases more complex sequences of human action. We apply situations of use in a very broad sense., for example, attending a lecture by a student is a situation of use.

the learner, characteristics of the educational context, and technological requirements have to be taken into consideration (cp. Tergan, 2000). It is unrealistic to recommend that every stakeholder has expertise in all the addressed topics. While the cooperation of a multidisciplinary design team allows to address many relevant topics it is still necessary (and sometimes even more important) to find ways to communicate the different ideas, concerns etc. within the design team. Scenarios seem to provide such a collective base for communication within the project. The necessity to formulate the possible consequences of certain variables, theories etc. on the concrete behaviour of an actor can assure the necessary information to make informed design decisions, and allows them to be communicated to the whole team. An adequate medium for communication is also an important condition to understand already made design decisions and as a starting point for further evaluation procedures.

Further Work

We are currently extending OLR functionality by a new user-interface as mentioned before. On the one hand the design of the new user-interface as well as the help files will be based on the results of the evaluation of the second generation of OLR. On the other hand the design will be guided by new scenarios-of-use that will address pedagogical theories and general conditions of the educational setting explicitly. We will also change the educational setting in which the OLR3 will be used in the next year to support a broader use of the OLR3 and the embedded learning materials. Good structured learning materials are very important for conventional learning and teaching, but appropriate and well structured learning materials for e-learning are absolutely crucial.

References

Allert, H., Dhraief, H., Nejdl, W. (2002). How are Learning Objects Used in Learning Processes? Instructional Roles of Learning Objects in LOM. *ED-MEDIA 2002, World Conference on Educational Multimedia, Hypermedia & Telecommunications*, Denver Colorado, USA.

Ausubel, D.P. (1968). *Educational psychology – A cognitive view*. New York.

Carroll, J.M. (2000). *Making use: scenario-based design of human-computer interactions*. Cambridge.

Dhraief, H., Nejdl, W., Wolf, B., Wolpers, M. (2001). Open Learning Repositories and Metadata Modeling. *International Semantic Web Working Symposium (SWWS) 2001*, Stanford University, California, USA.

IEEE Learning Technology Standards Committee (LTSC) (2002). *Draft Standard for Learning Object Metadata*. http://ltsc.ieee.org/doc/wg12/LOM_WD6_4.pdf.

Madl, A. (Chair) et al. (2002). *Enhydra Open Source Java/XML Application Server*, http://enhydra.enhydra.org.

Meder, N. (2000). Didaktische Ontologien. In: H.P. Ohly, G. Rahmstorf, A. Sigel. *Globalisierung und Wissensorganisation: Neue Aspekte für Wissen, Wissenschaft und Informationssysteme*. Würzburg.

Melnik, S. (2001). *SiRPAC RDF Parser*. Stanford, http://www-db.stanford.edu/~melnik/rdf/api.html.

Mylopoulos, J., Borgida, A., Jarke, M., & Koubarakis, M. (1990). Telos: A language for representing knowledge about information systems. *ACM Transaction on Information Systems*, 8.4.

Rautenstrauch, C. (2001). *Tele-Tutoren – Qualifizierungsmerkmale einer neu entstehenden Profession*. Hrsg.: Norbert Meder. Bielefeld.

Richter, C., & Allert, H. (2002). Bericht über die Interviews zum OLR-2 und KI-Skript - Kurzfassung. Technical Report. http://projekte.learninglab.uni-hannover.de/bscw/bscw.cgi/d9798.

Tergan, S.-O. (2000).Grundlagen der Evaluation: ein Überblick. In.: P. Schenkel, S.-O. Tergan, A. Lottmann (Hrsg.). *Qualitätsbeurteilung multimedialer Lern- und Informationssysteme – Evaluationsmethoden auf dem Prüfstand*. Nürnberg.

Tolle, K. (2001). *VRP RDF Parser*, ICS Forth, Greece. http://www.ics.forth.gr/proj/isst/RDF.

Wiesenfarth, G. (1992). Zum technischen Handeln als Grundbegriff der Technikdidaktik. In: *Zeitschrift für Technik im Unterricht*, H.66, 31-44.

World Wide Web Consortium (W3C) (1999). *Resource Description Framework (RDF) Model and Syntax Specification.* http://www.w3c.org/RDF.

World Wide Web Consortium (W3C) (2002). *RDF Vocabulary Description Language 1.0: RDF Schema.* http://www.w3c.org/RDF.

Cognitive Styles and Medical Students' Learning

AlRawahi, Z.
Sultan Qaboos University
Sultanate of Oman
E-mail: rawahiz@squ.edu.om

Abstract: Whilst a number of systems have been developed based on cognitive styles, and a significant body of research has been carried about learning with multiple representations, little was known about the effectiveness of systems based on multiple intelligences (MI). To address this, a prototype was built based on Gardner's theory of multiple intelligences and experiments were performed to study the effectiveness of the system on medical students' learning. The results showed that medical students accomplish deeper understanding of a topic when it is taught in a way that matches their cognitive styles. Moreover, the results indicated that providing students with a rich environment in which they can learn a topic via their chosen modality seems not to be as an effective teaching method as automatically adapting the material.

Introduction

The Interactive Medical Library (IML) prototype is a multimedia library in Medicine that adapts to learners' cognitive styles (AlRawahi, 1999). The IML act as a database which contains a large amount of information such as medical images, digital videos, textual information, laboratory data, etc. The Interactive Medical Library attempts to be a source of information that learners can return to whenever they need to confirm their understanding or to review and study certain medical material.

The design of the IML prototype was influenced by Gardner theory of Multiple Intelligences. In his multiple intelligences (MI) theory Gardner in 1983 claims that every cultural role requires a combination of different abilities regardless of the sophistication. He considers a person's mind as a collection of more than one intelligence or ability. He categorized the following kinds of intelligence: Linguistic, Logical-Mathematical, Spatial, Musical, Bodily-Kinesthetic, Interpersonal, Intrapersonal and Natural. They work together depending on the problem to be solved, within the limitations imposed by the individual environment. Some activities require the higher progress of a single intelligence, while others require development in more than one practice (Gardner, 1993a). According to Gardner "Nearly all cultural roles exploit more than one intelligence; at the same time, no performance can come about simply through the exercise of a single intelligence."(Gardner, 1993b p.27)

Thus, the aim of this paper is to examine the effectiveness of a multimedia system (Interactive Medical Library prototype) that supports cognitive styles based on the theory of Multiple Intelligences in medical students' learning.

Method

Subjects

The subjects were 44 medical students in their fifth year of medical training from the Sultan Qaboos University (Oman). The subjects were randomly divided into four study groups according to the learning environment that they were given in the hypermedia library of the Hospital Round prototype.

Procedure

The medical students were divided into four study groups. These groups were a Cognitive Style group, an Opposite to Cognitive Style group, a Traditional group and a Modality group. The Cognitive Style group was given material to study in keeping with their learning styles. The opposite to Cognitive Style group was given material to study opposite to their learning styles. The Traditional group was given material in various representations according to the method used in traditional teaching. Finally, the Multiple Representation or the Modality group could choose the modality they wished to learn with from a number of representations.

All subjects were given the Multiple Intelligences Developmental Assessment Scale (Shearer, 1996) questionnaire to fill out and they were asked to return the questionnaire and to come for the rest of the experiment on the following day. On the experiment day, the subjects were initially given the United States Medical Licensing Examination (USMLE) - step 1 to solve as a pre-test. After solving the pre-test questions each subject was given a demonstration about how to work with the computer using the Virtual Hospital Round Prototype. The subjects were then asked to work with a clinical case in the Cyber-Round individually. The cases in the Cyber-Round varied, some cases were relevant to the material in the library and other cases were not relevant to the material in the library. After working with a case, the subjects had to read 1-2 pages of medical material from the hypermedia library. Furthermore, according to the group the material that was given was:

a) according to their cognitive styles,
b) opposite of their cognitive styles,
c) according to the traditional way of teaching the topic, or
d) by using modality choices.

Soon afterwards, the subjects were given another clinical case to solve. Lastly, the subjects were given the USMLE post-test. The experimental structure is in Appendix I.

Hypotheses

The hypothesis was that students who were to be given material that adapted to their cognitive styles would do much better in understanding the medical material than all the other groups. In contrast, students who were to be given material opposite to their cognitive style their performance would do worse than all the other groups. While students who were to be assigned to a multiple modality group would outperform the students in the traditional group.

Testing Students' Medical Knowledge

The United States Medical Licensing Examination (USMLE) was used to test medical students' medical knowledge. This test is one of the standardised types of test normally used by various medical schools and testing authorities to test medical students and clinicians. The USMLE comes in three versions: Step 1, for medical knowledge, applicable for testing undergraduate medical students; Step 2, for resident and graduate students, who have just finished their clinical training; Lastly, Step 3 for clinicians who have some years of work experience. We used the Exam Master software product of the Exam Master Corporation to administer this test to our subjects. The Exam Master software allows the user to select certain topics to be examined in.

Since, our IML prototype focuses on Cardiovascular diseases, we selected for the test the subject of cardiovascular diseases and mainly the diseases of blood vessels and heart. This test contains 15 multiple choices questions. All subjects were given the same medical knowledge test twice, as a pre-test and then as a post-test. The first test was before working with the IML prototype and the second test was when they had finished working on all the activities of the prototype. The order of questions in the test was different in the pre-test and post-test. The function of these tests is to give us an idea about students' medical knowledge prior and after working with the Virtual Hospital Round Prototype. This test is described in Appendix II.

Structuring the learning representation

This section discusses the type of intelligences comprised in each group and the corresponding representations in the IML. The construction of different intelligence profiles in the IML involves a blend of various intelligences. These combinations are:

Profile 1: Visual > Linguistic > Musical;
Profile 2: Linguistic > Visual > Musical;
Profile 3: Linguistic > Musical > Visual,
Profile 4: Visual > Musical > Linguistic.

The profile (Visual > Linguistic > Musical) means that a student has a high visual, medium linguistic and low musical intelligence. Some students exhibited a slightly different profile such as *Visual = Linguistic > Musical; Visual > Linguistic = Musical; or Musical = Linguistic > Visual*. In order to verify the type of students' intelligences we used students' study habits and preferences as a second measure. Medical students' study preferences were gathered - by asking students about what do they think their preferences are - to verify weather the MIDAS profile matched the students' study preferences. These were included in the previous combination.

As mentioned earlier the Cognitive Style group were given representations that adapted to their intelligence profile, whilst the Opposite to the Cognitive Style group were given representations opposite to their intelligence profile. MIDAS profiles and the representations given in the hypermedia library of the IML are shown in Table 1 below. All the students in the Traditional group were given a mixed type of representation similar to the one used in conventional teaching. All the students in the Modality group were given multiple representations to choose from. The students in this group selected a representation according to their preferences.

	Multiple Intelligences Profile	Representation given in the IML
CS	*I. Visual > linguistic > musical*	*I. Visual > linguistic > musical*
	II. Linguistic > visual > musical	*II. Linguistic > visual > musical*
	III. Linguistic > musical > visual	*III. Linguistic > musical > visual*
	IV. Visual > musical > linguistic	*IV. Visual > musical > linguistic*
OCS	*I. Visual > linguistic > musical*	*III. Linguistic > musical > visual*
	II. Linguistic > visual > musical	*IV. Visual > musical > linguistic*
	III. Linguistic > musical > visual	*I. Visual > linguistic > musical*
	IV. Visual > musical > linguistic	*II. Linguistic > visual > musical*

Table 1. Categorization of the learning environment in the Cognitive Style group and the Opposite to the Cognitive Style group.

The numbers of subjects in the four groups were as follows:

CS	Cognitive Style Group(n=12)
OCS	Opposite to Cognitive Style Group(n=12)
TRAD	Traditional Group (n=10)
MR	Modality Group(n=10)

BEST COPY AVAILABLE

Results

Learning Modality and Individual Competence

The results of USMLE

The means and standard deviations of students' correct answer out of 15 questions in each learning environment are presented in Table 2 below.

	CS	OCS	TRAD	MR	Overall
Pre-Test	6.58 (1.56)	6.75 (1.71)	5.80 (2.15)	6.20 (1.75)	6.36 (1.77)
Post-Test	10.67 (2.06)	8.08 (1.31)	8.60 (1.78)	8.40 (1.90)	8.98 (2.02)

Table 2. Mean (standard deviation) of students' correct answers out of 15 questions in each learning environment.

	CS	OCS	TRAD	MR	Overall
Pre-Test	43.89 (10.43)	45 (11.41)	38.67 (14.33)	41.33 (11.67)	42.4 (11.8)
Post-Test	71.11 (13.73)	53.89 (8.74)	57.33 (11.84)	56 (12.65)	59.87 (13.47)

Table 3. Mean(standard deviation) of students' percentage of correct answers in each learning environment.

There was a gain from pre-test to post-test for each of the four learning environments. The mean gain for the cognitive style group was greater than all the other three groups (percentage gain is 27.22). In contrast, the mean gain for the opposite to the cognitive style group was worse than all the other three groups (percentage gain is 8.89). The percentage gain in the traditional group and in the modality group are 18.67 and 16.67 respectively. The graph below presents the USMLE pre-test and post-test results for the four learning environments.

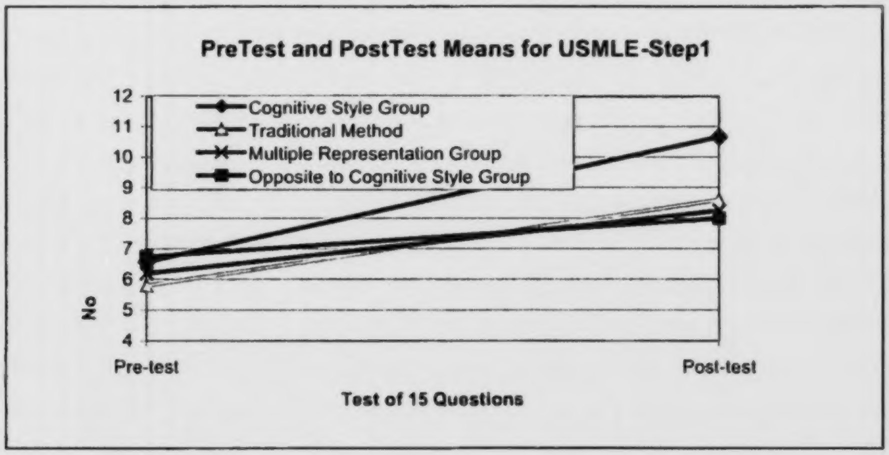


Figure 1. The result of USMLE pre/post tests in different learning environments.

BEST COPY AVAILABLE

A one way analysis of variance (ANOVA) was performed to see if there was any significant variation between the results of different learning environment groups in the pre-test and post-test. Table4 shows the between groups and the within groups differences.

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
PreTest	Between Groups	5.815	3	1.938	.604	.616
	Within Groups	128.367	40	3.209		
	Total	134.182	43			
PostTest	Between Groups	48.594	3	16.198	5.127	.004
	Within Groups	126.383	40	3.160		
	Total	174.977	43			

Table 4. ANOVA results of the pre-test and the post-test

The results of the ANOVA shows that there was a significant difference between different groups in the post-test F (3,40) =5.127; P = 0.004, and no significant differences between groups in the pre-test F (3,40) =.604; P = 0.616.

To get a more detailed understanding of what caused the differences in groups in the post- test to be significant, we performed Tukey HSD Post-hoc test. The post-hoc test showed there was a significant difference between the Cognitive Style group and all other groups in the post-test, but there were no significant differences between the other three groups.

The significant difference in post-test score between the Cognitive Style group and the Opposite to the cognitive style group was 2.58, (p = 0.005) See Table 9.2. The significant difference between the Cognitive Style group and the Traditional group was 2.07, (p = 0.046), and between the Cognitive Style group and the Modality group was 2.27, (p = 0.024). This result means that the cognitive style group benefited more than all the other three groups. On that account, teaching students in an environment that adapts to their cognitive style seems to help them to grasp the material more easily.

Time spent on the Library

The mean time (in minutes) that each group of students spent on the library is presented in Table 4 below.

Modality	Time (min.)	% Gain in test	No. pages viewed	Viewing time/page(min.)
CS	11.13 (2.80)	27.22 % (8.27)	4.58 (0.51)	2.43
OCS	11.01 (4.20)	8.89 % (12.50)	4.75 (0.45)	2.32
TRAD	12.45 (2.75)	18.67 % (7.57)	4.60 (0.52)	2.71
MR	15.26 (3.37)	14.67 % (7.57)	10.00 (2.83)	1.53
Overall	12.34	17.36	5.98	2.25

Table 5. Mean time in minute that students spent on the library, mean gain in test and mean number of pages viewed.

From Table 5 and Figure 3, it seems that students in the Modality group (MR) spent a much longer time using the IML (t = 15.26 min) than all other groups. However, the performance of this group was much less than the

BEST COPY AVAILABLE

performance of the Cognitive Style group. This Modality (MR) group viewed almost double the number of pages. The average amount of time MR students spent viewing a page was 1.53 minutes. This time was much less than the average amount of time students spent viewing pages in the other learning environments.

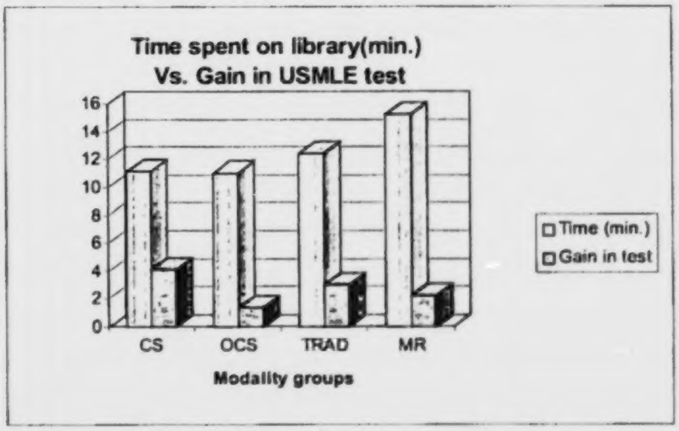


Figure 2. Time spent on library vs. gain in test in different learning environments.

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
PreTest	Between Groups	5.815	3	1.938	.604	.616
	Within Groups	128.367	40	3.209		
	Total	134.182	43			
PostTest	Between Groups	48.594	3	16.198	5.127	.004
	Within Groups	126.383	40	3.160		
	Total	174.977	43			
LIBTIME	Between Groups	124.049	3	41.350	3.676	.020
	Within Groups	449.895	40	11.247		
	Total	573.944	43			
Posttest-pretest	Between Groups	48.703	3	16.234	8.201	.000
	Within Groups	79.183	40	1.980		
	Total	127.886	43			

Table 6. One way ANOVA of USMLE tests and library time.

The results of the one way ANOVA in Table 6 shows that there was a significant difference in time spent on the library between the different groups F (3,40) = 3.676, p = .020. A Tukey HSD Post-hoc analysis was performed. This showed that there were significant differences in the amount of time students spent reading the material in the library between the Modality group and Cognitive Style group (Mean difference = 4.13 mins., p = 0.032), and also between the Modality group and the Opposite to the Cognitive Style group (Mean difference = 4.25 mins., p = 0.025).

Gain in test, amount of information viewed and time spent on Library

The ANOVA also shows there is a significant difference in the gain in the USMLE test (Post Test - Pre Test) between different modality groups F(3,40) = 8.201, $p < .001$. A Tukey HSD post hoc test shows that there is a significant difference in the amount of gain in the test between the Cognitive Style group and the Opposite to the Cognitive Style group (Mean difference = 2.75, $p < 0.001$), and between the Cognitive Style group and the Modality group (Mean difference = 1.89, $p = 0.017$), and also between the Traditional group and the Opposite to the Cognitive Style group (Mean difference = 1.67, $p = 0.041$).

Moreover, the ANOVA shows that there is a significant difference in the amount of information viewed by different groups F(3,40) = 37.14, $p < 0.001$. A Tukey HSD post hoc test shows that there are significant differences on the number of pages viewed between the Modality group and all other groups.

- The Modality group and the Cognitive Style group; Mean difference = 5.42, $p < 0.001$
- The Modality group and the Opposite to the Cognitive Style group; Mean difference = 5.25, $p < 0.001$
- The Modality group and the Traditional group; Mean difference = 5.40, $p < 0.001$.

The next section analyzes the modality group more deeply.

Modality Group

The results for the Modality group, in Table 7, shows that this group spent longer than all other groups in the library (t = 15.26min (SD=3.37)) but the average amount of time spent per page was much less than all other groups (t = 1.53min) and the gain in test score was less than the Cognitive Style and the Traditional group. Hence, we need to investigate number of questions such as how many pages students visited that matched their cognitive styles? and what was the average amount of time spent on these pages?.

Subjects	Total Time(min)	Total Pages Viewed	Modality Pages	% Modality pages	Time in Modality pages (min)	Time/ Modality page (min)	% Gain in Test
MR1	17.69	12	5	41.67	14.86	2.97	20.00
MR2	18.02	6	4	66.67	14.07	3.52	13.33
MR3	9.91	11	3	27.27	6.59	2.20	6.667
MR4	17.56	12	5	41.67	12.58	2.52	13.33
MR5	18.01	14	5	35.71	12.00	2.40	20.00
MR6	14.03	11	3	27.27	9.50	3.17	0
MR7	16.11	9	5	55.56	12.01	2.40	20.00
MR8	15.88	6	4	66.67	10.00	2.50	13.33
MR9	16.65	12	4	33.33	12.00	3.00	13.33
MR10	8.74	7	5	71.43	6.44	1.29	26.67
Total Mean	15.26	10	4.3	46.73	11.01	2.60	14.67

Table 7. Summary of the Modality group interaction.

In the previous section the results indicated that the students who were exposed to various types of representations (the Modality group) performed worse than the rest of the groups. This section investigates the Modality group in some detail. It examines the effect of just those pages viewed that matched students learning styles.

Table 7 shows that the mean percentage of the number of pages visited that matched the students' modality was 46.73% of the total pages viewed in the hypermedia library. The mean gain in the knowledge test was 14.67%

and the average time spent on this subset of pages, the Modality pages, was 2.60 min. per page. If we compare this Table with the previous one (i.e. Table 4), the overall average time the Modality group spent viewing a page was 1.53 min. We can summarize this finding as follows: Students in the Modality group were exposed to various types of representations and they tended to explore the learning material using various representations and they did not stick just to the representation that matches their preferences only. They shifted from one representation to another. Furthermore, they tended to spend longer time on the pages that matched their preferences.

Synthesis

The subjects in the Cognitive Style group learned significantly better than the other three groups. Providing students with a learning environment that adapted to their cognitive styles helped them to grasp knowledge more easily than without this adaptation. Giving students the freedom to choose the modality they was had from different representations did not seem to be as an effective method of teaching. The students shifted from one representation to another, as shown by the facts that the average amount of time spent per page was much less in comparison to the other groups and the proportion of pages chosen that did in fact match their profile was less than 50%.

From this study one can conclude:-

- Students accomplish deeper understanding of a topic when it is taught in a way that matches their cognitive styles
- Providing students with a rich environment in which they can learn a topic via their chosen modality seems not to be as an effective teaching method as automatically adapting the material.

References

AlRawahi, Z. (1999). Multiple Intelligences and Instructional Design. In: Ben du Boulay, Ann Light, Rose Luckin, Fabrice Retkowsky & Pablo Romero (Eds.). Proceedings of the 3rd Postgraduate Workshop on Human Centred Technologies, pp 7-10. Brighton: UK.

Gardner, H. (1993a). *Frames of Minds: The Theory of Multiple Intelligences*, 2nd edition. New York: Basic Books.

Gardner, H. (1993b). *Multiple Intelligences: The theory in practice*. New York: Basic Books.

Gardner, H. (1983). *Frames of Minds: The Theory of Multiple Intelligences*. New York: Basic Books.

Shearer, C. B. (1996). *Multiple Intelligence Developmental Assessment Scale (MIDAS): A Professional Manual*. Columbus, OH: Greydon Press.

The Usability of the Virtual Hospital Round

AlRawahi, Z. & AlShidhani, S.
Sultan Qaboos University
Sultanate of Oman
E-mail: rawahiz@squ.edu.om

Abstract: A usable instructional system is defined as a system that enables learners to accomplish learning goals or tasks in an effective and efficient way. This paper investigates the usability of Virtual Hospital Round (VHR) prototype, and explores medical students' and professionals' attitudes toward the VHR system. The evaluation of the prototype indicated that students and medical professionals liked and valued the program as a useful and enjoyable learning tool. The interface was mostly easy to use. The prototype stimulated learning and clinical reasoning.

Introduction

There are large number of methodologies exists for evaluating the usability and usefulness of information technology program. Oliver & Conole (1998) at the Open University developed a toolkit to help researchers in selecting an appropriate method for evaluating information technology program. The aim of this paper is to evaluate the VHR prototype. Thus, initially a brief overview of the prototype is provided. Then, the general usability method used to test the VHR is explained. Furthermore, the perceptions of medical professionals towards this type of learning environment and students' attitudes while working with the system are discussed.

Virtual Hospital Round

A Virtual Hospital Round (VHR) was developed for the domain of Cardiovascular diseases. The VHR prototype consists of an Interactive Hypermedia Library and a Cyber-Round. The Interactive Hypermedia Library enable students to explore a topic according to their learning style preferences. The Cyber-Round provides students with a simple simulated patient on which to practice clinical diagnostic reasoning abilities (AlRawahi, 1999). The design of VHR was influenced by Gardner theory of Multiple Intelligences (Gardner, 1983; 1993a; 1993b).

I. The Interactive Hypermedia Library

The adaptive Hypermedia Library contains study material (in several formats) about basic clinical science and the pathophysiology of diseases. As an implementation of Multiple Intelligences theory, the library web interface presents material in a set of different combinations of intelligences. The presented material can also be viewed according to traditional ways of teaching, or with multiple representations for comparison purposes. Figure I illustrate the VHR library interface.

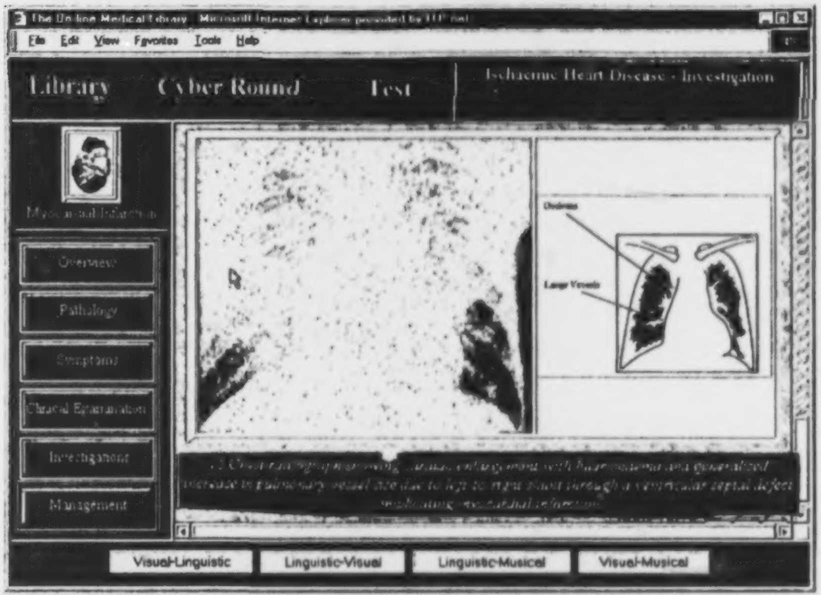

The On-line Medical Library - Microsoft Internet Explorer provided by ...
File Edit View Favorites Tools Help
Library
Cyber Round
Test
Ischaemic Heart Disease - Investigation
Myocardial Infarction
Overview
Pathology
Symptoms
Clinical Examination
Investigations
Management
Oedema
Large Vessels
Visual-Linguistic
Linguistic-Visual
Linguistic-Musical
Visual-Musical

Figure I. The interactive hypermedia library – Visual & Linguistic Intelligence representation

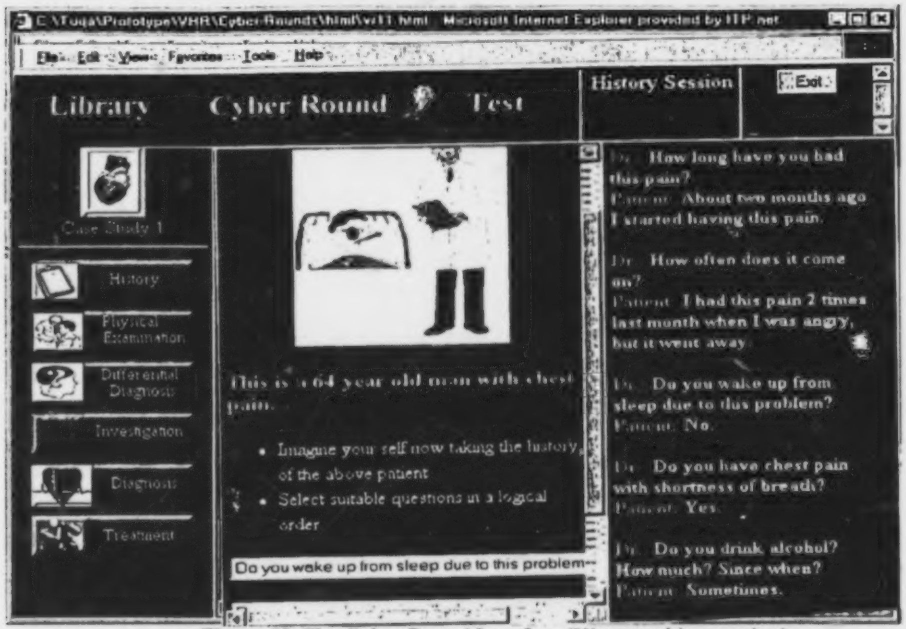
II. The Cyber-Round

The interactive Cyber-Round section is a practice-based learning tool in cardiovascular diseases, where learners can explore one or more clinical cases. Students are provided with a rich virtual environment to practice medicine similar to the actual hospital round. They are given a simple, simulated patient with which to practice clinical skills. The system tracks students' progress while they work with the simulated patient. They can start by taking the patient's history, selecting from a menu. They then can choose to

- ☐ Perform a physical examination (using a mouse to click on an interactive patient image),
- ☐ Hypothesize a differential diagnosis,
- ☐ Request laboratory or radiological tests, and/or
- ☐ Diagnose the patient.

To resemble the hospital rounds and to give a sense of reality, students are given a reasonable amount of freedom to perform the task, according to their intuition, as they would in a real situation. Figure II illustrate the Cyer-Round interface.

BEST COPY AVAILABLE


C:\Tuqa\Prototype\VHR\Cyber-Rounds\html\v11.html - Microsoft Internet Explorer provided by ITP.net
File Edit View Favorites Tools Help
Library
Cyber Round
Test
History Session
Exit
Case Study 1
History
Physical Examination
Differential Diagnosis
Investigation
Diagnosis
Treatment

This is a 64 year old man with chest pain.

- Imagine your self now taking the history of the above patient
- Select suitable questions in a logical order

Do you wake up from sleep due to this problem--

Dr. How long have you had this pain?
Patient: About two months ago I started having this pain.

Dr. How often does it come on?
Patient: I had this pain 2 times last month when I was angry, but it went away.

Dr. Do you wake up from sleep due to this problem?
Patient: No.

Dr. Do you have chest pain with shortness of breath?
Patient: Yes.

Dr. Do you drink alcohol? How much? Since when?
Patient: Sometimes.

Figure II. The Cyber-Round Interface (History taking session)

General system usability

Generally, researchers in the area of system usability define a number of usability criteria which must be met when designing a usable system. The PLUME (Browne & Simpson,1996) system encompasses most essential elements of testing an interactive learning environment, so it was used as a general evaluation method for the VHR prototype. The PLUME system emphasizes that a usable system must embrace the following characteristics: productivity, learn-ability, user satisfaction, memorability and a low error rate.

This section gives an overview of the definition of the different PLUME elements:

A. ***Productivity*** - a productive system is a system that enables learners to carry out the learning tasks quickly. This is important in clinical education, since medical students are busy and normally tend to discard most noncompulsory duties. Providing them with a productive system that helps them to process their learning more quickly is a necessity. Therefore, it is crucial to evaluate the productivity of the VHR.

B. ***Learnability*** - a learnable system is a system requiring little training. If systems are easy to learn and match the way the learner approaches a task, this will enhance learning.

C. ***User satisfaction*** - learner satisfaction motivates students to spend a longer time with the system, to learn and understand more.

D. ***Memorability*** - if system processes are memorable, learners will require less training and will be able to return to maximum levels of performance more quickly after absences.

E. ***Low Error Rate*** - a measure of the accuracy of the work carried out to complete tasks.

Method

11 fifth year medical students and 3 medical professionals with a minimum of three years experience as a general practitioner filled in a general usability questionnaire after they had worked with the VHR prorotype. This questionnire (see Appendix) was very short and simple and invited respondents to assess the system against the five PLUME criteria. It concentrated on the main system usability elements as discussed above. The users were given an explanation of each usability element and then they were asked to rank each element from 1 (least usable)-10 (most usable).

Results

The average for each element was calculated by summing up students' responses to the usability questionnaire and dividing it by the number of subjects. Then the percentage score was calculated by dividing the average score by the maximum score (10). Table 1 presents the main findings from the usability study. As indicated in this table medical students seem to value the prototype more than medical professionals.

Medical professionals assigned 80% for the VHR's productivity. While, medical students assigned it 91%. Regarding prototype learnability, medical professionals gave it 78% while medical student gave it 83%. Moreover, the satisfaction of medical professionals was 83%, while the satisfaction of medical students was 95%. Medical professionals estimated the memorability of the VHR prototype as 80%, while medical students thought it was worth 85%. Finally, the estimate of low error rate when using the prototype were given by medical professionals and medical students as 75% and 80% repectively. The higher the percentage of the error rate indicate that students had less difficulties or frustration working with the protoype.

PLUME Metrics	Medical Professionals	Medical Students
Productivity	80%	91%
Learnability	78%	83%
User-satisfaction	83%	95%
Memorabilty	80%	85%
Error rates	75%	80%

Table 1. Findings for the general usability elements.

Medical professionals' perceptions of the VHR

This section reports on medical professional's attitudes towards the usefulness and effectiveness of VHR as an instructional system.

Method

Initially, three graduate medical professionals were given a brief summary about the main objectives of designing the VHR and this evaluation. Then they were shown how to work with different sections of the VHR prototype. After that they were asked to work with the prototype and to examine its contents and functionality. They were asked to comment about the following:

1. The level of the material presented in both the adaptive medical hyper-media library and in the CyberRound cases;
2. The accuracy of the material presented in both the adaptive medical hyper-media library and in the CyberRound cases;
3. The degree to which the program would motivate learner to learn more about the topic;
4. The degree to which the program would help students to practice clinical reasoning skills;
5. The implementation of the various teaching methodologies;
6. The comparison between the VHR and the OSCE study material;
7. The value of the program as an educational tool;
8. What they liked and disliked about the program;
9. Any suggested modifications or improvements.

Results

The results of their input on the level of cases and material embedded in the VHR prototype indicated that Dr. H and Dr. N thought the level of material would suit 5th year medical students, while Dr. T thought that it was most suitable for 4th year medical students. Regarding the accuracy of the materials Dr. N believed that 85% of the material were accurate, while Dr. H felt 82% was accurate, and finally Dr. T assigned 80% for information accuracy.

Would the program help students to practice clinical reasoning skills?

The three medical professionals believed that the program would help students to practice their clinical reasoning skill through their exposure to authentic cases in a simulated environment. They thought the main advantage of these simulated cases was that they would guide students to practice the whole clinical reasoning process. For example, students could follow through on a simulated patient, including ordering lab tests.

While, medical students think the program is helpful in a way that if a mistake was made it will not be on a real patient. Medical students thought this point might help them to feel calm when practicing, while normally students feel uncomfortable or frightened.

Implementation of teaching methodologies

The medical professionals were pleased to see different representations in the learning environment. They believed these representations were very useful for medical students. All of them liked the visual-linguistic representation most and they appreciated the other representations. Two of the medical professionals thought that allowing students to choose the representation they prefer from among the representations (multiple modality group) might confuse students and might cause loss of concentration.

Comparison between the VHR, the OSCE study material and real clinical teaching

The three medical professionals were asked to compare cases in the VHR with objective structured clinical examination (OSCE) cases. The cases in the VHR prototype were judged to be similar to the OSCE and case-based learning, but did not compare with actual physical examination training because of the need to palpate, and the need for percussion and auscultation. Furthermore, the three medical professionals believed that the cases in the VHR outperformed the OSCE and short cases in its method of history-taking and on the general management of a patient in terms of clinical reasoning for a given problem.

The value of the program as an educational tool

All three subjects believed in the value of the prototype as an effective educational tool for clinical practice. Furthermore, they highlighted that the main advantage of the simulated patients as always being available, unlike real patients. Moreover, they believed that computer based learning tool motivate students to review notes, books and discuss the case with a tutor or peer while solving the case. In their view, this is normally difficult when working with a real patient, as students in real practice need to think and act spontaneously.

Suggestions for modifications or improvements

The medical professionals suggested that immediate feedback on every step while solving the clinical case is needed, especially when users (medical students) act erroneously. Moreover, they wanted the patient management part to be implemented.

Discussion

This section summarizes results of the medical professionals' evaluations of the prototype. The results show that they believed that the VHR prototype would be an effective and efficient multimedia learning tool for fifth-year medical students. Moreover, they were satisfied with the content and functionality of the prototype. For instance, one subject liked the cases in Cyber-Round as case-based learning, and stated that the VHR might help medical students in their fifth year preparing for an M.D. examination. This is because medical students often waste time in hospitals finding cases to practice on before an examination. It was thought that the adaptive medical hypermedia library section would motivate students as they were getting information in different representations. The other two subjects thought that the cases in Cyber-Round would act as a useful tool for practicing history taking and clinical reasoning skills before going to the ward. Furthermore, they believed that the cases would be very helpful as preparation for clinical examination.

All three medical professional subjects liked the fact that the VHR prototype allows practice with all aspects of clinical reasoning activity, because in a clinical setting students rarely get to practice the whole process. Finally, the subjects hoped that the treatment and management portions of the prototype would be implemented.

Medical Students' Perceptions and Attitudes Toward the VHR

Medical students were observed using the prototype. Notes were made on students' attitudes towards the system while observing them carrying out general actions. Moreover, 12 students were interviewed and data gathered about their perception of the usability of the VHR prototype. Items discussed included perceptions of the importance of the program as a learning tool; perceptions of different tasks and their affect on problem solving; how the prototype compared to a real teaching round; and likes and dislikes regarding the system along with suggestions for modification.

Method

Students were asked to solve two clinical cases as they would normally do in actual clinical practice. In addition, while they were working with the prototype they were asked to think aloud and to verbalize what they were doing and why they were doing it. They were observed while they were working with the prototype and notes were taken on their general actions executed and on their impressions while working with different parts of the prototype. As the subjects were very busy and they were already spending a long time doing the experiment voluntarily, it was difficult to get many of them to fill out the usability questionnaire. Therefore, we carried out the usability evaluation as a conversation (informal discussion) after students had finished working with the prototype.

Results

- 92% felt the program was easy to navigate, while 8% felt the program was very easy to navigate.
- 80% felt the program did not require initial training, while 12% felt training might be helpful and 8% felt training was needed.
- 84% thought the program was interesting and forced them to think and to reflect on their knowledge.
- The only difficulty students faced was identifying the questions to ask in the history session and certain types of tests in the investigation session. The reason for this was that the pop-up menu was filled with a large number of items.
- Students believed that they learned from the program, and they felt the program was an effective educational tool.
- Students appreciated the opportunity to practice gathering information and working with a patient problem from beginning to end.
- Students reported that the prototype helped to test their existing knowledge, and to identify knowledge limitations.
- Students reported the VHR helped them practice reasoning throughout a patient case and helped to sharpen their thinking processes. The program 'forced' them to diagnose the simulated patient. The diagnosis process was less distressing than actual clinical practice.
- Students wished the system provided feedback on their actions.
- Students wished the management part of the system was implemented.

Synthesis

The study found that students liked and respected the program as a valuable learning instrument. Most students agree that the interface was easy to use. The VHR prototype motivated learning and fostered students' clinical reasoning skills. Students thought this type of practice gave them the chance to work through the case independently, without relying on a tutor who might be busy, and without relying on a real patient who might be unavailable, busy with other students, or in a state that students cannot use for practice.

The study found that medical professionals were satisfied with the value of the program as an educational tool. They thought that students could learn through practice and apply their knowledge by free inquiry with the simulated patient. Students could identify their own limitations in knowledge. This would motivate them to search for knowledge in the interactive hypermedia library of the system. Finally, computer patients are handy at any time and location, while real patients may not be.

References

AlRawahi, Z. (1999). Multiple Intelligences and Instructional Design. In: Ben du Boulay, Ann Light, Rose Luckin, Fabrice Retkowsky & Pablo Romero (Eds.). Proceedings of the 3rd Postgraduate Workshop on Human Centred Technologies, pp 7-10. Brighton: UK.

Browne, D. & Simpson, N. (1996.) Usability Engineering: Designing for ease of use. *CiME*, 1(2).

Gardner, H. (1993a). *Frames of Minds: The Theory of Multiple Intelligences*, 2nd edition. New York: Basic Books.

Gardner, H. (1993b). *Multiple Intelligences: The theory in practice*. New York: Basic Books.

Gardner, H. (1983). *Frames of Minds: The Theory of Multiple Intelligences*. New York: Basic Books.

Oliver, M. & Conole, G. (1998). Evaluating Communication and Information Technologies: A toolkit for practitioners. Active Learning, 8, 3-8.

Social Inclusion, Security and e-Democracy Issues in e-Government: the Role of e-Learning

Miguel Baptista Nunes, Maggie McPherson, Amy Whiteside
Department of Information Studies
University of Sheffield
Regent Court, Sheffield, S1 4DP
j.m.nunes@sheffield.ac.uk
tel: 44 114 22 22645

Abstract:

This paper focuses on aspects of e-government with emphasis on how local authorities are coping with the transition into the Information Society. E-government will be reviewed in the light of such topics as social inclusion, security and e-democracy. The challenge has been set in the UK, for local authorities to deliver 100% of services capable of electronic delivery by 2005, with 25% to be delivered by 2002. The research was carried out with the support of a local authority council in South Yorkshire. It included a survey of members of Northern Authorities Benchmarking IT (NABit) to ascertain views on various aspects of e-government. The results were analysed to provide a more valid representation of local authorities' attempts to reach the 2005 target. The findings challenge some of the views portrayed in the literature review and show low confidence in achieving government targets. eLearning emerged as a key factor to prevent social exclusion and guarantee e-democracy.

Introduction

The information society could be seen as *"a world where it is possible to access vast quantities of information on demand and to transact remotely"* (Lampard, 1997:180). This quote emphasizes the view that the Internet is removing distance as a factor in many transactions and conversations. Mulquin (1998) thinks that the term "information society" is misleading because people want communication more than they want information. However, despite the fact that since the advent of email the desire to communicate appears to be greater than ever, it does not necessarily follow that people want correspondence more than they want particular facts and figures. It seems that the more access to information people have, the more access they want, which increases the relevance of the term, "information society". Mulquin (1998) also uses the phrase *"the death of distance"* but this does not reflect the fact is that most people live their lives on a local scale and are therefore most likely to be interested in local activities, businesses and information.

E-Government in the UK

It is in this context of the Information Society that the UK government has stated its commitment to providing better services for the public, and it is the citizen that is at the centre of the change. Departmentalism has characterised government for a long time and e-government seeks to challenge these rigid structures. Governmental demarcations have lead to inefficiency for the customer, as well as a frustratingly slow pace for those working within the sector. This research revealed that local authorities are aware of the necessity to break down this "silo effect" in order to create more flowing information systems and practices. However, the implementation of the required change process is being hampered by existing systems, for example, a top-down organisational structure of local authorities prevents the very change that needs to take place. Nevertheless, local authorities are aware of the need for a culture change, which is the first step in actually making the changes happen.

Academic literature has embraced the ideal of e-government. Generally, the ideas about e-government are similar, i.e. that it will revolutionise the way the government transacts and interacts with businesses,

BEST COPY AVAILABLE

citizens and other areas of government. In fact, it is thought that e-government will impact all aspects of an organisation, from the highest level down to the customer as an individual. However, although predictions for e-government in the UK appears to be optimistic, these initiatives are still in their infancy and it will take much longer for problems to be identified and resolved. Much of the literature at this point is somewhat theoretical and sparse, and any firm conclusions at this stage are likely to be later challenged.

Currently, Central Government stresses the need for Local Performance Indicators for Best Value. Evidence from this research would suggest that this has been taken on board, with the majority of authorities questioned using their own indicators. This is in line with the Audit Commission's recommendation mentioned in the literature review. However, if measured alongside the results from the question of whether the authorities thought that they would meet the 2002 and 2005 targets, some Local Indicators are not as effective as they might be, since the majority of authorities are not confident of achieving the 2002 target. Most authorities were confident of achieving the 2005 target though, which suggests that indicators may have been implemented too late in some authorities for them to make a big enough difference to the 2002 target. However it must also be remembered that these indicators are for guidance only and may not be as relevant to the targets as the results suggest. Evidence from the interviews conducted stresses some frustration over the changing of Best Value Performance Indicator 157, which might have caused some authorities to have to change or update their own indicators and cause delay in working towards their targets.

Electronic Service Delivery as a Form of e-Government

Overall it seems that the UK government is pushing for Electronic Service Delivery (ESD). There are already countless projects aimed at getting local authorities to bid for money to implement technological solutions. This may hide the real need for cultural change in local authorities organisations and structure in order to support and endorse ESD. Technology and cultural change have to work interdependently and even though this change process is apparently taking place, more will need to be done to change attitudes and ideas in local government.

As far as the development of e-government goes, there is certainly a good deal of progress being made, although not always at the level or speed that the government expects or claims it to be. Although the literature is very biased towards the benefits of e-government, the potential dangers are also highlighted and it is understandable that such a new form of government is seen as exciting at this stage. It will most likely be a few years down the line that mistakes and problems will be recognised. One problem that does need to be addressed is the need to train people in the new skills required in this new society so that they understand the uses of Information and Communication Technology (ICT).

Moving Towards E-Democracy

One of the major pillars of the Information Society, and the change process that is taking place in central and local government, is the need for consultation with the citizen. E-democracy therefore, has the potential to provide a forum for consultation processes. It is predicted that voting and voter registration will be carried out online in the next few years (DTLR, 2001), although while authorities appear to be concentrating on working towards other objectives, this could be a doubtful target at the moment. On the other hand, the advent of digital television, the opportunity to vote and ease of doing it from one's armchair, thus helping to increase public participation, might just make the 2005 target achievable. Nevertheless, it should be noted that voting is not the only cornerstone of democracy or e-democracy, but that ESD, associated with access to local and national politicians, is also imperative.

Councillors are taking tangible steps towards e-democracy, with many having email addresses so that citizens can voice their concerns/problems to a person, rather than a department. This should make the local councils more aware of people's concerns as well as making them answerable to their constituents. The literature on e-democracy highlights the need for the citizen to be part of the consultation process, but it does not seem likely that democracy will increase dramatically unless the other issues are addressed too.

However, all dreams of e-democracy may be at risk if the citizen is not prepared to make use of ESD services. The phenomenon of the non-networked citizen will tend to deepen the socio-economic divide.

BEST COPY AVAILABLE

Social Inclusion vs. the Digital Divide

There is a great deal of literature that confronts the ever-increasing problem of social exclusion and the threat of a "digital divide", not just concentrating on what the government is or should be doing, but its nature and possible consequences of this divide. Social exclusion can be defined as:

> *"What can happen when people or areas suffer from a combination of linked problems such as unemployment, poor skills, low incomes, poor housing, high crime environments, bad health and family breakdown. In the past, governments have had policies that have tried to deal with each of these problems individually, but there has been little success at tackling the complicated links between them, or preventing them from arising in the first place."*
>
> Stoker, (2000)

In 1997, the UK government set up the Social Inclusion Unit, with a remit to help improve government action across departmental boundaries to combat social exclusion, thus at least addressing the issue. As one of the principles of e-government is to challenge social exclusion, the UK government's Policy Action Team (PAT15) published a report in March 2000 entitled "Closing the Digital Divide" in which it announced a £252 million initiative to increase access to the emerging technologies.

The following statement shows that the government has indeed recognised the danger of the digital divide:

> *"We cannot risk leaving behind people living in our poorest communities. We must close the digital divide so everyone can reap the benefits of living in an e-nation. Government, business and voluntary and community organisations must work more closely together to help achieve this aim."*
>
> Department for Trade and Industry (2000).

Despite the fact that the report was written over a year ago, so far there has been no evidence that any goals set out in the report have actually been achieved. The report only stated new technologies were needed to help disadvantaged groups and did not elaborate on how these ideas should be actually implemented. Thus, whether or not the government will succeed in fulfilling its promises will be only seen in 2005.

Internet Access in the UK

The government claims that Internet use is growing rapidly (DTLR, 2001), although it recognises that there is still a divide between those who do and do not have access. Symonds (2000) produced a table showing the percentage of the population with Internet access in 2000, with Britain ranking eleventh out of the 31 countries examined, behind the US, Canada and Singapore, all leaders of e-government. Furthermore, in a report by the Centre for Analysis of Social Exclusion, Duffy (2000) presents the results of a survey that show that 71% of the respondents from deprived areas had no access to CMC technology at home or work. This may sound a significant figure. However, the findings of the same Social Exclusion report indicate that Internet/email is the least attractive medium for gaining information by the majority of people living in deprived areas. This being the case, it appears that although people may indeed have access to appropriate technology, often they are simply not aware of it and do not have the appropriate skills to use it.

In support of this, Booz, Allen & Hamilton (2000) proposed that Internet penetration should be above 70% for e-government to be considered a success and to prevent the development of a digital divide. Since this figure has not yet been reached, there is clearly some way to go before Britain achieves the desired level of Internet access. Stoker (2000) considers that the lack of computer equipment will not be the major factor preventing some people from access to online services, since digital television will provide access when it replaces analogue television in 2008. Nevertheless, cost for telecommunications equipment (for example obtaining sufficient bandwidth for mobile phone users) could well hamper further growth of Internet use. Furthermore, if insufficient use of the Internet is indeed due to lack of awareness, as well as lack of skills, then the reason for educating citizens regarding the uses and benefits of ICT is immense.

BEST COPY AVAILABLE

Addressing the Digital Divide: Access versus Education

Symonds (2000) argues that the digital divide is **not so much a question of access but of education**. The government is addressing this, for example the National Grid for learning is intended to provide access to the Internet for all UK schools. Other initiatives such as Learndirect, focus on empowering the socially excluded to take advantage of the opportunities offered by the "e-revolution" (DTLR, 2001). The Booz, Allen & Hamilton (2000) report also stresses the need for Internet skills to be part of the national curriculum. However the community members who have left school would still not be prepared to use ESD services. Thus, adding a new component to social exclusion, based on a generation gap. It is proposed that one possibility to address this new divide would be to assign a new role to younger members of the community who would then influence and educate their elders in the benefits of ICT. Nevertheless, and in the short-term, the government has to assume responsibilities in preparing the citizen for E-government, namely through e-Learning initiatives and encouraging Lifelong-Learning.

The Case Study

The overall aim of the research was to examine the current status of e-government, focusing at the local level. The research itself was carried out with the support of the Rotherham Metropolitan Borough Council (RMBC), South Yorkshire, UK and included a survey (questionnaires and interviews) of local authority members of NABit (Northern Authorities Benchmarking IT).

15 questionnaires were sent out to NABit members to ascertain thoughts and views on various aspects of e-government, both of the authority's own progress as well as personal thoughts. The results were analysed along with interviews conducted with members of RMBC to provide a more valid representation of local authorities' attempts to reach the 2005 target. Throughout the research a conceptual model has been used and referred to. The findings from the interviews and work experience at RMBC in particular challenge and update this model. The findings, along with the discussion and conclusion challenge the results of the literature review and show that out of all respondents, confidence in achieving targets is not as high as the government is projecting. Although progress is being made towards full ESD as a significant aspect of e-government, it is a slow progression.

The first objective was to examine the literature to discover information on and gauge reactions to the concept of e-government. In support of the research, literature regarding proposed e-government targets and ideal status was scrutinized. This revealed that the government has generally commissioned the reports that have been written, indicating a lack of independent research. Possibly one of the reasons for the lack of literature is because this area is constantly changing and evolving and any piece of work will quickly become out-dated. Perhaps after the 2005 target, more academic literature will emerge.

The second objective of the study was to examine RMBC and other local authorities' approaches to e-government, their future targets and perceived reasons for successes and failures. The research instruments used were successful in that they challenged the issues raised in the literature and indicated that not all authorities were achieving as much as others, those that the government highlights as being "beacon councils". The research investigated the results and outcomes of the latest projects and ideas for the progression towards the UK government's 2005 target.

The response rate received for this research was very good, although due to the relatively small sample size, it can only provide an indication of progress of e-government and since this was a small-scale piece of research, inferences, rather than conclusive deductions, have been drawn from this study.

The Research Findings

The survey discovered that direct online access to members of the authorities is one of the largest growth areas, suggesting that authorities are taking the need for citizens to have a different channel to voice their opinions seriously. The authorities that responded to the questionnaires felt that Internet penetration in public areas was increasing, which suggested that public access was increasing, as well as more focus on the skills necessary to use the Internet. Whether this is being achieved across the country would require a much more involved project, but the results obtained, along with the literature would suggest that the problem of social inclusion is to some extent being addressed. This recognition at least shows that the government is maintaining its awareness of the problem, but it also shows that the attempts to decrease this divide is not working as well as was hoped. However, the rapidly developing nature of the Internet means that it is very difficult for all involved to keep up to date with the latest developments.

The information about Pathfinder projects from both the literature and survey suggests that the government already had a view of an ideal pathfinder. The results from the questionnaire suggest that the bidding process had not been perceived as successful in terms of feedback received, either for bids that had been accepted or for those that had not. The questionnaires revealed that a number of participating authorities believed their bids failed due to larger and higher-status authorities receiving more money. The interviews conducted as part of the research also revealed a similar attitude, although the reason for these strong feelings from authorities could be due to resentment from a failed bid.

The research examined targets for local authorities and discovered that the government is very keen on promoting these projects but is frequently failing to provide the support needed at the local level. One of the most significant problems revealed by this research, is that the lack of funding to local authorities is hampering their chances of success. South Yorkshire is a region that has suffered a great deal with its declining basic industries over the past 20 years and even though the Objective 1 Funding has been granted into the region, funding still requires bidding, taking up time and resources which could be better spent.

The questionnaire has indicated that there is sufficient direction from the government about all of the changes that are due to take place, but the problem occurs when the local authorities actually receive the information. The evidence from the literature would suggest that the problem could be that disseminating the information around the authority is hampered by the very nature of local government. If this is the case, there needs to be a huge drive by the authorities to change their culture and make change happen. The findings suggest that involving citizens in the consultation process may be adapted and implemented at the local level, although it is not possible to say when.

The assistance of RMBC in this research has been invaluable. This enabled an in-depth examination of one authority's approach to e-government, which helped to validate the reliability of data collected from other NaBIT members. One of the most useful things about working within the council authority was gaining an awareness regarding the nature of local government and the frustrations that occur. Although this type of action-research approach could be said to cause problems of bias, working within this organisation enabled a greater insight into e-government at a local level than a simple literature review could do.

Conclusions

Worryingly, towards the end of the research period, the Guardian published an article on the 16th of August 2001, stating that the ESD targets were failing to be met. This article discusses the announcement by Andrew Smith, Chief Secretary to the Treasury, that the target of having 90% of routine goods and services online had been missed and was apparently less than half than expected. If this is true, what other failures can be expected along the way? Although progress towards the "information society" is increasing in pace, it seems the UK government needs to reassess its targets and closely monitor the real situation. The IEG statements might help, but even it may only be an empty gesture, since local authorities might prefer to be involved in more short-term projects and plans. The Guardian's article hints that the government is backtracking on its targets, downplaying their previous significance and that there is a real need to broaden significant participation. Perhaps this is the time for more literature on the field of e-government to emerge. It is now imperative that more clarity on e-government issues is provided and government bodies demonstrate a more responsible attitude

Bibliography

Booz, Allen & Hamilton. (2000). *Achieving Universal Access*. London. Available from http://www.number-10.gov.uk/default.asp?PageId=1203

DTI (2000). *Closing the UK's Digital Divide - Hewitt and Wills*. Press Release 216, DTI. Available from: http://www.nds.coi.gov.uk/coi/coipress.nsf [Accessed 9/7/01]

DTLR (2001). *Modern Councils, Modern Services, Access for All.* London: Department for Transport, Local Government and the Regions. Available at: http://www.local-regions.detr.gov.uk/egov/modcouncils/

Duffy, W. (2000) Satisfaction and Expectations: Attitudes to Public Services in Deprived Areas. Case Paper 45, London, UK: Centre for Analysis of Social Exclusion, London School of Economics.

Symonds, M. (2000). *The Next Revolution: a Survey of Government and the Internet.* Economist 24th June 2000

Guardian (2001). *The Shambles of e-Whitehall.* Guardian Online 16/8/01.

Hendry, J.D. (2000). Social Inclusion and the Information Poor. *Library Review* 49 (7) pp. 331-336

Lampard, L. (1997). Government departments: Developments in the delivery of information. *Business Information Review* 14 (4) pp.179-183

Improvement & Development Agency (2001). Implementing Electronic Government: Developing an IEG statement. IDeA. Available from: http://www.idea.gov.uk/ieg/advice.htm [Accessed 6/8/01]

Mulquin, M. (1998). Developing a people-friendly Information Society in the UK. *Information Technology & Public Policy* 16 (3) Summer, pp. 167-168

MORI Survey (1999) "Attitudes to Public Services in Deprived Areas"

NABit (2000). *Northern Authorities Benchmarking in IT Group.* Available from: http://www.barnsley.gov.uk/nabit/index.asp [Accessed 30/4/01]

Rotherham Metropolitan Borough Council.(2001a). *Rotherham 1981-1991.* RMBC. Available from: http://www.rotherham.gov.uk/pages/community/profiles/prof2.htm [Accessed 30/6/01]

Rotherham Metropolitan Borough Council. (2001b). *Best Value 2001: Priorities for Rotherham, 5 key themes.* RMBC. Available from: http://www.rotherham.gov.uk/pages/council/bestvalue/2001/theme4.htm [Accessed 3/8/01]

Rotherham Metropolitan Borough Council. (2001c). *Working in partnership to regenerate Rotherham.* RMBC. Available from: http://www.rotherham.gov.uk/pages/council/bestvalue/partners.htm [Accessed 3/8/01]

Stoker, D. (2000). Social exclusion, "joined-up government", public libraries and the internet. Journal of Librarianship and Information Science 32 (2) pp. 53-55

Verifying Success in Distance Education

William D. Barber
Department of Language, Reading & Exceptionalities
Appalachian State University
United States
barberdb@appstate.edu

Heather M. Clark
Department of Language, Reading & Exceptionalities
Appalachian State University
United States
clarkhm@appstate.edu

M. Elaine McIntyre
Department of Language, Reading & Exceptionalities
Appalachian State University
United States
elaine_mcknight@yahoo.com

Abstract: Appalachian State University (ASU) is a participating institution in the North Carolina Consortium for Distance Education in Communication Sciences and Disorders (CSD). This Consortium initiated a successful distance education masters degree program in 1997. Eight indicators of success are presented, including low attrition rate, indicators of student satisfaction, and data showing equal to superior performances of distance students in competition with traditional on-campus students.

Introduction

Appalachian State University (ASU) is a participating institution in the North Carolina Consortium for Distance Education in Communication Sciences and Disorders (CSD). This Consortium initiated a successful distance education masters degree program in 1997. This paper will present multiple evidences of that success. Other distance education programs may wish to conduct program evaluations with many of these measures.

Structure of the Consortium

The North Carolina Consortium for Distance Education in CSD offers a masters degree to public school speech-language pathologists (SLP). This mission was a response to legal action by the North Carolina Board of Examiners to require enforcement of a North Carolina Department of Public Instruction policy that all SLPs employed in the state's public school systems hold a masters degree in communication sciences and disorders, in accordance with guidelines of the American Speech Language and Hearing Association (ASHA). In 1996, the North Carolina Supreme Court upheld a North Carolina Court of Appeals ruling that public school SLPs who began that employment at the bachelors level after 1982 must obtain a masters by the year 2000, and that bachelors level SLPs who began employment in 1982 or earlier must also earn a masters degree in order to be eligible to continue working as public school SLPs after July 1, 2005. The imposition of these deadlines added urgency to the Consortium mission.

The five universities of the University of North Carolina System that participate in the Consortium are Appalachian State University, North Carolina Central University, University of North Carolina at Chapel Hill, University of North Carolina at Greensboro, and Western Carolina University. Each of these universities offers a masters degree in CSD, and each developed a corresponding distance education masters program in support of the Consortium efforts. Each of the five participating universities requires its distance education students to meet all of that school's requirements for this degree, and students receive their degrees from the universities in which they enrolled. The major function of the Consortium is to organize and facilitate distance delivery of a common set of core courses, so that Consortium students are able to complete distance coursework during the school year while maintaining their employments in the North Carolina public school system. Other functions of the Consortium include publicity, recruiting, and providing a support system for the students enrolled in the distance education Consortium.

Students and Distance Education Courses

Only public school SLPs are eligible to participate in this program. Students have enrolled who work in counties scattered throughout the state of North Carolina, including counties on each of the four borders of the state. Distance courses may be taught by any of the five participating university programs, and are telecast to as many as three interactive sites throughout the state. Those students who are within one hour's drive of the originating university or an interactive site are expected to attend classes at that site. Students who are more than a one-hour drive from an interactive site are provided videotapes of lectures; these videotapes are sent to those students within a few days after each class. Variations in this course delivery plan have been used for some of the more recent course offerings. Some courses are now being made available by videostreaming, and one of the authors is using a more web-based approach supported by editing videotapes of classes from previous semesters to produce a CD-ROM that is provided to students upon enrollment.

At ASU, the CSD masters program is 60 credit hours; the requirement at other Consortium universities varies from 54 to 63 credit hours. At least 36 of those credit hours are from coursework, but as many as 24 credit hours are required in clinical practicum experiences. ASU requires four one-semester clinical experiences, and a full-time internship during the summer or semester prior to graduation. Students are required to attend two eight-week summer sessions to obtain their first two clinical practica. During each of those two summers, they can also enroll in as many as nine credit hours of academic coursework. Some students have already completed as many as six appropriate credit hours prior to admission, so the average student completes approximately half of her academic courses by distance.

Therefore, the distance education program at ASU is actually a hybrid program, providing the opportunity for comparison of performances in on-campus vs. distance courses by individual students. In addition, comparisons of distance students and students enrolled in the traditional on-campus program are possible in summer courses in which both types of students enroll. Since most distance courses are taught in conjunction with on-campus sections of those courses, an additional evaluative comparison is possible.

Results of a Distance Student Opinion Survey

In 2001 a survey was distributed to fifteen program graduates and twelve students nearing graduation. Twenty usable responses were received; this high response rate is likely the result, at least in part, of indicating that the names of respondents would be entered in a drawing for a $25 gift certificate. Some survey questions were designed to obtain background information such as the number of courses that the student had completed by distance and the number completed on campus. Two survey questions designed to elicit comparative opinions regarding distance vs. on-campus courses asked students to list the courses they had enjoyed the most, and to list the courses in which they felt they had learned the most. Then they were asked to circle those courses that they had taken as distance courses. This noting of distance courses was checked against academic records to insure that the method of course delivery was reported correctly.

Table 1 shows the number of courses taken each way (distance vs. on-campus), the number of each listed as courses the students enjoyed the most, the number of each listed as courses in which they learned the most, and the results of paired *t*-test comparisons of these responses. Although not statistically significant, students listed almost twice as many distance courses as on-campus courses as the courses in which they had learned the most. This result leads the authors to believe that students did not consider distance courses to be less rigorous, nor did they consider their learning to be hampered by taking those courses at a distance. If they had experienced significant frustrations with distance coursework, those frustrations were not reflected by their opinions of comparative learning. Other questions on the survey asked respondents to write about problems encountered in each group of couses; their written responses to these questions did not reveal major differences.

Mean Number of Courses	Distance Courses	On-campus Courses	Paired 't'	p-value
Completed	7.28	7.83		
Chosen as most enjoyable	1.61	0.67	2.29	.035
Selected for most learning	1.59	0.88	1.32	.20

Table 1: Results of an opinion survey of twenty distance education students regarding enjoyment of, and learning in, distance courses.

The statistically significantly greater number of distance courses chosen as courses enjoyed the most supports a conclusion that this distance program has been successful, at least in terms of providing distance coursework that does not alienate distance students. There are three confounding factors specific to this program that might contribute to the selection of distance courses as those courses which students enjoyed the most. One is that many of these students have families, and they get to live at home while completing distance courses. Secondly, students can look forward to continuing in their chosen careers, and they realize they would not be able to do that without giving up their paychecks were it not for this distance education program. Thirdly, these students apparently enjoy their work as public school SLPs, and the sense of accomplishment and contribution they receive when they are actively working at that job may contribute to their general satisfaction level.

Even though the three possible confounding factors presented above would seem to make it more likely that students would choose distance courses as courses they enjoyed the most, there is a major reason why that is still surprising. Working as a public school SLP is a demanding and exhausting occupation. Most of the early graduates of this distance program were facing year 2000 deadlines, so they enrolled in two distance courses each semester. The workload of two distance courses took away a huge percentage of their personal, family, and even rest and relaxation time. The Consortium leaders were continually amazed at how students were able to keep up with their distance courses while working full time and dealing with the usual problems of living (Cochenour, unpublished). The fact that they tended to receive lower grades in distance courses than in their on-campus summer courses, as shown in Table 2, probably reflects the demanding workloads they faced while taking distance courses. Still, they more often chose distance courses as courses they enjoyed the most, and they chose distance courses as courses in which they learned the most at least as often as they chose on-campus courses.

	Distance students GPA	On-campus students GPA
Summer 1998	3.817 (54)	3.836 (605)
Summer 1999	3.995 (105)	3.864 (503)
Summer 2000	3.833 (54)	3.858 (333)
Total for 3 summers	3.894 (213)	3.851 (1441)
Distance courses	3.471 (291)	

Table 2: Grade point averages (and credit hours) for thirteen ASU distance students in distance and on-campus courses and corresponding data for traditional students at ASU.

Comparative Performance in Summer Courses on Campus

Mean GPAs for summer courses taken by ASU distance students are shown in Table 2, along with the mean GPAs in the same courses for on-campus students. There was no significant difference in mean GPAs of distance and on-campus students when enrolled in the same summer courses, but the mean for distance students was numerically higher than the mean for on-campus students. This is surprising because distance students had significantly lower admissions scores than on-campus students (Barber, 2002). However, both age differences and public school experience may have impacted this performance. Distance students would have had a number of years of practical experience during which they probably researched problems and issues that they faced with their case loads in the public schools. The years of experience of ASU distance students included in this data ranged from three to thirteen.

However, the age difference might work both ways. The older distance students regularly describe feeling paranoid about their ability to compete with students who have not had long breaks in their education, or they simply state they are afraid they can't do as well as younger students. Part of their fear may be that they did not have a high undergraduate GPA, so they lack faith in their academic abilities. In fact, a low undergraduate GPA may have been one of the factors that led to their decisions not to pursue the masters degree immediately upon receiving their B.S. However, the age difference may actually contribute to their performance if they are more mature, more determined, and less likely to invest a significant amount of time in social activities. Even their insecurity about competing with younger students may spur extra efforts.

So the Consortium distance education program is successful in terms of selecting students who have the ability to succeed in on-campus coursework. These students have also been successful in their clinical practicum and internship assignments; this is another indicator of program success.

Distance Course Performance

One of the authors taught a course which utilized three different content delivery modes. A group of on-campus students completed the course in a traditional classroom format. A second group of off-campus Consortium students completed the course by viewing videotaped lectures. A final group of on-campus students completed the course utilizing the distance format used by off-campus students. The mean scores of students in all three groups on a written comprehensive exam were not statistically significantly different, and, in fact, were almost identical (Table 3). Thus, distance students were as successful in this course as on-campus students completing the course in a traditional format or using distance technologies.

Group	Instruction Method	Number of students	Mean Score
On-campus students	classroom	35	90.93
On-campus students	distance	31	90.28
Distance students	distance	22	89.72

Table 3: Comparative performance on a written comprehensive exam of distance education students and on-campus students in a Dysphagia course.

Goal Achievement

The goal of the Consortium distance education program was to provide public school SLPs the opportunity to earn a masters degree without interrupting their service to the public schools of North Carolina. A total of sixty-three (63) students have entered the Consortium program. Only five of those students have left the program, and one of those five transferred to the on-campus program so that she could complete the masters sooner. Another decided to move back to her home state of New York, and she has entered an on-campus graduate program there. So our dropout rate has been below 10%, in contrast to the high drop out rates of many distance education programs. The authors consider the low attrition rate to be another indicator of success of this program.

A total of thirty-one (31) students have completed this program and earned their masters degree. Most of those graduates have continued to work in North Carolina public schools after graduation. There is a shortage of qualified SLPs who would have been available to work in these public school positions if the Consortium students had not been able to continue to do so during their masters program and upon completion of that program. So very few of their school systems would have been able to find replacement personnel in a timely manner. It is not possible to calculate the number of children in need of speech-language therapy who would not have been served had it not been for the Consortium program, but the actual number has to be thousands of child-years. The success of this program can also be expressed in terms of high graduation rates, in terms of enabling the public schools of North Carolina to keep employees that they knew and wanted to keep, and in terms of the number of children in need of speech-language therapy who would have not been served if it were not for this program.

A Major Reason for the Success of This Program

Not all distance education efforts are successful, and few enjoy the level of success of this program. There is little question that the North Carolina Consortium for Distance Education in CSD has enjoyed this level of success because its students are mature and very highly motivated. The prospective students who sought admission to this program were those public school SLPs who wanted to continue in this career. The fact that they could not do so without successfully completing a masters degree program provided huge incentives that resulted in superhuman efforts. While Consortium planners and faculty made the program workable, it has been student efforts that actually made it so incredibly successful.

Summary of Indicators of Success of This Distance Program

1. Five North Carolina universities have cooperated in a Consortium effort to share the teaching, delivery, and operation of a distance education masters program. That Consortium effort is entering its sixth year of course offerings, and it is still viable.
2. Students who have taken approximately equal numbers of distance courses and on-campus courses more often identified distance courses as the courses they enjoyed the most. They also identified distance courses as the courses in which they learned the most at least as often as on-campus courses.
3. Performance in on-campus summer session courses by students enrolled in the Consortium distance education program was equal to performance in the same courses by students enrolled in the regular on-campus program, despite the fact that distance students had significantly lower admissions formula scores.
4. When given exams over the same course material, students receiving instruction via distance delivery performed as well as students in on-campus sections.
5. The Consortium distance education program has a very low attrition rate, and promises to have a very high graduation rate.
6. SLPs working in North Carolina public schools have been able to maintain employment while earning a masters degree. Further, most have been able to earn that degree prior to a deadline that could have resulted in the loss of their jobs.
7. Many North Carolina public school systems have been able to keep employees that they know and value, rather than having to try to recruit replacement personnel when there are not enough qualified SLPs to meet the demand.
8. The number of North Carolina public school children in need of speech-language therapy whose therapy would have been delayed if it were not for this program is undoubtedly in the thousands. This is the ultimate measure of the success of this distance education program.

References

Barber, W.D., Cochenour, L., Barr, D.,G., Suddreth, J., and Setzer, R. (2002). Using Traditional Predictors to Make Distance Education Graduate Program Admissions Decisions. *Journal of American Association of Behavioral and Social Sciences (Special Edition on Distance Education)*, 18-25.

Cochenour, L. (2002). Unpublished minutes of the Advisory Council for the North Carolina Consortium for Distance Education in CSD. University of North Carolina at Chapel Hill. Chapel Hill, NC.

Architecture of an E-Learning System with Embedded Authoring Support

Andreas Baudry, Michael Bungenstock, Bärbel Mertsching
IMA Lab
Dept. of Informatics
University of Hamburg
Germany
baudry@informatik.uni-hamburg.de

Abstract: In this paper we introduce an architecture for an e-learning system with an embedded authoring system. Based on the metaphor of a construction kit, this approach offers a general solution for specific content creation and publication. The learning resources are IMS "Content Packages" with a special structure to separate content and presentation. We call these packages "Template Content Objects" (TCO). They contain a template coded in XML and additional files for multimedia learning objects. TCOs are similar to the SCORM "Sharable Content Objects" (SCO) and can be simply translated to them. The authoring system consists of different authoring tools that handle TCOs. Every task in the process of learning object creation is done by experts which we modeled with the help of roles. The architecture is a result of the math-kit project, a web based e-learning system that provides instructors and students with multimedia support for central topics in undergraduate mathematics.

Introduction

Our goal is the development of a multimedia construction kit, called „math-kit", that supports the learning and teaching of mathematical and technical content (Mathkit 2002, Unger 2002). Hence, the math-kit project provides a mechanism to find and combine learning objects to compose them to complete learning units and online courses. Students will be able to use math-kit to work through online courses to refresh their knowledge or to use the tools for further exploration of course material. In the same way the students use courses, instructors could apply parts of the courses to their lectures to make them more accesible to students.

Math-kit is a joint project, which is being developed at the German universities of Hamburg, Bayreuth, Hagen and Paderborn[1]. They combine their technical and didactic skills to produce mathematical and technical learning units for interdisciplinary use in higher education.

In a joint project, the creation of uniform learning content is very difficult to achieve. Often, different developers produce learning objects which are based on varying description languages such as HTML or PDF. The software market provides several tools for content creation, for instance, Microsoft Word, Adobe Acrobat, Adobe Framemaker or Macromedia Dreamweaver. Each of these programs provides special functionalities for specific problems but has weaknesses in other tasks. Also, defining rules for the style and layout of content is insufficient because the process of individual combination and the reuse of learning material in other contexts is not possible. For this purpose the architecture of math-kit uses the construction kit metaphor (Bungenstock 2002) that we have developed as a solution for this problem.

Briefly, this metaphor helps to plan a software system that supports both students and instructors in improving their work. To understand this metaphor, think of a LEGO construction kit with all contained bricks. The unique design of the bricks allows a multitude of stable models. In the math-kit context the learning objects are the bricks, which can be combined to individual courses. To define such a brick in a e-

---

[1] Support of the German Federal Ministry of Education and Research, project Math-Kit (08NM084) is gratefully acknowledged.

BEST COPY AVAILABLE

learning system, we provide the TCO approach that uses the *Extensible Markup Language (XML)* (XML 2002) to separate content and layout of learning objects.

Template Content Object

Before we describe the architecture for the math-kit project in detail, a deeper understanding of our special template mechanism is required. Our *Template Content Object (TCO)* is inspired by the *Sharable Content Object (SCO)* of the SCORM standard (ADL 2002) which has a strong influence on our design. Briefly, a SCO represents a collection of different files, called assets, and is the atomic learning resource for a *Learning Management System (LMS)*. One SCO is intended as a small and independent unit to be reused in different learning contexts. All learning resources and additional metadata describing the SCO can be bundled by a special *Content Package* mechanism based on the standard of the IMS (IMS 2002). SCORM offers two content packaging application profiles that describe how IMS content packaging is used. Both *resource packages* and *content aggregation packages* use a *manifest* for the internal description and the same file encoding like zip compression. However, significant differences exist between them. A resource package contains only assets with no relations or order and is therefore the SCO. The content aggregation package consists of SCOs or other content aggregations and offers higher structuring. Hence, higher-level structures like lessons, sections and chapters, as well as complete courses, can be built in the same way. Figure 1 illustrates the levels of content packaging. The arrows show the inclusion relation.

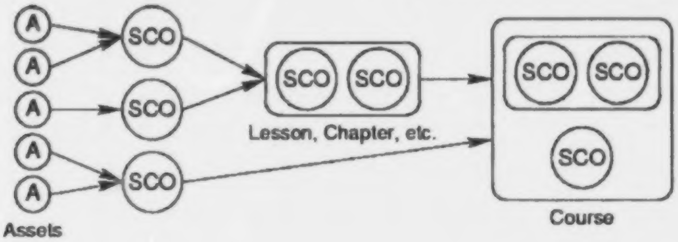


Figure 1: Recursive content packaging

In this simplified example, a course is a content aggregation package containing another content aggregation package and a resource package/SCO. The recursive definition of content aggregations allows any structure depth for learning content desired.

For assessment of learners, SCORM defines a simple protocol for comunication between SCO and LMS. At runtime, the SCO obtains the API adapter of the hosting LMS for interchanging data about the learner's behaviour.

The SCO approach meets the demands for content interchange and execution but lacks some important features for content creation. As already mentioned, the separation of content and view is one of the essential goals of math-kit. Therefore, the *Extensible Markup Langugage (XML)* and the *Extensible Stylesheet Language Translations (XSLT)* (XSLT 2002) are used. A TCO has the same structure as a SCO with the exception of one special asset: a template written in XML. In the case of math-kit, the template describes the texts, mathematical definitions and formulas in a well-defined fashion. Templates can be used for every kind of content but they depend on a special XML encoding. The further assets in the TCO are required only for the later translation of the template into a readable output format, like HTML or PDF. To make the conversion clear, figure 2 shows an example with a TCO containing two images and one animation. The TCO is translated into two different SCOs whereby the varying number of files in the SCOs is caused by technical differences. The PDF file format allows the integration of images but HTML contains only references to other resources.

BEST COPY AVAILABLE

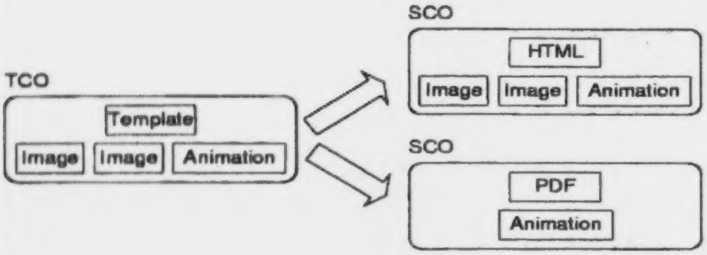


Figure 2: A TCO converted into two different SCOs

The translation process is controlled by different XSLT files which are used to convert XML into any hierarchical file format. Thus, the individual appearances of one TCO can be realized with only one translation technique. For instance, if you need to show the emblem of your company, school or university in the upper right-hand corner using particular colors, you only have to modify the XSLT files and not the template. This means that a created TCO never has to be changed for visual modification.

The Roles

We introduce roles to model the different views of our e-learning system. It is important to comprehend that one person can appear in several roles. The roles help us to model the static and dynamic behavior of our system with use cases and sequential diagrams (Bergner 1998). This allows us to have a strict and controllable development process.

Six different roles can be defined with math-kit: instructor, student, composer, learning object developer, publisher, and administrator. The *instructor* uses single blocks or complete courses to extend his own lectures or to create new ones. Important operations for this role are searching and archiving. The *student* role needs similar operations but for another purpose. Individuals in this role want to learn and can explore the entire database to use learning objects and courses of interest. These two roles don't depend directly on the construction kit metaphor because they work with math-kit through a LMS. Nevertheless, the construction kit is the foundation of the created content.

The composer uses math-kit to combine existing learning objects to make complete courses. Useful operations for this role include searching for learning objects, combining, previewing and perhaps editing. This role creates and edits the content package. In relation to the construction kit metaphor, the composer defines the construction plan. The *learning object developer* designs and implements new learning objects. This role consists of collecting and assembling the different assets like images, texts, and animations to SCOs. In view of the metaphor, the learning object developer creates several bricks. In context of math-kit, the learning content is coded in XML with a structure for mathematics. This XML code has to be translated into a readable format by the role *publisher*. Hence, the main operations of the publisher are the definition or choosing of particular styles and the compilation of the source document to a destination format. The last role, *administrator*, installs basic packages and software for the construction-kit. The main task of this role is to help all the other roles with technical problems. Maintenance, consulting and user administration are the important operations.

A little example should make the relations among the roles clear: Consider a professor who wants to extend an existing lecture in computer engineering with a multimedia course. First of all, the professor is in the role of the composer. Math-kit offers a wide range of content and most of the required themes ideally should be available. If some content is missing or has to be adapted the professor slips into the role of the learning object developer. For instance, the learning object developer is able to integrate the mathematical content of a colleague, which is not stored in math-kit. Figure 3 shows the role of the composer creating a course for computer engineering.

BEST COPY AVAILABLE

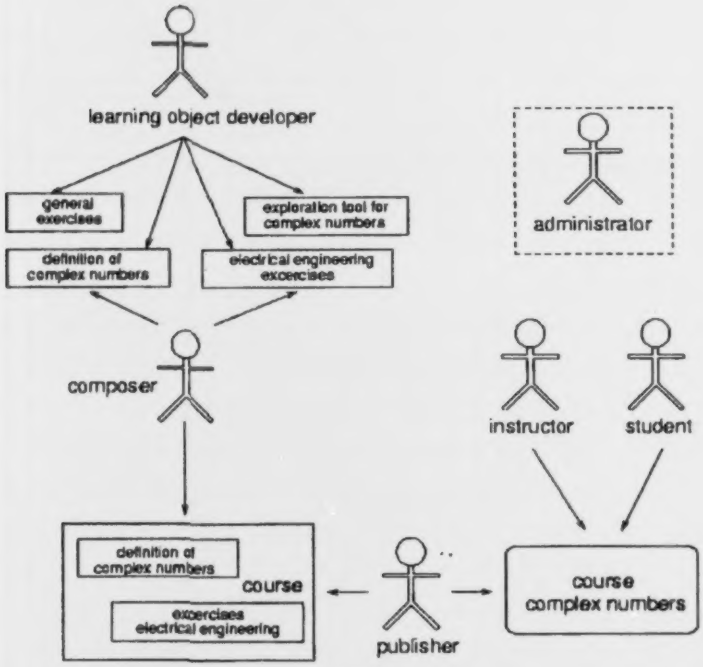

learning object developer
general exercises
exploration tool for complex numbers
definition of complex numbers
electrical engineering excercises
administrator
composer
instructor
student
definition of complex numbers
course
excercises electrical engineering
publisher
course complex numbers

Figure 3: The roles that interact with the construction kit

After the course is completed, another person, such as a scientific assistant, takes on the role of the publisher. He can adjust the university emblem or any other style-related features like font, background color or page size. The product, a viewable document in a preferred format, is used by the professor, in the role of instructor, in his lecture to illustrate complex themes with animations. If students do not understand everything during the lecture they can read the complete course online at home. If a student needs more detailed information, for example about complex numbers, math-kit offers the whole database of content. Furthermore, the student is able to work through special exploration units which are provided by the professor as well.

The role of the administrator doesn't appear in this example because this role exists only to support the other roles.

Architecture

To understand the realisation of the construction kit it is necessary to have a look at its architecture. Usually, students use online courses through *Learning Management Systems (LMS)* such as LON-CAPA or Blackboard (LONCAPA 2002, BLACKBOARD 2002). A LMS provides different categories, for instance communicating to other students, sending solutions of exercises to lecturers, work through courses or use of multiple choice tests for check progress. The courses can be created with the help of authoring tools, for instance macromedia's authorware application. Unfortunately, these tools can only be used for universal content creation. They provide solutions for quizzes or give the author the possibility to adjust predefined design properties. In the math-kit project we need a special mechanism to define individual learning content. On the one hand, learning objects should be combined and transformed to individual courses. Thus, an authoring tool must provide the possibility to define learning objects without any style definition. On the other hand, different output formats should be provided as well. To meet this demand, the need of an abstract mechanism to define equations is required.

BEST COPY AVAILABLE

Based on these facts, we used an arbitrary LMS to provide the content of math-kit. This enables students and instructor to use their favored webbrowser to work through the courses or to select a special course block for presentation in lecture. However, the process of content creation must be supported by special tools in order to meet our requirements. According to the role concept, the learning object developer, the composer and the publisher are experts in content creation and each of them has his or her own tool. Related to our construction kit approach, these tools work with a server that stores courses and TCOs as bricks.

Thus, the *Constuction Kit Server* (CKS) is an important extension of existing LMS for individual content creation. Figure 4 shows the CKS and its tools.

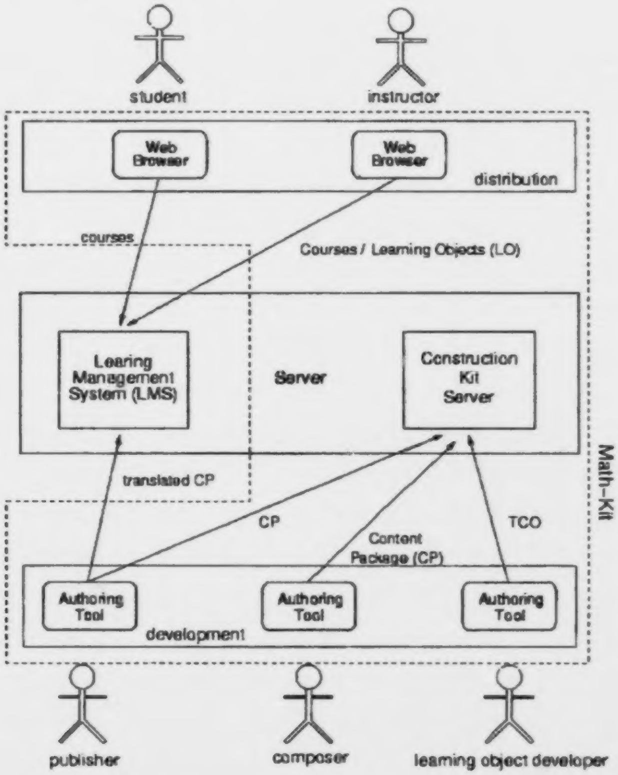

student
instructor
Web Browser
Web Browser
distribution
courses
Courses / Learning Objects (LO)
Learing Management System (LMS)
Server
Construction Kit Server
Math-Kit
translated CP
CP
Content Package (CP)
TCO
Authoring Tool
Authoring Tool
Authoring Tool
development
publisher
composer
learning object developer

Figure 4: The architecture of the construction kit

The tools are split up into two groups: one for distribution and the other for development. The development tools are used to produce content packages that will be distributed to instructors and students through the LMS.

The tool for the *learning object developer* creates new TCOs that can be stored into the CKS. It enables the developer to create or modify templates easily by integrating new assets, for instance, images, texts or applets. As already mentioned, the TCOs usually content packages that consist of one XML-file with several referenced assets. The developer works on a copy of the original TCO file which is stored on the construction kit server. The client works on his or her own copy of the TCO. Thus, when a TCO is saved on the CKS the copy is merged with the original file. This is achieved by the use of CVS, a system to handle concurrent work.

For the *composer* role a separate authoring tool is available. This tool helps the process of combining TCOs to create the so called *content aggregation packages (CP)* (courses). Therefore a manifest file that contains the structure of the course has to be created. In relation to the construction-kit metaphor

BEST COPY AVAILABLE

the manifest is the construction plan. In Addition, the composer is able to search for existing TCOs by keywords based on the *case based reasoning (CBR)* (Watson 1997).

Another tool is available for the publisher for transforming content packages into courses that can be stored into different LMSs. With the help of this authoring tool, an individual design and layout can be defined. The CKS uses a stylesheet that is generated by the tool of the *publisher* which can transform a content package into a special output format, such as HTML or PDF. Using XSLT to transform source XML-files, the publisher has the option of choosing a predefined layout, modifying an existing layout or defining a new layout.

The consumer of the learning content doesn't pay attention to the CKS. They only have to access a LMS to work through courses or to use single learning objects for lectures.

Realisation

The implementation of the construction kit is influenced by the previously mentioned SCORM standard. All specifications in SCORM offer XML bindings so that a XML parser is needed. Because of platform independence, Java is our programming language of choice. Standard interfaces for XML processing in Java exist which are supported by many available parsers. For confidence we use JDOM (JDOM 2002), a simple XML document representation in Java with its own API that is similar to the W3C DOM (DOM 2002) but offers more comfort. With these tools it is quite simple to read, edit and write the manifest of a content package.

The authoring tool for the learning object developer allows the creation and modification of TCOs. This requires the handling of resource packages containing a template, assets and a manifest. To facilitate the work with TCOs, the direct manipulaton of assets should be provided. This gives the opportunity for a rapid implementation process controlled by one tool. The connection between the contained files and the tools must be realized via the *Multipurpose Internet Mail Extensions (MIME)* (MIME 2002). This specification defines among other things media types and subtypes to classify data. The application can determine the media type of a particular file in several ways, e.g. by the file extension or an analysis of the file beginning. Furthermore, every media type should be combined with an action, i.e. create, edit, or show.

A combination of media type and action is adhered to a Java component, called *JavaBean*, or an external application like a PDF viewer. Sun offers the *Java-Bean Activation Framework (JAF)* (Calder 1999) which supports the development of MIME media type driven applications. For better integration of self implemented or foreign JavaBeans a mechanism is required that allows dynamic and flexible adaption to personal needs. Java is a strong typed language and therefore programs have to be recompiled after every change. To get an acceptable solution, we recommend a scripting language as a bridge between the construction kit and the Java-Beans respectively external applications. An interpreter, called Jython, of the object-oriented scripting language, Python, exists for Java and is easy to integrate in applications. This combination of Java and Python provides all the benefits we want to offer with our appliation.

The composer role needs content packaging as well as search functionalities. Different TCOs have to be combined to higher structures, in detail content aggregation packages. Therefore, the right learning resources have to be offered by the authoring tool. For the realization of the case-based-reasoning searching, special data records have to be stored. The adequate solution to store these records is a relational database system. With the JDBC API (DOM 2002) of Java, a SQL driven implemetation could be done indepentendly of the concrete database system.

The publisher role needs support for the creation of styles but for most authors it is not reasonable to code XSLT files. Hence, the authoring tool offers an abstract view of the translation process. Every tag appearing in a template needs its own translation rule. To automate such a style process, a meta description for the templates is necessary. With this information, the authoring tool can support the publisher.

For the translation into readable output format, different rules and perhaps special pre- or post-processing components are required. Consider PDF as the desired output format. One solution could be a direct transformation into this format but this would result a huge programing effort. A more simple way to get PDF is the usage of *LaTeX* (Lamport, 1998). In this case, the template is translated into LaTeX code by XSLT and then into PDF by the post processor calling the LaTeX program.

Conclusion

We presented the architecture of an e-learning system that is based on the construction kit metaphor. With such a system, courses can be created by the usage of already existing learning resources based on our TCO approach. This approach makes it possible to adapt learning objects to different courses independent of their format and style. The architecture was developed in relation to the role concept. The definition of the roles working with the construction kit helps us to develop an architecture of an authoring system that can be used by students as well as professors to improve their work.

The universities of Hamburg, Hagen and Paderborn effectually use the construction kit to produce their courses (Padberg 2002) in the field of computer engineering as well as mechanical engineering.

References

ADL (2002). Sharable content object reference model (scorm). http://www.adlnet.org/.

Bergner K., Rausch A. & Sihling M. (1998) A critical look upon UML 1.0. In *The Unified Modeling Language– Technical Aspects and Applications*, pages 79–92.Physica-Verlag, Heidelberg.

Bungenstock M., Baudry A. & Mertsching B. (2002) The construction kit metaphor for a software engineering design of an e-learning system. In *ED-MEDIA 2002– World Conference on Educational Multimedia, Hypermedia & Telecommunications*, Denver, Colorado,USA.

BLA CKBOARD (2002). B. Inc. The blackboard e-education. http://www.blackboard.com/.

Calder B. & Shannon B. (1999) Javabeans activation framework specification version 1.0a.

DOM (2002). Document object model (dom). http://www.w3.org/DOM/

IMS (2002). Ims content packaging specification. http://www.imsproject.org/content/packaging/.

JDOM (2002). http://www.jdom.org/

Lamport L. (1998). *LATEX A Document Preparation Syswtem User's Guide and Referencs Manual.* Addison-Wesley.

LONCAPA (2002). The learning online network with capa. http://www.lon-capa.org/

Mathkit (2002). http://www.math-kit.de.

MIME (2002). N. W. Group. Multipurpose internet mail extensions http://www.nacs.uci.edu/indiv/ehood/MIME/2045/rfc2045.html.

Padberg K. & Schiller S. (2002). Web-based drills in maths using a computer algebra system. in Proc. EDMEDIA.

Unger L., Oevel G., Mertsching, B. (2002). Web-based teaching and learning with math-kit, 2th International Conference on the Teaching of Mathematics, Crete.

Watson I. D. (1997). *Applying Case-Based Reasoning : Techniques for Enterprise Systems.* M. Kaufmann.

XML (2002). W3C. Extensible markup language (xml) 1.0. http://www.w3.org/TR/2000/REC-xml-20001006.

XSLT (2002). W.W.W. Consortium. Xsl transformations (xslt) version 1.0. http://www.w3.org/TR/xslt.

Education Network of Ontario: Content/Curriculum Models for the Internet-connected Classroom

Mary Beam
Education Network of Ontario
20 Toronto Street, suite 400
Toronto, ON
Canada, M5C 2B8
marybeam@enoreo.on.ca

Abstract

The Education Network of Ontario (ENO) is a telecommunications corporation creating an access and applications network for and by Ontario's 130,000-member education community. When educators register with ENO, they receive full industry-standard Internet and Intranet services in English and French. ENO/REO works from school or home. Statistics such as 100000 teacher members, over 23000 logins a day, 25000000 minutes a month of online time, and over 100000 mail or news messages per day are commonplace. Self-nominating teachers lead projects that deal with content creation, classroom projects and technology exploration. Results are as varied as a database of parent letters to go with report cards, solutions to keep small children exercised and content in ultra-cold winter months, an Internet radio station and investigation of video and voice technologies as well as pedagogical practices to support professional development.

We train teachers who now understand the need for, and use of, a sophisticated variety of applications and content to support and motivate students in our online environment. The result of this support is a classroom project model that is firmly based in curriculum but created in a way that the students and teachers use access to the Internet and other technologies to enhance learning of subject matter and processes, and not the technology itself.

The ENO project model is supported by an automated application so teachers need not become involved in web functions and software operations themselves. They do not need to understand web site creation or even negotiate web hosting with their school or District School Board. In this way they work from the outset with the skills and experience they already have and they add knowledge of online processes and course management only as they need them in practice. Many project leaders graduate from this initial template to major web site creation. Because we are our own Internet and Intranet Applications Service Provider, we have enabled teachers to create and use a continuously evolving 'bootstrap' model to support diverse, creative activities – projects, group work, lessons and student-to-student exchanges at every level of instruction.

1. Introduction/Context

The initial stage of the Education Network of Ontario (ENO) was a UNIX-based, cross-platform, TCP/IP distributed network which provided bilingual (English and French) electronic mail, moderated conferencing (facilitated newsgroups), and database and Internet access across Ontario. It consisted of a bulletin board system with just eighteen members in 1993 and has grown to register more than 100,000 teachers, administrators, trustees and education faculty. This now constitutes nearly the complete K-12 education personnel of the province.

The organization, a public sector Internet and Intranet Applications Service Provider (the second largest in the province), has moved from a project for the Ontario Government to become an independent not-for-profit corporation selling services to various levels of government and private and public sector organizations in Canada and abroad.

The project retains dial access from any educator's home or school location in Ontario as well as a full set of mail and newsgroup services. However, to assist teachers with implementation and to resolve issues of the blocking of traditional newsgroups, ENO is structured to enable browser-based moderated Intranet newsgroups and model classroom projects with interactive web creation scaled to accommodate hundreds of thousands of teachers and students as they develop creative, commercial level content. A bilingual call centre supports all of the members and a web site supplies automated tools for registration and classroom project creation.

2. Statistical Notes

Quantitative analysis tells us that our membership of 100,000 educators uses the dial access on average 20000 times a day. Statistics show total online time of nearly 20,000,000 minutes a month from the dial clients. This is in addition to access from school or office LANs and other service providers. Our servers handle as many as 100,000 messages a day. Some of our classroom activities sites register 30,000 hits a day during peak activity. Our records show that teachers have a sustained interest in the Internet and ENO resources, with 80% of the connect time registered after school and throughout the night. Any one of the hundreds of teachers involved in an 'ENO' classroom project, either in creation or participation, is using home or library access after-school hours because of the classroom pressures of their days.

3. Teachers' Practices

Our anecdotal analysis and day-to-day experiences tell us a great deal about how educators use this suite of services. One focus of the teachers continues to be moderated conferences/discussion groups that they open to solve such endemic concerns as 'local' versus 'standardized' evaluation, reporting to parents, community work/learn programs, and general subject-based or level-based curriculum issues such as primary school or science teaching. Whenever a new provincial license for software is purchased, a discussion group is opened in which the technical support team from the vendor can discuss issues of use and technical implementation.

Smaller groups of teachers voluntarily initiate a series of professional activities such as writing primary school curriculum units based on concepts such as two dimensions – measurement, journaling, drawing, and electronic and snail mail. This arose from a successful example, the web-based project devoted to showing young students how to conceptualize two dimensions with a central fictional character called 'Flat Stanley'. After the provincial collaboration, teachers mount and maintain the curriculum units on the ENO/Flat Stanley web site. This project is now international with thousands of schools and hundreds of thousands of students participating. Teachers in other jurisdictions are beginning to write curriculum modules and asking for them to be added to the site.

4. Classroom Projects

One of our largest projects involves over 100 schools and 4000 students across Canada. The Canadian National Marsville Program is a complete online and face-to-face environment. It is a content, activities and teacher professional development project based on the concept of intermediate-level students in a simulation of creating a living environment for themselves as pioneer astronauts and settlers of Mars. Students work through four months of content and activities to ensure their survival as Mars settlers. They upload team mission patches and then their air, water, energy, communications and food supply system drawings to their team's web pages. They and their teachers use the web to access content, activities and mentors' comments from companies such as Spar Aerospace or Macdonald Detweiler and the Canadian Space Agency. Both students and teachers use their personal Intranet accounts to use email and discussion groups to communicate with one another as they improve their devices for space exploration and prepare for the final 'link-up' day. Using technology applications such as newsgroups for sharing and interactive

BEST COPY AVAILABLE

web authoring prior to the face-to-face event enhances classroom learning. It is not an add-on or a distracter to normal classroom routines.

5. Project Model

The pedagogical model that is the basis for Canadian National Marsville is based in many years of practice, is demonstrably sound, and produces students who are motivated to learn. We have both system-derived and anecdotal evidence of increased achievement. We use this model of sophisticated technology integration, as well as a wealth of offline activities into problem solving simulations, for most of our funded classroom activities.

The following are the parts of the model with explanatory notes. It should be mentioned that the model is not linear and that teachers and curriculum specialists begin in a number of different ways and places in the model. We do ask that ENO project leaders, before they commence, consider all of the parts of the model, even if some segments are eventually deemed non-essential. To aid in understanding, I will use a consistent environmental problem example.

Problem

In this phase, the teacher determines the area of concentration of study. If the student group is at the elementary level, this will naturally be an integration of many disciplines. If the secondary curriculum area is determined to be science, the problem might be the issue of the level of pollution of the local river and feeder water. In all cases, it is preferable if there is more than one teacher and more than one discipline strength involved in the project. The students should pick the final problem or it should be incredibly interesting to students because it is a problem that is local and newsworthy and it starts with their knowledge of, and interest in, the issues of the project.

Scenario

The teachers then create a simulation or scenario into which the students can place themselves as they seek first information and then solutions. In the river pollution example, the scenario would involve a condition of the local river, a series of industries involved in proper and improper waste management, for instance, and the governmental agencies responsible for the river's water quality. The students could form the waste management and biological/chemical company consulted by local industries to study the issue. Another group of students could be the governmental agencies responsible for the river and local water quality. A group of four to six teachers, each with a different area of expertise and a shared commitment of time and resources for the project undertakes the development of activities that appeal to a large number of students since they will blend science with the study of legal regulations and the government as these relate to water. This embeds the knowledge of ground water and its properties and occurrence in the world of governance and political science. Because of the way it is framed from the teachers' initial plan, students become informed, responsible citizens mobilized to protect the environment, even as they come to understand the scientific principles which underlie their insights and conclusions

Team Roles

The scenario will determine the number and types of roles that can be given to students. In the river pollution example, the company would need a series of officers whose different skill sets might be mathematics (Chief Financial Officer), science (chemists, zoologists and botanists investigating the quality of the water and the species living in it), or media studies (creating the documents and multi-media objects used to create the case for the solutions). Students in history, business, or citizenship classes take on the roles for governing officials to study science from the point of view of regulations, their objectives, and their timing.

BEST COPY AVAILABLE

The more realistic and diverse the roles, the more students can divide the activities to concentrate on specific content. This increases motivation and encourages students to remain focused on solutions. It also allows them to study the core science in the context of their personal strengths. The more completely the students incorporate their personal roles, the more they will act professionally when they consult people in the community who have responsibility for these duties.

Clarification of the Problem and Critical Thinking

The students are presented with the scenario and assume their roles. They begin to clarify the problem and determine the area in which their characters will focus their efforts. They must state the problem clearly, assume the tasks of their roles, and determine the focus for their solutions. This is an important step for the students and is the best indication of how well they understand the problem. The teacher's main task consists in nudging the students to a good understanding of the issues in the problem. In the river scenario, the focus could be organometallic contaminants from local industries and their effects on flora and fauna in the river. A second group could focus on contaminants of drinking water and the ways that they are eliminated. Work needs to be accomplished by any one group in a sufficiently speedy way to keep the project in perspective and on schedule in the curriculum year.

Content Acquisition

The students in their roles now begin to assemble content and create solutions. Sources of information may be the more traditional ones of newspapers, books, and videos or even films. However, these students benefit by being able to access content on the Internet and determine its worth, validity, and timeliness. There are often groups in the community who can act as online mentors who are identified by teachers and who can be accessed by email or who participate in the discussion groups as the students gather their information. Student interviews with members of the community are worthwhile since much needs to be mastered and organized before the students leave the school to interview off-site.

The teacher can assist with the accuracy and completeness of the content by directing members to a wide set of possible sources. At this point, traditional classroom lessons on core content are an asset. They may be face-to-face or online with checks that students have mastered the core ideas.

Activities

As the students gather their content, they begin to assemble and integrate it into solutions based on their new knowledge. It is important that they do many offline activities in natural, role-based groups so that the discrete content they have gathered can be taught, debated and authenticated by the whole group. Activities should be stepped so that students are not overwhelmed. Solutions should culminate in substantial products that are well-documented and complete. For instance, students could create a public policy paper calling for new chemical limits, with supporting documentation from other jurisdictions and their experiments with their local water sources and supplies. They might create a digital video to show members of government or the community the present case with a model and evidence for desirable change. The product depends on the context and capacity of the classroom.

Solution/Assessment

As the students work on their activities, they will create products which need attention from the teacher and mentors. If the students have not found sufficient content or have been sloppy in collecting and presenting evidence, the solutions posited may be superficial or even wrong. Teacher intervention can turn students to redress this and the solutions can go through iteration to ensure that students work much as developers and writers working in the 'real world'. In most cases, students enjoy the opportunity to learn more and their improving solutions become a source of pride. The students finish when they and the teacher are satisfied, but motivation remains high where initial goals and schedules are followed.

Exhibition

This model for learning benefits from an opportunity to exhibit solutions. Face-to-face events are optimal if much time has been spent using technology in groups separated by distance. A final event like an exhibit, a presentation to the local municipal council or even a synchronous event among schools supported by videoconferencing will enable students to polish products for a deadline and for someone else than their school and teachers. In some cases, an exhibition may be the only way to make students complete and move to other studies.

6. Implementation Notes

Teachers can approach this model in a variety of ways. They can start with a scenario that is exciting to students and work backwards to make the curriculum links. This will often happen to a certain extent because good teachers will think of various other parts of their curriculum that they are accomplishing in these problems such as communication, co-operative work, career study, or even the use of technology in their discipline.

Teachers often start with a relatively rudimentary scenario but as they begin to trust the focus and variety of approaches that the roles afford students, they invest more time and energy in the scenario or simulation description. Student motivation is directly proportional to the excitement of the scenario problem.

All sections, but particularly the core content and activities, are profitably produced on the web since the project web site will give students the framework for their work. Many teachers working on one project can make a substantial site with activities which will encourage other teachers to join them, use the project, and suggest improvements. A number of teachers will also help in establishing a solid foundation for student evaluation. Only if the curriculum objectives are apparent and the evaluation methods authentic will a critical mass of teachers in a jurisdiction adopt the project and make it worth the effort that has been expended by the first core teachers. Once this happens, the effort to enhance the site is minimal and the returns great.

The project model has been incorporated into a web application that allows teachers interested in initiating a project to create a web site which describes their problem, establishes their team, and establishes their 'lessons'. External teachers can request to join a team and then enhance the site with their additions. Projects that are very creative and attractive often grow out of this template environment to full web production supported at a provincial or national level.

In all of this activity, ENO is in varying degree enabling personal, small group and province- and nation-wide professional development. As such, some of our activities have been researched and monitored or even funded by research grants. We have yet to induce research into this model but many teachers in Ontario, Canada, and even around the world have adopted it.

6. Partnerships and Sustainability

Our work with the Ontario education community has burgeoned to other Ontario and Canadian government ministries and jurisdictions. This gives us economy of scale and allows us to move services through a developing spectrum not dependent on individual contracts.

We are working with Brazil to support secondary reform to integrated disciplines and critical thinking through technology. This involves four projects in at least seven states with nearly one hundred schools and hundreds of teachers over the next two years.

7. Summary

All of this experimentation, integration, and implementation create a healthy and knowledgeable corporation able to develop and offer vertically integrated services to communities, professional groups and government ministries and agencies. We use the economies of numerous parallel contracts to continually improve our service and applications offerings. As we embark on our international activities, we invite participation and partnership.

The Changing Role of Instructors in Distance Education: Impact on Tool Support

Anke Biedebach
LVU-Entwicklung, URZ
FernUniversität Hagen
Germany
anke.biedebach@fernuni-hagen.de

Birgit Bomsdorf
Praktische Informatik I
FernUniversität Hagen
Germany
birgit.bomsdorf@fernuni-hagen.de

Gunter Schlageter
Praktische Informatik I
FernUniversität Hagen
Germany
gunter.schlageter@fernuni-hagen.de

Abstract: At the university of Hagen a lot of experience exists in performing web-based teaching and in implementing tools supporting e-learning. To share this knowledge, (inexperienced) instructors more and more ask for tool-based assistance in designing and administrating e-learning courses. Considering experience from other universities it becomes obvious, that there is in general a lack of a broad system support of tasks to be fulfilled while performing e-learning. Within this paper we propose an adaptable course assistant which provides the required tool support. It helps in selecting and utilizing Internet and web technology, respectively. The knowledge of how to run a virtual course is modeled by means of course templates, which may be adopted to special needs. Before introducing the assistant we will discuss the changing role of instructors in distance education and its impact on the requirements of tool support with respect to designing and administrating a course.

Introduction

At the university of distance education (FernUniversität) Hagen, Germany, a lot of experience exists in performing web-based teaching as well as in implementing tools supporting e-learning (e.g. Buhrmann et al. 1997). In the beginning the main objective of the projects started to introduce e-learning was to remove the severest restrictions of traditional distance teaching. The decision to perform web-based teaching and thus to use the tools and platforms developed was up to the instructors of the individual courses.

Caused by the fundamental decision to "bring the whole university on the net" (Hoyer 2001) the different systems were integrated into one single platform, the *Virtual University*[1],[2], to be used by all instructors for online teaching. Thus, in general, the role of instructors in distance education is changing imposing additional and new tasks on them. They have, for example, to develop web-pages, moderate newsgroups, or administrate cooperative learning environments. Besides such tasks resulting from using the Internet-based tools and services, instructors have to redesign their teaching courses and to find new ways of distance teaching. Altogether, the predominant question, not only of inexperienced instructors, is "How to utilize Internet technology to enhance web- based teaching and learning?" This implies aspects of didactics as well as of the technique to be used.

At the university of Hagen several workshops are organized periodically within which instructors share their knowledge ("teach the teacher"). However, organizing as well as participating in such events is often claimed to be too time consuming. Furthermore, it doesn't help if an instructor needs ad-hoc clues for designing his online course. Instructors of the university more and more ask for tool-based assistance in designing and administrating e-learning courses. Considering experience from other universities it becomes obvious, that there is in general a lack of a broad system support of tasks to be fulfilled while performing e-learning (e.g. Klobas & Renzi 2000, Tielmans & Collis 1999).

Within this paper we propose an *adaptable course assistant* which provides the required tool support. It helps in selecting and utilizing Internet and web technology, respectively. The knowledge of how to run a virtual course is modeled by means of course templates, which may be adopted to special needs. Before introducing the assistant we will discuss the changing role of instructors in distance education and its impact on the requirements of tool support with respect to designing and administrating a course.

---

[1] https://vu.fernuni-hagen.de

[2] This system is currently being improved and extended by the developer group of the University Computer Centre (URZ) as well as by research groups of different departments.

From traditional distance learning to web-based learning

Traditionally, the university of Hagen delivers its learning material (textbooks and workbooks) in print. The material for a course is partitioned into units to be sent to the students sequentially. Each unit is designed to be worked out within a time period of two weeks. Communication takes place by means of traditional media like telephone and physical mails.

In a few cases the students have to be physically present at the university. Typical examples are hands-on trainings performed in a lab located at the university or oral examinations. This conventional mode of distance teaching and learning is afflicted with different kinds of problems, most of which can be avoided by using Internet technology, and tools and services based on it. In 1996 the university of Hagen started several projects towards becoming a virtual university. Within these projects interactive and multimedia learning material as well as tools and platforms supporting e-learning were developed. The latter are now integrated into a coherent platform constituting the teaching and learning environment of the whole university. In the beginning the main objective was to remove the severest restrictions of traditional distance teaching:

In time feedback. From the students' view, as all learning material was delivered by physical mail, the time delay between sending their homework and receiving feedback (e.g. corrections and comments) were too large. Often students got remarks on their exercises several weeks later when they were already working on other topics of their material. From the didactical prospect this disadvantage was one factor of slowing down the learning process. Tools incorporating Internet technology, e.g. WebAssign (Brunsmann et al. 1999) which supports submitting and receiving electronic assignments, enable students to receive feedback in time.

Being up-to-date. Because of the typographical process instructors had to hand over the complete learning material of each course to the print office six months before it started. Using web-based delivery facilities enables ad hoc modifications, e.g. to introduce latest research results into the course material.

Enhanced communication. At the traditional university of Hagen the communication between instructors and students was usually reduced to information letters (regularly sent to the students to announce course information) and telephone calls. Using synchronous and asynchronous communication services of the Internet enables in time information and tutoring as well as building communities between students.

Virtual presence. Students participating in face-to-face seminars or hands-on experience had to be physically present at the labs of the university. These types of courses are often criticized as being too expensive and time consuming as students have to travel from far away. The web-based forms of these course types (*Virtual Seminar* and *Virtual Practical*) enable the students to meet in virtual rooms (Berkel & Mittrach 1997), to perform laboratory experiments by remote control or by means of simulation and visualization within a virtual environment (Bischoff & Röhrig 2001).

The Changing Role of Instructors

As shown in the above examples introducing web-based teaching enables instructors to enhance learning and teaching for the benefits of the students. On the other side, the role of instructors changes:

- from textbook author to author of interactive and multimedia learning material,
- from text provider to tutor interacting with students by means of the new communication facilities like e-mail, newsgroup, and chat,
- becoming a group member slipping into different roles within computer supported collaborative learning environments,
- being a user of the new media utilizing Internet techniques and tools,
- becoming a course designer defining different e-course types, e.g. Virtual Seminars or Virtual Practical,
- becoming a course administrator, e.g. administrating the course web-site.

Years of experience show that the acceptance to adopt the new role varies between instructors. It becomes obvious that it is highly influenced by the fact whether the decision to perform web-based teaching is driven *externally* or *internally*.

The dominant external factor is given by the decision of the institution to bring the whole university on the net, i.e. to launch a virtual university (Hoyer 2001, Krämer 2000). In addition, and this holds true for distance universities in general as well as for traditional universities, instructors have to be online. They are expected to provide an Internet presentation showing, e.g., their research topics and teaching activities. Furthermore, students more and more ask for web-based learning materials.

If external aspects constitute the main factor for introducing web-based teaching acceptance is generally low. In particular, the following aspects were identified as problems:

- How to use Internet technology and services as well as tools based on it? (aspects of the technology to be used)
- How to perform web-based teaching? (aspects of didactics)
- Will the Virtual University prescribe how to teach? (independence of teaching)

Although web-based learning and teaching is in its infancy and still evolving, distance education can benefit from it in many respects. Hence, most of the instructors are motivated to investigate ways of e-learning within their field of research and applying it in practice. In this case changing the role of instructors is driven internally, i.e. motivated by themselves searching for answers to the questions mentioned above.

The division in externally given decisions and internally driven motivation is not as strict as it may sound above. It shows only two extremes somewhere between which the instructors are located. In addition to these factors the acceptance of the new role is influenced by the knowledge and experience in computer and Internet technology of the individual instructor. In other words, it depends on existing tools enabling e-learning. In the following we will focus on tool support with respects to course design and administration, as other aspects are often discussed elsewhere.

The Role of Course Designer and Course Administrator

How can the Internet be utilized to enhance web-based teaching and learning? There are a lot of decisions to be made with respect to the structure of virtual courses, their organization (e.g. announcements of examination, providing course web pages) and the use of existing tools and Internet services (e.g. the possibility to use an Interned-based exercise system or chats).

Forms of teaching	**Aspects of didactics**	**Tools, Services**
Virtual Lecture (basic version)	S: self-study of learning material, solving exercises; ... IS: communication (tutoring); ...	text processing system, web-editors, authoring systems E-Mail
Virtual Lecture	S: self-study of course material, participation in the Internet-based exercise system, participation in discussions, ... IS: communication (tutoring); ISS: communication (exchange); ...	text processing system, web-editors, authoring systems, newsgroups; E-Mail, chat; ...
Virtual Seminar	S: self-study of course material, elaboration and presentation of a topic, team-work, ... ISS: communication (participation in discussions, exchange of contributions), ...	text processing system, web-editors, authoring systems, up-load-areas, newsgroups; E-Mail, chat; ...
...	...	...
abbreviations: S: Student, I: Instructor, IS: Instructor and Student, ISS: Instructor and Students		

Table 1: Rough classification of existing kinds of learning activities

At a university there are different kinds of teaching events like "lectures" (i.e. courses within which content is delivered analogical to traditional lectures), seminars, exercises, and practical trainings. For each of them different forms of performing them "virtually", i.e. based on Web and Internet technology, are elaborated. Table 1 exemplifies a rough classification of *Virtual Lecture* and *Virtual Seminar*, showing didactical aspects and the tools and services typically used within these course types. The example shows that different concepts of teaching forms and specifications are realized. In the basic form of a Virtual Lecture, for example, the instructor and the student communicate by E-Mail. In its version described in the next row newsgroup and chat are used in addition to support group discussions of students. Usually this communication tools are also used while running a virtual seminar, within which additional services are utilized, e.g. ftp as entrance for an up-load range for the exchange of elaborations.

In particular, instructors who are inexperienced with e-learning like to access existing knowledge. Therefore, at the university of Hagen several workshops are organized within which instructors have the chance to share their knowledge ("teach the teacher"). However, organizing as well as participating in such events is often claimed to be too time consuming. Furthermore, it does not help if an instructor needs ad-hoc information for designing his online course.

Even if an instructor knows how to design a virtual course the tasks related with its administration often cause significant problems and effort. The influence of this additional problem can be discussed in terms of *technical aspects* and *degree of support*. Many instructors have problems to handle the platform (often the effect of the "users don't read manuals" phenomenon) as well as Internet services like videoconferencing or chat-rooms. Even if the services are well known their handling appears confusing due to the different user interfaces providing access to them. Inexperienced users require a simple integration of Internet services thus "hiding" the underlying techniques. Experienced users ask for an open system allowing easy integration of additional services and tools. Furthermore, this group of instructors wants to get rid of tasks dealing with technical aspects, for example, administrating a server or setting up a chat room or newsgroup.

Tool Support: Adaptable Course Assistant

Altogether, besides assistants in developing learning materials the instructors require functionalities for administrating and managing courses. Considering experience from other universities it becomes obvious, that there exists in general a lack of a broad system support regarding different processes, which takes into account organizational as well as teaching tasks to be fulfilled while performing e-learning (e.g. Klobas & Renzi 2000, Tielmans & Collis 1999). Thus appropriate system functionalities have to be implemented with regard to

- aspects of didactics (e.g. showing the instructors how to utilize Internet technology in online courses),
- technology to be used (e.g. free the users from pure technical aspects as far as possible), and
- organizational aspects of a course (i.e. of the university as these are part of running a course, e.g. exchanging data with the examination office).

To provide such system support we are currently developing an adaptable course assistant[3] supporting instructors in selecting and using web technology while they are planning and running their courses. The basic concepts are:

Course Templates. Based on the instructors experience each course template describes a possible way (as a small workflow) of running a type of course, e.g. a web-based seminar, lecture, or practical course. It shows how and when different technologies of the web may be utilized while running a course. Thus, the course templates are reflecting the knowledge about the appropriate technology to be selected in the context of a specific type of course.

Configurable Building Blocks. A template consists of different building blocks. Each one groups functionalities provided by the platform Virtual University or offers special web-services, e.g. functionalities for using a chat room. Most of the building blocks can be configured according to special needs of an individual course. The chat building block, for example, provides parameters for specifying the date and time within which the chat should be available. As an example, the left frame within the window in figure 1 shows a template of the essential version for content teaching courses (named *Basisschablone*, Basic Template in English). The structure of the building blocks constituting a template are visualized by means of a hierarchical tree notation.

---

[3] in German: ALVA – Adaptierbarer LehrVeranstaltungsAssistent; the project is funded by the Federal Minister of Research and Technology

Adaptability. Most of the instructors have their own ideas about how to realize web-based teaching. For example, an upload-area or chat room is not used by all of them within a virtual seminar. In addition, even a single instructor changes the way of handling a given course from time to time. Hence, support is required not only for different types of courses but also for different ways of processing a special kind of course. For this purpose a course template is adaptable, which is realized by means for removing and inserting building blocks. The editor supporting adaptation is depicted in figure 2 (a), which shows a modified version of the basic template containing additional building blocks with respect to the template shown in figure 1. The working area comprises a list of building blocks which are provided by the assistant but not included in the template so far. From this list the instructor can select those building blocks he wants to include in his template.

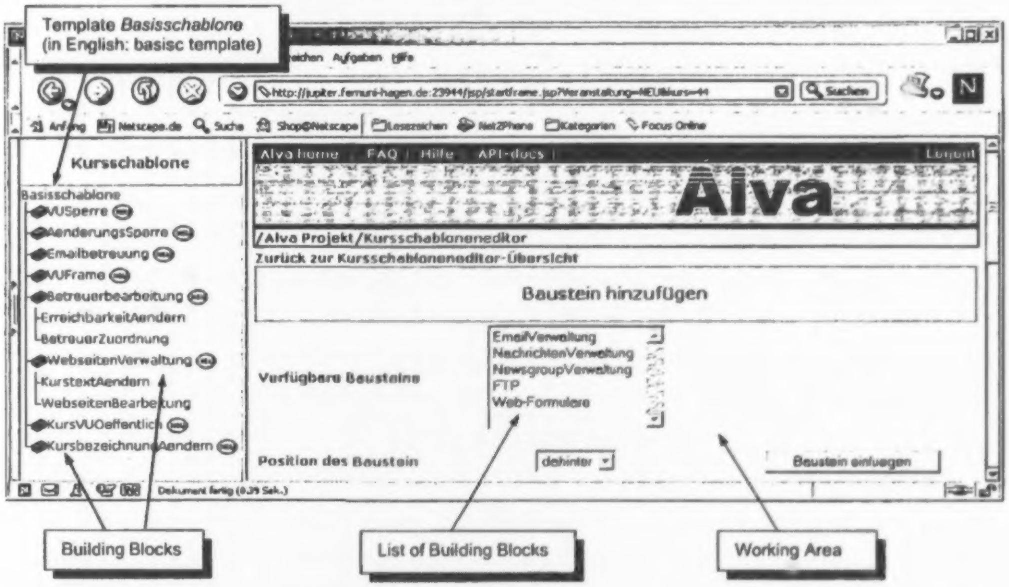
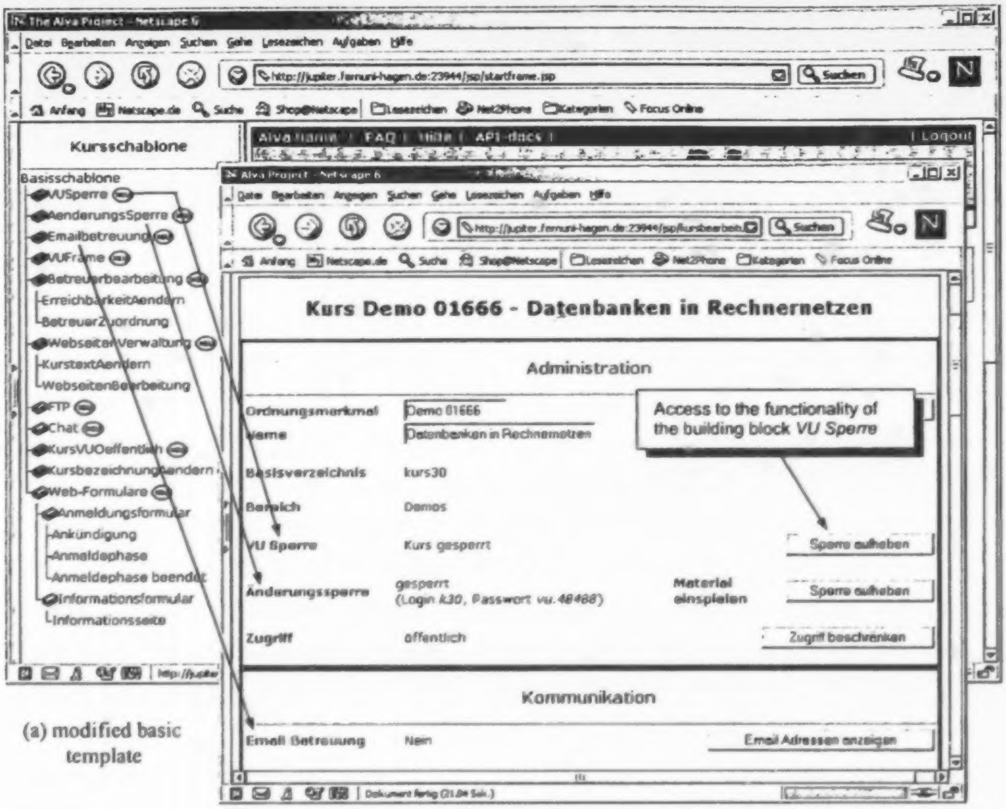

Template *Basisschablone*
(in English: basisc template)
Aufgaben
Hilfe
http://jupiter.fernuni-hagen.de:23944/jsp/startframe.jsp?Veranstaltung=NEU&kurs=44
Suchen
Anfang
Netscape.de
Suche
Shop@Netscape
Lesezeichen
Net2Phone
Kategorien
Focus Online
Kursschablone
Basisschablone
VUSperre
AenderungsSperre
Emailbetreuung
VUFrame
Betreuerbearbeitung
ErreichbarkeitAendern
BetreuerZuordnung
WebseitenVerwaltung
KurstextAendern
WebseitenBearbeitung
KursVUOeffentlich
KursbezeichnungAendern
Alva home
FAQ
Hilfe
API-docs
Logout
Alva
/Alva Projekt/Kursschabloneneditor
Zurück zur Kursschabloneneditor-Übersicht
Baustein hinzufügen
Verfügbare Bausteine
EmailVerwaltung
NachrichtenVerwaltung
NewsgroupVerwaltung
FTP
Web-Formulare
Position des Baustein
dahinter
Baustein einfuegen
Dokument fertig (0.29 Sek.)
Building Blocks
List of Building Blocks
Working Area

Figure 1: Editor for adapting course templates

Runtime support. The templates describe possible ways of performing courses online while their building blocks provide appropriate system functionality. This runtime system, i.e. the adaptable course assistant, provides access to the web technology as implemented by the building blocks of a template, and functions for managing the course (in some aspects similar to a workflow management system). This is implemented by generating, based on the template description, the runtime component and its user interface. Hence, for each building block the assistant provides access to the respective functionality. For example, according to the template depicted in Figure 2 (a) the assistant enables to invoke those functionalities implemented by the building blocks of the basic template Figure 2 (b) depicts parts of the generated user interface, within which the instructor gets access to the functionality, for example, of the building block "VU Sperre".

BEST COPY AVAILABLE


The Alva Project - Netscape 6
Datei Bearbeiten Ansehen Suchen Gehe Lesezeichen Aufgaben Hilfe
http://jupiter.fernuni-hagen.de:23944/jsp/startframe.jsp
Suchen
Anfang Netscape.de Suche Shop@Netscape Lesezeichen Net2Phone Kategorien Focus Online
Kursschablone
Alva Home | FAQ | Hilfe | API-docs |
Logout
Basisschablone
VUSperre
AenderungsSperre
Emailbetreuung
VUFrame
Betreuerbearbeitung
ErreichbarkeitAendern
BetreuerZuordnung
WebseitenVerwaltung
KurstextAendern
WebseitenBearbeitung
FTP
Chat
KursVUOeffentlich
KursbezeichnungAendern
Web-Formulare
Anmeldungsformular
Ankündigung
Anmeldephase
Anmeldephase beendet
Informationsformular
Informationsseite
Alva Project - Netscape 6
http://jupiter.fernuni-hagen.de:23944/jsp/kursbearbeiten
Administration
Sperre aufheben
Material einspielen
Sperre aufheben
Zugriff beschränken
Kommunikation
Email Adressen anzeigen
Dokument fertig (21.84 Sek.)

Kurs Demo 01666 - Datenbanken in Rechnernetzen

Ordnungsmerkmal: Demo 01666
Name: Datenbanken in Rechnernetzen
Basisverzeichnis: kurs30
Bereich: Demos
VU Sperre: Kurs gesperrt
Änderungssperre: gesperrt (Login *k30*, Passwort *vu.48488*)
Zugriff: öffentlich
Email Betreuung: Nein

Access to the functionality of the building block *VU Sperre*

(a) modified basic template

(b) user interface of the runtime system

Figure 2: Dependency between template description and runtime support

Discussion

Starting with the development of the first prototype of the Virtual University (Buhrmann et al. 1997) the usergroup of the instructors was analyzed. As a result an increasing demand for tools supporting the tasks of the roles course designer and course administrator was identified (see also Biedebach et al. 2002, Feldmann & Schlageter 2001). In the following special components allowing dedicated support like the Seminar Assistant (Biedebach et al. 2001) and the WebAssign (Brunsmann et al. 1999) were developed. The Seminar Assistant aids instructors in conducting virtual seminars and allows easy utilization of the required internet services. Its implementation, however, is based on a very specific type of course, preventing its adaptation to other kinds of virtual seminars. The system WebAssign allows to perform online exercises and can be used within different types of courses. It represents a special "building block" and was developed separately, such that direct integration into the whole platform is not possible easily.

The approach of adaptable course templates proposed in this paper allows adaptation of planned course types to individual requirements. The system helps in selecting and utilizing Internet and web technology, respectively, to enhance distance education. For that purpose it provides different templates showing how a course of a special type, e.g. a content teaching course or a virtual seminar, may be executed. Each template can be altered to meet the special needs of a course and the individual ideas of its instructor. At runtime it provides access to the web technology as implemented by the building blocks constituting the template. Furthermore, functions are available for managing the course (like a small workflow management system).

BEST COPY AVAILABLE

A similar approach is provided by TeleTOP (de Boer & Collis 1999), within which web-based course-support environments are generated. Similar to our assistant all courses have a common interface design, but differ in their chosen functionalities. In contrast to TeleTOP our assistant provides not only pure building blocks but also diverse templates depicting established ways of running different kinds of web-based courses.

Workflow management system technology is also investigated in other approaches aiming at tool support for instructors. There it is employed to coordinate e-learning activities within a single course, in particular in conjunction with groupware tools to manage collaborative learning (e.g. Medélez et al. 1999). However, in these environments the underlying model is fixed and thus not adaptable to different course structures and types.

The described software assistant will be a part of the platform of our university, thus integrating this approach into a general environment which also supports organizational aspects (business processes). Our current work is aiming at the implementation of an assistant supporting students of the university. Its runtime system will also be based on the course templates specified by the instructors.

References

Berkel, T., Mittrach, S. (1997). Internet Technologies for Teleteaching - Report on an Internet-Based Seminar in the Virtual University, ICCE97-Conference, Malaysia, 12/97.

Biedebach, A., Laskowski, F., Schlageter, G. (2001). Experience, Concepts and a Proposal for Support of Tutoring while Virtual Leaching and Learning (in German: Erfahrungen, Konzepte und ein Vorschlag zur Betreuungsunterstützung beim virtuellen Lernen und Lehren), *GI Jahrestagung* (2), 2001, 1111-1116.

Biedebach, A., Bomsdorf, B., Szwillus, G. (2002). Instructors in a Virtual University: Divergence of Requirements concerning Tool Support, (in German: Reale Dozenten in einer virtuellen Universität: Divergenz der Anforderungen an die Systemunterstützung), *Conference Proceedings of the German HCI Conference "Mensch und Computer 2002"*.

Bischoff, A., Röhrig, Ch. (2001). A Multiuser Environment for Remote Experimentation in Control Education, *IFAC Workshop on Internet Based Control Education*, IBCE'01, Madrid, Spanien, Dezember 2001.

Buhrmann, P., Mittrach; S., Schlageter, G. (1997). Conception and Development of a Netbased Communication and Cooperation Environment for a Virtual University, *Neties97-Konferenz*, Ancona, Italien, 10/97.

Brunsmann, J., Homrighausen, A., Six, H.-W., Voss, J. (1999). Assignments in a Virtual University: The WebAssign-System, *19th World Conference on Open Learning and Distance Education*, Vienna/Austria, 1999.

de Boer, W., Collis, B. (1999). How Do Instructors Design A WWW-Based Course Support Environment?, *Conference Proceedings of ED-Media 1999*, 299-310.

Feldmann, B., Schlageter, G. (2001). Five Years Virtual University – Review and Preview, *Conference Proceedings of WebNet 2001*.

Hoyer, H. (2001).*University of the future*. Domröse-Druck, Hagen, 2001.

Klobas, J., Renzi, S. (2000). *Selecting Software and Services for Web-Based Teaching and Learning*, In: Web-Based Learning and Teaching Technologies: Opportunities and Challenges, (ed. Aggarwal, A.), Idea Group Publishing, 2000, 43-59.

Krämer, B. (2000). *FernUniversität's strategy to Build a Virtual University*, http://www.et-online.fernuni-hagen.de/Forschung/Forschungsbericht2-2000.PDF.

Medélez, E., Ayala, G., González, C., Lerch, J. (1999). Awareness and Cooperation Tools for a Simulation-based Learning Environment, *Conference Proceedings of ED-Media 1999*.

Tielmans, G., Collis, B. (1999). Strategic Requirements for a System to Generate and Support WWW-Based Environments for a Faculty, *Conference Proceedings of ED-Media 1999.*

Acknowledgements

This work was funded by the Federal Ministry of Education and Research. The authors would like to thank the group members of the ALVA project for implementing the prototype of the adaptable course assistant.

Virtual University of Applied Sciences – German Flagship Project in the Field of E-Learning in Higher Education

Rolf Granow , Michael Bischoff; University of Applied Sciences, Luebeck

1 Introduction

In 1997, the German Federal Ministry of Education and Research started an initiative to promote e-learning in Germany by installing an extensive research program. Actually, more than 100 projects have been funded by the German Federal Ministry of Education and Research in the field of e-learning in higher education. Three of them are so-called Flagship Projects, of which the Virtual University of Applied Sciences in Engineering, Computer Science and Economic Engineering is the most prominent, and with DM 42 million the best funded.

Officially begun in 1999, its origins go back to 1997 when the faculties at Luebeck University of Applied Sciences set up a working group on online education. In October 2001, the study program of Computer Sciences started in seven joint universities of applied sciences with six courses. In the meantime, first results are available. The second study program, Economic Engineering, will start in winter semester, 2002.

2 Presentation of the Project

Twelve universities of applied sciences, two universities, federal employees' association, unions, and businesses of seven federal states are involved in the development of the two complex online study courses Computer Sciences and Economic Engineering.

2.1 Objectives and Project Tasks

The ambitious goal of the project is to form a virtual organization of ten existing campus-universities of applied sciences from six German federal states[1]; in essence, this means a decentralized and distributed management.

The responsibilities of each of the involved universities are precisely defined, i.e. for administrative services, technological support, deployment of the common curricula of the study programs, development of courses and learning objects, instruction and tutorial support etc. The design of each of the courses is always incumbent on only one chosen member of one of the involved universities. Later on, the complete course will be adopted by all participating universities. All courses are being approved jointly. Suitable modules from commercial vendors may also be employed, provided they meet the required quality standards. The traditional unity of course design and teaching is thus partly abrogated.

The conception of the Virtual University of Applied Sciences is based on the combination of multimedia course materials, a professional online tutoring including students' coaching and group working and a sophisticated administration of the whole study program.

The last-mentioned topic required the choice of a suitable learning and administration management system which would be able to combine the individual demands of the universities due to their inscription and student management modalities as well as a flexible tutoring of the students by their professors and tutors, and to offer sufficient communication tools for the social and course specific exchanges between the students.

---

[1] For a list of participating universities see www.oncampus.de

The large amount of about 60 subjects to fill the curricula of the two study courses made intensive research efforts necessary in order to deliver the technical, ergonomic and didactic fundamentals for a common and high standard of the course material and concepts. The common conceptual guidelines for the subjects should furthermore take care of the individual didactic belongings of course subject and the responsible experts.

For the implementation of the study courses in the participating universities, the instruction of the teaching and tutoring personnel as well as the foundation of common working groups and specialist peer groups had to be taken into account . First experiences which delivered the knowledge for this part of the project had been collected during the pilot phases of the first developed courses.
In the meantime, nearly 35 percent of the courses have been finished. Most of them were tested in pilot trials with distributed students. With the results of these tests, quality criteria and procedures for the courses at the Virtual University of Applied Sciences could be determined. On the basis of these experiences, all students and tutors involved are integrated in a well developed evaluation system which enables the continuous optimisation of course production and course maintenance.

2.2 The Virtual Campus Association of Universities of Applied Sciences

The Flagship Project will provide the courses for the common study programs up to the end of 2003. To run these study programs is task of the involved universities. To achieve this, in April 2001 7 of the universities founded a consortium, the so called "Virtuelle Fachhochschule", which has been offering the study programs to online students first beginning in October 2001.

Forming this virtual organisation, the universities defined and agreed on the rules of cooperation, of handling the intellectual property rights of the learning objects, of responsibility for quality of learning objects and tutoring, and of financing the future activities.

The responsibilities of the universities in detail affect for example the sustainability of the course range, the rights on the course materials, the use of the learning management system, the commitment to the maintenance of courses, and the organisation of students' inscription.

The universities of the consortium signed a contract on these topics to be able to run and sustain the study programs in the long term. Partners of this consortium are those universities within the project that have started or soon will start with at least one of the common developed study programs. The conditions of the study programs are equivalent within the whole consortium. So students normally apply to the university where they want to have their residential periods.

The common organisation is gradually being reduced to an optimum, a process being ruled by the federal legislation, the individual needs for autonomy of the joint universities, and by economic criteria. So after the end of the project, there will only remain a small common bureau for the joint universities which will be responsible for the technical support, marketing and data management.

The administration of students, tutors and professors as well as the running of the courses and the maintenance of course materials will be the responsibility of the single universities.

3 Conceptions of Learning and Teaching

3.1 Course Materials and Course Tutoring

The online study programs of the Virtual University of Applied Sciences are especially directed to students who have an essential need for flexibility regarding time and space as a prerequisite in taking up a university course.

The curricula of the programs are strictly modular and based on the European Credit Transfer System.[2] A modular study program at the Virtual University of Applied Sciences, e.g. Economic Engineering, consists of several courses, for instance marketing, accounting, logistics etc. It is being stressed that the approach favours student-centered learning. Final examinations (in the end of each course) are identical at each of the universities.

A typical course consists of 80 percent e-learning components and 20 percent face-to-face encounters. Students are not isolated while doing an online course and using interactive course materials. Professors and tutors, especially trained for the demands and needs of online students, guarantee regular contact and qualified advice. Communication with fellow students in the virtual learning room enhances the learning process.

The training of the tutors and online professors aims at teaching the different special skills necessary to carry out online courses instead of face-to-face lectures. Partly, these are technical and organisational abilities, as for example the handling of hard- and software, communication and information tools of the Learning Management System (LMS), the organisation of course materials and the administration of student groups. Concerning technical questions, the tutors should be able to offer a first level support in order to support students during their working processes.

Furthermore, tutors and teachers have to learn how to compensate the restrictions of web based learning. These can be missing awareness and missing social contacts with other students, missing direct reactions to open questions and misunderstandings. These shortages are disadvantages of the online teaching and learning and can lead to demotivation. To compensate these disadvantages teachers have to learn to apply very consciously and carefully specific social and pedagogical measures. Students have to be motivated for and integrated into the learning processes. They must learn to use the flexibility of web based training but also to accept the specific requests of the medium. That is what the teachers have to do. A special ability to learn is the initiation and moderation of virtual group works via the internet and LMS.

Virtual group work is an integral part of the didactic concept of the Virtual University and integrated in several study courses. Students are building a network of specialists whose communication and competence extends beyond the demands of the study program.

The online study is complemented by various residential periods that also strengthen the social components. Residential periods are organised by the respective university and - as a rule - take place as compact seminars in the weekend. Within the consortium, practical training, lab work, tests and/or final exams take place during residential periods.

Each course contains a large amount of multimedia course materials. Typical elements are html pages, flash animations, graphics, sounds and video. These elements are completed by scripts, links, online books or databases.

The content of the course material is selected by one responsible expert, normally a professor and member of one of the joint universities. The content and the design of the course is fixed in agreement with a peer group of colleagues from partner universities. At least one member of the peer group is experienced in the design of e-learning courses.

---

[2] For further and detailed information on the study-programs and their courses see www.oncampus.de

The production process was developed over the first two years of the project, heading for a constant and continuous quality. It includes the design of a prototype of the course on the basis of a common and quite complex styleguide and a multimedia catalogue. The prototype is evaluated by expert groups concerning didactic, technical and ergonomic aspects.

After a common review and discussion of correction measures, a team of multimedia producers writes the story board and subsequently produces the whole course. The last step is the testing of the course material in a pilot phase.

During the term, these especially developed course materials are supplemented by additional assignments and partially by group works and case studies.

Pursuant to the European Credit Transfer System each course (5 credit points) is designed for a working load of 150 h.

3.2 The Learning Management System

The delivery of the course contents is decentralised and spread to different universities. Each university that matriculates students to the common programs must have access to the whole course program. To get a high availability of all the courses and a cost-efficient system design, the operative systems work on a common server architecture with a common learning-management-system. The servers are designed with back-up systems on different locations, using existing net resources with high-speed access.

As a common learning-management-system, a standard application was achieved. After an evaluation of different systems, the Blackboard V level III-software was installed for the needs of the whole consortium. The performance and scalability of the system was tested in pilot applications for 3 semesters.

The production of course materials for self-organised learning is independent from this platform, so that the learning objects can also be used in other environments without redesign. To improve the course production some specific tools had been provided, especially for navigating the learning objects, including glossary and annotation functions.

During the evaluation, 15 platforms for the learning management system were analysed. 8 of them were installed and tested in the project. These were the products: Lotus Learningspace (IBM), CourseInfo (Blackboard), WebCT, Pathware (Macromedia), LUVIT, TopClass, Gentle (Hyperwave), DLS (ETS-Online).

The selection of the LMS was done on the basis of common criteria such as[3] Web Browsing, Asynchronous and Synchronous Sharing, Student Tools, Support Tools (Course, Lesson, Data, Resource, Administration, Help Desk) and Technical Administration (Server Platform, Client Platform, Limitations). The criteria were weightened with highest values for the communication tools and administration facilities. These facilities are of high priority for the cooperation and common course running of the joint universities. Three products were proven in pilot tests: Lotus Learningspace, Gentle, and Blackboard. As a result of the evaluation in 1999, the Blackboard System was chosen as platform for the project because it achieved the highest total evaluation score. In the detailed analysis it fitted best according to the demands of students' administration.

---

[3] www.c2t2.ca/landonline

3.3 Computer Supported Collaborative Learning

One of the project's working groups is involved in the development and testing of Computer Supported Collaborative Learning, especially supported group learning. In this context, an interesting new form of online collaboration, called the jigsaw method, was carried out.Group techniques and methods show great promise in the learning effects, also in Computer Supported Collaborative Learning (CSCL). These should result from the perspective of cognitive elaboration, the construction of shared knowledge and the possibility of multiple perspectives. However, previous results in this field of research were not very extensive. Therefore a jigsaw was started in CSCL.

The jigsaw method is a group work teaching process which is well known in traditional classroom learning but new in online teaching. The method bases on the working on a topic under different perspectives and with different intentions. One instrument to reach an intense preoccupation with the topic is to mix the groups at least one time and to force the members of the new groups to represent and defend the results of their former groups in order to find to a new synthesis. The jigsaw method is carried out in several phases, with each of them resulting in a concluding report or a group statement.

During the course of 'Environment-oriented Management" (EoM) (subject in the study course Economic Engineering), the different assumptions and suppositions of the effect of the jigsaw method were tested. The case study focused on the evaluation of the degree of collaboration and the influence of the group method. The result was that jigsaw proved to be an efficient method of intensifying collaboration in CSCL. However, there are certain conditions to be considered. Facets like group cohesion, individual competence, and awareness have a significant influence on the result of the jigsaw.

3.4 Cooperative Teaching

Teaching at the Virtual University of Applied Sciences is a cooperative process. It starts with the foundation of one expert group for each subject. This group comprises one responsible expert of each university which offers this subject. Normally, these expert groups meet for special training programs in online tutoring, designed for the members of the joint universities. The expert groups discuss and balance the details of the course tutoring, the residential periods and the final assignments. These steps need a very intense process of discussion.

Despite several differences in the expert groups concerning the subject details, by now it has been possible to reach a cooperative teaching for each of the offered subjects. . This can be regarded as a real success of the project. The chosen model for the course tutoring which was installed seems to allow a rather satisfying degree of individuality for the participating experts on the basis of the common course materials.

4 Running of the Study Course Computer Sciences

4.1 Organisation

The Bachelor study program in Computer Sciences started in winter 2001 with about 200 students at 6 universities. Participants in the tuition fee-free Bachelor degree program will graduate after six semesters, a Master's candidate after additional four semesters. These study programs are part of the regular studies of the universities.

A concept was generated for sustainable financing of these study programs regarding the costs for

- permanent updating of the courses

- online-tutoring
- residential phases and
- organisation of the consortium and common services.

The virtual organisation is dedicated to the purpose of developing and offering common online study programs and of optimising the use of the courses for study as well as for further education. For using synergies, this virtual organisation is related to the existing academic organisation of the member universities. The online programs are implemented in the existing departments and professors of these departments are responsible for the residential periods and the quality of the tutoring.

The virtual organisation is defined on three levels:

- on the management level, the heads of the universities form a common board for all fundamental decisions
- on the department level, the heads of departments form a common committee for each field of study program: one for Computer Sciences and one for Economic Engineering.
- on the course level, professors from each department who are engaged in the same field form a common committee in which one is responsible for the availability of the modules for the whole consortium. The other members bear the local responsibility in their courses for their students concerning online as well as face-to-face tutoring.

4.2 Experiences

As one of the first results from the pilot phases in different courses and from the profiles of the online students enrolling for winter term 2001, it can be stated that these new kinds of study programs are accepted mostly by people who want to do their studies and jobs in parallel.

The online students at the University of Applied Sciences differ significantly from on-campus students: they are older, they have got jobs, and above all, they appreciate the flexibility that e-learning provides. This is not the case with many on-campus students who, as several tests showed, did not take advantage of the flexibility and instead accessed the online modules from the schools' computer labs during regular office hours. This might, in part, be explained by the still high costs for Internet access at home. Most of the on-campus students preferred the traditional face-to-face teaching.

Thus, the study program of the Virtual University of Applied Sciences does not compete with existing higher education, but rather supplements the range of teaching methods and courses available.

One positive aspect of the network for the universities is that not every institution has to fund and develop costly web-based study courses on its own. Consequently, even the medium-sized and small universities of the network will now be able to offer attractive online study courses.

5 Conclusion

The project Virtual University of Applied Sciences shows new ways of qualification models in higher education. It enables universities to reach new customer groups. The traditional universities will be able – following the model of the joint universities in the project – to step into this market using the economic advantages of cooperative teaching and course administration.

One of the main advantages of this project in comparison to others is the extensive course material which is produced during the runtime. This material enables the joint universities to create several new study programs using parts of the existing material combining it with new course contents. So the project will be the nucleus for universities reacting very flexible to demands of the labour market.
Future aspects of this project will be the internationalisation and the expansion into new study courses.

References

Arnold, P.; Didaktik und Methodik telematischen Lehrens und Lernens, Verlag Waxmann, 2002

Bischoff, M., Kwast, G., Waltje, A.; Lernmodule für das Umweltorientierte Management, Zeitschrift Umwelt, März 2001

Granow, R.: Virtual University of Applied Sciences: Book of Abstracts Online Educa, Berlin, 1999

Granow, R.: Complete online-programmes of study be a confederation of campus universities:Book of Abstracts Online Educa, Berlin 2001

Granow, R.: Virtuelle Lernarchitekturen in der Hochschule -Vom Leitprojekt zum Hochschulverbund Virtuelle Fachhochschule: Tagungsband der Learntec 2002, Karlsruhe

Hinze, U., Bischoff, M., Blakowski, G.; Jig Saw Method in the Context of CSCL, Vortrag ED Media Denver, 2002

Horton, W. Designing Web-Based Training, New York, John Wiley 2000

Kerres, M.; Multimediale und telemediale Lernumgebungen. Konzeption und Entwicklung. Verlag Oldenbourg, München, 2001

Schulmeister, R.;Virtuelle Universität. Virtuelles Lernen, Verlag Oldenbourg, München, 2001

Schulmeister, R.; Grundlagen hypermedialer Lernsysteme. Theorie - Didaktik – Design, Verlag Oldenbourg, München, 1997

Herzceg, M., Triebe, J. K., Hartwig, R.; Handbuch Ergonomie der VFH, Institut für Interaktive und Multimediale Systeme der Medizinischen Universität zu Lübeck, 2000

VFH (2000a): Zusammenstellung von diversen Lernräumen. Internes Projektpapier der Virtuellen Fachhochschule für Wirtschaft, Informatik und Technik

VFH (2000b): Zusammenfassung Lernräume. Internes Projektpapier der Virtuellen Fachhochschule für Wirtschaft, Informatik und Technik

VFH (2000): Kurzbericht Lernraum LUVIT. Internes Projektpapier der Virtuellen Fachhochschule für Wirtschaft, Informatik und Technik

VFH (2001): Handbuch Prozessleitfaden, 2001, Internes Projektpapier der Virtuellen Fachhochschule für Wirtschaft, Informatik und Technik

VFH (2002): Styleguide der Virtuellen Fachhochschule, Fachhochschule Lübeck, 2002

The New Paideia

Raj Boora
3-105 Education North
Division of Technology in Education
Faculty of Education
University of Alberta
Edmonton Alberta Canada
T6G 2G5
raj.boora@ualberta.ca

Abstract: To travel is one of the greatest ways to learn about the world. It is the "getting there" that provides the learning experience, not so much as the destination itself. Education is also a journey, one that should last a lifetime. But for many students today it is one that lasts only for as long as they are in the classroom. In such short trips, many students do not see themselves going anywhere. The new paideia offers a means to allow students to once again find their way.

Ideas From History

A seasoned traveler will often understand where the road is leading judging by where the road has been. Looking back down the road of education, the road may have begun in Ancient Greece, with Aristotle.

Aristotle felt that an important key to education was communication, and the ability to move the hearts and minds of those who were being spoken to (Neal, 2001). Giving students relevant instruction was both vitally important and successful for Aristotle. One of Aristotle's greatest students, Alexander (the Great) learned these lessons well (Popovic, 2001). Alexander brought forth the Hellenistic age, and with it paideia: the idea of lifelong learning. Paideia, was a journey of discovery throughout an individual's life. It created the world as a classroom and every day as an important and relevant lesson to be learned. Within paideia, learning was a lifestyle.

Looking up the road from Aristotle, we find Dewey. His ideas regarding educational reform are still influencing us today. Dewey believed, in a Hellenistic manner, that school should be a life long process, an extension of society within the classroom (Field, 2001). Dewey also acknowledged that progress was vital. Keppel (1990) noted, "[Dewey] taught us that the only danger confronting us is being closed to the emergent, the new, the manifestation of progress." If Dewey was correct, then classrooms in general, both online and offline have committed a folly in not changing significantly over the course of the last few decades. Classrooms are seemingly stuck in time without computer-mediated communications and in a world that does not value leisure.

The Destination

A positive attitude is important for success in any endeavor. If education is to create successful students in today's world, then a positive attitude must be created in these students. Creating this positive attitude will require teaching classes in a manner that is relevant to today's students. Connecting the classroom with the outside world will create a journey that does not start and stop in the classroom, but continues throughout life in the tradition of paideia. Here learning is a process, a journey that one takes, not a trip that one is taken on (Volman & van Eck 1995; Basile & D'Aquila, 2002; Hatcher & Hinton, 1996; Connolly, McMaster & Hatchette, 1999).

A Start Down the Path

Some elements of the paideia paradigm are already in use in many classrooms. Active learning and constructivist learning models are used to help make the classroom an extension of societal elements. Generally the use of these methods is limited due to resources, but it is successful in presenting the material being taught to students in a largely holistic fashion (Lunenberg, 1998; Roberts, 1998). These instructional paradigms can peak the interest of students and encourage them to follow a potentially life long journey of exploration. Students starting on this path might likely find the journey it's own reward.

The dominant mode of instruction is still, however, an instructor centered model; one where information is broken into pieces that are easy to present and easy to assess. It is a cold and efficient process to deliver information to a large audience. The onus is on the student then to reconstruct the whole from the parts that are presented. Often students never succeed in this task and become uninterested in what is being presented (Lunenberg, 1998). Within this mode, the student is merely being taken to the destination, experiencing a cold and impersonal journey with the destination as the only goal.

Elements of the New Paideia

Blending the successful elements of active learning and constructivism, the new paideia uses communication, empathy and community to overcome the issues that currently plague the educational system. If used appropriately, more students may be encouraged to explore and enjoy their own personal life long journeys of learning.

Communication

Within the new paideia, communication is an omni-directional exercise. Everyone involved with the class has an equal voice (Roberts, 1998) that can be expressed freely inside and outside the classroom. Regardless of age, students frequently engage in social conversation. By the time a student is in post secondary education, they often spend an equal amount of time in social conversation as they do in the classroom (Neal, 2001). Instead of trying to control this communication, instructors should seek to use it to their advantage, seamlessly combining the discussion of social topics with classroom material at all times.

Empathy

Empathy is an important social skill, encouraging individuals to be responsible to themselves and to their community (Roberts, 1998). This is a skill that is encouraged in early childhood education and later in professional school. But between these two extremes, there is little use of empathy in the classroom.

Empathy seems to be an innate human ability so it is odd not to include it throughout the educational process. From birth, young children are seemingly able to have a "feel" for the experiences of others. Empathy in a classroom is vital because it allows individuals to gain an understanding regarding their own thoughts and ideas by experiencing the opinions of others. To gain the appreciation of other individuals in the class, students must first be encouraged to deconstruct their own ideas. The class then shares these ideas to arrive at a communal understanding of various topics and opinions (Burns, 2001).

Community

By sharing ideas, a community emerges. Communities are powerful tools that benefit individuals by providing a place of safety and belonging. Within the new paideia, this is a community of learners. Belonging to these communities requires only the open exchange of ideas and through these communities society becomes part of the classroom.

Once internalized, students as learners become self-directed to seek new ideas to add to the community and are rewarded intrinsically through these contributions (Hatcher & Hinton, 1996; Howard, et. al., 2000). Hobbyist and researcher communities are prime examples that these communities exist and work.

Fusion: Technology and Paideia

An effective way to look at various technologies, including computers, is to see them as extenders of human ability (Kritikou, 2000). The most important ability that computers can be used to extend in terms of the new paideia is an individuals' ability to communicate. In extending this ability to communicate, all elements associated with communication are also extended, allowing for the classroom to exist at all times and the life long journey of learning to continue non-stop.

Often computing technology is merely an add-on to the classroom and in this manner it is very ineffective (Strommen & Lincoln, 1992). The key to using computers effectively in the classroom in terms of the new paideia is to integrate them into the way students and instructors communicate within the class. From this point, all other ways and means of integrating computers into the classroom will emerge.

The popularity of email and instant messaging provide good examples of how technology can be integrated into the classroom. Students and instructors become available to each other at all times thus allowing for the seamless interfacing of the classroom and the outside world that was mentioned before. It is likely that with a bit of encouragement, students and instructors would find ways to include multimedia elements in their communication and before long, computing will become ubiquitous inside the classroom as it is outside the classroom (Burns, 2001; Rice & Wilson, 1999; Varvel, 2001).

Leisure – The Modern Paideia?

Judging by the amount of money that is spent worldwide on the pursuit of leisure, one would think that its influence would be far reaching. However, it seems that the reach of this human desire to play stops at the classroom door. Play is seen to be disorganized and primitive, not suited for the classroom that aims to teach the virtues of civil and ordered society.

When individuals play, alone or in groups, they learn. They become self- motivated and self-structured, able to take what they learned in the past and apply it to novel situations (Bower, 2000; Strommen & Lincoln, 1992). Today many of the toys that are being played with are technological. So again, not fearing progress, it would be wise then to bring this technology into the classroom and use it to teach students (Soloway, 1991). Using communication technology, students can "play" with ideas; creating interest where there was once none.

To affirm that these ideas for the road ahead are sound, we can look back at the work of Aristotle where leisure is identified as one of three forms of paideia (Kritikou, 2000). In play students can create their own knowledge as they interact with their peers, instructors and educational materials to arrive at ideas that they can offer to their classroom community (Roberts, 1998; Rice & Wilson, 1999; Seeler, Turnwald & Bull, 1994). At the same time as they play, students chart a personal journey exploring the materials presented to them.

Application to Online Classes

The challenge is to apply a way of life to a single course, a point in one's life. To accomplish this task, one can approach the delivery of the course as an attempt to create a habit. Starting from the first class, showing students how communication permits empathy, which creates community, is important. The goal of the instructor is not to make the course compete with other elements in the life of the student, but rather to integrate into them in an active fashion. Thus they encourage students to view the course as a place to make a number of new friends that are sharing the same experience for a time. Completing the course becomes a matter of working with these new friends to complete a task that requires the unique talents and ideas of every student in the class.

Application of the new paideia to courses that are offered online begins with communication of ideas among the members in the class in a free, open and supporting manner. Students and instructors alike share ideas and concerns, creating empathetic relationships between individuals. These relationships blossom into the establishment of the learner community that extends beyond the course.

Some number of social or leisure-like elements must be integrated into the course. In this formalized "play" students are allowed to explore the material as a group, gaining the advantages of motivation and self-direction that are gained by group participation. As students begin to play with material that is increasingly relevant to their own lives, their abilities grow and they become ready to engage new educational challenges. Without a social element being included in a meaningful manner to the course, the advantages of the new paideia such as self directed exploration from within learner communities will never emerge. A suggestion for this is to use email lists rather than requiring students post a message to a Web board or similar system in their first week. In this way the communication comes to the student in a manner that is more personal and akin to conversation. Rather than forcing students to go out to a specific "place" to meet and greet, every individual in the class will be able to communicate from where ever they are. Often for those who are online, this location will be from their email inbox.

Limitations

Online courses must however be wary of the issues involved with class size. It may seem to some that the upper limit to the number of students who can enroll in an online course is limited only by the capacity of the servers to distribute the material and the markers to mark the material. But in light of the new paideia, this is an oversight. The maximum number of students is equal to the maximum number of individuals who can be meaningfully incorporated into the learner community. Personal communication must be present between all members of the class and all ideas and feelings must be appreciated and used within the knowledge base of the learner community.

The other issue that should be addressed is that of the staff's workload. In an online class the only way that an instructor can know that too much work has been assigned is if the students complain; however, students are often too burdened by their workload to protest. Paying attention to the social activities and communicating personally with students should help address this concern.

Conclusion

Like the traveler at the end of the journey, the destination is often a chance to look back on the road that has been traveled. Education in general is facing a major dilemma as students are becoming less interested in what goes on in the classroom. Often citing that the material covered in the classroom does not pertain to them or is not enjoyable. They find themselves in classrooms that have not changed significantly from the time of their parents and all the while, society outside the classroom is evolving faster each day.

The solution for education is to follow society's lead. The new paideia offers a means of achieving this by using communication to create a community that goes beyond the classroom or the monitor. Students feel like they belong in a community where the material that they are learning is relevant and where they stand as individuals are important. Appreciating that learning is a process or a journey where the path taken to the destination is at least as important as the destination itself.

Online and offline, the new paideia may be the solution to the problem of what is missing in education today. The new paideia brings to the classroom a learner community that uses leisure and technology to integrate course material into the lives of students.

References

Adler's Life and Works: The Paideia Curricular Framework. Retrieved April 15, 2002 from the World Wide Web: http://cyberspacei.com/greatbooks/authors/adler/lifeworks.htm#_Toc513522766

Basile A., D'Aquila, J. M. (2002). An Experimental Analysis of Computer-Mediated Instruction and Student Attitudes in a Principles of Financial Accounting Course. *Journal of Education for Business, 77*, (3), 137-145.

Bower, J. (2000). *The Importance of Play*. Retrieved from the World Wide Web April 15th, 2002: http://www.instituteforplay.com/5importance_of_play.htm

Burns, C.P.E. (2001). Teaching and self formation. *Teaching Theology and Religion*, *4*, 15-22.

Connolly, J. A., McMaster, L. E., Hatchette, V.C. (1999). Academic achievement in early adolescence: do school attitudes make a difference? *Education Quarterly Review, 6*, 20-.

Field, R. (2001) *John Dewey (1859-1952)*. Retrieved April 7, 2002 from the World Wide Web: http://www.utm.edu/research/iep/d/dewey.htm

Hatcher, T., Hinton, B. (1996). Graduate student's perceptions of university team-teaching. *College Student Journal*, 30, 367-377.

Keppel, F. (1990). Paideia, Then And Now. *Teachers College Record, 92*, 287-293.

Kritikou, M. (2000). Hellenism, Group-Analytic Training and the Median Group. *Group Analysis, 33*, 63-76

Lunenberg, F. C. (1998) Constructivism And Technology: Instructional Designs For Successful Education Reform, *Journal of Instructional Psychology, 25,(2)*, 75-82.

Neal, E. (2001). *Active Learning Beyond the Classroom*. Retrieved April 7, 2002 from the World Wide Web: http://www.inform.umd.edu/EdRes/FacRes/CTE/library/podresourcepackets/alternatives/active.html

Popovic, J.J. (2001) *Alexander The Great*. Retrieved April 7, 2002 from the World Wide Web:http://1stmuse.com/frames/index.html.

Rice, M.L., Wilson, E.K. (1999). How Technology Aids Constructivism In The Social Studies Classroom. *Social Studies, 90*, 28-34

Roberts, T. (1998). *The Power of Paideia Schools: Defining Lives Through Learning*. Retrieved April 7, 2002 from the World Wide Web: http://www.ascd.org/readingroom/books/roberts98book.html#intro

Seeler, D. C., Turnwald, G. H., Bull, K. S. (1994). From Teaching to Learning: Part III. Lectures and Approaches to Active Learning. *Journal of Veterinary Medical Education, 21,* (1), Retrieved from the World Wide Web April 15th, 2002: http://scholar.lib.vt.edu/ejournals/JVME/V21-1/Seeler1.html.

Soloway, E. (1991). How the Nintendo Generation Learns. *Communications of the ACM, 34, (9)*, 23-26.

Strommen, E.F., Lincoln, B. (1992). Constructivism, Technology, And The Future Of Classroom Learning. *Education & Urban Society, 24*, 466-477.

Varvel, V.E. Jr. (2001). *Facilitating Every Student in an Online Course.*, Retrieved from the World Wide Web April 15, 2002 : http://www.ion.illinois.edu/pointers/2001_03/index.html.

Volman, M., van Eck, E. (1995). Girls in science and technology: The development of a discourse. *Gender & Education, 7*, 283-293.

Acknowledgements

I would like to extend my thanks and appreciation to Drs. Craig Montgomerie and Joanne Davies, as well as Ms. Katharine Mascardelli for their help and support through the preparation of this paper.

Knowledge as Relationship and E-learning

Luca Botturi
Istituto Comunicazione e Formazione - IceF
Università della Svizzera italiana
Lugano, Switzerland
luca.botturi@lu.unisi.ch

Abstract: The shift to new paradigms in education pushed by new media has initiated a critical re-thinking of the way we talk of and practice teaching and learning which is still open. Some concepts of the Western educational tradition can be helpful in finding a new way of integrating IT in learning. This paper propose to consider knowledge as a relationship and shows how this provides helpful insights in instructional design and in the exploitation of new media in education.

Introduction

During the last decade the communities of educators and instructional designers have experimented the impact of IT in their professional activity with an impressing rush. The shift to new paradigms of education has been accompanied by great hope and many hypes. Mixed to real opportunities and to a sometimes ideological debate, something has actually happened: maybe not in the way we teach and learn, but in the way we consider and understand education. New technologies have acted as a catalyst on the way we think about learning and teaching, on the categories we use for designing and talking about education. New media have been the impact wave that rumbled the system and brought to a conceptual paradigm shift in Western education, concentrating and empowering the forces that were already latently in motion. Nevertheless, while the aggressive speed of technology gave a first impulse to the shift, it left little energy for a thorough rethinking of education. Issues brought from the Psychology and Education communities are the topics for a discussion which is still open and lively.

This paper proposes a first description of a new approach to curriculum design based on a traditional conceptual framework. Goal of this paper is to bring a theoretical contribution for interpreting the development of educational technologies and integrate them into the Western teaching and learning practice. The basic understanding of learning and of knowledge is in fact the soil in which the plant of a well-shaped education system can grow, thus we propose to consider some of the issues raised by e-learning going back to the roots of traditional Western educational theories. Maybe surprisingly, this approach does not end up in a conflict, but offers a fruitful mindset and several high-level design principles for new learning environments.

Knowledge as a Relationship

Knowledge is one of those words that anybody understand effortlessly until required to provide a definition, just like *conscience*, *I*, or *time*.

In the last decades, Information Systems and - more recently - Knowledge Management literature proposed a vision in which knowledge is produced, stored and retrieved. Managing knowledge with IT systems is indeed a process which much resembles a production chain, and modeling such situations actually requires a precise definition of knowledge. A certain overstatement and unclear understanding of these disciplines have brought to the spread of such metaphors outside their application domain to that of curriculum design and education, specially in the field of new media in education. This conception of knowledge, though effective in many contexts, does not fit completely and hides ambiguous implications for an educational system.

Outside conferences in fact we talk of knowledge in quite another way. We mainly use a verb, more than a noun, the latter being the abstract word we use when we need to substantiate the action. "Of course I *know* him, I met him last month in Wandsworth" "Wandsworth? Oh, yeah, I *know* where it is. It's near Clapham, isn't it?" In common language, *to know* is the action involving knowledge: a subject and an object of knowledge are put in relationship by this verb.

BEST COPY AVAILABLE

Classic philosophy and medieval scholastic considered knowledge as a relationship between a *subject* person and (a part of) reality, an object, a place, an invisible essence or another person, that we call a *knowledge object*. Learning was conceived as a dynamic through which this relationship was put into place. Taking that perspective, on the track of authors who reproposed it more recently such as (Lonergan 1957) and (Lonergan 1990), we claim that knowledge has the status of *relationship*, which is an activity of a person's and can not be stored, codified in bits and measured - at least directly. What can be measured, stored, retrieved and transmitted, are data and information, which are the basic part of a more complex phenomenon called knowledge.

This approach to learning and knowledge is insightful as it concerns the exploitation of new technologies in education and provides powerful concepts for tackling many design issues.

Cognition as Establishing a Relationship

Cognition is therefore a process aimed at establishing effective knowledge relationships between the subject and the world. Learning can be modeled as a dynamic occurring on three levels: experience, understanding and judgment.

At first, learning could be described as a process with three main steps, each of them defined by the specific questions concerning the main knowledge object (Lonergan 1990)

- *Experience* is the level in which the subject perceives the object. Perception is to be understood as a partially unconscious but active process, such as in the research track initiated by the New Look (Bruner & Goodman 1947) (Bruner & Goodman 1949). This is the level mainly addressed by Dewey's work in the first part of '900 (Dewey 1900) (Dewey 1938), who considered schools as the place where an intensive experience of the world could be made.
- *Understanding* is the level in which the subject asks "what is it?" or "how does it work?" and develops an enquiry until he/she "gets it", i.e. reconstruct a mental model for the specific knowledge object she is considering, eventually afterwards reworking it as a concept through generalization and abstraction. This is the level mainly concerned by the current work of Constructivism in education.
- *Judgment* is a further level, often unconsidered but essential, in which the subject turns to the acquired understanding or concept and asks "is it true?" or "is it adequate to my experience?". This step requires the gathering of evidence (as recognition of fact, or as activation of previous knowledge) in order to accept the model constructed by the learner: thought is transformed in knowledge.

But learning is of course not only a process, but a dynamic (as represented in Figure 1) in which each level is influenced and influences its neighbors. Concepts and understanding e.g. influence our perception in a "top-down" manner, exactly as previous knowledge on the level of judgment influences concepts and understanding

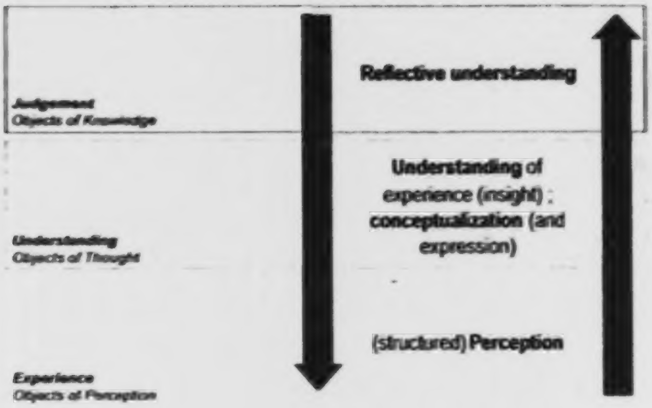


Figure 1 - the learning dynamic

A more detailed of this model, here just sketched, can be found in (Lonergan 1993). Considering learning with an interdisciplinary approach, it is interesting to see how this traditional insight matches and merges with more recent studies and with current information and communication theories, e.g. memory studies - remarkably (Glenberg, A.M. 1997) - or cognitive science, like in (Brennan 2002), (Staudinger & Joos 2000) or (Carassa & Tirassa 1995).

It is clear, and it is one of the greatest gains in the current educational discussion, that this process is undergone *in primis* by the learner. IT can not guarantee learning, but may help establishing or renewing knowledge relationships by managing adequately data and information, providing support for conceptualization and creating a favorable social environment.

Properties of knowledge

Considered this way, knowledge presents four basic properties:

- Knowledge is *synthetic*: real knowledge, as real relationships, is somehow "natural", and in act is not reflexive. We really know something when this shapes our action: knowledge, as any kind of relationship, is actually owned inasmuch it becomes a habit [1]. A knowledge relationship is an operative synthesis of experience, understanding and concepts.
- Knowledge is *inter-connected*: each bit of knowledge is not independent in one's mind: in non-pathological situations, all of them should be harmonized, put together in order to form a consistent whole, one unitary vision of the world. This process was described e.g. by the piagetian concepts of ***acquisition*** and ***accomodation***.
- Knowledge is *extra-connected*: human understanding and knowledge operate on the dimension of totality. Any experience – which is the only source of knowledge – is positive if it opens, requires, and introduces to other new experience (Dewey 1938): one bit requires, like magnetic attraction, to be completed with other knowledge. The extra-connectedness of knowledge is therefore a reflection of the innate human curiosity and attitude toward learning, and on the other side, of the (perceived) connectedness of reality itself.
- Knowledge is *current*: as relationship, knowledge develops and has effect in the *hic et nunc* of an action. Once acquired and established, knowledge can become somehow latent, like a relationship with a friend we seldom meet: the relationship still exists but is like asleep. In the same way, we know objects we do not handle any more, e.g. because we have changed our job place. Knowledge

---

[1] From the Latin ***habitus***, dress. It recalls the ***habit change*** that effective communication produces in the addressee according to the Pragmatics paradigm.

BEST COPY AVAILABLE

is still there and still interacts with other knowledge bits as part of the whole interconnected system, and still suggests new experiences to be acquired as part of the extra-connected system.

We will show in the following paragraphs that this perspective allows powerful insights in learning and in designing and managing learning with new technologies. IT are in fact tools that can play a role in learning.

New Media in Education: Tools for a Relationship

In the proposed perspective, learning is the *activity* of establishing a knowledge relationship, and as such requires a subject actor, some one who holds the ends of the process and execute it. In order to be a real and complete activity, the whole subject should be involved, i.e. his/her reason, will and affection [2].

Consequently, none can learn for someone else: like eating or breathing, none can do that for us. Put it the other way round, none can grant that someone else will learn, as personal freedom is required. As a good teacher is not a warranty for his pupils to get a graduation, educational designers should keep in mind that no structured learning environment or skilled tutoring system can grant success. Even more, no technology allows let us to take knowledge acquisition or creation for sure. Everything can help us, support us, let us learn more easily and quickly – nothing can take our place.

In this view, new media represent powerful tools. The simple fact of providing a more structured and rich environments can in fact be a help for learning. On the other hand, several studies from cognitive science (Light & Light 1999) and web usability (Stover, Coyne & Nielsen 2000) have proved that learning to use a technological apparatus is a job in itself - both for teachers and learners. This is one reason why with IT good students perform even better, while the other still lag behind. In any case, we have to discard many of the e-learning hypes stating "learn faster, learn better" or "increase your knowledge". Moreover, IT have higher *affordance* as media (Clark & Brennan 1991), and so are more likely to be actually used by learners only when really necessary for more effective learning.

How can this issues be addressed from the point of view of curriculum design? In this paper, three general topics will be discussed: the definition of a role for new media in a real educational environment; user-centered design and adaptive systems; teaching roles in educational environments.

Defining the Role

New media, as tools that may be exploited in teaching and learning, should be carefully controlled and managed. The complexity and power of technology has revealed the necessity for a more structured process of instructional design, and requires the interaction of different professional profiles for an effective implementation and management (Harasim et Al. 1985). All this effort is rewarding only if these tools are properly introduced for supporting educational activities.

A structured model of the learning process as the one proposed above can be used as a sort of map for planning such introduction. At any moment in the learning dynamic, tools can be used for supporting the current status, e.g. conceptualization, reflective understanding, etc. This allows to define exactly what is expected from a technological system, and - most of all - what cannot rely on the system.

For the course *The Institutional and the Society*, given for 180 freshmen at the Università della Svizzera italiana, the Istituto Comunicazione e Formazione developed a set of 22 online multimedia case studies offering texts, video and audio materials taken from newspaper, radio and TV programs, describing the nature, goals and activities of different institutions (e.g. UNO, Amnesty International, etc...). Goal of the digital media support was to provide "live" portraits of the institutions, to be matched with the theoretical approach offered during lectures. Their use was planned at two levels, according to our model:

Objective 1	Providing an overview of real and active institutions: on the level of *experience*, the digital materials were used to let students make acquaintance with the object of their study;
Objective 2	Offering real case-studies: on the level of *judgment*, the external description of institutions could be used for verifying the matching of theory and practice.

---

[2] This is true also from a juridic point of view: any suspect will not be condamned if he was not able to understand what he did, or if he had done it not freely, e.g. under direct menace.

During Summer Semester 2002, while such materials were in use, the teaching staff encountered some mismatch between their expectation and the actual results being performed by the students [3]. While students got perfectly the importance of the digital materials for more concrete and practical perspective of the course (objective 1), they had difficulties in analyzing with some degree of detail the case studies (objective 2). The structured requirement analysis briefly reported above was then the possibility for tracking the causes of the problem, and the model of learning was a way for interpreting them and figuring out a viable solution.

The missing step for objective 2 was a lack of understanding of two elements:

1. The case studies in relation with the concepts proposed in the course: students did not have the time to grasp the concepts in the course *before* working on the case studies, so that concepts where no help in getting an insight of the particular institution being analyzed.
2. On the other hand, the great complexity and variety of institutional communication made it difficult to define concepts inductively, starting from the case study itself in order to re-construct the concepts.

This analysis allowed to define specifications for a redesign of the digital materials and of their introduction in the course (they are currently under revision and will be implemented in Winter Semester 2002/2003). Each case study will present a sort of "introductory path" leading the students through the main digital materials and providing one working hypothesis for a more structured analysis and understanding of the single institution. Moreover, one lecture will be devoted to work with groups of students on one case study, so to show how the connection theory-practice can be achieved.

User-Centered Design and Adaptive Systems

User-centered design is a concept, taken from engineering and interface design, which is being successfully applied to education. Curriculum designers should be concerned with making learning more effective and attractive, and this can not be done without considering the peculiarities of each learner. We have to consider that in a lifetime, a person will pass through a number of knowledge re-structuring steps, when new knowledge relationships are integrated with previous knowledge, forming one whole dynamic and interconnected system (see above). Any single act of learning belongs to a history and concerns all previous knowledge. Moreover, each of us has a personal way of learning and a different mix of learning styles (Kolb 1999). Each learner is unique, in him -/herself and for his/her personal history and knowledge relationships.

Yet it should not be forgotten that knowledge relationships have two poles: the learner on one side *and* the object on the other. In a real situations, this means a discipline, learning materials, and a teacher. User-centered design means a stress on the learner, which nevertheless should not forget the other pole. Even more, it should focus on both of them as a system.

In designing an education system, the learners' previous history and learning style should be taken into account. Adaptive hypermedia systems (De Bra & Calvi 1998) (De Bra, Houben & Wu 1999) and student modeling research (Kay 2001) consider these issues, which on the other hand can be included also in less sophisticated educational environments design. Tutoring and mentoring describe didactical relationships that may adapt the learning experience to each learner's personality. The very role of teacher (or facilitator) could in fact be understood as the person who monitors the learning process and supports it in critical events. A student tracking system can from this point of view an important success lever in an educational environment.

In the course *The Institutional and the Society* described above, students were asked to post a synthesis and an evaluation after lecture. On the one side, this helped students to build progressively a set of notes for rehearsal; on the other side, allowed the teaching staff to monitor the level of understanding of the class, possibly to individuate particular cases that could benefit of extra support.

Learning as being in dialogue

---

[3] Observation has been conducted with three instruments: a survey for each lecture (average of students answering: 104 out of 180); semi-structured interviews with a group of 20 students; an open discussion with the whole class at the end of the course.

Learning, as the activity aimed at producing or acquiring knowledge, is essentially a dialogic activity. Establishing a knowledge relationship with an object means being in dialogue with it – once more, the activity is stretched between two poles.

But the creation of a new relationship does not happen in an empty space. All knowledge relationships, form a whole, which is the perceived world of a person's. Among these relationships there are person-to-person relationship, which define the social context. Any creation or modification or re-actualization of a relationship is therefore, at least potentially, a social activity. This is why learning is as well and traditionally the gateway to *belonging to a community*and knowledge the sign of belonging in so many cultures.

Starting from Vygotsky (Vygotsky 1978) collaborative learning research and CSCL have the merit of revealing the importance of the social dimension of learning (Dillenbourg et Al. 1996). This has been often translated into peer-to-peer interaction models, which catch only half of the issue. The fact is that when saying *collaboration*, we should include the teacher/instructor as well: he too collaborates with the learners – he is somehow a learner as well, renewing his/her own knowledge relationship. In the next paragraphs we will focus with more detail on this issue. If the consideration of the educational environment as a whole system (learners-teacher-object-materials) takes the proposed perspective, social interaction in learning acquires a more relevant meaning, passing from being one among several didactical techniques to representing an essential element in learning. This is way any communication system (an online forum, email, meetings) is a critical element in any educational environment.

The learning model proposed above can be a track for planning social interaction at precise step of the cognitive development. Some of the step in the learning dynamic are in fact intrinsically social, while other are strictly dependent on personal engagement. Conceptualization, for instance, can be enhanced by exposition and negotiation of definition; on the other hand, understanding - as getting an insight of a situation - is an individual achievement coming from individual work.

The last two paragraphs have already introduced the relevance of teaching roles in education. On this topic is focused the last part of the paper.

On the Role of Teaching

The most common way for getting in confidence with someone, be it a successful business man that can finance our projects or a beautiful girl that could hopefully marry us, is chatting. The art of chatting is that of finding common interests, of meeting other people on a ground that they can move on with confidence. A known person who introduces us, and suggests us possible conversation topics is a key factor that can increase dramatically our success chances. Chatting can be used for creating the common soft atmosphere of mundane dinners, as well as for getting in confidence with people we can help, such as patients in a hospital or children at school. It is a common way for initiating an eventually stable relationship. The teacher is somehow the person who introduces us to a new knowledge relationship, suggesting interesting and relevant topics, showing us the right communication protocol, providing advice on a favorable language. A teacher is the element that can start the communication flow in the right way. In the beginning, he/she may even embody the dialogical pole the student has to come in touch with, by representing the subject matter in itself, by being directly (or through a medium) in dialogue with students.

But as any professional mediator, the teacher is a time-bound presence, tending to disappear. The more the learner actually learn, the more his/her relationship with the object is stable and strong, the less the teacher is required. Once introduced to each other, the teacher can not require any percentage on the agreement – it was just his/her duty. This ability to introducing pupils to new relationships, and this habit of professional shyness should be the goal of all didactical skills. If we consider higher education, the teacher introduces students not only in a discipline, but in the social environment of a scientific or professional community, acquires.

Out of the metaphor, a teacher - or better, the array of teaching roles configured in any real educational environments: trainer, tutor, coach, media designer, etc. - is the one who consciously controls, anticipates and support the learning dynamic, intervening at different moments with different tools.

This short considerations, which would actually require more space, are the basis upon which we claim that the word *teacher* should not be canceled by the e-learning vocabulary. Of course learning acquires new horizons, but still a relationship can be better and more effectively established if a good teacher provides help. Moreover, several researches show that new media increase the requirements of staff activity and training (teachers, instructors and tutors) in education (Flueckiger & Mazza 2001) (OU 2000).

BEST COPY AVAILABLE

The teacher is a learner

What makes a teacher as such is his/her continuous learning, i.e. the continuous reshaping, adaptation, deepening of his/her personal knowledge relationship with what is being taught. A teacher is lively knowledge in action who invites motivated and interested learners to take part in the movement.

From this perspective lifelong education for teachers is necessary, covering both didactical skills and domain competence. The opportunities offered by e-learning in this domain are therefore appreciable and valuable. This should possibly avoid the trap of simply "being technologically up-to-date": keeping a knowledge relationship lively means much more than that, and means keeping alive motivation (reason and will) and be in touch with a social environment (learning is dialogic) that foster knowledge, a scientific community. We believe that any of our readers will probably have in mind such teachers in his own learning career more than other, maybe didactically skilled teachers.

Conclusions

In this paper we faced some elearning issues starting from very far, going back to one of the roots of Western educational theories, as renewed in more recent authors' work. We did this in the belief that a condition for a successful integration of new media in education is a critical rethinking of education as such, and this can be achieved only renewing our epistemological and pedagogical tradition.

We proposed a conception of knowledge as relationship and tried to show how this approach is scientifically valid and promising for developing a framework for curriculum design and new media in education. We proposed some examples in education theory, education system management and instructional design.

References

Armani, J., Botturi, L. & Rocci, A. (2002). Maps as Learning Tools: the SWISSLING Solution. *4th International Conference on New Educational Environments - ICNEE '02*, Lugano - CH, 2.1/7-10

Brennan, S.E. (2002). Visual Co-presence, Coordination Signals and Partner Effects in Spontaneous Spoken Discourse. *Journal of the Japanese Cognitive Science Society*, 9, 7-25

Flueckiger, F. & Mazza, R. (2001). Open Distance Learning at Southern Switzerland Universities. *European University Information Systems Conference - EUNIS 2001*, Berlin

Kay, J. (2001). Learner Control. *User Modeling and User-adapted Interaction*, 11, 111-127

Stover, A., Coyne, P. & Nielsen J. (2000). *Site Map Usability*, Nielsen Norman Group, online at www.useit.com

OU (2000), report on *Technology Strategy for Academic Advantage*, Open University

Staudinger, U.M. & Joos, M. (2000). Interactive Minds: a Paradigm for the Study of the Social-Interactive Nature of Human Cognition and its Lifespan Development. *Schweizerische Zeitschrift für Bildungswissenschaft*, 3/2000, 559-574

De Bra, P., Houben, G.J. & Wu, H. (1999). AHAM: A Dexter-based Reference Model for Adaptive Hypermedia. *Hypertext and Hypermedia*, Association for Computing Machines, 147-156

Kolb, D.A. (1999). *Learning Style Inventory*, Boston: Hay/McBer Training Resources Group

Light, P., & Light, V. (1999). Analysing Asynchronous Learning Interactions. In Littelton, K. & Light, P. (eds.), *Learning with Computers*, London: Routledge, 162-178

De Bra, P. & Calvi, L. (1998). Towards a Generic Adaptive Hypermedia System, *9th Hypertext and Hypermedia*, Association for Computing Machines, Pittsburgh, 5-11

Dillenbourg, P., Baker, P., Blaye, A. & O'Malley, C. (1996). The Evolution of Research on Collaborative Learning. In Spada, E. & Reiman, P. (eds.). *Learning in Humans and Machines: towards an Interdisciplinary Learning Science*, Oxford: Elsevier, 189, 211

Glenberg, A.M. (1997). What Memory is for. *Beahvioral and Brain Sciences*, 20 (1), 1-55

Carassa, A. & Tirassa, M. (1995). Architetture per agenti adattivi. In AAVV, *Il divenire del pensiero*, Milano: Antonietti

Lonergan, B. (1993). *Topics on Education – the Cincinnati Lectures of 1959 on the Philosophy of Education*, Crowe, F.E. & Doran, R.M. (eds.), Toronto: University of Toronto Press

Clark, H.H. & Brennan, S.E. (1991). Grounding in Communication. In Resnick, L.B. & Teasley, S.D. (eds.), *Perspectives on Socially Shared Cognition*, Washington, D.C.: APA

Lonergan, B. (1990). *Understanding and Being – the Halifax Lectures*, Crowe, F.E. & Doran, R.M. (eds.), Toronto: University of Toronto Press

Harasim, L., Hitz, S.R. , Teles, L. & Turoff, M. (1985). *Learning Networks* Boston: MIT Press

Vygotsky, L.S. (1978). *Mind in Society*, Cambridge: Harvard University Press

Lonergan, B. (1957). *Insight: A Study of Human Understanding*, Crowe F.E. & Doran, R.M. (eds.), Toronto: University of Toronto Press, 1992 (original edition 1957)

Bruner, J.S. & Goodman, C.C. (1949). On the Perception of Incongruity: A Paradigm. *Journal of Personality*, 18, 206-223

Bruner, J.S. & Goodman, C.C. (1947). Value and Need as Organizing Factors in Perception. *Journal of Abnormal and Social Psychology*, 42, 33-33

Dewey, J. (1938). *Experience and Education*, New York: Kappa Delta Pi

Dewey, J. (1900). *The School and Society*, Chicago: University of Chicago Press, 1990 (original edition 1900)

A software tool for developing critical judgments about student writing

This presentation describes the development and design of a software tool designed to assist educators in learning about writing assessment. It also permits back-end data gathering to support research on features of the tool, which include coaching, making judgments and justifying them, and comparing judgments and justifications to those of peers and experts.

The web-based experience, which allows teachers and others to learn about dimensions of writing through rating writing samples and receiving feedback on their ratings, is coordinated with the Nebraska State Writing Assessment. The goal is to help teachers learn to judge dimensions of students' writing and allow them to share their judgments with fellow educators. The project is funded through the Center for Instructional Innovation at the University of Nebraska and NCITE, the National Center for Information Technology in Education.

The project has two complementary dimensions, research and service. The research component is comprised of three related research themes. The first is to test a web-based resource for developing critical judgment and thinking called the ThinkAboutIt! tool. In this tool (1) course content is presented in any of the formats available to Internet delivery (e.g., expository text, narrative text, pictures, video clips, audio clips, etc.). Learners (2) are required to make a choice about how the content should be interpreted or applied. In addition to making a choice, the tool also (3) requires learners to provide a justification or rationale for their choice. When learners have provided their rationales, the tool (4) returns a dynamic graphical display of the frequencies of all choices in the population of learners working on this application. The tool also (5) returns the learner's own rationale and those of all other learners in the population, sorted according to the choices that the learners have made. This permits learners to compare their judgments and rationales to those of their fellow learners. In presenting the rationales, the tool (6) provides learners with the opportunity to interact with the rationales of fellow learners in a variety of ways, including requiring them to select the best rationales, rate a subset of rationales for their quality, e-mail comments to authors of particular rationales, or simply read the rationales. The second research thrust possibility is a study with a sample of students from the Statewide Assessment (March, 2003). Questionnaires and interviews will be used to examine students' experiences with writing and perceptions of writing, efficacy and outcome expectancies for writing, etc. The third research approach will use latent semantic analysis, or a related technique, that compares LSA scoring to the 6-Trait Scoring provided by human scorers of the Nebraska Writing Assessment.

The service dimension involves fulfilling the need to educate the teachers of Nebraska (current and future) on writing assessment. By working with these web-based materials, the teachers will be encouraged to engage more deeply with the content and think critically about the writing samples as they assess them. There are "Coaching", "Expert" and "Peer" functions available within the website. The coaching function is accessed through a "Coaching" button, which provides video, text, or audio coaching in advance of learner judgments to assist them in making informed decisions and forming higher level rationales. The expert judgment function is also accessed by through learners clicking on an "Expert Judgment" button. This function is not available to learners before they make a judgment, but only becomes available after the teachers have made their judgment and provided a rationale. The peer function is also only available after the teachers have made their judgment and provided a rationale and allows for an online discourse on the ratings and judgments for the various student writing samples.

A Framework for Adaptive E-Learning Based on Distributed Re-usable Learning Activities

Peter Brusilovsky and Hemanta Nijhavan
School of Information Sciences
University of Pittsburgh
Pittsburgh PA 15260
peterb@mail.sis.pitt.edu

Abstract: This paper argues that a way to the new generation of powerful E-learning systems starts on the crossroads of two emerging fields: courseware re-use and adaptive educational systems. This paper presents the KnowledgeTree, a framework for adaptive E-learning based on distributed re-usable learning activities that we are currently developing. The goal of KnowledgeTree is to bridge the gap between the information power of modern educational material repositories and the just-in-time delivery and personalization power of ITS and AH technologies.

Introduction

Adaptive Web-based educational systems and standard-based courseware re-use systems constitute two large research and development streams in the field of E-Learning. *Courseware re-use* systems emerged as a reaction to the standard practice of "hardwiring" high-quality educational material items in the course content. This practice made it impossible to reuse educational material and resulted in wasted efforts of the educational community as a whole due to the need to re-develop the same material again and again. The early answer to this problem was a database of educational resources and a courseware-reuse approach to authoring new courses (Olimpo et al., 1990). The courseware reuse ideas has found a fertile ground in Web-enhanced education. Some early large projects in the field of Web-based education like ARIADNE (Forte, Forte & Duval, 1996) and MTS (Graf & Schnaider, 1997) funded by the European Community were centered on courseware reuse. ARIADNE provides a very good example of courseware reuse architecture. It includes multiple *pools* (repositories) of educational material indexed with metadata and an open set of tools to produce, index, and reuse this material. Other well-known European project driven by the same motivation are PROMETEUS (http://www.prometeus.org/) and GESTALT (http://www.fdgroup.com/gestalt/). In the USA the reusability approach has been promoted by EOE Foundation (http://www.eoe.org/) and GEM Consortium (http://www.geminfo.org/).

Adaptive Web-based educational systems (Brusilovsky, 1999) emerged as an alternative to the traditional "one-size-fits-all" approach in the development of educational courseware. These systems build a model of the goals, preferences and knowledge of each individual student, and use this model throughout the interaction with the student in order to adapt to the needs of that student. The first pioneer adaptive Web-based educational systems were developed in 1995-1996 (Brusilovsky, Schwarz & Weber, 1996a; Brusilovsky, Schwarz & Weber, 1996b; De Bra, 1996; Nakabayashi et al., 1995; Okazaki, Watanabe & Kondo, 1996). Since that time, a good number of systems were created all around the world. The majority of adaptive Web-based educational systems are based on technologies developed in the areas of Adaptive Hypermedia (Brusilovsky, 1996) and Intelligent Tutoring Systems (Polson & Richardson, 1988).

The methods and tools developed by the researches on courseware re-use systems and adaptive Web-based educational systems can contribute to creating better Web-enhanced courses. Each of these approaches has strong and weak sides. The courseware re-use frameworks such as ARIADNE allow a course author to search for the relevant learning objects in repositories of educational material and include them in their courses (Figure 1). This approach reduces course development time and improves the quality of courses by making high-quality educational material available for the learning community. At the same time, current implementations of this approach have at least three serious problems.

First of all, modern reusability frameworks implicitly assume that a learning object is a moveable entity - usually a file that is stored in a repository and can be re-used by *copying* into the course to be created. However, advanced re-usable educational objects in modern Web-based education are not files, but activities (services) delivered by a Web server. These activities that can't be simply packaged, stored, and copies as an image, a text file, or even an applet - they have to reside on a dedicated server. This kind of activities is quite typical for adaptive Web-based systems. For example, ELM-ART, an adaptive LISP course (Brusilovsky et al., 1996a) includes many LISP programming problems. Problems are more than just textual problem statements. They are fully interactive learning activities backed by ELM-ART unique knowledge-based functionality. In response to student program solution sent to ELM-ART server, the system can check, diagnose, and correct it. ELM-ART problems can't be moved or copied - they have to be served directly from a dedicated ELM-ART server. There is a clear need to re-use these service-based activities. For example, a teacher may want to re-use ELM-ART problems (based on more than 10 man-year of research) in a very different LISP course. Current re-usability frameworks do not support this.

The second problem is related to the very idea of finding and attaching resources to online course material at the time of course development. The resource repositories are being constantly updated. Some better resources could be added to the existing repositories, some completely new repositories could become available. However, the students can't benefit from these resources due to the static nature of the approach.

The third problem is related to the "one size fits all" problem. When identifying relevant material and organizing it within a course section, the teacher has to think about the class in general. The students in the class have different interests, knowledge, backgrounds, and learning styles. Some material carefully selected by the teacher can be useless for some students and only distract them. Some material that is important for particular students may not even be selected. An organization of material that benefits one category of learners may create obstacles for other categories. This problem is becoming especially important in Web-based education where the variety of learners taking the same course is much greater.

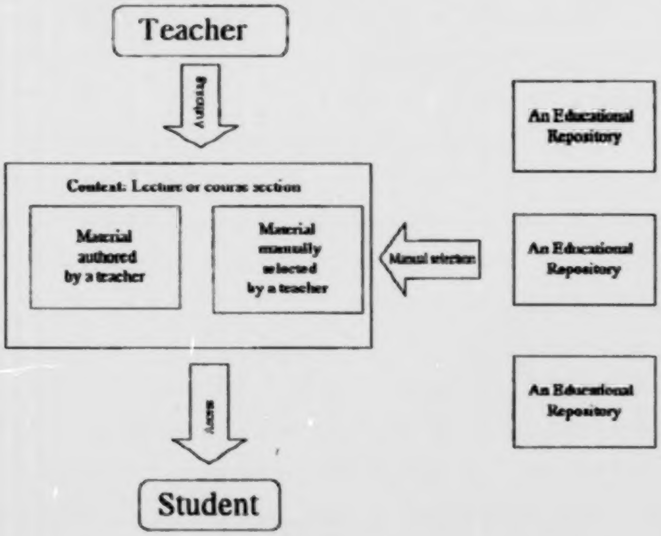

Teacher
Authoring
Content: Lecture or course section
Material authored by a teacher
Material manually selected by a teacher
Manual selection
An Educational Repository
An Educational Repository
An Educational Repository
Access
Student

Figure 1: Courseware re-use approach to course design and delivery. Authoring tools allow the teachers to find and include resources into their course material. The student accesses static course material.

The situation is essentially different in the case of courses produced using adaptive hypermedia (AH) technologies or intelligent tutoring systems (ITS) technologies. Using individual student models and educational material enhanced with domain knowledge, AH and ITS technologies are able to dynamically select the most relevant learning material from their knowledge bases and present it at the right time and in the right way for every individual student, thus making the best use of every fragment of educational material. Educational material in many systems includes "service-style" activities backed by the intelligent capabilities of the system. At the same time, all known ITS and AH systems are build around a "close corpus" material. Collecting and preparing this material for use in adaptive systems is an expensive process. Thus these systems can't directly benefit from existing repositories of learning material.

We believe that a way to the future starts on the crossroads of courseware re-use and adaptive educational systems. This paper presents the KnowledgeTree, a framework for Adaptive E-Learning Based on Distributed Re-usable Learning Activities that we are currently developing. The goal of KnowledgeTree is to bridge the gap between the information power of modern educational material repositories and the just-in-time

BEST COPY AVAILABLE

delivery and personalization power of ITS and AH technologies. The following sections present our vision of the KnowledgeTree framework, review several known problems that it addresses, and describes its most recent version that has already been used in several courses at the University of Pittsburgh.

KnowledgeTree: The Architecture

The KnowledgeTree is a distributed architecture for adaptive E-learning based on re-use of educational activities. It replaces the current monolithic course management systems (CMS) such as Blackbord (Blackboard Inc., 2002) or WebCT (WebCT, 2002) with a community of communicating servers. The architecture anticipates the presence of at least three kinds of servers: activity servers, learning portals, and student model servers (Figure 2). A *learning portal* plays a role similar to modern CMS. It allows a teacher to design a course and manages the student interaction with the course. The difference with CMS is that the learning content (activities) used by the students reside not in the portal, but in multiple distributed *activity servers*. An activity server plays a role similar to an educational repository in the sense that it hosts some (usually specialized) learning content. Unlike repositories that are essentially pools for storing learning materials that can be copied and inserted into courses, an activity server not only stores, but also delivers the activities. A portal has an ability to query activity servers for relevant activities and launch remote activities selected by students. An activity server should be able to inform portals about available activities and provide a complete support for a student working with one of its activities. *Student model server* collects data about student performance from each portal and each activity server that work with a student. In exchange, it provides information about the student that can be used by adaptive activity servers to personalize their communication with the student. The presence of multiple adaptive activities requires a centralized user modeling architecture.

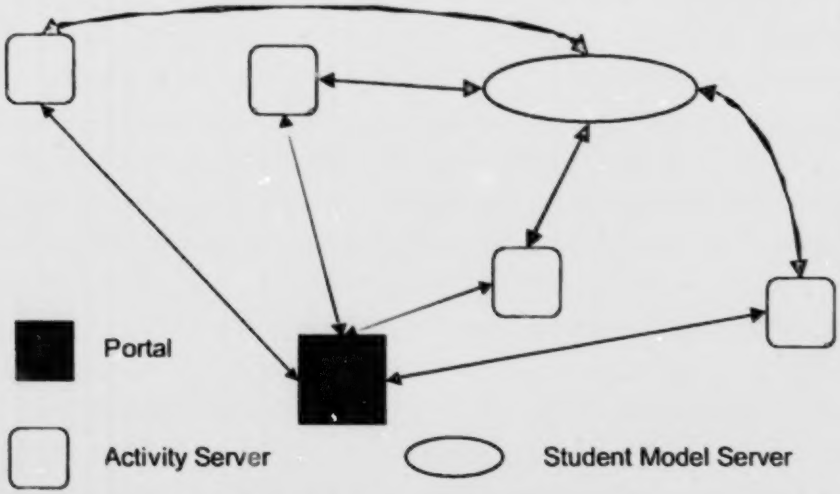


Figure 2: Main components of the KnowledgeTree distributed architecture.

With the KnowledgeTree architecture, a teacher develops a course using one portal and many activity servers. A student works through the portal serving this course, but interacts with many learning activities served directly by various activity servers. The adaptivity is provided by a student model server that collects student performance data from the portal and the activity servers and provides them with integrated information about the student. In particular, a student model server can reside on student's own computer and support just one user. It also can reside on a university computer and support the whole class of students.

The KnowledgeTree architecture is open and flexible. It allows the presence of multiple portals, activity servers, and user modeling servers. The open nature or it allows even small research groups or companies to be "players" in the new E-learning market. An activity server that provides some specific innovative learning activities can be immediately used in multiple courses served by different portals. An innovative portal with a good interface can successfully compete with other portals since it has an access to the same set of resources as other portals. A more powerful student model server can successfully replace older servers.

The open nature of the architecture is based on several clearly defined communication protocols between components. To start with, the architecture needs a protocol for transparent login and authentication. Each adaptive activity should know the identity of the user to use the proper user model, however the student logs in only once. Second, it requires a standard proto[illegible] for a portal to send a query to the activity servers and the standard protocol for the activity servers to respond. Third, it requires a protocol for an activity server to send the information about the student progress to the student model server and a protocol to request information about the student from the student model. Finally, the architecture needs a resource discovery/exchange protocol. A portal can provide an access to a wide variety of learning activities residing on many servers. However, to benefit from this feature, a portal should know about many servers and kinds of activities they can offer.

The current version of KnowledgeTree provides offers very simple implementation of the first three protocols. Every activity us called directly by a dedicated URL. The transparent authentication is implemented by passing a session and a student identifiers as a part of activity URL. We use a rather simple http-based communication language between components, similar to the one we have developed in our past research on distributed intelligent tutoring (Brusilovsky, Ritter & Schwarz, 1997). While these protocols offer some solution that enables us to work and explore the distributed architecture, they are clearly "homegrown". More research is requited to develop protocols that can be commonly acceptable.

The resource discovery issue has not been addressed in the current version of KnowlegdeTree. Currently, we simply "tell" the portal about all existing activity servers. In the open context none of the portals can know all relevant activity servers and there is no centralized authority to collect this information. This requires a "resource propagation" mechanism for various portals to exchange information (metadata) about known servers and activities.

KnowledgeTree: The Portal

The KnowledgeTree architecture allows multiple portals that can support different educational paradigms and approaches. At the moment, we have implemented one portal also called KnowledgeTree that is targeted to support a lecture-based educational process and is focussed on dynamic and adaptive selection of learning activities.

Main users of any portal are course authors (teachers) and learners. Course authors are responsible for shaping a course as a structured container of educational activities. The KnowledgeTree model allows an author to develop a course as a tree of modules (note that a sequence is also supported since it is a a one-level tree). While for most authors a module will correspond to a lecture, an author has a freedom to define larger modules that comprise several lectures as well as smaller-size modules. The course can also be structured independently from a sequence of lectures – as an interactive electronic book. In any case, the role of the author here is to structure the set of modules and to select primary educational material for each module. We distinguish primary material that comprises minimal set of activities necessary for an average student to learn the module and additional material that enhances learning experience and provides relevant activities for the students with different learning styles and levels of knowledge.

To select the material for each section an author specifies an educational goal for a section. The specification can be done in both natural language and in a formal language that expresses the goal in terms of metadata associated with necessary learning activities. During the course design process, the educational goal is used by the system to select subset of relevant educational activities from multiple learning repositories known to the system. The selection can be done using a formal query to metadata-backed repositories or using a fuzzy text-based matching for repositories that have no metadata. From this pre-selected subset of activities an author can simply manually select most relevant primary and additional learning activities. To complement the set of activities found in the repositories, some activities can be designed by the author.

The above process is quite similar to the process supported by advanced courseware re-use tools. New feature of the KnowledgeTree model is that the learning goal specified by the author is retained and stored with the module. When a particular student accesses the module during educational process, the *learning portal* uses this learning goal as well as the student model to select adaptively most relevant additional material for the given student *at the runtime*. Adaptive runtime selection allows the system to accommodate to the volatile and expanding nature of learning repositories and to student individual differences (Figure 3).

It is easy to anticipate that in the future, when learning repositories will be quite rich, the runtime selection will return a relatively large number of relevant learning activities. In this context, adaptive hypermedia technologies will provide further adaptation for an individual student. Adaptive navigation support (such as adaptive annotation, sorting, and direct guidance) will be used to help the student to select the currently most relevant items in the personalized learning space. Here the system will adapt to student knowledge and individual learning styles. Adaptive presentation will be used to deliver selected items adaptively. Here the system will adapt to the student level of knowledge and educational goal. In addition, the system also allows the student to search for relevant educational material using her own criteria and to add material permanently to the module. It produces a dynamic and personalized learning space for each course module where personalization is provided by both the system and the student (Figure 3).

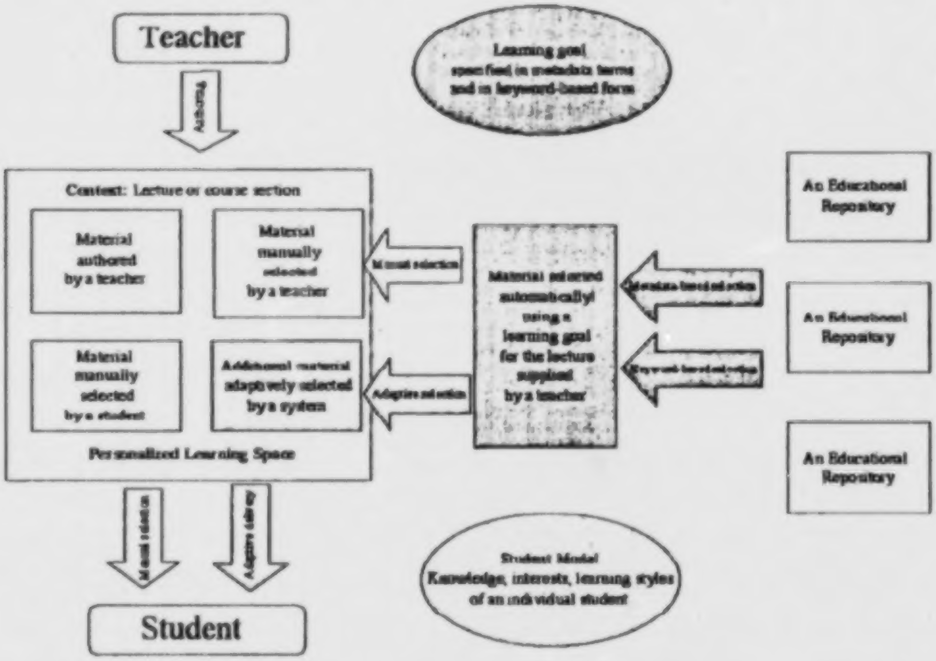

Teacher
Learning goal specified in metadata terms and in keyword-based form
Content: Lecture or course section
Material authored by a teacher
Material manually selected by a teacher
Material manually selected by a student
Additional material adaptively selected by a system
Personalized Learning Space
Manual selection
Adaptive selection
Material selected automatically using a learning goal for the lecture supplied by a teacher
An Educational Repository
An Educational Repository
An Educational Repository
Student Model
Knowledge, interests, learning styles of an individual student
Student

Figure 3: KnowledgeTree portal combines the benefits of courseware re-use systems and adaptive Web-based educational systems. It solves the problem of statically built courses, and provides personalized support that maximizes an educational opportunity for every learner.

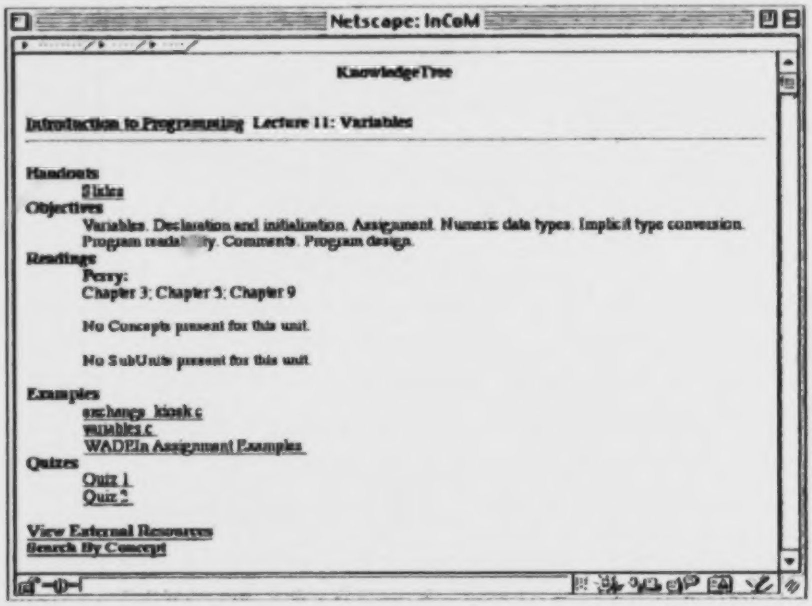
The above scheme presents the most generic case of the system use. The system naturally supports any subset of the underlined functions. For example, the author may specify a partial educational goal and choose not to select any primary educational material. In that case, the system still will be able to use a partial goal to select and organized relevant educational material for every section. Thus, with little efforts from the author the system will be able to provide an impressive level of adaptive support.

Current State of Work

In addition to the overall architecture, a set of protocols, and the KnowledgeTree portal, the list of components developed so far includes four protocol-compliant activity servers and a simple user modeling server. Three of these activity servers have been developed for the area of teaching programming. Each server supports authoring of a specific kind of activity and supports student's interaction with a selected activity of this kind. The WebEx system (Brusilovsky, 2001) serves interactive annotated program examples, the QuizPACK (Pathak & Brusilovsky, 2002) serves parameterized questions, and WADEIn (Brusilovsky & Su, 2002) serves demonstrations and exercises related with expression evaluation. The fourth server KnowledgeSea (Brusilovsky & Rizzo, 2002) is domain independent, and currently used to provide an interactive access to open corpus learning material. All activity servers are self-containing Web servers running on different

BEST COPY AVAILABLE

platforms and completely independent from a portal. WebEx is implemented using Microsoft ASP technology and served by Internet Information Server (IIS) working on a Windows PC. QuizPACK is developed as a set of C++ CGI scripts and is served by Apache server working on a SUN Solaris platform. WADEIn is implemented as a configurable Java applet embedded into a page generated by a Java servlet running on a Tomcat server. KnowledgeSea is based on JavaScript functionality and can be delivered by any Web server. Each server can work independently from the KnowledgeTree architecture, but will require a student to login in this mode of work. Only one of the activity servers (WADEIn) serves adaptive activities. It use the information about students to adapt to their knowledge. Other servers use information about the student simply to trace the student performance. All these servers implement our simple transparent login protocol, resource delivery protocol, and student modeling protocol. They can work (with transparent login) with any compliant portal and user modeling server.



KnowledgeTree

Introduction to Programming Lecture 11: Variables

Handouts
    Slides
Objectives
    Variables. Declaration and initialization. Assignment. Numeric data types. Implicit type conversion. Program readability. Comments. Program design.
Readings
    Perry:
    Chapter 3; Chapter 5; Chapter 9

    No Concepts present for this unit.

    No SubUnits present for this unit.

Examples
    exchange_kiosk.c
    variables.c
    WADEIn Assignment Examples
Quizes
    Quiz 1
    Quiz 2

View External Resources
Search By Concept

Figure 4: A module view in a second version of KnowledgeTree portal. The learning activities in Examples and Quiz categories are delivered by external activity servers WADEIn, WebEx, and QuizPACK.

The first version of the KnowledgeTree portal together with WebEx and QuizPACK servers and a primitive student model server was piloted in the Fall 2001 semester in the context of a programming and data structure course. In Spring 2002 semester the version 1.5 of the portal (Figure 4) and all four activity servers were used as a primary course support tool in the context of another programming course. Many activities created for the first course were re-used in the second course and we have appreciated ourselves how easy was it to assemble a course from re-used activities. The students were using the system and its components on everyday basis. All components of the system were formally evaluated and got very positive feedback from the students.

Currently we are completing the second version of the portal. Following the earlier versions, it is implemented using Java Servlet and JDBC technologies and delivered by Tomcat server. It supports hierarchical course design (first version supported sequences only), specification of educational objectives of a module in terms of course concepts/topics. It is able to retrieve external learning activities that matches the educational objectives of the module. The second version also supports multiple course authors and groups. We are also developing the second version of the student model server. The second version implements in full the centralized user modeling approach developed in our earlier research. (Brusilovsky, 1994; Brusilovsky, 1995). This version is based on Java Servlet and JDBC and will replace the current simple user model server that is based on Microsoft ASP technology.

We expect that in the Fall 2002 semester several faculty will be using the KnowledgeTree in the context of their courses. The readers are welcome to try the current version of the system available from our lab home pages: http://www2.sis.pitt.edu/~peterb/taler.html.

BEST COPY AVAILABLE

Other Relevant Research and the Prospects for the Distributed Framework

Significant amount of work and cooperation of several research groups is required to turn the proposed framework into the practice of e-learning. We have started with implementing the core functionality of the system within our local group using some rather simple ways to implement the required protocols. However, any open architecture has to be based on a number of standards. Fortunately, our work shares some core goals with several other active research areas. Instead of inventing the solution we intend to re-use as much as possible standards, solutions and ideas from these area.

- The problem of searching for relevant educational activities in learning repositories is now well explored by courseware re-use movement and Learning Object Metadata groups (such as LTSC http://ltsc.ieee.org) in particular. Solutions developed within this field can be directly adopted by our framework
- A good variety of powerful adaptation methods and techniques have been explored in the field of adaptive Web-based educational systems. This field is our primary source of ideas for developing both the portals and the adaptive activities.
- Several consortia such as uPortal (http://www.uportal.org) and AICC (http://www.aicc.org) explore the issues of distributed component-based architectures for E-learning as an alternative to monolithic courseware management systems. These groups have already produced some solutions for transparent authentication and communication standards between a portal and an "intelligent" learning activity.
- The problem of gathering and sharing metadata of distributed resources has been carefully investigated in the field of Web information retrieval. Some interesting centralized architectures as FAB (Balabanovic & Shoham, 1997) and decentralized architectures as Harvest were suggested. These ideas can be certainly re-used for the needs of E-learning. In the context of e-learning EDUTELLA (http://edutella.jxta.org/) and LOMster (Ternier, Duval & Vandepitte, 2002) projects develop frameworks for peer-to-peer metadata exchange.
- The issue of user and student modeling for multi-component adaptive systems has been well-researched in the fields of ITS and User Modeling. A number of user and student model servers have been already reported (Kobsa, 2001). These works can certainly contribute to the development of the user model component of KnowledgeTree framework. The AICC CMI standard can also contribute to this aspect of our framework since it suggest a way for an "activity" to report the results of student work with it.

We should conclude by mentioning that the problems of developing distributed adaptive and intelligent educational system based on shared educational resources has also been explored in the field of ITS (Brusilovsky, 1995; Brusilovsky et al., 1997; Eliot, Woolf & Lesser, 2001; Murray, 1998; Ritter, Brusilovsky & Medvedeva, 1998; Ritter & Koedinger, 1996). However, the lack of matching works in other fields and the proper technology in general didn't allow these pioneer works to go beyond the level of ideas and simple lab systems. The current situation is quite different. Not only we can now use some matching solutions from the areas listed above, the Web in general now provide a powerful platform for implementation of the long discussed ideas. The race for e-commerce, enterprise systems, Web services, personalization, brought to life many technologies that can be used for development of adaptive distributed E-learning. We hope that our group together with other groups motivated by similar goals will be able will now succeed in bringing our a new generation of E-learning systems that integrates best features of several emerging systems.

References

Balabanovic, M. and Shoham, Y. (1997) Fab: content-based collaborative recommendation. *Communications of the ACM* 40 (3), 66-72.

Blackboard Inc. (2002) Blackboard Course Management System 5.1, Blackboard Inc. http://www.blackboard.com/ (Accessed 21 January, 2002)

Brusilovsky, P. (1994) Student model centered architecture for intelligent learning environment. In: Proceedings of Fourth International Conference on User Modeling, Hyannis, MA, 15-19 August 1994, MITRE, pp. 31-36.

Brusilovsky, P. (1995) Intelligent learning environments for programming: The case for integration and adaptation. In: J. Greer (ed.) Proceedings of AI-ED'95, 7th World Conference on Artificial Intelligence in Education, Washington, DC, 16-19 August 1995, AACE, pp. 1-8, also available at http://www.contrib.andrew.cmu.edu/~plb/papers/AIED-95.html.

Brusilovsky, P. (1996) Methods and techniques of adaptive hypermedia. In P. Brusilovsky and J. Vassileva (eds.), *User Modeling and User-Adapted Interaction* 6 (2-3), Special Issue on Adaptive Hypertext and Hypermedia, 87-129.

Brusilovsky, P. (1999) Adaptive and Intelligent Technologies for Web-based Education. In C. Rollinger and C. Peylo (eds.), *Künstliche Intelligenz* (4), Special Issue on Intelligent Systems and Teleteaching, 19-25, http://www2.sis.pitt.edu/~peterb/papers/KI-review.html.

Brusilovsky, P. (2001) WebEx: Learning from examples in a programming course. In: W. Fowler and J. Hasebrook (eds.) Proceedings of WebNet'2001, World Conference of the WWW and Internet, Orlando, FL, October 23-27, 2001, AACE, pp. 124-129.

Brusilovsky, P., Ritter, S., and Schwarz, E. (1997) Distributed intelligent tutoring on the Web. In: B. du Boulay and R. Mizoguchi (eds.) *Artificial Intelligence in Education: Knowledge and Media in Learning Systems*. (Proceedings of AI-ED'97, 8th World Conference on Artificial Intelligence in Education, 18-22 August 1997) Amsterdam: IOS, pp. 482-489.

Brusilovsky, P. and Rizzo, R. (2002) Map-Based Horizontal Navigation in Educational Hypertext. In: K. M. Anderson, S. Moulthrop and J. Blustein (eds.) Proceedings of 13th ACM Conference on Hypertext and Hypermedia (Hypertext 2002), College Park, MD, June 11-15, 2002, ACM, pp. 1-10.

Brusilovsky, P., Schwarz, E., and Weber, G. (1996a) ELM-ART: An intelligent tutoring system on World Wide Web. In: C. Frasson, G. Gauthier and A. Lesgold (eds.) *Intelligent Tutoring Systems*. Lecture Notes in Computer Science, Vol. 1086, (Proceedings of Third International Conference on Intelligent Tutoring Systems, ITS-96, Montreal, June 12-14, 1996) Berlin: Springer Verlag, pp. 261-269.

Brusilovsky, P., Schwarz, E., and Weber, G. (1996b) A tool for developing adaptive electronic textbooks on WWW. In: H. Maurer (ed.) Proceedings of WebNet'96, World Conference of the Web Society, San Francisco, CA, October 15-19, 1996, AACE, pp. 64-69, also available at http://www.contrib.andrew.cmu.edu/~plb/WebNet96.html.

Brusilovsky, P. and Su, H.-D. (2002) Adaptive Visualization Component of a Distributed Web-based Adaptive Educational System. In: *Intelligent Tutoring Systems*. Vol. 2363, (Proceedings of 6th International Conference on Intelligent Tutoring Systems (ITS'2002), Biarritz, France, June 2-7, 2002) Berlin: Springer-Verlag, pp. 229-238.

De Bra, P. M. E. (1996) Teaching Hypertext and Hypermedia through the Web. *Journal of Universal Computer Science* 2 (12), 797-804, http://www.iicm.edu/jucs_2_12/teaching_hypertext_and_hypermedia.

Eliot, C., Woolf, B., and Lesser, V. (2001) Knowledge extraction for educational planning. In: Proceedings of Workshop on Multi-Agent Architectures for Distributed Learning Environments at AIED'2001, San Antonio, May 19, 2001, also available at http://julita.usask.ca/mable/eliot.doc.

Forte, E., Forte, M. W., and Duval, E. (1996) ARIADNE: A supporting framework for technology-based open and distance lifelong education. In: F. Maffioli, M. Horvat and F. Reichl (eds.) Proceedings of Educating the engineer for lofelong learning. SEFI Annual Conference '96, Vienna, Austria, September 11-13, 1996, pp. 137-142.

Graf, F. and Schnaider, M. (1997) IDEALS MTS - EIN modulares Training System für die Zukunft. In: C. Herzog (ed.) Proceedings of 8. Arbeitstreffen der GI-Fachgruppe 1.1.5/7.0.1 "Intelligent Lehr-/Lernsysteme, Duisburg, September 18-19, 1997 Published as No. TUM-19736, Technische Universität München, München. pp. 1-12.

Kobsa, A. (2001) Generic user modeling systems. *User Modeling and User Adapted Interaction* 11 (1-2), Special Issue on Ten Year Anniversary Issue, 49-63, http://www.ics.uci.edu/~kobsa/papers/2001-UMUAI-kobsa.pdf.

Murray, T. (1998) A Model for Distributed Curriculum on the World Wide Web. In J. Spohrer, T. Sumner and S. B. Shum (eds.), *Journal of Interactive Media in Education* , Special Issue on Educational Authoring Tools and the Educational Object Economy, http://www-jime.open.ac.uk/98/5/.

Nakabayashi, K., Koike, Y., Maruyama, M., Touhei, H., Ishiuchi, S., and Fukuhara, Y. (1995) An intelligent tutoring system on World-Wide Web: Towards an integrated learning environment on a distributed hypermedia. In: H. Maurer (ed.) Proceedings of ED-MEDIA'95 - World conference on educational multimedia and hypermedia, Graz, Austria, June 17-21, 1995, AACE, pp. 488-493.

Okazaki, Y., Watanabe, K., and Kondo, H. (1996) An Implementation of an intelligent tutoring system (ITS) on the World-Wide Web (WWW). *Educational Technology Research* 19 (1), 35-44.

Olimpo, G., Persico, D., Sarti, L., and Tavella, M. (1990) On the concept of database of multimedia learning material. In: Proceedings of World Conference on Computers and Education, Amsterdam, Australia, 1990, North Holland, pp. 431-436.

Pathak, S. and Brusilovsky, P. (2002) Assessing Student Programming Knowledge with Web-based Dynamic Parameterized Quizzes. In: P. Barker and S. Rebelsky (eds.) Proceedings of ED-MEDIA'2002 - World Conference on Educational Multimedia, Hypermedia and Telecommunications, Denver, CO, June 24-29, 2002, AACE, pp. 1548-1553.

Polson, M. C. and Richardson, J. J. (eds.) (1988) Foundations of intelligent tutoring systems. Hillsdale: Lawrence Erlbaum Associates.

Ritter, S., Brusilovsky, P., and Medvedeva, O. (1998) Creating more versatile intelligent learning environments with a component-based architecture. In: B. P. Goettl, H. M. Halff, C. L. Redfield and V. J. Shute (eds.) Lecture Notes in Computer Science, Vol. 1452, (Proceedings of 4th International Conference on Intelligent Tutoring Systems (ITS'98), San Antonio, TX, August 16-19, 1998) Berlin: Springer Verlag, pp. 554-563.

Ritter, S. and Koedinger, K. R. (1996) An architecture for plug-in tutor agents. *Journal of Artificial Intelligence in Education* 7 (3/4), 315-347.

Ternier, S., Duval, E., and Vandepitte, P. (2002) LOMster: Peer-to-peer Learning Object Metadata. In: P. Barker and S. Rebelsky (eds.) Proceedings of ED-MEDIA'2002 - World Conference on Educational Multimedia, Hypermedia and Telecommunications, Denver, CO, June 24-29, 2002, AACE, pp. 1942-1943.

WebCT (2002) WebCT Course Management System 3.8, WebCT, Inc., Lynnfield, MA. http://www.webct.com (Accessed 2 July, 2002)

BEST COPY AVAILABLE

Perceived Organizational Climate and Internet Self-Efficacy: Identifying the Best Climate to Promote E-Learning

Dale Burnett
University of Lethbridge
Lethbridge, Alberta, Canada

Keith Skamp
Southern Cross University
Lismore, NSW, Australia

Allan Ellis
Southern Cross University
Lismore, NSW, Australia

Abstract

This report describes a research project designed to investigate the relationship between perceived organizational culture and the current general level of Internet self-efficacy as well as with two sub-categories of expertise: use of course management shell software and Web authoring software. The perceived organizational dimension of "employee focus" was positively correlated with the three technology measures whereas the perceived organizational dimension of "results focus" was negatively correlated with these three measures. Although the findings are mitigated due to the small sample size, they do correspond with a general perception within academic institutions that staff are more likely to be innovative when there is support for their efforts than when there is simply pressure to produce. Overall, the findings of this research project suggest that organizations moving online need to be cognizant of the effect of different organizational climates on their staff and should take this into account when planning their change management strategies.

Introduction

There is a burgeoning literature on topics related to the integration of Information Technology (IT) within organizations. Two disciplines that have shown a particularly strong interest in this topic are Business and Education. The impact of these technological developments on institutions is putting increasing stress on almost all aspects of their operation (Isaacs, 1999; McMurray, 2001). In many cases it seems to require a complete rethinking of an organization's goals and functions. In some cases it may recommend a complete reorganization of an institution or company. In other cases the change may be less dramatic but still important. This appears to be the case within educational institutions, where the core purpose of the institution appears to remain relatively intact, but where there are new opportunities for how we may best provide a dynamic and relevant environment for our students. Wallace (1999) has provided a timely review on various psychological issues related to the use of the Internet. At the same time there must be increasing attention placed on some of the difficulties of developing online instruction. Factors such as reliable technology, support for faculty, and the familiarity of the system among students are commonly mentioned (Auter, P. J. & Hanna, M. S., 1996; Rogers, C. S. & Laws, P., 1996).

Background

The business literature consistently emphasizes the importance of the organizational culture in understanding a corporation's effectiveness. The ideas appear to apply equally well to any large organization, including that of a university. Quinn and Rohrbaugh (1983), Quinn et al. (1996) have developed a theoretical model for describing such a culture, called the Competing Values Framework (CVF), sometimes also referred to as the Competing Values Model (CVM). The model was originally derived empirically from multivariate analysis of response data. Howard (1998) has recently provided an important psychometric validation of this model. Dastmalchian (1999) has broadened the idea to provide a

BEST COPY AVAILABLE

comparison of perceived emphasis with desired emphasis and although the model was originally designed to describe business organizations, Barath (1998) has extended the sphere of application to that of school jurisdictions.

Basically the CVF postulates a three-dimensional bipolar model for organizational culture. The three dimensions are labelled (control & stability)/flexibility, internal/external focus and means/end emphasis. Each of these three dimensions is considered to be orthogonal to the others. The model is sometimes simplified to incorporate just the first two-dimensions (Dastmalchian, 1999). These two dimensions divide the organizational culture into four quadrants, each representing a set of core values (Figure 1).

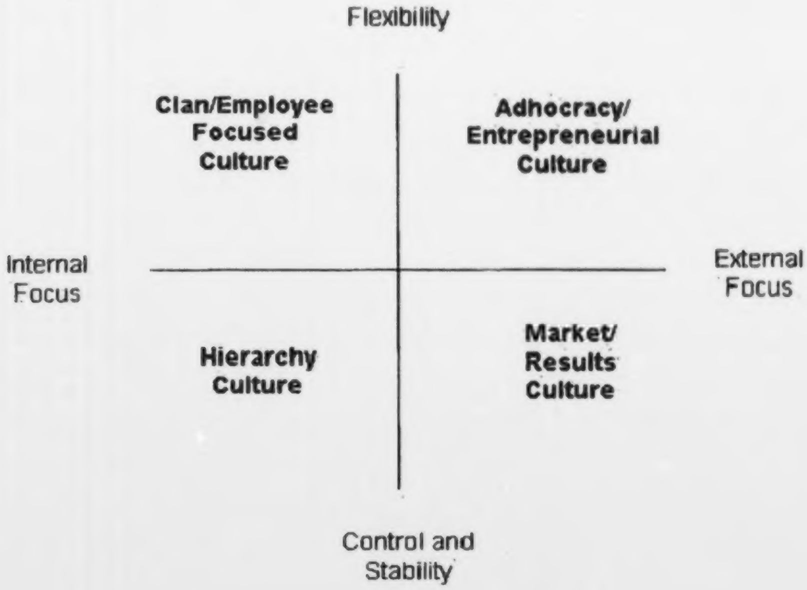


Figure 1 Perceived Organizational Cultures

Usually this model is then used as a framework for plotting the institutional profile, obtained by averaging the data from the individuals responding to the study. However in the present case, it was decided to treat each individual profile on its own, and examine how well that profile corresponds to data obtained on Internet self-efficacy. It is worth noting that the measure for each quadrant is based on the "perceived" emphasis of that characteristic by a respondent within the culture, rather than as some form of judgement about the culture by an external assessment.

Data Collection

The approach taken in this project was to create two survey instruments, based on the available research literature on organizational culture and on computer self-efficacy, and administer this to the staff of a small university. In addition to a series of Likert scale items, a number of open-ended questions were added that asked the respondent to comment of their present activities and future plans within the context of preparing for online instructional materials. The present report presents an analysis of the CVF questionnaire and the Likert items from the Internet questionnaire.

Sampling

The original sample involved two organizational departments. Participation in the study was voluntary. A total of 16 people were approached in one department and 12 in the other. Of these 28 potential respondents, a total of 16 (57%) filled in at least one of the two survey forms. The study was not designed to compare departmentss, but to examine individual profiles, so all of the data were either analyzed at an individual level or were combined for a global analysis. Notices were sent to other departments, informing them of the research project and inviting their participation. This resulted in an additional 6 subjects responding from 4 different departments.

Instruments

The first questionnaire, based on the concept of Internet self-efficacy, was designed specifically for this study. Many of the items were originally used in previous research studies (Eastin & LaRose, 2000; Kelley, Higgins and Compeau, 1999), but were some items modified to provide information directly related to the use of the Internet and the development of online instructional materials. The second questionnaire was obtained from Dastmalchian (1999) and was used without modification. An online version of each questionnaire was also developed and everyone was given the option of using either the hardcopy or online version. The online version was completed by 16 respondents whereas 6 selected the hardcopy form.

The organizational culture exercise asked respondents to distribute 100 "points" across 4 descriptions of hypothetical organizations, depending on how close each description was to their perceived situation. For example, if a subject felt that the university was very much like this description: "Organization A is a very personal place. It is like an extended family. People seem to share a lot of themselves", then they would allocate most of the 100 points to that description. Similar descriptions were provided for organizational cultures similar to the other three quadrants of the CVF. This exercise was repeated a total of 6 times with different aspects of the organization (e.g. Dominant Characteristics, Organizational Leader, Organizational Glue, Organizational Climate, Criteria of Success, and Management Style) being profiled. The scores for each of the four organizational climates were then totalled. Thus, a total of 600 points were distributed over 4 organizational climates, with the average value being 150 if all four climates were rated as equally valid.

The Internet questionnaire contained two sets of questions that asked respondents to indicate on a 7-point scale the degree of experience they had with various course management shell programs (e.g. Learning Space, BlackBoard, WebCT) and with different Web authoring tools (e.g. FrontPage, HomePage, Dreamweaver, GoLive, Fusion). In addition a 17 item (each item a 7-point scale) Internet self-efficacy instrument was included in the questionnaire. Average ratings for each subject on each of these three scales were computed.

Analysis

The small sample size ruled out the use of inferential statistics, however there is merit in reviewing the descriptive statistics. Correlations were computed for each of the four competing value framework dimensions with the three indices of Internet experience (Figure 2).

	Shell Management	Web Authoring	Internet Self-efficacy
Clan/Employee	0.43	0.08	0.41
Adhocracy/Entrepreneurial	-0.03	-0.05	0.05
Hierarchy	0.02	0.18	-0.10
Market/Results	-0.45	-0.22	-0.32

Figure 2 Correlation Matrix of CVF Scores With Internet Experience

The correlation between the perception of an Employee Focused Culture and course management shell experience (Learning Space, BlackBoard, WebCT) was 0.43. Similarly, the correlation between a perceived Results Culture and this same experiential dimension was -0.45. The remaining two organizational culture dimensions did not exhibit large correlations with the experiential variables. Thus the principal finding of the research project was the indication of a strong positive relationship between a perception of being in an

Clan/Employee Focus Culture and having learned to use course management shell software, whereas there was an equally strong negative relationship between a perception of being in a Market/Results Culture and this experiential dimension.

Figures 3 and 4 show the radar graphs for two individuals with high scores on either perceived "Clan/Employee Focus Culture" or "Results Focus Culture". These are both fairly typical of the graphs for people scoring high on these two dimensions. Note that these diagrams emphasize the value for each of the four CVF quadrants, rather than values for the bipolar dimensions outlined in Figure 1. That is, 1 = Clan/Employee Focused Culture; 2 = Adhocracy/Etrepreneurial Culture; 3 = Market/Results Culture; 4 = Hierarchy Culture.

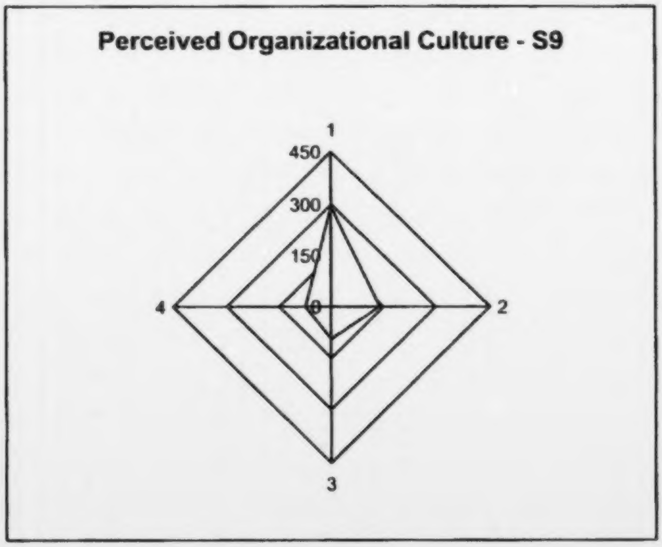


Figure 3

In addition to observing that the highest value is for dimension 1, it is worth noting that values for dimensions 2, 3 and 4 are all under 150. The instrument produces an ipsative measure, which means that, in this case, a total of 600 points were distributed among the four dimensions. An allocation of a large number of points to one dimension results in fewer points available for distribution among the remaining dimensions. If all four dimensions were to receive the same weighting, then all scores would be 150. In the case of Subject 9, the Clan/Employee Focus dimension has a weighting of almost 300 and all of the remaining three dimensions have values less than 150. Recall that the computing of the three scales related to Internet expertise was simply the average rating of a number of 7 point Likert questions. This individual indicated an average score of 6.7 for experience with course management shell software, 4.0 for experience with web authoring software, and 6.6 on the Internet self-efficacy variable. The latter two scores were the highest scores among the group that replied to the survey. This is consistent with the correlations, namely a high score on "Clan/Employee Focused Culture" and a low score on "Market/Results Culture" both correspond to a high scores on experience with course management shell software, experience with web authoring software and Internet self-efficacy.

BEST COPY AVAILABLE

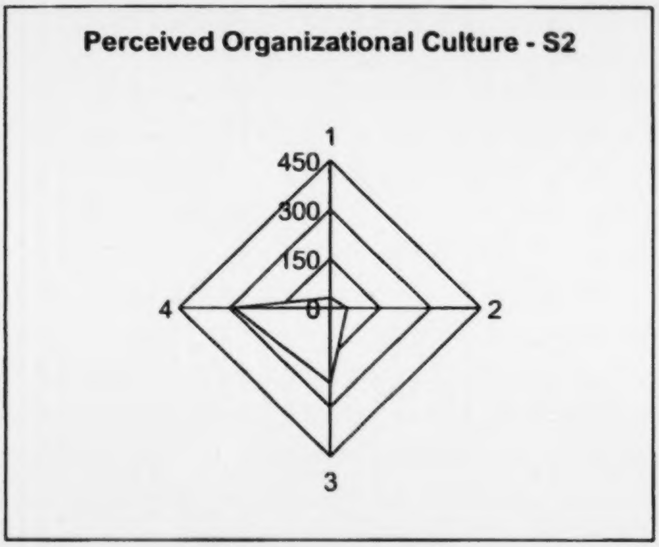


Figure 4

The graph in Figure 4 is also typical of those for people who gave the highest value to dimension 4 – a perception that the organizational climate has a "Results Focus". In this case, the third dimension, "Hierarchical Structure" also tended to receive a fairly high score. This individual had an average score of 0.67 for experience with course management shell software, 0 for experience with web authoring software, and an average score of 4.5 (out of 7) on an Internet self-efficacy variable, which was below the overall average for the group that replied to the survey. That is, a high score on "Results Focus" corresponds to low scores on the three Internet related variables.

Discussion and Conclusions

The results are suggestive of a strong relationship between perceived organizational climate and involvement in utilizing the Internet. Both a general index of Internet self-efficacy as well as two measures of experience with Web support software were shown to be related to this organizational climate, with the dimension of "Employee Focused" being positively related to use of the Internet and the dimension of "Results Focused" being negatively related to use of the Internet. While much attention has been given to specific support strategies to aid in helping faculty become more involved with e-learning, one should not lose site of the impact of the overall perceived organizational climate as a contributing factor to the incorporation of Internet related activities in instructional activities. In general, it appears that an organizational climate that is "Employee Focused" is more likely to result in activities that involve innovation and exploration, such as the learning of new Web-related skills. Keeping in mind that the entire field of Web-based educational courseware development and delivery is presently in a state of rapid evolution, such a supportive organizational climate is important for staff members to continue to play with new ideas that will eventually impact on the overall effectiveness of the institution.

References

Auter, P. J. & Hanna, M. S. (1996). The challenge of developing on-line courses. [ED 406 701] Last accessed May 1, 2002.

Barath, T. (1998). Models and concept of effectiveness in public education. Paper presented at 23rd ATEE Conference, Limerick, Ireland. http://www.jate.u-szeged.hu/~barath/tanulm/ATEE98.htm Last accessed May 1, 2002.

Dastmalchian, A. (1999). Organizational culture profile of the Faculty of Education: A summary report. Internal report, University of Lethbridge, Lethbridge, Alberta, Canada.

Eastin, M. S. & LaRose, R. (2000). Internet self-efficacy and the psychology of the digitial divide. Journal of Computer-Mediated Communication, 6 (1).

Howard, L. W. (1998). Validating the competing values model as a representation of organizational cultures. International Journal of Organizational Analysis, 6 (3), 231-250.

Isaacs, N. (1999). Technology marches on. InfoWorld, 21 (28), 77-78.

Kelley, H., Higgins, C., & Compeau, D. (1999). Attribution analysis of computer self-efficacy. Proceedings of the Fifth Americas Conference on Information Systems (AMCIS '99), pg. 782-784. Milwaukee, WI: AIS.

McMurray, D. W. (2001). The importance of 'goodness of fit' between organizational culture and climate in the management of change: a case study in the development of online learning. Alt-J: Association for Learning Technology, 9(1), 73-83.

Quinn, R. E. & Rohrbaugh, J. (1983). A spatial model of effectiveness criteria: Towards a competing values approach to organizational analysis. Management Science, 29 (3), 363-377.

Quinn, R. E., Faerman, S. R., Thompson, M. P. & McGrath, M. R. (1996). Becoming a master manager: A competency framework. 2nd ed. New York: John Wiley.

Rogers, C. S. & Laws, P. (1996). Successes and lessons learned in an on-line course on socioemotional development. [ED415 830] Last accessed May 1, 2002.

Wallace, P. (1999). The psychology of the internet. Cambridge: Cambridge University Press.

Distance Education Quality:
The Resources—Practices—Results Cycle and the Standards

Dr. Cathy Cavanaugh, Curriculum and Instruction, University of North Florida, USA. ccavanau@unf.edu

Abstract: The development and implementation of effective distance education happens in an iterative cycle. The three stages in the cycle are (1) procurement and preparation of the resources necessary to meet the distance education goals, (2) delivery of instruction using the best practices from education, business and research, and (3) analysis of the results of distance education to gauge achievement of the goals. Each stage of the Resources–Practices–Results (RPR) cycle continually revisits lessons learned in the other stages and builds upon the successes realized in the other stages. This paper explores the match among the established success factors incorporated into the RPR cycle and six sets of distance education standards published by higher education boards and councils in the UK and in the US at national and regional levels. There is variation in the degree to which the standards address the RPR success factors.

Defining Quality

In its December 2000 report to Congress, the Web-Based Education Commission made high quality online educational content one of its seven critical issues. In order for a student or institution to determine whether quality has been achieved, quality must be defined. Primarily, distance education programs must serve institutions in meeting their goals. A central goal of education is developing independent learners who can capably apply their knowledge to new situations. To ensure that distance education offerings meet this goal, providers must identify desired learning outcomes and instructional methods. Quality indicates that instruction is effective and appropriate. The definition of quality may include quantitative elements such as completion rates, student performance, and student evaluations of the learning experience. Qualitative dimensions may include ratings of teaching-learning events, materials, learning process, pace, activities, content and options offered to students. Several higher education accrediting and policy groups have recently released distance learning standards as guides toward quality improvement.

The Quality Distance Education Cycle

The process of developing and implementing effective distance education happens in an iterative cycle. Broadly considered, the three stages in the cycle are (1) procurement and preparation of the resources necessary to meet the distance education goals, (2) delivery of instruction using the best practices from education, business and research, and (3) analysis of the results of distance education to gauge achievement of the goals. Each stage of the **Resources–Practices–Results (RPR)** cycle continually revisits lessons learned in the other stages and builds upon the successes realized in the other stages (Cavanaugh 2002). Each stage requires participation of all stakeholders, including students, instructors, support and design professionals, administrators, and the community. The success factors included in each stage are based on decades of research and experience with learners from professions, higher education and K-12 education (Barker, 1999; Bruce, Fallon & Horton, 2000; Cavanaugh, 1999; Educational Development Associates, 1998; Fredericksen, E., Peltz, W. & Swan, K., 2000; Institute for Higher Education Policy, 2000; Mantyla, 1999).

This paper explores the match among the established success factors incorporated into the RPR cycle and the distance education standards published by higher education boards and councils.

The Resources Phase of the RPR Cycle

The resources required to sustain a quality distance education program exist to support students, faculty, and the program or institution toward achieving the goal of effective and appropriate learning. Responsive and flexible human resources, knowledge, skills, policies, procedures and technical infrastructure enable quality practices and contribute to quality results. Procurement, development and adaptation of resources are ongoing processes.

Success factors for the Resources phase:

- Institutional policy that values distance education
- Strategic plan for delivering distance education to students
- Stakeholder analysis to determine needs of graduates
- Financial commitment that gives the direction regarding program implementation
- Team support for distance educators and students
- Appropriate technology infrastructure
- Program standards to guide course design and delivery
- Program review to ensure that all components of the program meet standards and to ensure that the standards contribute to program goals
- Effective communication of policies and expectations to students
- Student services: information, advising, orientation, and security
- Information privacy
- Qualified, experienced staff and faculty
- Community involvement in the program's goals, policies, and outcomes
- Information provided to faculty about teaching in the distance learning environment
- Instructor release time for course development
- Instructor training in distance education pedagogy and technology
- Course design and delivery assistance
- Well-designed and appropriate learning materials
- Student orientation and training
- Student access to learning resources and instructors
- Technical support for instructors and students
- Technology plan to communicate goals to all users

The Practices Phase of the RPR Cycle

With the right resources in place, the stage is set for dramatic distance learning performance. At this point the spotlight shifts from the institution to the instructor. Quality distance teaching begins with the careful design of courses, materials and learning activities. Next, the instructional practices employed during instruction will aim at developing independent learners with the ability to transfer their learning to novel situations. Throughout the course, effective communication and community building are essential foundations for all events.

Success factors for the Practices phase:

- Focus on content and students
- Relevant and important skills and knowledge addressed in courses
- Structured information presented in motivating context
- Social strategies to promote student comfort, control, challenge
- Fast feedback from instructors to students
- Consistent design throughout each course
- Highly interactive activities for student engagement

BEST COPY AVAILABLE

- Authentic communication among students, instructors and experts
- Course activities designed to maximize student motivation
- Activities focused on high-level cognitive skills
- Development of information literacy
- Development of applied technical skills

The Results Phase of the RPR Cycle

The only way to know whether a distance education program has achieved quality is to compare the program results to established quality benchmarks. Measures of quality are tied to institutional goals, and account for the specific context of the program. To maintain success, a distance education program evaluation must account for institutional and instructional factors as well as student factors. Evaluation of course and program results is a continual process that involves all stakeholders and requires a wide range of tools. Success is evaluated by through assessment of student learning, program review, and program accreditation.

Success factors for the Results phase:

- Student independence developed through opportunities for self-assessment
- Peer review of student work as a professional experience
- Creation of student portfolios to showcase accomplishments
- Varied assessments for an accurate view of student abilities
- Open-ended assignments to increase thinking skills and reduce cheating
- Secure online testing
- Ongoing course evaluation by students
- Evaluation of program by students and faculty
- Review of program outcomes and components by all stakeholders
- Program accreditation

Standards

Worldwide, organizations with an interest in distance education have published standards to guide institutions and instructors in delivering quality courses and programs. Standards have been developed by regional and national higher education accrediting bodies, by national education labor unions, and by national councils concerned with higher education and distance learning.

Title of standards document	**Agencies**	**RPR success factors addressed**	**Web address**
Distance Learning Guidelines	The Quality Assurance Agency for Higher Education. UK	10	http://www.qaa.ac.uk
Standards in Open and Distance Learning	Open and Distance Learning Council. UK	10	http://www.odlqc.org.uk
Distance Education Guidelines for Good Practice	Higher Education Program and Policy Council of the American Federation of Teachers. US	16	http://www.aft.org

Evaluation of Distance Learning Programs	National Council for Accreditation of Teacher Education	14	http://www.ncate.org
Principles of Good Practice	Southern Regional Education Board. US	17	http://www.electroniccampus.org
Distance Education: Definition and Principles	The Commission on Colleges Southern Association of Colleges and Schools. US	19	http://www.sacscoc.org

Table 1: Standards used in this analysis

The *Distance Learning Guidelines* of The Quality Assurance Agency for Higher Education in the UK "offer advice on assuring the quality and academic standards of higher education programmes of study provided through distance learning" and "are concerned with arrangements made by UK universities and colleges to provide programmes of study by means of distance learning" (QAAHE 2002). The standards will be reviewed and become the starting point for a code of practice for distance learning.

> The guidelines have been produced at the request of the distance learning community in the United Kingdom, which has recognised not only that the continued development of this form of higher education and its worldwide acceptance depend upon rigorous quality assurance, but also that there are many areas in which the usual ways of doing things for 'on-campus' provision are not necessarily appropriate in the context of distance learning (QAAHE 2002).

The Open and Distance Learning Council of the UK developed *the Standards in Open and Distance Learning* to apply across the range of open and distance learning. The Council accredits ODL programs meeting the standards, and acts as a clearinghouse of information on ODL providers for students. An independent body, the Council was set up at the request of government to enhance quality in education and training, and "to protect the interests of learners, through the accreditation of open and distance learning providers. Accreditation includes a rigorous assessment of a college's administrative and tutorial methods, educational materials and publicity. Accredited colleges are monitored to ensure that students continue to receive good service, and are re-assessed at least once every three years." (ODLC 2002)

The Higher Education Program and Policy Council of the American Federation of Teachers (AFT) in the US created the *Distance Education Guidelines for Good Practice*. The AFT, a labor union, developed the guidelines from distance learning literature and from surveys of distance educators. A goal of the standards project was to specify in detail practices found to be effective. The guidelines were published to "assist faculty members teaching, or preparing to teach, distance education courses, as well as higher education locals negotiating distance education issues with management" (AFT 2000). The guidelines are also designed to serve "college administrators and public officials who want to put quality at the center of their technology programs, as well as other organizations around the country" (AFT2000). The primary focus of the standards is the college credit-bearing two-year, four-year and graduate program.

The National Council for Accreditation of Teacher Education (NCATE) in the US released the *Evaluation of Distance Learning Programs* as a guide for evaluators of teacher preparation programs. Distance learning components are subject to the same standards as other components of accredited teacher preparation programs.

The Southern Regional Educational Board (SREB) in the US helps students find in high-quality courses and programs at colleges and universities in the SREB region. The *Principles of Good Practice* "were developed to assure students about the quality of courses and programs at the Electronic Campus. The principles draw upon the work of the Western Interstate Commission for Higher Education and other organizations. All courses and programs to be listed in the Electronic Campus have been reviewed against the Principles of Good Practice by the offering colleges or universities and have been coordinated through the state higher education agency" (SREB 2001).

The Commission on Colleges Southern Association of Colleges and Schools is the recognized regional accrediting body in the eleven U.S. Southern states and Latin America for institutions of higher education. "In order to facilitate the evaluation of distance education throughout the United States, the regional accrediting associations have agreed upon the following definition and principles. This agreement is based on an extension of the Principles developed by the Western Interstate Commission on Higher Education" (SACS 2000).

The success factors of the RPR cycle include practices at the instruction, program, and instructor levels. Because of the varying foci of the groups producing distance education standards, there is variation in the degree to which each set of standards matches the RPR success factors. The two sets of UK standards addressed the fewest (10 each) of the 44 success factors, with the matches occurring in the areas of program policy and review, accreditation, student evaluation and support, and developing student skills. The two sets of standards developed by national agencies in the US addressed many more (14 and 16) of the success factors. The factors addressed by the US national standards included student and instructor support, program planning and review, instructor qualifications, course interactivity and student assessment. The two sets of standards created by regional agencies in the US addressed the highest number of success factors (17 and 19). Areas covered include student and instructor support, program planning and review, instructor qualifications, course interactivity, student assessment, learning materials, and information privacy.

Only 13 of 44 success factors were not specifically addressed by any of the reviewed standards documents. Factors not mentioned in the standards related to involvement of community members or stakeholders in course or program review processes, and to specific teaching strategies found to be effective in distance education, such as motivation-building, teamwork, peer review, portfolio assessment, open-ended assignments, and social strategies leading to student success.

Together, the UK, US and regional distance education standards reviewed addressed the majority of the success factors identified in the literature and practice of distance education. The standards should be considered valuable guidelines, but not complete instruction manuals for distance education providers. Providers are encouraged to continue to review the literature to add their own standards of practice to the standards provided by outside agencies.

Conclusion

With the worldwide number of Internet users expected to reach 1 billion by 2005 (Computer Industry Almanac, 2002), and the increasingly frequent need for employees to update their knowledge and skills to adapt to the rapidly changing workplace, interest in distance education will continue to grow. In response, distance education offerings will grow, and competition for students will grow. Students online have access to any online course, and the tools of the web allow students to quickly compare courses. A strength of distance education is its potential to focus the learning process on the student. Courses and programs that emphasize their focus on the student's strengths and needs will succeed in attracting students. In order to build their reputations and keep students, courses and programs must reach quality goals. High-quality distance education achievement is the outcome of the dedication of all constituents in the continual quest for the best possible resources, practices and results. With increased need for new career skills and improvement in delivery technology, distance education students will demand evidence of quality and authenticity in distance courses. It is imperative that distance education providers implement and review quality benchmarks regarding Resources-Practices-Results in response to the needs of students, employers and the community. Educational institutions must continue to develop and maintain standards, and they must clearly communicate those standards to the public. When students benefit from an education program that meets their needs, the community benefits as well.

BEST COPY AVAILABLE

References

Barker, K. (1999). Quality guidelines for technology-assisted distance education. Washington, DC: U.S. Department of Education Office of Learning Technologies.

Bruce, B., Fallon, C., & Horton, W. (2000). Getting started with online learning. Macromedia, Inc. Online at http://www.macromedia.com/learning/online_learning_guide.pdf

Cavanaugh, C. (2001). The Effectiveness of Interactive Distance Education Technologies in K-12 Learning: A Meta-Analysis, *International Jl. of Educational Telecommunications* 7(1), 73-88.

Cavanaugh, C. (2002). Distance Education Quality: Success Factors for Resources, Practices and Results in *The Design and Management of Effective Distance Learning Programs*. Discenza, R., Howard, C. & Schenk, K., Eds. Hershey, PA: Idea Group Press.

Computer Industry Almanac, Inc. (2002). Internet Users Will Top 1 Billion in 2005.
Wireless Internet Users Will Reach 48% in 2005. Arlington Heights, IL: Author. Online at http://www.c-i-a.com

Educational Development Associates. (1998). What quality distance learning courses for an institution? Las Cruces, MN: Author.

Fredericksen, E., Peltz, W. & Swan, K. (2000). Student satisfaction and perceived learning with online courses: principles and examples from the SUNY learning network. Journal of Asynchronous Learning Networks, 4 (2).

Higher Education Program and Policy Council of the American Federation of Teachers. (2000). Distance Education Guidelines for Good Practice. http://www.aft.org

Institute for Higher Education Policy. (2000). Quality on the line: benchmarks for success in internet-based distance education. Washington, DC: Author.

Mantyla, K. (1999). Interactive distance learning exercises that really work. Alexandria, VA: American Society for Training and Development.

National Council for Accreditation of Teacher Education. (2000). Evaluation of Distance Learning Programs. http://www.ncate.org

Open and Distance Learning Council. (2000). Standards in Open and Distance Learning. http://www.odlqc.org.uk

Southern Regional Education Board. (2001). Principles of Good Practice. http://www.electroniccampus.org

The Commission on Colleges Southern Association of Colleges and Schools. (2000). Distance Education: Definition and Principles. http://www.sacscoc.org

The Quality Assurance Agency for Higher Education. Distance Learning Guidelines. http://www.qaa.ac.uk

Thinking Outside the Circle: the Design of Face-to-Face Collaborative Learning Facilities

Robert W. Cavenagh
Director of Instructional Technology
Dickinson College
Carlisle, PA 17013, USA
cavenagh@dickinson.edu
http://dickinson.edu/~cavenagh

Abstract: Learners working on collaborative assignments in a face-to-face environment while using computers must engage in social as well as intellectual tasks. Indeed, at the residential undergraduate level, the development of interactive skills is often one of the more important aspects of their collaboration. Many existing facilities support such interaction badly if at all. This writer has undertaken a continuing investigation of persons-computer-facility interaction and has developed a series of learning facilities that appear to strengthen the quality of learner interaction by increasing time on tasks. This report demonstrates the process of creating groupwork oriented class and study spaces, the challenges and variables encountered, and the first pedagogical results of this work-in-progress. It also explores pedagogical issues and strategies for instructors using such arrangements.

Overview:

This paper is about fostering collaboration, and in particular about fostering collaboration among learners who work together in face-to-face environments and use computers. In practice such learners also tend to use computer tools on their own: e-mail, online learning environments such as Blackboard and WebCT, the web itself, PowerPoint, and a variety of other options. Collaboration can take place in a classroom with an instructor, in other learning spaces with an instructor, and in a variety of settings without an instructor present.

The use of collaboration to prompt learner interaction has been much noted in the educational literature. Learners in interactive groups are more likely to play active than passive roles. The participative nature of such learning experiences can lead to social reinforcement for participation from other group members; the negotiations required in interactive activities are also useful in modeling other forms of social interaction, such as occur in many workplaces. Such results are not automatic, however, and faculty need to understand how to nurture these processes.

The rise of useful computer technologies in the last decade---tools such as the World Wide Web or PowerPoint, and (more recently) video editing---and the increasing availability of such technologies in schools, colleges and universities, make these things seem ready-made for collaborative learning activities. Many faculty create assignments requiring groups to use such tools for research or for reporting.

Unfortunately, the actual use of technology by groups can occasion some difficulties. Most computer installations are designed for single users and are not easily shared by groups. When more than two learners attempt using such facilities, one or more tend to hold back, to be passive, to observe at some distance. This is not useful in facilitating the group goals.

I first encountered these problems while teaching classes in Instructional Technology and observed students assuming uncomfortable postures while trying to share a screen with a group. This led in turn to an iterative process of observation, experimentation, and the development of learning facilities and pedagogical procedures.

This paper will recount the paths taken, and will provide a preliminary report on the latest steps, classrooms specifically designed for group work at computers. It will also consider the issues involved in teaching and learning in such environments. You will find updated information at the listed website.

Background:

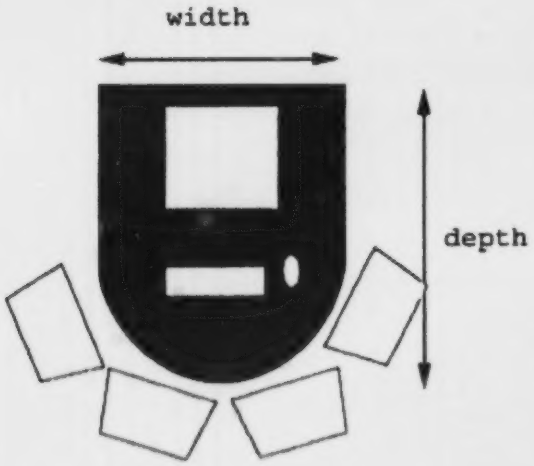
In 1992 I first observed that students who attempted to share a computing task encountered a series of physical barriers. Computer labs were routinely organized in rows, monitors were just large enough for a single user, and the close spacing of computers precluded more than a pair of students sharing a screen. The rapid growth of the Web in the mid 1990's prompted a sense of urgency in solving this problem and a 1998 sabbatical provided an opportunity to undertake some experiments.

In 1972 I studied the design of learning facilities at Indiana University with Visiting Professor Gerald McVey. I was introduced to Robert Sommers' chapter Small Group Ecology, in his 1969 volume *Personal Space*; it then seemed particularly trenchant. It still is. Sommers showed the seating chosen by library users for different sorts of tasks. Those engaged in cooperative tasks tended to select arrangements that facilitated eye-to-eye contact. They also demonstrated a tendency toward adjacency. In the mid-1990's I renewed my acquaintance with Sommers' work and bent it to my purposes.

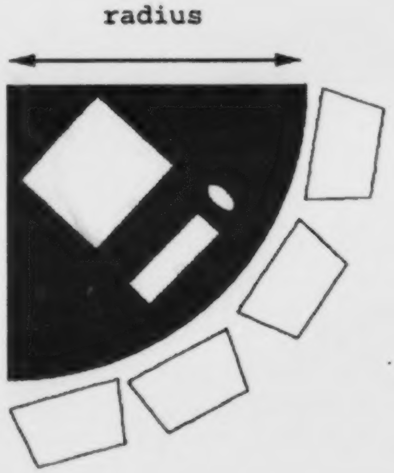
Sommers' insights led me to create a series of cardboard mockups of computer workstations in different shapes and sizes. These were tested with small groups of students. Their feedback in turn resulted in the design and construction of two working prototypes, one shaped something like a horseshoe, the other like a wedge of pie. The stations were provided with large 21 inch monitors and armless chairs with castors, to facilitate easy movement by users. These workstations were placed in a student computing area; faculty were asked to bring or direct their students to these stations, and, with their consent, I observed the student's interactions.

It was quickly apparent that students working at these stations spent greater time on task, that more individuals participated in activities, and that their products were more representative of the group than of some leading individual. This prompted further experimentation on more subtle variations.

The hallmark of all these designs has been the use of a partially circular table, with the learners literally gathered 'outside the circle.' This circular form has become a sort of trademark for our subsequent efforts.



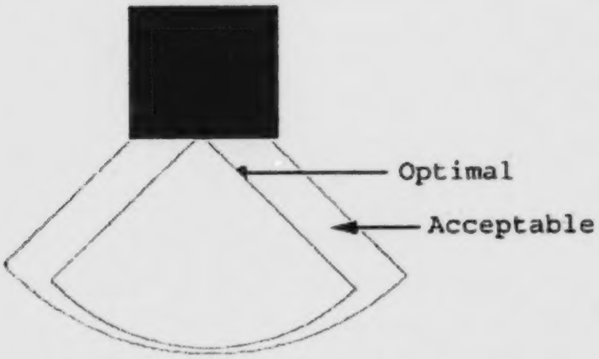
Horseshoe Table



Wedge of Pie Table

The Horseshoe model has proved the most popular design of several we have tried and has become the progenitor of most of our later efforts. The Wedge of Pie model is also effective, but less effective and less popular than the Horseshoe. This apparent difference is probably due to the superior sight lines provided by the Horseshoe model.

These units require satisfactory sight lines AND fields of view, as in the drawing below:



Optimal and acceptable fields of view

In a well-conceived installation, each participant should have good sight lines to the screen and to every other participant, without excessive movement being required. And each participant should sit within at least the acceptable field of view. It is typically the fields of view that determine realistic seating capacity at a particular table.

Our empirical development process led me to postulate some norms for the design and construction of our collaborative stations. The dimensions of the furniture and equipment appear to occupy a narrow range if the stations are to be effective.

The Horseshoe Table needs to occupy a rather narrow range of sizes for effective performance, ranging from 4 to 5 feet in width, and 4 to 5 feet in depth. Width determines seating, or is determined by the desired number of seats. Depth needs to be determined by equipment: larger computers and large CRT monitors require more depth, while smaller computers and LCD monitors can get away with slightly less depth. Here are the combinations we currently favor:

Width	Seating capacity	Monitor (diagonal)	Depth
42 inches	3 (4 very difficult)	19" is adequate	48-54 inches
48	3 or 4	19-21"	48-54 inches
54 inches	4 (5 is difficult)	21-22"	54"
60	4 (5 is manageable)	21-22"	60"

We have found 21-22" monitors to be cost effective in current units, thanks to drops in pricing. We normally configure monitors at SVGA or XGA resolution, as required to insure that everyone can read text adequately. Monitors are set as far back on the tables as is practicable to increase field of view.

Keyboards and mice are simply placed on the tabletops without mouse pads, and passed from one user to another. While we at first anticipated a need for wireless keyboards, the wired version has proved quite adequate. The larger tables also provide adequate room for some ancillary devices such as scanners.

The Wedge of Pie units do function adequately and prove useful in certain locations where corners or rooms are available. The optimal dimensions for these units require a radius from 4 to 5 feet, and, as with the Horseshoe units, larger installations require larger monitors.

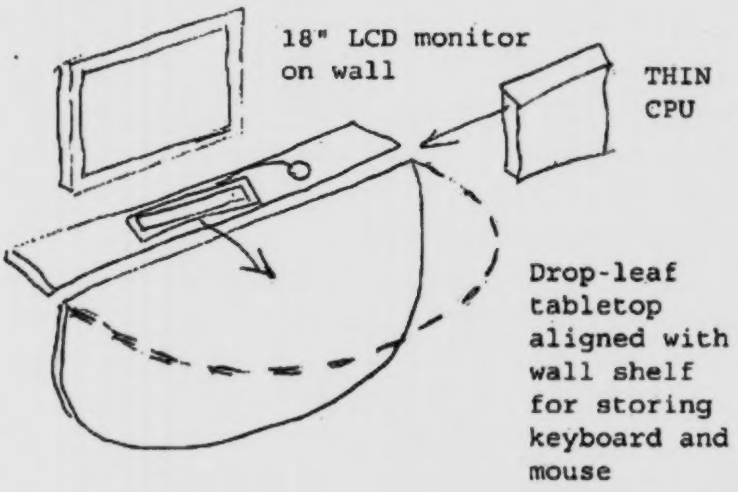
New Options:

The original workstations were used outside of class by students, or by students and faculty. It gradually became clear that some faculty wanted the benefits of such workstations WITHIN their classrooms. This was often expressed as 'responding to class interests,' or 'the teachable moment.'

Our college has responded with energy to the desire of faculty for 'smart' classrooms equipped with a computer and data projector, and for 'studio' classrooms which also have a number of computers for individual students AND a central seminar table. These options do not permit small groups of students to work together, however, and so we have explored other options.

Two new types of facilities have emerged. While similar, they each have distinct features:

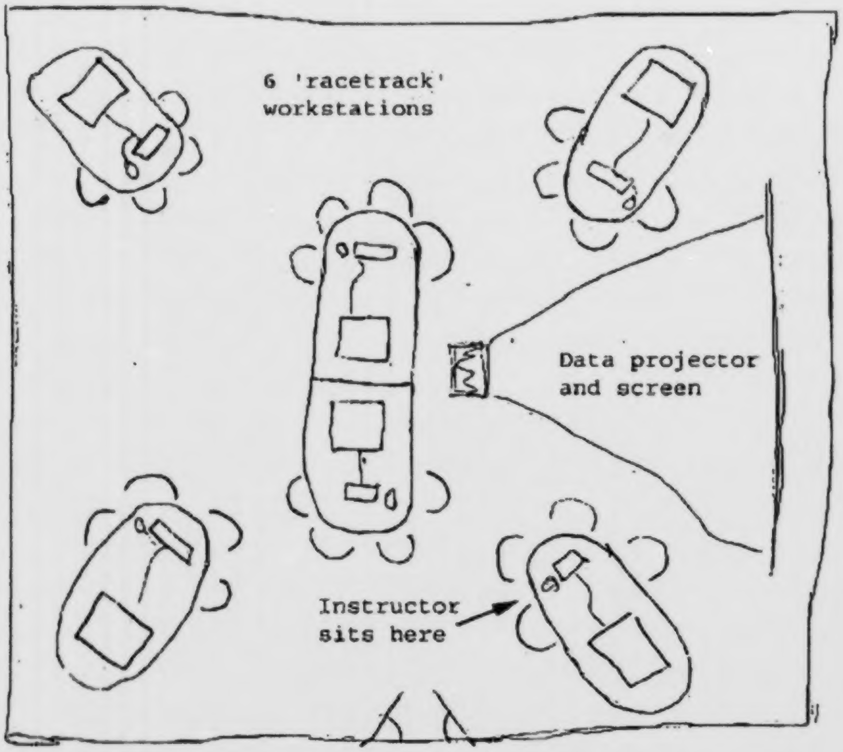
1. A language facility, recently funded, provides for a convertible classroom in which the teacher can change configurations in a very brief time by moving chairs and sending learners to stations that are installed along walls. These are described as the 'barnacle' model and the prototype is under construction as of this writing. (It should be in operation by the time this paper is actually presented, and will be illustrated on the website.) This room is intended to provide maximum flexibility for ongoing classes so that a teacher can show a videotape clip, hold a discussion with all students, send groups to computers, and bring everyone back for a meeting of the whole, all within a single period. This room will be assigned to courses for an entire semester.


18" LCD monitor on wall
THIN CPU
Drop-leaf tabletop aligned with wall shelf for storing keyboard and mouse

The barnacle unit has been designed to occupy only 9-10" of depth along a classroom wall. We are placing 4 units in the initial classroom, along with an instructor's station designed to do double duty as a group workstation. In a classroom equipped with simple tables and chairs, it will be possible to switch modes very quickly. These installations will take up very little floorspace, so will not have a negative impact on existing classrooms. These stations depend on the availability of affordable 18" or larger LCD monitors and the recent availability of compact CPUs that can be mounted on their sides in tower fashion.

BEST COPY AVAILABLE

2. The second facility is somewhat similar in its equipment but radically different in its expected application. (Its equipment is being installed as of this writing and, again, updated information will appear at the website). This model is designed SOLELY for group activities. Located in the Library as part of our Information Commons project, this room is equipped with six workstations each seating up to four learners. Each station is equipped with a compact computer, a scanner, and a large (22" diagonal) monitor. Station dimensions are detailed below. The room also incorporates a data projector and a player for video/DVD. The room is intended to be available on a period-by-period basis for courses, and will be available for use by groups working outside of class at all other times.



The use of an oval 'racetrack' table may seem unusual; the rounded rear of the tables is a somewhat cosmetic feature that responds to the tendency of janitorial staff to align straight lines in furniture with adjacent walls. As we wanted four of the tables to 'float' at roughly 45 degree angles to the walls, we chose to use a circular form at each end.

Both facilities should be regarded as well-informed experiments.

BEST COPY AVAILABLE

Collaborative Learning in face-to-face groups ("f2f")

Any group of faculty will offer a range of motivations for wanting to use collaborative learning. Some simply seek a change from more traditional modes of instruction. Others are committed to group processes because they believe it reflects much of the actual work and learning that takes place 'in the real world.' Still others subscribe to constructivist theories of learning and believe that it is only through their own self-aware and active engagement in the learning process that learners can be come autonomous.

While the notion of collaborative learning has held buzzword status for a number of years and is generally thought to be a "good thing," it is important to isolate several types of collaboration that may be taking place simultaneously.

a. Using technology: every collaborative group in these environments spends some time simply using the relevant technology; this usually involves a learning component and a series of decision components. In creating a PowerPoint presentation, to give a simple example, it frequently happens that some students are more adept with the software than the others. They share a number of simple decisions about what features to use, and some learn technology skills from others. In this instance we often suggest that faculty tell students to 'pass the mouse' to insure that all participants literally have a hand in the mechanical process. This can run contrary to student wishes, as the learners would often prefer to leave the manipulation of the technology to those who are already adept.

   Sometimes the use of the technology is actually the primary learning goal for part of a lesson. Students learning to manipulate library catalogs, for example, may be encountering software that is new to every member of their group, and a strategy for insuring that each group member participates is essential. This is a situation in which the presence of the instructor during the learning session is very important.

b. Much of the time collaboration will entail manipulating higher level, less mechanical concepts. The design rather than the construction of a PowerPoint presentation, or the search for information upon which to base it, is one example. Making decisions about video edits is another. Here, the role of the instructor is more similar to that in traditional class discussions: helping learners to weigh ideas, to consider other options, encouraging the group to find a consensus that exceeds some least-common denominator.

c. Students also engage in a range of social collaborations. Some of these are inevitable and desirable, while digressive behavior needs to be contained. Faculty may do best by encouraging students to focus on assigned tasks rather than remonstrating about digressive behavior. It is important for both students and faculty to recognize that purely social activity is not the same thing as collaborating. However, it is equally important for faculty to recognize that effective collaboration virtually requires a social dimension, and that practice in social negotiation is an important aspect of the process for undergraduates.

These forms of collaboration and perhaps others are all interwoven in practical learning situations. At one moment the group is being social, an another it considers technology, and at still another it works on a higher level goal. The group will alternate rapidly among these modes.

It is also very important to recognize that learners come to the collaborative process with a range of skills and a range of motivations, that they are by no means equals. The recent literature has made it clear that there are differences among learner's success rates in face-to-face and online collaboration. Since some individuals are more confident in working online than in live groups, it makes sense to create both face-to-face and online aspects for group learning tasks. It may well make sense to begin collaborative tasks on line in order to help enfranchise the more reticent members of the group, then use that experience to help cement the face-to-face groups.

My office supports students and faculty using group workstations. Over time, it has become quite evident that some faculty profit from some assistance in structuring assignments, and some students need some feedback or prompting during the learning process. These two needs are in some ways more interesting than the facilities themselves.

Consider this example: A faculty member new to PowerPoint decided that program offered beneficial possibilities in the learning process. The student groups were to manipulate this presentation medium and create presentations that they obtained from external research. The instruction was to 'create a PowerPoint presentation, ' which seemed analogous to the instruction 'write a paper.' The creation of papers, however, is undergirded by years of experience on the parts of both teacher and learners. Few teachers or students have anything approaching that depth of historic experience with PowerPoint. Somewhat predictably the groups created presentations with excessive reliance on transitions and effects that contributed little to the communications and actually reduced quality. The instructor was disappointed by this result, but thought the collaborations had worked well. Conducting a *post mortem*, we discovered that the instructor had felt apprehensive about personal PowerPoint skills so had stayed out of discussions, simply watched the groups from afar. More active feedback to the groups would have prompted more time on the higher level issues, and less on technical frills. In fact, a second round of sessions with the same instructor was found to be much more satisfying.

As antidote to these sorts of problems, I offer faculty a (growing) series of heuristics that can help guide them in using electronic tools for collaboration.

Conclusions:

The results of our most recent experiments will be on hand by the date of this presentation. We have high expectations for both the 'barnacle' and the collaborative classroom models. We will be tracking performance of both in-class and out-of-class users. Our past experience with collaborative facilities has been very positive, and these new facilities should run true to form.

Reference

Sommers, Robert (1969): *Personal Space*. Englewood Cliffs, New Jersey: Prentice Hall

A Case and Implications of Implementing and Evaluating an Online Virtual Learning Community Environment

ABSTRACT

The knowledge distributed web-based learning community (KnowDisLC) based on knowledge sharing for college students has been constructed, implemented and evaluated. The system helps students form a virtual learning community through web-based learning, which they can use to facilitate learning and growth. Ultimately they would like to accomplish the goals of knowledge sharing, resource sharing, information exchange, experience interchange, and emotion communication. Both a point accumulation mechanism and a web-based learning record have been the features of the KnowDisLC system, which prove to stimulate student involvement by allowing them to know about the performance and involvement of themselves and their peers. Most students agree that the community could help them learn more and faster, and most students also confirm that the overall operation and implementation of the system is generally good.

LEARNING COMMUNITY ON THE WEB

Although some research in Taiwan on web-based learning environments and knowledge guidance systems for in-service teachers has noted the concepts of a learning community, none of them has developed any system based on the complete idea of a learning community. However, there are many related systems, documents and research all over the world. Founded on the concept of community of practice, CoVis (Learning through Collaborative Visualization) aims at research related to science learning (climatology and geology) (Pea, 1993). It provides online discussion, e-mail, teleconferencing and other WWW tools to link experts, teachers, students and field workers to form a collaborative learning community. Students may actively learn through participating in knowledge building, knowledge sharing and collaborative-based activities as a member of an online group (Brandon & Hollingshead, 1999).

CSILE (Computer-Supported Intentional Learning Environment) is a kind of collaborative database style of learning community which aims at providing students with strategic tools that can stimulate thinking. In CSILE's collaborative database, students can share knowledge asynchronously. A student can access the thoughts of the present or former students and can leave his own thought for other students. CSILE was used in the context of a community with emphasis on "knowledge building and sharing" instead of "knowledge inoculating." An evaluation by Scardamalia & Bereiter (1994) of the CSILE project clamed that the collaborative learning community formed by students facilitated knowledge building and generated positive learning outcomes with the use of telecommunication technologies. Whereas use of technology does not absolutely make a community occur, a learning community needs to be planned and created.

SYSTEM ENVIRONMENT

The KnowDisLC provides access to utilities that include an ID verification center, news bulletin board, counter of online user number, discussion board, curriculum center, learning activity bulletin, learning resources browsing and sharing, user profile center, expert consultation, website resource searching, opinion bulletin board, point accumulation system, web-based learning record, and system management. Dynamic HTML flexible menu has been adopted in the system to avoid a problem of long screen resulting from too many sub-menus of functional buttons.

The construction of a point accumulation system for learning activity is one of the features of the KnowDisLC system. It displays both the learning score and frequency of visits of each user. It is a reference for performance evaluation of students. To increase student motivation, the system gives users different scores according to their involvement in the web-based learning, e.g. logging on to the system (1 point a day), sharing and provision of file resources, sharing and provision of related websites, participation in discussion (raising questions and making replies), moderating a discussion or conference. The second feature of the KnowDisLC system is its web learning status log, including learning log statistics, conference records, assignment upload statistics, performance statistics for discussion or conference moderators, etc. This facility can be used by students in order to find their learning status at anytime and use it as a reference for correction. The website and file resource browsing and sharing functions are based on the concepts of sharing and provision of knowledge, distributed knowledge, knowledge building, and information exchanging. This is the third feature of the KnowDisLC system. Community members can enter or link to the URL address of a related learning resource site and upload/share or download/browse files of materials related to course subject for the goals of collaborative academic growth.

IMPLEMENTATION AND ISSUES

The aim of the implementation of the KnowDisLC was to observe the collaborative learning that was taking place in the system. Since the development of the KnowDisLC, we have been using it as part of teaching materials in the class and self-oriented learning materials after the class of "Distance Education" in my Department. Students study the "Distance Education" course through learner-centered, inquiry-based, discussion-oriented, and project-based learning activities in the virtual social community on the Web environments.

It began in 2001 Spring Semester with 67 college students in our department as well as 1 teacher, 1 online assistant and 1 field expert. It has now expanded to include around 103 college students as well as 2 teachers, 2 online assistants and 2 field experts in "Distance Education" course. The KnowDisLC is committed to supporting the spread of project-based learning in which students formulate their own questions, exchange their information, provide distributed knowledge, share learning resources, collaboratively work on their project and homework, build their own knowledge, while being guided and facilitated by their teachers, field experts, and experienced students (Cang, 2000).

The course required students to evaluate other students' posts and replies in discussion, information sharing and resource provision. The teacher required students to collaboratively find a case study using real-world problems or cases and to collaboratively analyze information and propose a resolving method as part of their response.

We used project-based collaborative learning to develop transferable skills, enhance knowledge-building, facilitate teamwork and mentor skills of the students. Students were encouraged to do collaborative exercises by sharing ideas, exchanging information, providing resources, and constructing knowledge toward finding a solution to their common learning objectives. Students shared the idea and knowledge by uploading learning materials, providing the addresses of web sites, and posting the idea in the discussion board. During group collaborative learning and doing project, groups of 3-4 students solve a problem or create a teamwork product collaboratively through the use of a conference room, discussion board, e-mail, and mailing listserv. Groups of 3-4 students were assigned problem-based learning exercises in the courses to solve collaboratively.

Implementation results of the KnowDisLC showed that using the telecommunication technologies took more time than learning the on-line course materials and participating in the learning activities on the web. Based on a review of the records of web activities, the more actively the students participated in the web-based activities the better performance students had in classroom instruction. In other words, highly motivated students generally participated much more than poorly motivated students. It reveals that there is a positive correlation between the participation in web-based learning activities and the participation in classroom instructional activities.

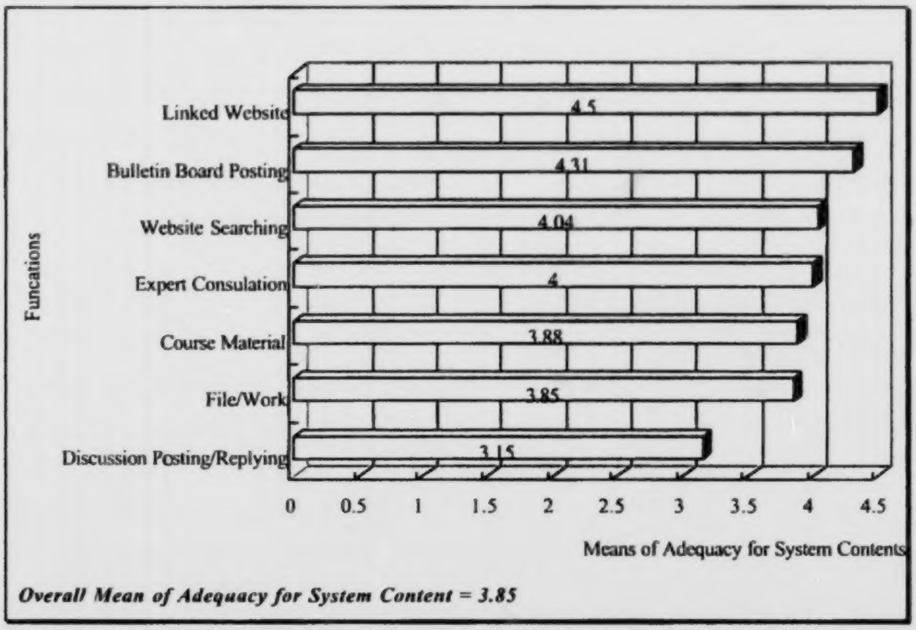
This results are quite consistent with a study of the Virtual Classroom by Hiltz' (1993) concluding that students with a high level of academic performance and self-motivation in classroom setting would have more positive outcomes on online activities. Using the telecommunication tools on the virtual learning environment, college students have access to large amount of information and knowledge provided by their peers in the class and experts in the field.

SYSTEM EVALUATION

An evaluation of the system was conducted right after the 3-month implementation of the KnowDisLC. Its purpose was to understand the effects and pertinence of the implementation of the KnowDisLC in university education. A target group of the evaluation consisted of 67 students who took the courses. They were all required to use KnowDisLC and gave comments related the system. The evaluation was conducted through a questionnaire survey; a self-developed 5-point Likert rating scale evaluation form was distributed to the students. After the evaluation, students completed the questionnaire. The questionnaire included six main evaluation items : system contents, screen design, user interface, system functions, use frequency, and learning effects. Resulting from the survey of students' satisfaction showed that in general, they rated their learning experiences in the web-based learning environment consistently higher than those in the instruction of traditional classrooms. As far as the students' feedback on the satisfactions for the content, interface, and functions of KnowDisLC system reported that the system interface was easily accessible and usable to users.

System Content

In the comparison of the content adequacies of KnowDisLC elements, students perceive that *linked website* is the most adequate element for content (mean = 4.5). As high as 92.3% of the students regard *linked website* adequate to support their learning. Only 7.7% of the students think otherwise. The subsequent elements are *bulletin board posting* (mean = 4.31), *website searching* (mean = 4.08) respectively. Adversely, students perceive that the *discussion posting and replying* (mean = 3.15) is the least adequate elements for content. 34.6% of the students regard that quality and quantity of the *discussion posting and replying* are adequate to support their learning. 23% of the students think otherwise. These results reveal that students' posting and replying in discussion board need to be improved. As a matter of fact, we also regard that there are actually much room for improvements such as course materials, and file/work. Figure 1 shows the distribution of the means for student comments on the content adequacies of KnowDisLC elements.



Overall Mean of Adequacy for System Content = 3.85

Figure 1. *The distribution of the means for student comments on the content adequacies of KnowDisLC elements*

User Interface

In the comparison of the interface applicability of KnowDisLC elements, students perceive that the interface of *opinion bulletin board* is the most used-friendly (mean = 4.46). As high as 92.3% of the students regard the interface of *opinion bulletin board* easy and convenient to operate. No one (0%) thinks otherwise. The subsequent elements are *online registration* (mean = 4.38), *ID verification center* (mean = 4.35), and *website sharing* (mean = 4.27) respectively. Adversely, students perceive that the interfaces of *synchronous conference room* (mean = 3.58), *online calling* (mean = 3.69), and *course material* (mean = 3.81) are the less used-friendly. As high as 61.7% of the students regard that the interface of *synchronous conference room* easy and convenient to operate, however, 26.9% of the students think otherwise. Figure 2 shows the distribution of the means for student comments on the interface applicability of KnowDisLC elements.

BEST COPY AVAILABLE

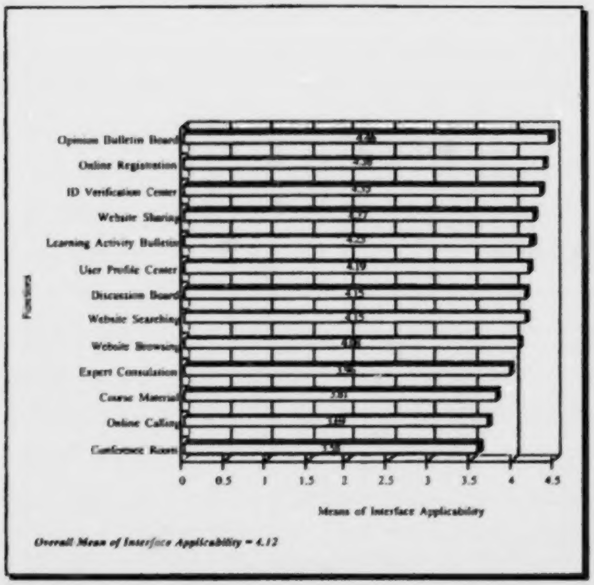


Figure 2. *The distribution of the means for student comments on the interface applicability of KnowDisLC elements*

System Functions

In the comparison of the functional applicability of KnowDisLC elements, students perceive that *ID verification center* is the most applicable-functionally element (mean = 4.31). As high as 80.8% of the students regard function of *ID verification center* applicable to use. No one (0%) thinks otherwise. The subsequent elements are *activity bulletin board* (mean = 4.19), *news bulletin board* and *asynchronous discussion board* (mean = 4.15) respectively. Adversely, students perceive that the *website index* (mean = 3.5), *file/work resource index* (mean = 3.54), and *synchronous conference room* (mean = 3.54) are the less applicable-functionally elements of the system. 53.8% of the students regard that the *website index* is applicable to use, however, as high as 26.9% of the students think otherwise. Figure 3 shows the distribution of the means for student comments on the functional applicability of KnowDisLC elements.

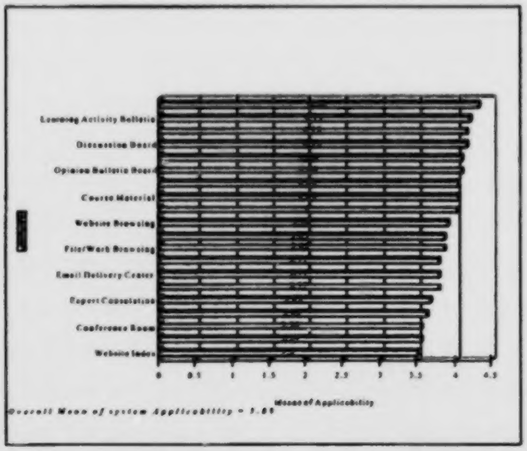


Figure 3. *The distribution of the means for student comments on the functional applicability of KnowDisLC element*

BEST COPY AVAILABLE

Use Frequency

Most students approve of the overall operation and instructional application of the KnowDisLC system, whereas, there are still some functional elements that are rarely used by students. The less-frequently used functions include *expert consultation, website sharing, online calling, ………, synchronous conference room* and so forth. The results show that although the system functions and learning effect are generally both good, there is still wide room for improvement with uses, operation, implementation and management of the system.

This low use of the system in comparing with the system contents, screen design, user interface, system functions, and learning effects, the performance of the users in terms of system use seems to be far behind. This phenomenon shows that even if the system is a rather good one, the users may still encounter other practical difficulties in using it. These difficulties might be the key factors that decrease the successful possibility of online learning community. Therefore, it has turned out to become an issue worthy of further research and investigation.

In the comparison of the use frequencies of KnowDisLC elements, students perceive that *news bulletin board* is the most frequently used element (mean = 4.19). As high as 76.9% of the students frequently visit *news bulletin board* to see news announced by the teacher or system manager. No one (0%) rarely visit *news bulletin board*. The subsequent elements are *asynchronous discussion board* (mean = 3.42), and *website searching* (mean = 3.42) respectively. Adversely, students perceive that the *expert consultation* (mean = 2.0), *website sharing* (mean = 2.58), *and online calling* (mean = 2.77) are the most rarely used elements of the system. No one frequently ask question for the expert (0%). As high as 65.4% of the students rarely ask question for expert. In comparison with overall mean of the system use (overall mean = 3.25), the means of use frequencies for these three least used elements seem to be quite behind. Figure 4 shows the distribution of the means for student comments on the use frequencies of KnowDisLC elements.

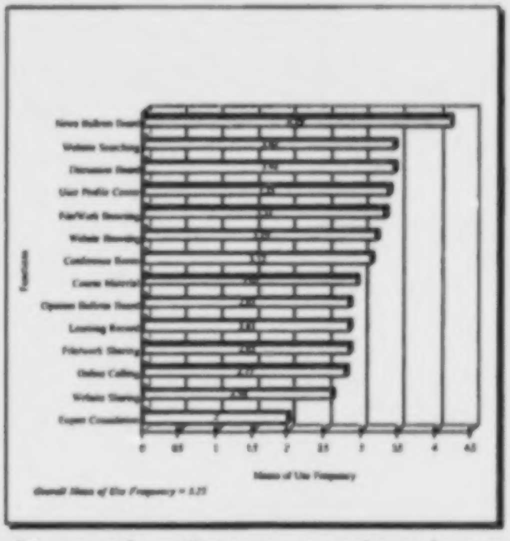


Figure 4. *The distribution of the means for student comments on the use frequencies of KnowDisLC elements*

Impacts on Learning

In terms of negative comments on the effects of KnowDisLC, 11.5% of students regard that the articles in the *asynchronous discussion board* posted are not beneficial to their academic growth (mean = 3.65). As high as 23.1% of the students regard that the communication mode in the *asynchronous discussion board* cannot enhance the interaction between them and other students (mean = 3.46). 15.4% of the students regard that the discussion mode in the *online synchronous conference room* cannot promote their abilities of discussion with people (mean = 3.5). 11.5% of students regard that the *opinion bulletin board* cannot make them know the feelings of other students and cannot achieve the goal of emotion communication (mean = 3.58). However, averaging the above two items (mean = 3.65+3.46 = 3.56), the mean of usefulness for the *asynchronous discussion board* will be 3.56; thus the perceived least beneficial element of the KnowDisLC system will be the *online synchronous conference room* (mean = 3.5).

BEST COPY AVAILABLE

In the comparison of the effects of KnowDisLC elements, students perceive that *point accumulation system* is the most beneficial element (mean = 4.23). As high as 80.8% of the students regard *point accumulation system* useful to stimulate learning motivation and make their learning outcomes better (mean = 4.23). Only as low as 3.8% of the students think otherwise. The subsequent elements are *resources browsing* (mean = 4.08), *course material* (mean = 4.08), *file/work* (mean = 4.08), and *linked website* (mean = 4.0) respectively. Adversely, students perceive that the *online synchronous conference room* (mean = 3.5), *asynchronous discussion board* (mean = 3.56), and *opinion bulletin board* (mean = 3.58) are the less beneficial elements of the system. *online synchronous conference room* is the least effective element (mean = 3.5). However, in terms of interactive effect, it is slightly more interactive than *asynchronous discussion board*. As high as 15.4% of the students regard that the discussion mode in the *online synchronous conference room* cannot promote their abilities of discussion with people (mean = 3.5). In comparison with overall mean of the system (overall mean = 3.89), the means of effects for these three least effective elements seem to be quite behind. Figure 5 shows the distribution of the means for student comments on the effects of KnowDisLC elements.

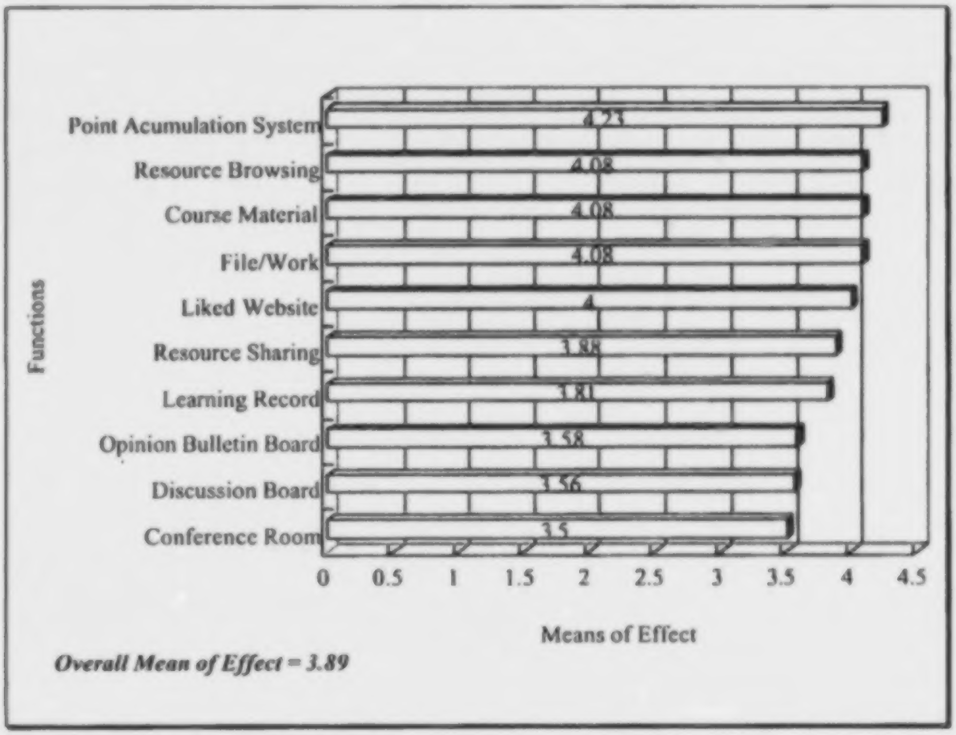


Figure 5. *The distribution of the means for student comments on the effects of KnowDisLC elements*
Note: Resource includes file/work resource and website resource

IMPLICATIONS AND LESSONS LEARNED

There were many lessons learned regarding the KnowDisLC system, from physical setup to technological support, to teachers' teaching preparation, and to students' learning experiences and so forth. Important considerations about technological support were: the reliability of the server and the system software, the technical support available for the users, less waiting time when browsing and navigating system, friendly use of the system interface, and easy access to the system content, and so forth.

Over the past semester, the successes of the KnowDisLC have argued strongly for the value of web-enhanced learning environment for college students. The creation and implementation of the KnowDisLC system has obtained

BEST COPY AVAILABLE

high support from students and teachers, therefore additional materials for other courses provided by the Department are being developed. Integrating traditional classroom instruction and web-based learning appears to have become a major departmental focus primarily due to the greatly successful experiences of the creation and use of the KnowDisLC system.

Based upon the observation of the learning behaviors taking place at the KnowDisLC, it is apparent that the facilitators such as teacher, tutor, and online teaching assistant have an important role to strike the desired balance of motivator, mentor and mediator which can affect the success of a learning community. The role of teacher is changed from a knowledge provider to an informational facilitator and a learning mentor. Teacher has become guides and coaches, while students have taken a more active role during the learning process in the KnowDisLC. Students in the learning community gain more attention from instructor and online assistant. Additionally, they may spend more time thinking about, responding to, and exploring, whatever question peers or instructors give.

One interesting observation is that the grade point computing system resulted from the records of web activities such as login frequency, staying time on web, discussing frequency (post and reply), the frequency of learning resources provision etc. may highly stimulate more students to actively participate web-based learning activities. Additional, allowing students to view each other's work and project appeared to result in a better expression of ideas among them.

The web-based learning environment may play a great role of equalizer through providing an alternative for students to participate in the web's interactive activities such as asking questions and discussions, and to actively give feedback to each other and to instructor. Just like Palloff and Pratt (1996) claim, introverted students who may not feel comfortable speaking out or asking for help in a face-to-face classroom may flourish in an online learning community. Moreover, most of students gain the gratification of control over their time during online learning and the opportunity to be more thoughtful about their interactions (Palloff and Pratt, 1996, p.164). This kind of equal opportunity is especially suitable to those who shy away from speaking up when face-to-face in traditional teaching situation but who eagerly share their ideas on the web.

Web-based learning absolutely has the positive effects on student participation and learning outcomes. Moreover, it can encourage peer-to-peer interaction, increase student motivation and engagement in the learning process, and reduce some barriers of participation that are present in face-to-face mode. This study identified that a web-based learning environment appears to promote comprehensive and critical thinking as well as to empower and engage active learning. The KnowDisLC has reshaped individual and active learning experiences for many students at our university. Encouraged by the success of the KnowDisLC, we are intended to engage in developing the other learning subjects.

CONCLUSIONS AND FUTURE WORKS

The research has designed, constructed and evaluated a distributed knowledge learning community as an aide to web-based learning, in hopes that it will help students form a virtual learning community through web-based learning. They can use the system to facilitate learning and academic growth through the curriculum center, discussions, conferencing, learning resources browsing and sharing, expert consultation, web resource searching, and opinion bulletin board. Ultimately they would like to accomplish the goals of knowledge sharing and provision, resource sharing and provision, information exchange, experience interchange, and emotion communication. The KnowDisLC provides college students with effective telecommunication and collaboration tools, and students' responses toward KnowDisLC have been very positive and encouraging. The KnowDisLC thus facilitates academic growth and interpersonal interaction of college students through collaborative learning environments and telecommunication tools in the context of a virtual community.

Both a point accumulation mechanism and a web-based learning record have been the features of the KnowDisLC system, which prove to stimulate student involvement by allowing them to know about the performance and involvement of themselves and their peers. The system has been officially implemented in a university course for 3 months, and both the implementation and operation are running smoothly. The system evaluation shows that most users are satisfied with the system contents, screen design, user interface, and system functions. Most students agree that the community could help them learn more and accelerate their professional growth. In addition, they also confirm that the overall operation and implementation of the system is generally good.

With regards to use frequency of the KnowDisLC system, most students approve of its overall operation and instructional application. However, there are still some functional elements that are rarely used by students. What we have received negative feedback are the less-frequently used functions such as *expert consultation, website sharing*, and *online calling*. The results show that although the system functions and learning effects are generally both good, there is still much room for improvement with using and management of the system functions.

Standard computer-mediated communication technologies of the Internet and the Web are used and benefit has been obtained from the development in the KnowDisLC system. The establishment of a virtual distributed and collaborative learning community will be an important outcome dedicated to college teaching and learning. KnowDisLC certainly has its problems and limitations, but the lesson of its developing and implementing experience in creating a lively social system is that there are knowledge-sharing mechanisms that can have an important effect on encouraging active learning and thus successful online learning communities.

In the future, we will reinforce: expansion and maintenance of system functions; the automatic management, and learning management in particular(such as a mechanism of learning resources establishment and management); web page browsing record and learning path management; web-based learning duration and log-out time; learning resources and website browsing time; automatic approval functions of website upload; graphic display and full text indexing of discussions board and activity bulletin; cross-disciplinary uses of the system; an online assessment (e.g. web-based portfolio), in order to optimize the system. Subsequent research will also include qualitative and quantitative experimental studies of the system, in order to understand more about students' learning behavior pattern and its authentic effects on the students.

REFERENCES

Brandon, D. & Hollingsheda, A. (1999). Collaborative learning and computer-supported groups. *Communication Education, 48*(4), 109-126.

Chang, C. C. (2000). Evaluation of web-based distributed collaborative learning community based on knowledge building for academic growth of college students. In *Proceedings of 12th World Conference on Educational Multimedia, Hypermedia and Telecommunications 2000 (pp.1253-1254)*, June 26-July 1, Montreal, Canada.

Hiltz, S. (1993). Correlates of learning in a virtual classroom. *International Journal of Man-Machine Studies*, 39, 71-98.

Hsinchu Teacher College. (1999). *DALE (Distance-assisted learning environment)*. http://www.dale.nhctc.edu.tw and http://kids.dale.nhctc.edu.tw

Palloff, R. & Pratt, K. (1999). *Building learning communities in cyberspace*. San Francisco, CA : Jossey-Bass Publishers.

Pea, R. (1993). The collaborative visualization project. *Communications of the ACM, 36*(5), 60-63.

Scardamalia, M. & Bereiter, C. (1994). Computer support for knowledge-building communities. *Journal of the Learning Sciences, 3*(3), 219-225.

Scardamalia, M., Bereiter, C., & Lamon, M. (1994). The CSILE project: Trying to bring the classroom into world 3. In K. McGilly (Ed.), *Classroom lessons: Integrating cognitive theory and classroom practice* (pp.201-228). Cambridge, MA: MIT Press.

Assessing the Usability of MOA Interface Designs

Yaowen Chang
Teachers College
Columbia University
yc371@columbia.edu

Abstract: This study evaluates the usability of the proposed MOA (mouse-over-abstract) interfaces that could be implemented in web-based or stand-alone applications. The MOA designs provide users with an abstract that serves as context cues about the information presented in the linked page. The context cues are available in visual and/or audio formats. Evaluation of the MOA usability focuses on its affordances in efficiency, effectiveness, and user satisfaction. The proposed study aims to examine the influence of the MOA interfaces and presentation modality on program usability. The study also aims to evaluate the relationships among the three aspects of usability. Findings of the proposed study have implications in bridging the gap between research and practice. While results serve as empirically tested guidelines for interface designs applicable for computer-based learning programs, the application of study results also set examples for usable educational research.

Rationale

In the digital era, an information space contains more than text. The incorporation of the Internet and interactive multimedia have provided users with alternative ways of handling information. Hypertext structure, for example, allows the user to share the authorship of the intended reading. Consequently, there has been an ample amount of research conducted on user behavior in the electronic information space, and best practices have been suggested regarding information use within the digital medium. Studies that have contrasted reading on screen from reading printed matter (Dillon, 1992; Egan, Remde, Landauer, Lochbaum, & Gomez, 1989; Martin & Platt, 2001; Poynter Institute, 2000) support the notion that the electronic information space is more than just a variation of document media. Users actually develop ways to interact with the electronic information space that are substantially different from how they would interact with other media.

Traditional information space – such as books and journals – provides facilities such as tables of content, headings, and abstracts. This "meta-structure" serves to make both the organization and content of the material explicit to the user. Given that such improvements in the design usability of printed material has been an evolutionary process that has lasted at least 500 years (Febvre & Martin, 1976), it is reasonable to expect that it will also take some time before we come up with the best meta-structure for information retrieval in the electronic space. As a result, the usability of the electronic information space is an issue worth addressing.

Conceptual Framework

Usability

Although "usability" is a term that has been widely discussed, there is a lack of consensus on its definition (Jordan, 1998; Marchionini & Crane, 1994). Numerous authors have adopted the definition of the ISO (1998), by which effectiveness, efficiency, and user satisfaction are the three aspects of usability.

Evaluation of the general concept of usability is then made possible by concretely defining the parameters of the three terms (Frøkjær, Hertzum & Hornbæk, 2001; Nielsen & Levy, 1994).

Effectiveness is usually measured by the extent to which an intended task is successfully completed. *Efficiency* refers to the amount of effort it takes to complete the task and may be measured according to indicators that include deviations from the correct path, error rate, the amount of time spent, and mental workload. *User satisfaction*, the last component of this product usability scheme, refers to how comfortable users are using a certain product to achieve a specific goal; user satisfaction is usually measured using the method of self-report. While effectiveness and efficiency yield measures of objective performance, user satisfaction provides insight about subjective preferences of application users.

It has been suggested that claims of usability should take into consideration all three aspects of usability as well as their interrelationships (Frøkjær, Hertzum & Hornbæk, 2000; Nielsen & Levy, 1994). For instance, because it is difficult to measure effectiveness as a component of usability, many studies have rested on the assumption that effectiveness equals efficiency of user performance. However, caution should be applied to conclusions based on such assumptions, because it remains to be proven that effectiveness is reducible to efficiency. In essence, when examining product usability, one must recognize the interplay among the defining properties.

Web usability and information seeking

The evaluation of Web usability can not be conducted without the context of information-seeking behavior. This is because the evaluation criteria of Web usability -- such as effectiveness, efficiency, and user satisfaction – are essentially the perceived outcome of information-seeking activities. According to Marchionini (1995), how someone interacts with the information space is determined by the given individual's "personal information infrastructure." This personal information infrastructure is a constellation of interconnected mental models.

The concept of mental models (Johnson-Laird, 1983) is one of the theories proposed by cognitive psychologists to explain human cognitive activities. The mental model theory proposes that individuals react to situations or make predictions about circumstances in reference to their pre-existing mental models. In other words, the mental models serve as the individuals' inner template of the real world. In the present case, a mental model about the content of a Web page will allow the reader to make predictions about the material; thus, it may facilitate – or impede – the reader's comprehension of the information being presented.

Previous research findings support the notion that mental models play an essential role in information-seeking behavior (e.g., Borgman, 1986; Dimitroff, 1992; Liebscher & Marchionini, 1988; Kerr, 1990; Webb & Kramer, 1990). In fact, information seeking may be viewed as the process humans undertake specifically in order to modify their mental models – by changing the state of their knowledge so as to better resolve internal contradictions. It is assumed that, when an information problem is detected, information-seeking behavior is initiated in order to repair the perceived deficiency.

Web-usability problems

Although there has been much discussion about Web-usability problems over the years, there is still a lack of consensus on what the core difficulty is (Marchionini, 1995; Toms, 2000). It has been suggested that some problems might be due to the fact that certain information used to navigate printed text is not available in electronic text environments. Two of the oft-cited Web-usability problems are *cognitive overload* and *disorientation*.

The term cognitive overload or information overload is usually used to describe a state wherein the received information becomes a hindrance rather than a help. Even though cognitive overload is not a new concept, it was not until the 1990s that this phenomenon started to be perceived as a major problem associated with the new technological advances (Bawden, Holtham & Courtney, 1999).

Disorientation – or "getting lost in cyberspace" – is another negative consequence of information seeking in the electronic information space. Conklin (1987) defined disorientation as the users' tendency "to lose their direction and sense of location" in a non-linear information environment. It has been suggested that such phenomena might be due to factors such as unfamiliarity with the document structure (Foss, 1989) and lack of contextual cues (Park & Kim, 2000; Soderston, 1986).

Over the years, various types of interface designs have been proposed to tackle Web usability problems (e.g., Florance, 1992; Foss, 1989; Furnas, 1986; Gecsei & Martin, 1989; Hammond & Allinson, 1987; Kerr, 1989; Park & Kim, 2000). Most of these meta-structural designs aim to help users have a sense of what kind of information is to be found, where they are in the system, and how to move around the information space without incurring cognitive overload (Toms, 2000). Essentially, a lot of these designs aim to deal with issues such as cognitive overload and disorientation by providing users with *context information*.

Context information is here defined as the explanation of the user's current situation in the Web environment. For instance, Park and Kim (2000) conducted a study to examine the effectiveness of contextual navigation aids in Web browsing activities. It was found that participants preferred the Web system with context information. Provision of context information also seemed to increase the efficiency of users' information-seeking activities. Over the years, various types of interfaces have been proposed to facilitate users' information-seeking behavior in the electronic information space (e.g., Conklin & Begeman, 1989; Egan, Remde, Landauer, Lochbaum & Gomez, 1989; Florance, 1992; Foss, 1989; Furnas, 1986; Gecsei & Martin, 1989; Hammond & Allinson, 1987; Nielsen, 1990; Webb & Kramer, 1990). Most of these designs present information through visual rather than audio channels.

In response, the current study aims to propose an interface design called MOA, an acronym for Mouse-Over-Abstract, that provides Web users with context cues in visual *and/or* audio formats. The context cues appear when users place the mouse over a hyperlink and they are abstracts of the information presented on the linked page. It is anticipated that such contextual cues will serve as landmarks in the hypertext environment to ameliorate the issue of disorientation and, therefore, minimize the amount of cognitive load attributable to navigation.

Following are some questions concerning the evaluation of the proposed design.

1. Do participants perform better with, and show a preference for, MOA interfaces as opposed to an interface that does not have this feature?
2. Do different modalities (e.g., text, audio) of MOA interfaces result in differential degrees of participant performance and/or preference?
3. What are the relationships among the three aspects of usability: effectiveness, efficiency, and satisfaction?

Methodology

Participants

Eighty participants will be recruited from colleges and universities in the New York metropolitan area. There will be a twenty-dollar compensation for their one-and-a-half-hour participation. Educational level and experience with computers and computer-mediated information systems have been found to be confounding variables of usability. As a result, eligible participants will need to have at least a college-level education and have at least three years of experience with computer-based information systems.

Materials

The domain contents in the current study will include both natural science and social science topics. Content materials will be provided and edited by experts in the given fields. Content experts were given three guidelines to take into account when choosing their topics. First, the difficulty level of the domain content should be comprehensible for individuals with a college-level education. Second, contents should not be easily guessable, and comprehension of the given content should require the user's efforts and cognitive processing. Third, the topic should be interesting to the general public. Based on these guidelines, two topics were chosen.

The natural science topic addresses the specific question: "Why does the moon have phases?" The social science topic concerns the functions and histories of Institutional Review Board.

Two Web applications will be generated based on the provided contents. Subject materials will be divided into subsections and presented in HTML format. JavaScript will be used to develop the interface needed to present the visual and audio context cues. Basic interface design of the Web pages will adhere to general guidelines suggested by Web usability experts (e.g., Nielsen, 2000).

Experimental treatments

The current study involves four kinds of interfaces including one control interface and three experimental interfaces. Participants in the experimental groups will be presented with the MOA interfaces that provide context cues when they put the mouse on a hyperlink. One MOA interface provides context information in text format, another in audio, and the other contains information in both modalities. No such add-on mechanism is available in the interface for the control group.

Measures

Demographic information. Participants will be required to provide background information on a demographic sheet. These questions include gender, age, level of education, college major, number of computer-usage hours per week, years of experience with computers, years of experience with the Internet, and the computer platform (e.g., PC, Mac) with which they are most familiar.

Efficiency. A system log will be used to record the time participants spend and the links they click on the Websites. Participants will also complete a set of questions, which rates their subjective perception about the mental load during their interaction with the interfaces. The mental load ratings are based on a 7 point Likert scale, with 1 indicating very easy and 7 indicating very difficult. Previous research has indicated the subjective measure easy to administer and as reliable as objective methods (e.g., Mayer & Chandler, 2001).

Effectiveness. After the interaction with the experimental system, the users will be given a set of multiple-choice questions to assess their recollection and comprehension of the domain contents.

User satisfaction. User satisfaction will be evaluated using an abbreviated version of the Shneiderman's Questionnaire for User Interaction Satisfaction. There will be a set of eight Likert scale items included in the questionnaire (Toms, 2000).

Procedure

The experiment will be conducted in the computer lab of the Academic Computing Services located at Teachers College and supervised by two experiment administrators. Equipment required to run the study includes twenty PC laptops with external mouse attached. The applications will be loaded on the hard drives of these laptops before the experiments. Four group experiments are expected be conducted with twenty subjects within each section. Individual sections may also be considered.

At the beginning of the experiment, the participants will be requested to fill out a demographic sheet. After the completed demographic sheets are collected, the participants will be informed that the entire experiment will be divided into two forty-minute sessions with a five-minute break between sessions. Participants will be requested to browse through the provided Websites.

Participants will be randomly assigned to one of the four groups: a) the control group will be presented with the control interface which contains no add-on features; b) the visual group will be provided with the text-based MOA interface; c) the audio group will receive an audio-supplemented MOA interface; and d) the hybrid group will have a MOA interface providing context cues in both visual and audio format. Within each of the four sub-groups, half of the participants will be given the natural science topic first and half the social science topic. Efforts will be made to ensure equal gender distribution among different treatment groups.

After the browsing session, participants will be asked to respond to the measures mentioned above in order to assess the efficiency, effectiveness and user satisfaction properties of the interfaces. Five minutes will be allocated for the mental load ratings, ten minutes for the recollection and comprehension task, and five minutes for user satisfaction questions. At the end of the first session, the participants will be provided with a five-minute break. The break aims to alleviate the possible impact of fatigue on user performance. Upon their return, the same procedure will take place again. In the second session, participants who were provided with the natural science topic in the first session will be given the social science topic, and vice versa.

Anticipated Results

Methods of analysis

Efficiency. Three measures will be implemented to determine the concept of efficiency. First, efficiency (E1) will be measured based on the ratio of the time a participant devoted to reading (Tr), to the total amount of time spent (Tt): E1= Tr / Tt. Second, efficiency (E2) will also be measured based on the number of links required for a perfect path (Cp), over the number of links the user clicked through to complete the task (Cn): E2 = Cp / Cn. For both E1 and E2, a higher degree of efficiency is indicated as a value of E1 or E2 approximating 1, a low degree of efficiency by values approaching 0. These two measures both rest on the assumption that excessive clicking behavior may be a sign of *disorientation*. The total value of the individual mental rating items will be tabulated and serve as a third measure for efficiency. Because an efficient interface should require participants less cognitive load, higher mental load scores represents lower degree of efficiency and vice versa.

Effectiveness. The degree of comprehension (Effectiveness) will be assessed based on the number of correct items (Ic), over the total number of items (It): Effectiveness = Ic / It. A higher degree of effectiveness is indicated as a value of Rec approximating 1, a lower by values approaching 0.

User satisfaction. Summing up users' responses to the eight-item Likert scale questionnaire will generate a total score for user satisfaction. The final score will be used as the final indicator of user satisfaction.

Results

The two-by-two factorial design of the current study results in four groups of twenty participants each, as indicated in the matrix shown in Table 1.

	No audio cues	**Audio cues**
No visual cues	Group 1 (Control Group)	Group 2
Visual cues	Group 3	Group 4

Table 1: Mapping the treatment received by the 4 groups.

Efficiency. Efficiency is defined both as the amount of time it takes to find the topic of interest and the amount of cognitive load it requires for participants to process information. Because the MOA interfaces will provide users with a general overview of the linked page, such provision should help users find information of interest efficiently. As a result, it is expected that participants provided with the MOA Interfaces (Groups 2, 3 and 4) will spend more time reading and less time browsing than the comparison group (Group 1).

Effectiveness. Effectiveness is indicated by the participant's performance in recollection and comprehension. Fundamental to the interface design are the assumptions that: 1) the provision of an abstract will provide the users with a mental model about the content in the linked page; 2) elements in the abstract will prime and sensitize the users to the essential information to look for; and 3) information contained in the MOA interfaces could serve as a landmark in the information space. As a result, it is expected that participants provided with the MOA interfaces (Groups 2, 3 and 4) will perform better than the comparison group (Group 1). Moreover, among the three MOA interfaces, the hybrid MOA interface is expected to show the highest degree of effectiveness because two channels of the same message should have a reinforcing effect.

User satisfaction. User satisfaction is evaluated based on participants' self-report. Although the MOA interfaces will provide users with a facilitating mechanism to achieve the information-seeking goal, users may not be familiar with the given interface design. Therefore, it is expected that participants without MOA interfaces (Group 1) will provide higher scores on the measure of user satisfaction than the comparison groups (Groups 2, 3 and 4).

Interactions between usability components. In the current study, a negative correlation is expected between the measure of effectiveness and user satisfaction. This is because, while the MOA interfaces facilitate learning and comprehension, the unfamiliarity with the interface results in lower degree of user satisfaction.

More importantly, the current study will also find the redundancy principle of multimodality (Mayer, 2002) to be inapplicable. The redundancy principle argues that the incorporation of multiple modalities might have detrimental rather than beneficial impacts, when it is the same information being presented. It should be noted that most of the supporting research for the redundancy principle present contents in multiple modalities. Yet, content provided in the MOA interfaces are only to prime users with concepts to be covered; detailed information are provided in the same format across all four conditions in the current study.

Implications

One goal of the proposed study is to bridge the gaps between practices and research. While most recommended Web design guidelines are not empirically based, there has been lament about the lack of "usability" in educational research. The proposed study will set forth an example to address the given issues.

Findings also can provide evidenced guidelines for technology-based projects, such as distance-learning education and online libraries, concerning how multimodal presentations should be deployed and how cost-beneficial such practices could be. Moreover, results of the proposed project will also point to the fact that, when evaluating technology projects, it will not be sufficient to assess user satisfaction because usability is a multifaceted concept.

References

Bawden, D., Holtham, C. & Courtney, N. (1999). Perspectives on information overload. *Aslib Proceedings, 51* (8), 249-255.

Borgman, C. L. (1986). The user's mental model of an information retrieval system: An experiment on a prototype online catalog. *International Journal of Man-Machine Studies, 24* (1), 47-64.

Conklin, J. (1987). Hypertext: an introduction and survey, *Computer, 20* (9), 17-41.

Conklin, J. & Begeman, M.L. (1989). gIBIS - A tool for all reasons. *Journal of the American society for information science. 40* (3): 200-213.

Dillon, A. (1992). Reading from paper versus screens: a critical review of the empirical literature. *Ergonomics: 3rd Special Issues on Cognitive Ergonomics, 35* (10), 1297-1326.

Dimitroff, A. (1992). Mental models theory and search outcome in a bibliographic retrieval system. *Library and Information Science Research, 14*, 141-156.

Egan, D.E., Remde, J.R., Landauer, T.K., Lochbaum, C.C. & Gomez, L.M. (1989). Acquiring information in books and Superbooks. *Machine-Mediated Learning, 3*, 259-277.

Florance, V. (1992). Medical knowledge for clinical problem solving: A structural analysis of clinical questions. *Bulletin of the Medical Library Association, 80*, 140-149.

Foss, C.L. (1989). Tools for reading and browsing hypertext. *Information Processing and Management, 25* (4), 407-418.

Febvre, L. & Martin, J.J. (1976). The coming of the book. London: Verso.

Frøkjær, E., Hertzum, M. & Hornbæk, K. (2000). Measuring usability: Are effectiveness, efficiency, and satisfaction really correlated? In *Proceedings of Chi '00*, 345-352.

Furnas, G.W. (1986). Generalized fisheye views. In *Proceedings of Chi'86*, 16-23.
Gecsei, J. & Martin, D. (1989). Browsing access to visual information. *Optical Information Systems, 9* (5), 237-241

Hammond, N. & Allinson, L. (1987). The travel metaphor as design principle and training aid for navigating around complex systems. In: D. Diaper and R. Winder (Eds.), *People and Computers III: Proceedings of the 3rd Conference of the British Computer Society* (pp. 75-90). University of Exter, Cambridge: Cambridge University Press.

ISO 9241-11. Ergonomic requirements for office work with visual display terminals (VDTs) - Part 11: Guidance on usability (1998).

Johnson-Laird, P.N. (1983). *Mental Models*. Cambridge, MA: Harvard University Press.
Jordan, P.W. (1998). *An introduction to usability*. London: Taylor & Francis.

Kerr, S.T. (1990). Wayfinding in an electronic database: The relative importance of navigational cues vs. mental models. *Information Processing and Management, 26* (4), 511-523.

Liebscher, P. & Marchionini, G. (1988). Browse and analytical search strategies in a fulltext CD-ROM encyclopedia. *School Library Media Quarterly, 16* (4), 223-233.

Marchionini, G. (1995). *Information seeking in electronic environments*. Cambridge: Cambridge University Press.

Marchionini, G. & Crane, G. (1994). Evaluating hypermedia and learning: Methods and results from the Perseus project. *ACM transactions on Information Systems, 12* (1), 5-34.

Mayer, R. (2002). Cognitive theory and the design of multimedia instruction: An example of the two-way street between cognition and instruction. *New directions for teaching and learning, 89* (Spring), 55-71.

Mayer, R. & Chandler, P. (2001). When learning is just a click away: Does simple user interaction foster deeper understanding of multimedia messages? *Journal of Educational Psychology, 93* (2), 390-397.

Morkes, J. & Nielsen, J. (1997). Concise, SCANNABLE, and Objective: How to Write for the Web [Online]. Available URL: http://www.useit.com/papers/webwriting/writing.html

Nielsen, J. (1990). Miniatures versus icons as a visual cache for videotex browsing. *Behaviour and Information Technology. 9* (6), 441-449.

Nielsen, J. (2000). *Designing Web Usability*. Indianapolis, Indiana: New Riders Publishing.

Nielsen, J. & Levy, J. (1994). Measuring usability. *Communications of the ACM. 37* (4), 66-75.

Park, J. & Kim, J. (2000). Effects of contextual navigation aids on browsing diverse web systems. In *Proceedings of Chi '00*, 257-264.

Poynter Institute (2000) Standford-Poynter eyetrack project [Online]. Available URL: http://www.poynter.org/eyetrack2000/

Soderston, C. (1986). A study of spatial models and human navigation within complex computer interfaces. (Doctoral dissertation, Department of communication and Rhetoric. Graduate School of Rensselaer Polytechnic Institute). Dissertation Abstracts International.

Toms, E.G. (2000) Understanding and facilitating the browsing of electronic text. *International Journal of Human-Computer Studies. 52*, 423-452.

Waterworth, J. A. & Chignell, M. H. (1991). A model for information exploration. *Hypermedia, 3*, 35-58.

Webb, J.M. & Kramer, A.F. (1990). Maps or analogies - A comparison of instructional aids for menu navigation. *Human Factors, 32* (3), 251-266.

Ethical Issues in E-learning: Insights from the Application of Stakeholder Analysis in three e-learning Cases.

Polyneikis Chozos
Miltos Lytras
Dr. Nancy Pouloudi

Athens University of Economics and Business, Greece
Department of Management Science & Technology,
ELTRUN, the eBusiness Center
pchozos@aueb.gr
mdl@aueb.gr
pouloudi@aueb.gr

Abstract: The application of emerging digital technologies such as e-mail, the World Wide Web (WWW) and the Internet in the educational setting has received wide acceptance all over the world. Both corporate and academic agendas have recognized the potential advantages of e-learning; however, as a new field, e-learning comes with important issues that have yet to be tackled. Issues either pre-existing in the academic context, or stemming from the intertwinement of new technologies with the delivery and assimilation of education, minimize the effectiveness of e-learning implementations and therefore decrease the value perception of this practice. Such an issue is academic integrity and ethics. This paper attempts to identify ethical issues that concern the stakeholders involved, and stress the need for their consideration when implementing an e-learning course.

Keywords: E-learning, ethics, academic cheating, stakeholder theory

1. Introduction

Educational institutions have always been confronted with behavioural incidents that constitute ethical and moral implications among students, teachers and/or management. In order to deal with these implications, academic institutions proceed in the development of policies, regulations and disciplinary procedures. However, the introduction of Information Technology (IT) practices within the academic context has created a new set of questions considering value standards and ethics.

The cases of e-learning and distant learning are far more challenging, as physical presence and interaction are no longer required among students and educators. As all interactions are virtual, all academic standards, policies and regulations need to be re-examined, in order to constitute an e-learning course 'ethical'. Issues regarding equity, legality, privacy and justice stemming from political, social, cultural and economical implications need to be studied for the design and implementation of web based courses, as they have been in traditional educational practices (Athanasou, 1998).

The inquiry on ethics is the first and foremost task when evaluating an e-learning course (Athanasou, 1998). The consideration of ethical issues within such a course is as important as in any other educational setting. However, although most -if not all-academic institutions have formulated codes of ethics and teach ethics in their curriculum, little work has been done in e-learning so far (Stahl, 2002).

The purpose of our research is to identify ethical issues that need to be considered in the design and implementation of e-learning courses. Considering the socio-technical nature of e-learning, *stakeholder analysis* is employed as a tool to identify stakeholders, their relationships and potential ethical and moral implications within this context. More specifically, we have applied stakeholder analysis in three e-learning cases, and examined stakeholder interests and potential conflicts of interest that could trigger implications of ethical nature. Finally, we have proceeded in making some initial suggestions as to how our research findings can be used in order to formulate mechanisms for avoiding or/and dealing with such occurrences.

2. Education, IT and Ethics

Academic integrity has been under investigation for over a century. Cheating and plagiarism are two of the most popular 'unethical' practices students engage in (Philips and Horton, 2000). However, a mere 1.3% of students has been reported as 'being caught' (Haines *et al,* 1986 in Philips and Horton, 2000) from the 50% to 75% of students which admit having participated in some sort of academic dishonesty Baird, 1980 in Philips and Horton, 2000).

BEST COPY AVAILABLE

However, cheating is not the only ethical issue appearing in academic institutions. Issues such as gender or racial discrimination, as well as complaint procedures, disciplinary procedures, student responsibilities and rights are addressed in codes of ethics of universities. The introduction of IT has brought changes to how these issues become apparent. Also, IT has brought changes to the skills required, the roles of people involved, and the communication and interaction among students and teachers (Stahl, 2002; Watson, 2001; Schell, 2001). Therefore, changes must be brought to codes of ethics or the approach on ethical issues by academic institutions that employ IT in their facilities.

"Ethics is the philosophical study of the moral value of human conduct and the rules that govern it". Furthermore, ethics is mainly associated with specific people or groups of people that have social responsibility (L'Etang, 1992 in Grimshaw, 2001). Therefore, in order to apply ethical thinking in our context, it is important to identify the "groups of people that have social responsibility" in academic settings, and examine their position within the network of relationships and operations (Grimshaw, 2001, p.43).

3. Methodology

Ethics is a sensitive and delicate issue. It is a subject that concerns people's opinions and behaviours which can not be approached easily. Also, ethical issues often arise from hidden or unobvious agendas and are therefore difficult to spot directly. Another point that needs to be considered is that in the specific context of e-learning, ethical issues stem from the interaction of education and computing- hence human agents with computers. The socio-technical nature of e-learning implies that the investigation on ethics requires a wider frame of reference, and a need for employing special tools to our purpose. Stakeholder theory is a prominent approach to the examination of social networks, considered as a capable socio-technical tool.

Stakeholder theory is primarily used to identify stakeholders, their interests, and conflicts of interest, often with a moral perspective (Key, 1999). We therefore decided to apply stakeholder analysis to e-learning cases, aiming to identify stakeholder groups and how they and their interests are related within an e-learning environment.

The three cases used in our analysis, which will be described briefly later on, were documented using several techniques. The main process for getting input in our research was by taking interviews. About 20 interviews were conducted and recorded in order to provide the initial data for analysis. Additionally a number of documents were analysed including technical reports, deliverables, memos, e-mails and discussions. Finally a number of informal discussions contributed to our research.

Interviews are favoured because they allow the researcher the "best access to the interpretations that the participants have regarding the actions and events which have or are taking place, and the views and aspirations of themselves and other participants" (Walsham, 1995). An added benefit is that it allows researchers to step back and examine the interpretations of their fellow participants in some detail.

From the findings of the interviews and discussions, we have identified common issues within the three cases, which we have grouped and presented as being most critical. The reported issues should be considered both in terms of the analysis and design of the information systems, and the day-to-day practice of the learning/ teaching processes.

3.1 Stakeholder Theory

Stakeholder theory has been used extensively in the business context since the eighties (Key, 1999; Barrett, 2001; Papazafeiropoulou *et al.*, 2001). Stakeholder Analysis attempts to evaluate the role of actors in a firm's environment, as Freeman (1984) -considered to be the founder of stakeholder theory- suggests in his original work that both internal and external actors influence the organization's behaviour and performance.

There are various definitions of what a 'Stakeholder' is (Barrett, 2001; Papazafeiropoulou *et al.*, 2001). Freeman (1984, p. 46) defined a stakeholder within an organization as "any group or individual who can affect or is affected by the achievement of an organization's objectives". Another approach, provided by Clarkson (1995), describes stakeholders as:

> "*persons or groups that have, or claim, ownership, rights, or interests in a corporation and its activities, past, present, or future. Such claimed rights or interests are the result of transactions with, or actions taken by, the corporation, and may be legal or moral, individual or collective*" (p. 106).

The application of stakeholder analysis in an organization attempts to identify stakeholders, their claims, rights and interests, the transactions and relationships among stakeholders, as well as the moral and ethical "guidelines for the operation and management of corporations" (Donaldson and Preston, 1995). As the authors suggest, stakeholder theory has three main aspects: The descriptive, the instrumental and the normative:

- The *descriptive* aspect of stakeholder theory concerns the identification, description and possibly explanation of characteristics and behaviors of an organization.
- The *instrumental* aspect considers the identification of internal and external organizational connections.
- The *normative* aspect, where the theory attempts to elaborate on the function of the organization, and identify various moral and ethical issues that stem from the interconnections within the organizational network.

Ethical issues, as stated by Key (1999), are not considered in the traditional philosophical sense; rather, their identification aims at measuring the " 'fit' for utilitarianism" (p. 320), or, bringing to light the necessary trade-offs that need to be made between stakeholders' goals and the organization's goals.

Since the eighties, stakeholder analysis has found wide application in various contexts, such as the Information Systems (IS) area, and lately in the e-commerce area (Papazafeiropoulou *et al.*, 2001). Therefore, it seems appropriate that stakeholder analysis can be applied to e-learning cases, and perhaps assist in clarifying what issues need to be addressed in the design and delivery of an e-learning course.

3.2 Description of Cases

The proposition of theoretical directions for the case of elearning can be justified if empirical evidence can support conceptualisations that are not only descriptive but also incorporate and entail substantial practical implications. To this end, we have applied stakeholder analysis to three e-learning cases.

The case studies in our research are:

(1). The Global E-management Master (GEM) e-learning system and especially the T1 course entitled E-technology, which was delivered to the student of the GEM consortium. GEM provided expertise from an international e-learning implementation targeting on executives training with specific characteristics.

(2). The XEXO project (Educational space without limits), which objective was to establish an e-learning system and to deliver a master degree course to the students of three universities in Greece. XEXO was a joint effort of three well-known universities in Greece to design a common curriculum and to establish an infrastructure for e-learning.

(3). Finally, the Teleducation Center of Athens University of Economics and Business (TC-AUEB) which utilizes the WebCT platform in order to provide learning content to students. The TC of Athens University of Economics and Business, one of the biggest and well-organized universities in Greece with more than 8000 students refers to the implementation of an infrastructure for the delivery of e-courses, and the documentation of relevant services to educators and learners.

4. Applying Stakeholder Analysis to the three Cases

As mentioned before, we decided to perform stakeholder analysis to the three cases, compare our findings, and produce a generalized report on stakeholder groups, their interests and their relationships. This way, we could both gain more insights from multiple cases, and provide a set of issues which are identified in all cases, and are therefore most possible of appearing in other e-learning cases. Following we present a brief overview of the findings of stakeholder analysis in the three case studies.

4.1 Identification Of Stakeholders

Global E-management Master (G.E.M.)

1. The project manager
2. An e-learning specialist (webCT specialist)
3. An HTML programmer and a multimedia specialist that adopt the book oriented learning content to HTML pages with multimedia features.
4. Three content seekers, who based on general guidelines were searching internet, books and other sources in order to select content
5. Teachers in others Universities of the GEM consortium that would use the content in their teaching (in GEM same content is used in different universities)
6. A contact person for the facilitation of communication between development team and teachers in other universities

7. Students

XEXO project

1. The project manager, prof at the Technical university of Crete
2. Two project coordinators in AUEB, and Univ. of Macedonia
3. An e-learning specialist, owner of a company specialized in multimedia solution (Extreme media solutions S.A)
4. A content responsible for each course module, who worked according to the guidelines agreed by the committee constituted by (1, 2, 3)
5. An e-learning specialist for each course (webCT specialist)
6. An HTML programmer for each course module and a multimedia specialist that adopt the book oriented learning content to HTML pages with multimedia features.
7. A secretary who supported the project manager.
8. A help desk person who provided help at the pilot run of the system.
9. Students

Teleducation Center of Athens University of Economics and Business (TC-AUEB)

1. The Project Manager, a professor of the AUEB
2. The projects' scientific coordinator, an e-learning specialist
3. A project manager for each course that was developed (1,2 & 3 constitute a steering committee that is responsible for the specification and agreement on general guidelines).
4. A content responsible for each course, who evaluated the learning content in close cooperation with the teacher / content provider
5. An HTML programmer for each course and a multimedia specialist that adopt the book oriented learning content to HTML pages with multimedia features.
6. Two e-learning platform (WebCT) specialists, employees in the Teleducation Center) who facilitated the whole process of uploading learning content on content server.
7. A secretary who supported the project manager
8. A help desk person who provided help atthe pilot run of the system.
9. Students

4.2 Summary of Findings

Following the identification of key stakeholders in the three cases, we have proceeded in clustering them in 5 main categories, according to their generalized roles. In Table 1 we present the clusters of stakeholders that need to be examined. Following Table 1, we have proceeded in discussing their roles and interests.

CASE STUDY/ STAKEHOLDERS	GEM	XEXO	TC-AUEB
MANAGEMENT	Project Manager	Project Manager Project coordinators	Project Manager
CONTENT DEVELOPMENT	Three content seekers	One content developer for each module	Scientific Coordinator One for each course Teachers
TEACHING STAFF	Teachers	Teachers	Teachers
TECHNOLOGY RELATED STUFF	E-learning specialist HTML programmer Multimedia specialist	E-learning specialist HTML programmer Multimedia specialist	E-learning specialist HTML programmer Multimedia specialist
STUDENTS	Students	Students	Students

Table 1: Stakeholder Groups

1. **MANAGEMENT**: Overall, management issues regard adherence to deadlines and milestones, strategy, policy and meeting the implementation objectives.

   Project Manager: The Project Manager has an overall responsibility for *managerial issues* and performs all the necessary processes that secure the timely alignment to *timetable*. Deadlines, and project milestones are of critical importance. The ultimate objective of this stakeholder is a well functioning elearning system that has *meet the implementation objectives* through the establishment of flexible control managerial mechanisms.

Institution Policy Maker: In business environment or in academic environment this person has an overall authority to determine or to *influence the strategy* and the consequent *policies*. Concerning elearning this person influences the importance that is paid to e-learning implementations since in many cases e-learning is recognized as of limited importance and an evangelist is required in order to transform this opinion within organization.

2. **CONTENT DEVELOPMENT:** This stakeholder group is concerned with developing the content to be taught to students.

   Content Author: The main concern of this stakeholder group is to provide content that meets the standards that have been specified by the Scientific Coordinator, or have been agreed by a correspondent committee. In many instances the limited experience in e-learning is a main obstacle for his performance since the majority of content providers have a book-oriented perspective, which in e-learning becomes boring.

   Scientific Coordinator: This stakeholder pursues a two-fold goal. Firstly he has to align good *practices of e-learning* in specific implementation and secondly to demand for *high quality learning content*. Of course the alignment of good practices implies a number of issues such as collaboration, motivation, active participation, ethics, etc.

3. **TEACHING STAFF:** This stakeholder group is *managing the learning process* through the capabilities of the e-learning platform. He has in mind a learning scenario and a personal way of teaching which in many times tries to simulate in e-learning through technological capacities.

4. **TECHNOLOGY RELATER STAFF:** Implementation of the system is the main concern of this stakeholder group.

   E-learning platform specialist: This person is the critical *connector that stands between content provider and learner*. The performed utilization of e-learning platform's capabilities requires the establishment of a common language between content author and e-learning platform specialist. In some cases authors do not know what an e-learning platform offers

   Technical Manager: A technical manager has an overall responsibility for all the technical aspects of the implementations concerning e-learning platforms and other applications necessary for the development of content. He justifies economical proposals of technology providers and according to several criteria proposes solutions to the project committee or the project manager.

   Multimedia & HTML specialist: They are responsible for the preparation of learning content and the transformation of hard copy material to electronic learning modules. Their work has often bottlenecks since have to wait for content from authors or content providers.

   Technology Provider: The technology provider has a product to sell and he tries to convince the project manager or the scientific coordinator that his solution is closer to project needs.

5. **STUDENTS:** This stakeholder group is either forced or willing to participate in an e-learning course. The main interest of students is the assimilation of knowledge and the acquisition of the degree or diploma the course presumably provides. Very often he is disappointed from the static content of html pages, which are the containers of learning content in e-learning implementations.

4.3 Stakeholder Relationships

Following the identification of stakeholder groups, we illustrate how they are interrelated within the e-learning network (Figure 1).

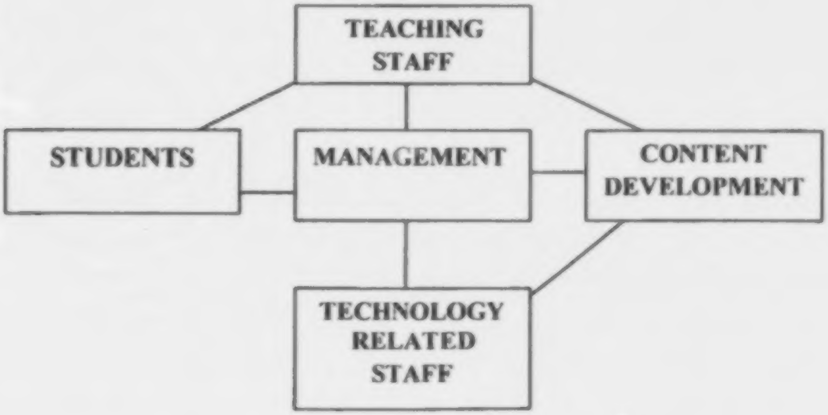


Figure 1: Stakeholder Relationships

5. Ethical Issues in e-Learning

In a recent study on the role of codes of conduct in ethical behavior in academic institutions (Rezaee *et al*, 2001), the authors project the main issues that codes attempt to deal with. It should be noted that the issues discussed concern traditional academic institutions, and not e-learning environments. The most common issues are:

- Conflicts of interest
- Compliance with university policies
- Faculty grievances
- Administrators, faculty and staff performance
- Confidentiality of proprietary information
- Tenure and promotion policies and procedures
- Financial fraud
- Allegation of fraudulent conduct in research or scholarly procedures

Other ethical issues discussed in literature are integrity, equality, economic efficiency and equivalence (Tucker *et al.*, 1999), as well as security and privacy (Stead and Gilbert, 2001). All the presented issues need to be re-examined for e-learning environments. However, as discussed earlier on, academic fraud is the most problematic ethical issue in the academic agenda; for this reason we will elaborate on this issue further.

5.1 Academic Cheating

Dealing with the issue of cheating is not an easy task. It requires efforts regarding both academic and technological interventions. Due to the nature of the e-learning environment, these efforts need to take place from the design of the system and course rather that making adjustments, if they are to be mostly effective. Furthermore, these efforts regard various stakeholders, as we shall see further on.

Philips and Horton (2000) have suggested four 'strategies for monitoring and discouraging cheating':

1) Continuously update topics for projects and avoid 'classics'
2) Promote group effort
3) Police the internet for potential violations
4) Develop a well thought-out set of policies and regulations regarding cheating

Indeed, these four strategies should be able to promote a more ethical pattern for e-learning practices. However, the role of technology within these considerations is very critical. In order for the preceded propositions to be mostly utilized, they should be considered primarily in the design of the system, while keeping in mind the stakeholders and their interests as proposed in the findings of the stakeholder analysis. Following we apply the suggestions of the two authors to the stakeholder groups we have identified.

Continuously update topics for projects and avoid 'classics'
By achieving this, it should make it more difficult for students to find reusable assignments, either from previous academic terms, or from the internet.

This task regards primarily the TEACHING STAFF stakeholder group. They will be required to always be current, and continuously look for new topics while searching for similar topics available on the web. However, this task does not only depend on TEACHING STAFF, but CONTENT DEVELOPMENT as well. Teaching material should also be updated and new events or e.g. case studies should be incorporated.

Promote group effort
Group effort can minimize cheating to a great extend. Apart from creating a 'moral obligation' towards other group members, it also reduces the possibility of actually having a whole project done by someone else, unless the whole group decides to do so. It would also be sensible to change groups often, based upon random choice of members.

Having such a strategy is a matter of MANAGEMENT, as well as the stakeholders involved in the previous proposition. However, this task requires certain technological applications that promote online collaboration, which would therefore require the involvement of TECHNOLOGY RELATED STAFF.

Police the internet for potential violations
Although it might not seem as the most preferable strategy, it is necessary to do so. Submitted assignments should be checked on the web.

Develop a well thought-out set of policies and regulations regarding cheating
Before all, it is necessary to consider all possibilities that can potentially arise, develop a set of regulations and procedures and make everyone aware.

This is an issue of the MANAGEMENT to develop the set of policies and regulations. However, CONTENT DEVELOPMENT STAFF, TEACHING STAFF, TECHNOLOGY RELATED STAFF and even STUDENTS should not be kept in isolation during such a task.

Apart from the four strategies discussed by Philips and Horton, there are a few other suggestions:

- Ethics should be included in the curriculum of every course. Students should be taught ethics, not only for the sake of academic ethical behavior, but professional ethics as well. Ethical awareness is perhaps more important than a new code of ethics (Doost, 1997).
- Surveillance techniques should be established for e-learning. Technological advancements should be incorporated in e-learning applications that could, to a certain extend, monitor students.
- Research should be conducted in the matter of what causes unethical practices. Crown and Spiller (1998) suggest individual and situational factors that lead to cheating, such as age, gender, religion and previous education. Such work should also be done for e-learning, which would help in best understanding how to avoid and/or deal with unethical behavior.

6. Conclusion

"The G.E.M. degree will displace classical marketing, accounting and law studies with e-commerce versions. There is a strong belief that this is essentially what a regular MBA will look like in five or six years" (Brin, 1999 in Stead and Gilbert, 2001). Indeed, in terms of quality of course content, delivery, and overall practice, G.E.M. and other e-learning cases may well be of high standards. However, in order for e-learning to establish a stronghold alongside traditional university education, social factors need to be considered equivalently.

It has been noted that ethical issues are not given the necessary attention in e-learning implementations, as they do in traditional formal educational practices. Although these issues arise from the application of new technologies in the educational context, the subject is not purely technological, but merely a matter of the design and delivery of the service, whilst considering the changes in the delivery and assimilation of education that e-learning technologies bring about.

In our paper, we have conducted a stakeholder analysis and identified the following stakeholder groups in an e-learning environment: Management, Teaching Staff, Content Development, Technology Related Staff and Students. After a presentation of their generalized roles within an e-learning environment and their relationships, we have proceeded to the presentation of various ethical issues addressed in academic environments, and, with a focus on the issue of academic cheating, reflected various proposed strategies on the identified stakeholder groups. By doing so, we have generated a clearer picture of how one issue concerns all the stakeholder groups in an e-learning environment. Also, we can see how stakeholder interests are interrelated and therefore where potential conflicts of interest reside.

We believe that if e-learning opts to grow of equivalent respect to traditional education settings such as universities, ethics and morality are of the primary issues to be considered. In this paper, we have initiated a discussion regarding the issue of ethics in e-learning environments, with a focus on academic cheating. However, a more in-depth analysis is required in order to generate considerable input for the design of such an information system. Finally, as Colette (2001) suggests, in order for e-learning systems to be successful, they must be designed and constructed with care, using scientific procedures and techniques. In turn, this calls upon ethical responsibility and professionalism in the design and development of an e-learning system.

References

Athanasou, J. A. (1998). A Framework for Evaluating the Effectiveness of Technology-assisted Learning. *Industrial and Commercial Training, 30 (3)*, pp. 96-103.

Barrett, M. (2001). A Stakeholder Approach to Responsiveness and Accountability in Non-Profit Organizations. *Social Policy Journal of New Zealand*, 17, pp. 37-51.

Brin, D. W. (1999). Business Schools Add E-Commerce Programs, *The Wall Street Journal, B11B, (August 3)*.

Colette (2001). Electronic Education System Model. *Computers and Education*, 36, pp. 171-82.

Crown, D. F. and Spiller M. S. (1998). Learning from the Literature on Collegiate Cheating: A Review of Empirical Research. *Journal of Business Ethics*, 17, pp. 683-700.

Doost, R. G. (1997). Viewpoint: Code of Ethics or no Code of Ethics- a University Experience. *Managerial Auditing Journal*, 12 (1), pp. 31-34.

Grimshaw B. (2001). Ethical Issues and Agendas. *Facilities*, 19 (1/2), pp. 43-51.

Johnson, J. D. (2000). Levels of Success in Implementing Information Technologies. *Innovative Higher Education*, 25 (1), pp. 59-76.

Key, S. (1999). Toward a New Theory of the Firm: A Critique of Stakeholder "Theory". *Management Decision*, 37 (4), pp. 317-28.

L' Etang, J. (1992). A Kantian Approach to Ethics, *Journal of Business Ethics*, 11, pp. 737-44.

Papazafeiropoulou, A., Pouloudi, A. and Currie, W.L. (2001). Applying the Stakeholder Concept to Electronic Commerce: Extending Previous Research to Guide Government Policy Makers, *Proceedings of the 34th Hawaii International Conference on System Sciences*.

Philips, M. and Horton, V. (2000). Cybercheating: has Morality Evaporated in Business Education? *The International Journal of Educational Management*, 14 (4), pp. 150-55.

Rezaee, Z., Elmore, R.C. and Szendi J.Z. (2001). Ethical Behavior in Higher Educational Institutions: The Role of the Code of Conduct. *Journal of Business Ethics*, 30, pp. 171-83.

Rezmiersky, V.E. (1991a). Creation and Implementation of Policy for Information Technology Use: Abounding Ethics and Values Issues. *ACM SIGUCCS XIX*, pp. 317-24.

Rezmiersky, V.E. (1991b). Ethics and Value Issues, Information Technology and University Responses to the Mix. *ACM SIGUCCS XIX*, pp. 21-23.

Schell, G.P. (2001). Student Perception of Web-based Course Quality and Benefit. *Education and Information Technologies*, 6 (2), pp. 95-104.

Stahl, B. C. (2002). Ethical Issues in E-Teaching - a Theoretical Framework. *Proceedings of INSPIRE VII, Quality in Learning and Delivery Techniques, Limerick, Ireland, 25-27.03.2002: The British Computer Society*, pp. 135-48.

Stead, B. A. and Gilbert, J. (2001). Ethical Issues in Electronic Commerce. *Journal of Business Ethics, 34, pp. 75-85*.

Tucker, L. R., Stathakopolous V. and Patti C. H. (1999). A Multidimensional Assessment of Ethical Codes: The Professional Business Association Perspective, *Journal of Business Ethics*, 19, pp. 287-300.

Walsham, G. (1995). Interpretive Case Studies in IS Research: Nature and Method. *European Journal of Information Systems*, 4 (2), pp. 74-81

Watson, D. M. (2001). Pedagogy before Technology: Re-thinking the Relationship between ICT and Teaching. *Education and Information Technologies*, 6 (4), pp. 251-66.

Science Education in the Web Era

Leon L. Combs, Ph.D.
Department of Chemistry and Biochemistry
Kennesaw State University
Georgia, USA

I. Introduction

Education has entered a new era and there is considerable uncertainty among higher education administrators and faculty about how to proceed. Of course, the web era started some years ago, but education does not quickly accept the need for change, and reluctance to quickly adopt possible new methodologies is sometimes wise. Some institutions have tried quickly introducing online courses and many of them have failed to meet expectations. Other institutions seem to be attempting to ignore that we are in a new era and that a new format is available to help students reach a new level of understanding of subject matter. Several new companies have come into existence to offer the expertise to allow universities to quickly develop distance education programs using the web, and some of them have disappeared. As we proceed along the time line of the web era of education, it seems that perhaps some combination of what has seemed to work in the past, and what new techniques seem to work now is the best approach. This combination approach we will call the hybrid approach. In developing such a hybrid approach, what we need to do first is to establish how, in this new web era, we should proceed to help our students learn to the best of their abilities.

I. Education Technique

I hope that every educator in every discipline would say that we want our students to learn to think creatively as they learn. A method proven to enhance creativity is the learning theory of constructivism (Elizabeth Murphy, 1997; C. Fosnot, 1996), which is based on the philosophy that learners should actively construct knowledge in their attempts to understand their universe. Educators using this method want the students to have an opportunity to use their prior knowledge and senses in making connections to the new concepts introduced. Educators also want the students to be able to explain a new set of data based upon the new concepts they have understood. Therefore, if one accepts that constructivism is the route to choose for the basis of our educational philosophy, and if we admit that we are in a new web era of education, we must ask "how can educators use technology to guide the constructivist approach to science education?" The discussion here is not the first study of the use of technology in constructivism (Perkins, D). In addition, others have discussed constructivism in science education (Anthony Lorsbach and Kenneth Tobin, 2000). However, this paper will attempt to answer that question for education in the sciences, and with techniques explicitly applicable for today's web format. We will begin by addressing some pertinent questions for education in this new era.

II. Questions and Answers

A. What is Education?

Since about ten years ago, it has been said that information has been doubling every five years. Given this rapid rate of development of information, what then does it mean to be educated today? In addition, what does it mean to be well rounded in education? Since information is changing so rapidly in all fields, it is only the truly exceptionally bright and mature person that can continue to be considered knowledgeable in more than one discipline. Everyone has to be a life-long learner or be hopelessly behind the information curve early in life. People can't continue to just stay in school all their lives, so they must learn to learn on their own and the web affords an excellent venue for such education. Of course, just because a topic is presented on the web does not necessarily mean that the information is current or even correct. Therefore, there is a need for some sort of accreditation of web sites for correct information, and that presents the need for some group of knowledgeable people that spend time checking and validating web sites. Organizations such as the American Chemical Society could use retired faculty members to periodically review such sites and provide some seal of acceptability for the site. We would stress the tremendous need for some sort of validation of knowledge base on the web sites.

B. Where is the classroom?

This discussion leads us to asking, "Where does the student receive education?" Such a question can have different answers depending upon the status of the student. Since we all must be students all of our lives, there are two categories of students: those without a degree, and those with a degree. This article will not develop the inquiry about what a degree will be in a few years! [Nevertheless, just for thought, in the future perhaps instead of a "degree" there will be standardized exams for people to take to prove the attainment of a certain level of current information.] However, regarding the classroom, it seems that there will continue to be a need for classroom instruction for some years in the future. There still are many students without the necessary learning skills and self discipline to learn complex topics completely on their own. Many of these students will continue to need the classroom and the live instructor to help them develop an acceptable understanding of the disciplines. However, we are convinced that an extremely promising method of successful teaching in this web era is a hybrid approach of web-enhanced classrooms. Other people are coming to similar conclusions (Jeffrey R. Young, 2002). Universities currently actively investigating this hybrid model include Fairleigh Dickinson University, Pennsylvania State University, Harvard University, the University of Central Florida, and the University of Wisconsin system.

C. Where are the students?

The next logical question is "where are the students?" and, based upon the discussion above, we think that the answer is that they will be on the campus and anywhere. We believe that the demand for completely online courses will increase in the next few years, and probably increase more as students from the high schools become more adapted to self-learning as their teachers begin to also use a hybrid approach.

However, it seems that educational institutions must be ready to serve students both on campus and online.

D. What do we teach?

Now we are led to the next question "what do we teach?" Do we teach material from a textbook? Do we teach material from the world (ideas, concepts, and information developed since a textbook has been written)? Since information is increasing so rapidly, especially in the sciences, do we continue to use a written textbook? The answer probably depends upon the level of the course. For introductory mathematics, chemistry, and physics, the written textbook is probably "safe" for a few more years regarding the need for some means of presenting fundamental concepts. The textbook companies have been supplementing the textbooks with videos and demonstrations on CDs for several years. One company (Thinkwell) is now marketing a web/CD combination for a substitute for the standard written textbook, and we will be experimenting with such at this university in some chemistry and mathematics courses the fall of 2002.

E. How do we teach?

The next question to be answered by educators is "how do we teach?" The answer could be a formal lecture style, discovery based with classroom small group interactions, some combination of these first two possibilities, the first two with web supplement, or completely web-based. We think all of these methods need to be used in the modern "classroom". As mentioned before, there will be an increasing number of students with the necessary skills to learn completely from a web site and such web sites need to be available for these students. We believe that such web sites should be developed based upon the web components required for various learner styles. Such a methodology of web course development will be published in 2002 (Leon L. Combs, 2002) and so will only be briefly reviewed next.

III. The Web Course

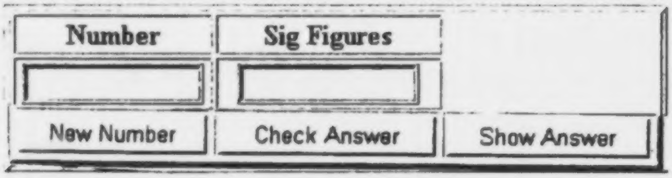
We must never try to fit pedagogy to technology. We must always have firm learning goals for the web course and use the technology that best enhances the learning experience. The web course must have a process for evaluation and assessment built into it from the development stage, and it must have a design for stimulation of interactivity among the learners. Frequent activities must be required as well as recurrent student reflection. The site must be interactive from the beginning and this can be accomplished using simulations, online quizzes, java-based repetitive exercises for acquiring needed knowledge, discussion groups using electronic bulletin boards, submitted assignments, and frequent proctored testing. Video is needed for the visual learners and such presentations can be done with streaming video from the web site or, probably preferably for the next few years, presented on accompanying CDs. Animated gifs can sometimes substitute for a short video. Slides with audio discussions are effective learning tools and can be easily developed with Real Slideshow.

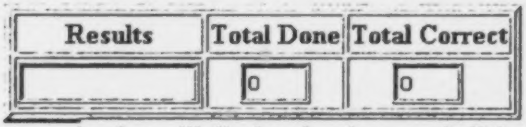
Everybody's role changes for a web course, for the teacher is now a tutor and a facilitator, and the students are independent learners. The facilitator must create the environment, guide the process, moderate the process, manage the content, and create a learning community among the learners. The teacher should give a learner style pre-test for all learners to help the teacher and the student better understand what is needed for that particular learner to best proceed.

The reader can go to http://ChemNet.kennesaw.edu and from that site choose from among four courses in freshman chemistry for examples of web courses in chemistry. These web sites were designed by utilizing web components corresponding to the following learner styles: visual, auditory, read/write, kinesthetic, sequential or global, inductive, deductive, active, and reflective. It should be stressed that there is a need for only web site for each course, so faculty members need not fear that all of them are going to have to develop such a course. Every course should have one web site that is easily accessible to the learners. Every faculty member can then used the web site in whatever hybrid manner is best for their course and their teaching philosophy.

IV. The Web Advantages

Every student of science must develop basic understandings that require repetitive practice to make sure that the concept is understood. One such concept is significant figures and the web can provide that assistance by the use of sites that look like the following



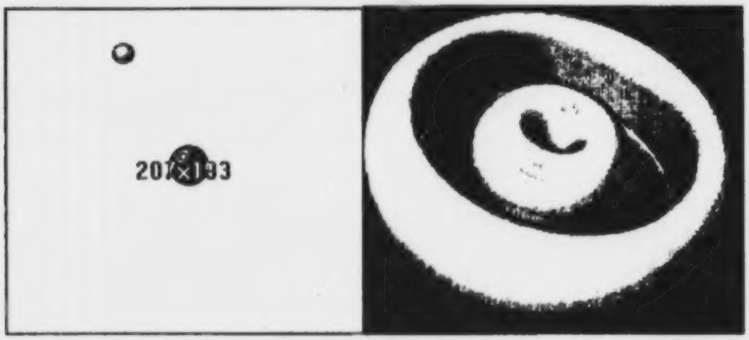


Results	Total Done	Total Correct
	0	0

The student goes to a site that will display the above and clicks "New Number" so that a number like 0.047249 appears. The student enters the number of significant figures for the number in the next space provided and clicks "Check Answer" to determine if he/she was correct. This process needs to be repeated, as new numbers will cover all types of numbers requiring a thorough understanding of significant figures for correct answers to be obtained. This same sort of repetitive testing can be done with many concepts such as moles, molarity, molality, the periodic table, quantum numbers, etc. Upon completing these web site testings, the student will know how to use these concepts. This site (http://proton.csudh.edu/lecture_help/lechelp.html) has many such testings.

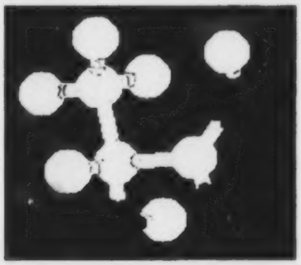
BEST COPY AVAILABLE

Another area in which the web excels is in the use of animations and simulations of abstract concepts such as the Bohr and quantum mechanical model of the atom.



In this animation the student can click on one of the orbits and cause the yellow ball (electron) to change orbits and the student will see if energy will be given off or if it is must be supplied. Since the Bohr model is not correct, the student can click on a particular orbit and see the corresponding quantum mechanical illustration of the probability of where the electron is as seen to the right above. Such animations and simulations can be developed for many areas of the sciences and are of tremendous help in the learner developing a deeper understanding of the concepts. In such simulations, variables can be changed and the student will immediately see the result and determine if the result was what was expected based upon the understanding of the theory. If the result is not what the student expected then he/she must develop a better understanding of the theory (constructivism).

Another important web application is being able to click on the structure of a molecule and rotate the molecule in any manner desired. Such an application gives the student a better understanding of the three-dimensional structure of the molecule than any two-dimensional representation. Below is lactic acid as it could appear on the web site except that you have to imagine that you can click on it and rotate it in any direction.



Imagine a course web site containing discipline information; online comprehension quizzes; electronic discussion boards; and many such repetitive testing, animations and simulations, and diagrams that can be rotated as noted above, and we begin to understand the huge advantage that the web has to offer education in the sciences.

BEST COPY AVAILABLE

V. Conclusions

The web era offers educators a very rich venue for expanding our educational methodologies. A few minutes spent on a web search will show web applications in many disciplines. Particularly in science, the web-enhanced classes can greatly enrich the experience of the learners. We have comparison testing results showing that students in web-enhanced chemistry classes consistently score higher on standardized exams that the students in the traditional lecture style classes. Other data collected by following students through advanced classes also suggest that students retain the understanding longer than students in traditional classes do. The conclusion is that we are in a wonderful new era of education: the web era. At this point in the era, it seems that the most promising direction for universities to pursue is the hybrid approach of using the web material as a supplement to the still-evolving classroom structure. This era is developing so fast that conclusions reached today could be invalidated tomorrow.

However, it does seem that the web-enhanced class is the method of choice today, and that universities need to be developing web-based instruction in all disciplines for the short-range purpose of enhancing the classes. Commercial organizations such as Thinkwell are already developing such enhancements, and it may be that outsourcing to such organizations is the most practical way for universities to proceed at this time. Since many universities use the phrase "life-long learners", they need to be helping students develop the skills, resources, and desires to learn how to properly use the web for life-long learning.

References

Elizabeth Murphy, "Characteristics of Constructivist Teaching and Learning", http://www.stemnet.nf.ca/~elmurphy/emurphy/cle3.html, 1997.

Fosnot, C. (1996), "Constructivism: A Psychological theory of learning." In C. Fosnot (Ed.) *Constructivism: Theory, Perspectives, and Practice*, (pp.8-33). New York: Teachers College Press.

Perkins, D. (1992) "Technology meets constructivism: Do they make a marriage." In T. Duffy & D. Jonassen, *Constructivism, and the technology of instruction: A conversation* (pp.45-56). New Jersey: Lawrence Erlbaum Associates, Publishers.

Anthony Lorsbach and Kenneth Tobin, "Constructivism as a Referent for Science Teaching", http://www.educ.sfu.ca/narstsite/research/constructivism.htm, National Association for Research in Science Teaching, 2000.

Jeffrey R. Young, "'Hybrid' Teaching Seeks to End the Divide Between Traditional and Online Instruction", The Chronicle of Higher Education, March 22, 2002.

Thinkwell, http://www.thinkwell.com/

Leon L. Combs, "The Design, Assessment, And Implementation of a Web-Based Course", *Educational Technology Review*, accepted for publication, 2002.

Towards a Standards-based Approach to e-Learning Personalization using Reusable Learning Objects

Owen Conlan, Declan Dagger, Vincent Wade
Trinity College, Dublin,
Ireland.

E-mail oconlan@cs.tcd.ie, daggerd@tcd.ie, vwade@cs.tcd.ie

Abstract: e-Learning systems that produce personalized course offerings for the learner are often expensive, both from a time and financial perspective, to develop and maintain. Learning content personalized to a learners' cognitive preferences has been shown to produce more effective learning, however many approaches to realizing this form of personalization involve considerable re-authoring of existing learning material. To reduce the implementation overhead on the content author and course designer it is imperative to facilitate the maximum reuse of learning resources.

This paper investigates a standards-based approach to delivering personalized learning content to learners using WWW technologies. Detailed is an implementation of a personalized eLearning service, called the OPen Adaptive Learning Environment (OPAL), which is based on delivering content personalized to the learner's cognitive and presentation learning preferences using aggregation models based on ADL SCORM (ADL).

INTRODUCTION

Mechanisms that facilitate the reuse of learning content allow course authors to increase the life span of the content they develop. As these are often expensive and time consuming to develop the potential for any reuse should be maximized to achieve maximum return on investment. There are a number of factors that increase the potential reuse of learning content –

1. Granularity of the content
2. Effective and descriptive metadata
3. Appropriate packaging of the content and metadata for distribution

These factors, however, do not directly improve the pedagogical quality of the content produced. Learners have been shown to respond well to content and education systems that adapt to their personal preferences. The key to this process is an appropriate learner model constructed either explicitly through an online instrument or implicitly through the learner's interaction with the learning environment.

This paper details an approach to content authoring and packaging that enables the course author to create learning content that is both reusable and capable of supporting different pedagogical approaches through a content aggregation model. Section two details content issues such as packaging standards and granularity, section three shows how content packaging can support some approaches to adaptivity, section four discusses techniques for modeling the learner, section five covers the OPAL Environment and section six gives a summary of the paper.

PACKAGING LEARNING CONTENT

Packages of learning content and associated descriptive metadata are produced to facilitate the portability of learning content between different Learning Management Systems (LMS). The packages usually contain additional information about how the amalgamated learning content should be sequenced and additional metadata that describes the learning resources.

As the learning content, from which the content packages are built, may be stored in searchable repositories, with appropriate metadata, the course author may simply have to search for pre-authored material and combine it into a new offering. This is the model adopted by the EASEL IST project (EASEL) were a basic semantic registry and learning resource repositories were constructed to facilitate metadata searching across multiple schemas.

By re-sequencing the learning content in the package or by adding additional content or by adding content that supports different approaches to learning the course author may produce additional packages tailored to specific learning approaches and learner prior knowledge, while still supporting a common learning objective in the different course offerings. For example, the author may produce three packaged instances of a course, each tailored for a different level of prior knowledge from prospective learners. A simple knowledge pre-test instrument may be used to determine which package is the most appropriate for each individual learner.

Multiple content packages may be aggregated together to assemble an aggregated content package. This enables a learner's requirements to be met from more than one package.

Content Granularity

The size and scope of the pieces of learning content that are combined to form the content packages is a key consideration. For example, if a content package is comprised of only a few pieces of large grained learning content then re-sequencing them to form a new package that supports a different pedagogical approach may not be possible, as the new narrative flow may not make sense in the context of the learner's learning. This issue is paramount in the reuse of any learning object (Conlan et al. 2002).

To facilitate reuse learning objects should be fine-grained, paragraph or diagram size, for example. Content packages should be used where larger grained learning resources are required as they may be constructed using smaller learning resources and/or other content packages. Both IMS Content Packaging and ADL SCORM facilitate the assembly of content packages by combining other content packages or assets, such as in the case of SCOs.

With smaller grained learning objects the course author has greater flexibility in the creation of additional content packages. For example, if learning objects are available at the paragraph level then the course author can add/remove content at this level to produce tailored courses.

Candidate Standards

IMS Content Packaging IMS Content Packaging is an interoperability specification to allow content creation tools, learning management systems and run-time environments to share content in a standardized set of structures. Version 1.1.3 of the specification is focused on defining interoperability between systems that wish to import, export, aggregate, and disaggregate packages of content (IMS CP).

The primary goal of the IMS Content Packaging specification is to provide a mechanism which, once implemented by producers and vendors, will allow content to be exported between systems with the minimum of effort. Version 1.1.3 of this specification is currently available as a public draft.

ADL SCORM In 1997 the United States Department of Defense (DoD) and the Whitehouse Office for Science and Technology Policy (OSTP) set up the Advanced Distributed Learning (ADL) initiative to push development plans for standardization of Learning Resources. Their standardized approach to creating cross-compatible systems and content is encapsulated in their Sharable Content Object Reference Model (SCORM) (ADL). The SCORM constitutes three key components –

- The Content Aggregation Model (CAM).
- The Run-Time Environment (RTE).
- Content Packaging.

Through these components the ADL aims to meet the high-level requirements of –

- **Reusability**, content persistence over different LEs. A unified method of content markup.

- **Accessibility**, globally accessible content repositories. Metadata search facilities.
- **Durability**, learning resource and system component persistence over time.
- **Interoperability**, create systems and learning resources that are operation system and platform independent.

The purpose of the Content Aggregation Model (CAM) is to provide a common gateway for the composition of learning content from discoverable, reusable, sharable and interoperable sources (ADL). The CAM describes the Content Structure Format (CSF). The CSF allows standalone learning resources to be aggregated into either a complete course or a section of a course. Also described are mechanisms that facilitate the movement of content between different LMSs and repositories.

The three components described by the SCORM CAM for use in building reusable content are –

1. **Assets** A primitive representation of learning content, e.g. an applet, flash animation, image etc.
2. **SCO (Sharable Content Object)** Represents the finest grained learning resource traceable by the LMS e.g. a collection of one or more assets. A SCO should be system independent, i.e. should contain a compatible launch sequence persistent across multiple SCORM compliant LMSs.
3. **Content Aggregation** Involves the virtual mapping of SCOs together to form cohesive units of instruction that can be delivered to the learner through the SCORM Run-time Environment. (ADL)

Through the SCO (Sharable Content Object) markup the content may be described using an XML binding based on the IMS Learning Resource Metadata (IMS LRM) specification XML Binding. This specification has been extended as part of the EASEL IST Project (EASEL) with descriptive elements to facilitate the description of adaptive material (Conlan et al. 2001).

Describing the Content

The reuse of learning resources is aided considerably by appropriate, descriptive metadata accompanying the resource, enabling the content author to assemble new course offerings from existing content. If the metadata used to describe these resources is compliant with a known standard the reuse of the learning resources is extended beyond the bounds of the initial course delivery system.

The XML binding for extended IMS Learning Resource Metadata (Conlan et al. 2001) can be used to describe particular attributes of the content to which a system may adapt. For example a piece of content may include in its metadata –

```
<adaptivity>
        <adaptivitytype name="learningstyle.vark.visual">
                <candidate>4</candidate>
        </adaptivitytype>
        <adaptivitytype name="learningstyle.vark.auditory">
                <candidate>2</candidate>
        </adaptivitytype>
        …
</adaptivity>
```

This XML snippet describes a piece of content that rates quite highly on the visual scale of VARK (Fleming 1995),(Bruen & Conlan 2002). If the learner's profile is built using a similar mechanism then the LMS will have a framework in which to compare the learner with candidate content.

ADAPTIVE TECHNIQUES

There are many adaptation effects that may be supported and facilitate using content packaging. Most of these techniques have their origins in Intelligent Tutoring Systems (ITS) and Adaptive Hypermedia Systems (AHS). The most effective uses of content packaging to provide adaptivity, however, involve situations where learning content re-sequencing or replacement produce course offerings that differ to large degree in pedagogical approach.

Curriculum Sequencing Curriculum sequencing is an adaptive technique that can produce very effective differences in how learners perceive learning content. Pedagogical theories such as Kolb/McCarthy place great emphasis on how content is sequenced and the ways different learners react to that learning content.

Content packaging allows a course author to produce several *versions* of the same course, each sequenced in a different manner. For example, one version of the course may start with a case study and derive the theoretical aspects of the material from that study. While another may start with the theory, present some examples and finish with a self-assessment quiz.

The effective production of these different versions assumes that the constituent parts of the packages are sufficiently small-grained that they may be re-sequenced. There may be a need to author some additional narrative content to facilitate the different routes through the content the individual content packages offer.

Contextualization When courses are being offered to corporate learners it is often desirable to use case studies and examples that pertain to those student. For example, if you are offering a programming course for accountants a course that uses accounting examples will be more familiar to the students. If the examples used are individual *grains* of content then that same programming course may be offered to civil engineers by simple changing the example learning objects for more appropriate examples. In this way content packages may be used to store several versions of the same course that differ only in context.

MODELING THE LEARNER

A learner/user model contains explicitly modeled assumptions that represent the characteristics of the student which are pertinent to the system. The system can consult the user model to adapt the performance of the system to each student's characteristics. User modeling allows the system to personalize the interaction between the student and the contents. To achieve effective learning this personalization should put the content in a context that the student can understand and to which they can relate. There are several techniques for modeling the student and refining this model.

The Stereotype Model Creating fixed stereotypes is one of the simplest ways of user modeling (Rich 1989) . New students are categorized and the system will customize its performance based on the category that has been set for the student. A common example would be the notion of novice, intermediate and expert users within a system. This approach is useful when a quick but not necessarily completely accurate assessment of the user's background knowledge is required (Kobsa 1993).

The Overlay Model The overlay model is widely used in the adaptive hypermedia systems in the educational domain. A model of the student's knowledge is constructed on a concept-by-concept basis and updated as the user progresses through the system. This allows for a flexible model of the student's knowledge for each topic (Brusilovsky 1996).

For this model the knowledge domain must be modularized into specific topics or concepts. The complexity of the model depends on the granularity of the structure of this domain knowledge and the granularity of the estimation of the student's knowledge. This estimation is build up by examining the sections the student has read and the test he has performed.

The Combination Model The Stereotype and Overlay techniques of user modeling are often combined in educational adaptive hypermedia systems. The student may be categorized by stereotype initially and then this model is gradually modified as the overlay model is built from information acquired from the student's interaction with the system.

There are a number of implicit approaches that may be used in acquiring and refining the user model. These include –

- The observation of the users direct-manipulative interaction with the software system.
- The analysis of the information which the user retrieves from a database or repository (Kass & Stadnyk 1992).
- The system can also explicitly ask the user for information (Kobsa 1993) employing mechanisms such as questionnaires and tests.

Learner Model Standards and Specifications

Candidate Learner Model specifications include PAPI (PAPI) , IMS Learner Information Package (IMS LIP) and the GESTALT (GESTALT) user model. As yet none of these specifications deal with the representation of pedagogical aspects of the learner, such as learning styles, prior knowledge or life long learning goals (i.e. career path). Even if there was a recognized standard for passing this information there is no common vocabulary to which AHSs could adhere to process the information. Individual AHSs will however have their own mechanisms and vocabularies for storing pertinent learner information.

PAPI PAPI (PAPI) is the IEEE Public and Private Information Specification which is a standard format for the representation and communication of student profiles. The purpose of the specification is to allow the creation of student records which can be communicated between educational systems over the lifetime of a learner.

The profile information,for a learner is divided into four areas - Personal information which is for private consumption such as the student's name, address and Social Security Number; Preference information which may be for public consumption, such as the technology available to the student, the learning style of the student, physical limitations or disabilities. This information is collected with the cooperation of the student, i.e. it is negotiated; Performance information which is for consumption by technology. This consists of the observable behavior of the student and may include grades, reports and logs.

The PAPI specification also incorporates the Dublin Core metadata element set. The information used to construct the user profile is inferred by the system, directly input by the user or is constructed by the user and system in collaboration. PAPI also intends to address the privacy and security issues involved in the storage and communication of user profile (PAPI) .

IMS Learner Information Package The IMS Learner Information Package (IMS LIP) specification addresses interoperability between internet-based learner information systems. Learner information concerns Learners (individual or group) or Producers (creators, providers or vendors). LIP includes facilities for the Learner to determine which aspects of their information are sharable with other systems. LIP has been designed with four basic requirements in mind –

- Distributed Information
- Scalability
- Privacy and Data Protection
- Flexibility and External References

The last requirement is described in (IMS LIP) as Learner information includes many constructs, such as learning objectives and learning history, which are in practice represented by different structures in different contexts. Learner information data models must be flexible enough to accommodate this need. IMS LIP v1.0 is currently available as a public draft.

GESTALT GESTALT (Getting Educational Systems Talking across Leading Edge Technologies) (GESTALT) which is funded by the ACTS project, is an educational environment for online learning which extends the IMS metadata definitions. A user profile is constructed from information acquired from the user by asking the user to complete forms displayed by a wizard. The user model is created as an XML document which is then stored physically on the user's machine. The profile information stored includes the user's educational history and technology available to the student.

Some of the profile details acquired include personal details, contact details, qualification details, skill details, learning preferences and mode of delivery. The learning preference is stored as a boolean value of 'Yes' or 'No'. The user profile is created as an XML document that will be stored physically on the user's machine.

Modeling Cognitive Preferences

VARK (Fleming 1995) This technique of learner modeling uses a concept of multi-modal learning strategies, where the student being modeled does not have an outstanding preferred mode of learning but instead uses a combination of two, three or even four of the styles.

For example, one student may prefer a combination of the visual aspect and the kinesthetic aspect, to produce a comfortable learning experience for them. Another may prefer an aural, read-write combination for their learning environment. In rare cases students being modeled score evenly across all four spectrums.

Kolb/McCarthy Kolb's learning style model categorizes learners on two continuums, *abstract/concrete* and *active/reflective*, based on personal preferences for the consumption of new information. It suggests that the learner should cycle through all four styles in order to gain a full understanding of the topic.

The overview of this model is to present the learner firstly with their preferred style of learning, based on the two continuums and then cycle through the other 3 modes.

Bernice McCarthy has applied the original model set out by Kolb to categorize learners in accordance to the different cycles as follows.

1. Innovative Learners: *concrete/reflective*.

   This learner prefers to be shown the practical applications of the new material being presented.

2. Analytic Learners: *abstract/reflective*.

   This learner prefers to be presented with the results of research and well ordered sequential presentation of new material

3. Common Sense Learners: *abstract/active*

   This learner is a "try it and see" learner. Provide guided activities and keep them updated on where they are in the content.

4. Dynamic Learners: *concrete/active*

   This learner prefers the ability to explore other sources of information on the relative topic, hyperlinks to those resources.

THE OPAL ENVIRONMENT

The design approach of the OPAL (OPen Adaptive Learning) Environment architecture follows, in many ways, that outlined in the SCORM documentation specification. This approach has a central *repository* of content remotely stored on a database. The job of the Learning Management System is to access this data, display it to the learner in a coherent manner, and track their progress through the material.

System Components

Figure 1, below, shows the main components of the OPAL environment. The functionality of these components is implemented using twelve Java Servlets, through which the learner interacts with the system. The OPAL Environment is an LMS supporting learning resources that are descriptively tagged by SCORM metadata. The OPAL environment uses SCOs as the basic unit of content storage. The environment has some additional functionality that enables it to perform adaptivity at the level of content packages and at the content delivery stage by employing stretch-text type methods to selectively hide or remove individual types of content.

This mechanism is implemented by the key servlets –

- **AHSQuestionnaire** This servlet queries the learner, by delivering an appropriate online instrument to them and assembles the returned answers from which the learner profile is built.
- **LMSAddNewLearner** This servlet is responsible for authenticating the learner and selecting appropriate SCOs (content packages) to deliver to the learner as a content aggregation model (CAM).
- **LMSCourseServlet** This servlet accesses the CAM and determines how the SCOs should be assembled and the first SCO to be delivered to the learner.
- **LMSDisplaySCO** The LMSDisplaySCO servlet is responsible for the delivery of the content from the different SCOs in the CAM to the learner.

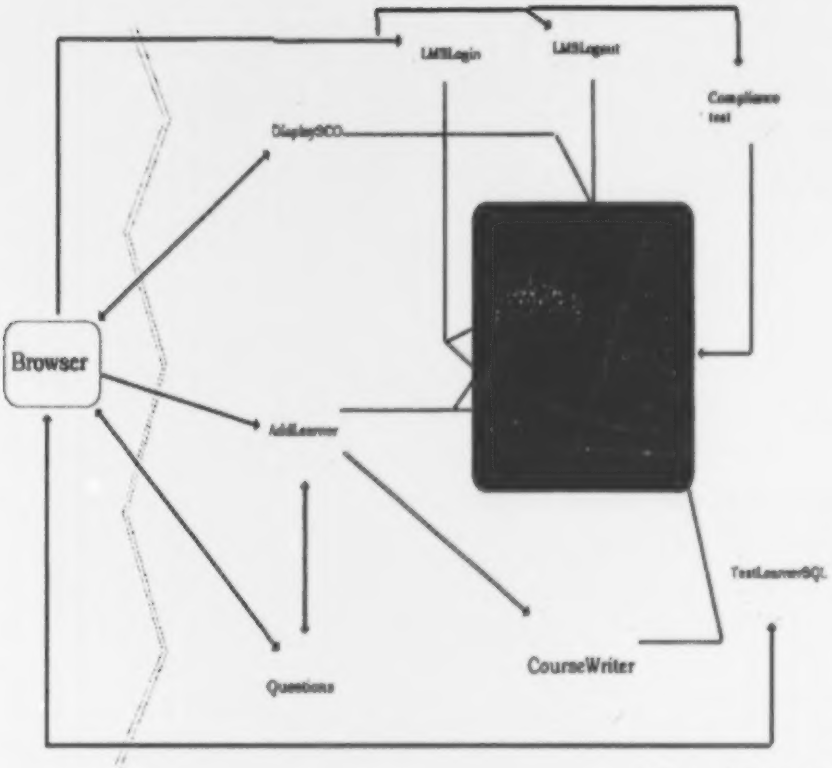


Figure 1: System Components

Building the Learner Profile

The AHSQuestionnaire servlet is responsible for building the learner model and adding it (using the LMSAddNewLearner servlet) to the profiles repository in the system. The model is determined explicitly by querying the learner. For example, in the case of the VARK (Fleming 1995) model the learner is asked 36 simple questions to build a profile of their visual, auditory, read/write and kinesthetic attributes. Once the questions are completed the results are returned to the LMSAddNewLearner servlet where the values are interpreted. This interpreted profile is stored in the profiles repository.

Building the Personalized Course

There exists only a finite number of SCOs in the content repository and it is the role of the LMSCourseServlet to assemble the SCOs selected by the LMSAddNewLearner servlet into a course offering tailored to the learner's profile with a personalized navigation structure. A selection process is initialized based on the learners' profile. This process induces an aggregation model for the learner based on their existing profile. The learning resources' metadata could also be used in this process. This metadata may be described in the manner section 2.3 Describing the Content. Once the servlet has identified the appropriate aggregation model it assembles the content, ready for delivery. This course structure is persistently stored in the course_table in the LMS repository.

BEST COPY AVAILABLE

Delivering the Personalized Course

It is the role of the LMSDisplaySCO servlet to display a personalized navigation structure to the learner around the selected SCOs. This servlet presents the learner with a simple next/previous navigation buttons for changing pages within the SCO as well as textual links to those pages. Also provided to the learner are links to other sections (other SCOs) and to a course index. This navigation structure is built by examining the structure of the SCO and its constituent learning content.

SUMMARY

This paper describes an approach to developing personalized e-Learning content using content that is reusable both in an adaptive and static manner. The key to this reuse is appropriate metadata and the use of content packages.

Also described was the OPAL Environment as an implementation of an adaptive e-Learning system based on SCOs. As in most Adaptive Hypermedia Systems the cornerstone of the personalization process is the building of an appropriate learner profile. This profile is induced to a selection process to assemble a personalized course for the learner.

REFERENCES

1. ADL. "ADL Sharable Content Object Reference Model", Version 1.2 , http://www.adlnet.org/.
2. Bruen, C.; Conlan, O. (2002): Dynamic Adaptive ICT Support for learning Styles – A Development Framework for re-useable learning resources for different learning styles & requirements. ITTE 2002, Annual Conference of the Association of Information Technology for Teacher Education.
3. Brusilovsky, P. (1996): Methods and techniques of adaptive hypermedia. In P. Brusilovsky and J. Vassileva (eds.), Spec. Iss. on Adaptive Hypertext and Hypermedia, User Modeling and User-Adapted Interaction 6 (2-3), 87-129.
4. Conlan, O., Hockemeyer, C., Lefrere, P., Wade, V., & Albert, D. (2001): Extending educational metadata schemas to describe adaptive learning resources. In Hugh In Proceedings of the twelfth ACM Conference on Hypertext and Hypermedia (Hypertext 2001), pp. 161-162, New York: Association of Computing Machinery (ACM), 2001.
5. Conlan, O.; Wade, V.; Bruen, C.; Gargan, M. (2002): Multi-Model, Metadata Driven Approach to Adaptive Hypermedia Services for Personalized eLearning. In proceedings of the Second International Conference on Adaptive Hypermedia and Adaptive Web-Based Systems (AH2002), P100-P111.
6. EASEL. Educator Access to Services in the Electronic Landscape, IST Project 10051.
7. Fleming, N.D. (1995): I'm different; not dumb. Modes of presentation (VARK) in the tertiary classroom, in Zelmer, A., (Ed.) Research and Development in Higher Education, Proceedings of the 1995 Annual Conference of the Higher Education and Research Development Society of Australasia (HERDSA), HERDSA, Volume 18, pp. 308 – 313.
8. GESTALT. "Getting Educational Systems Talking Across Leading Edge Technologies", Work Package 3, D0301 Design and Specification of the RDS (Resource Discovery Service), 1999.
9. IMS CP. IMS Content Packaging, Public Draft, Version 1.1, December 2000.
10. IMS LIP. IMS Learner Information Package, Public Draft, Version 1.0, December 2000.
11. IMS LRM. IMS Learning Resource Metadata, Version 1.2, http://www.imsproject.com/metadata/.
12. Kass, R. and Stadnyk, I. (1992): Using User Models to Improve Organizational Information. In Proceedings of the 3rd International Workshop on User Modeling. 1992, Dagstuhl, Germany.
13. Kobsa, A. (1993). User modeling: Recent Work, Prospects and Hazards. In Adaptive User Interfaces: Principles and Practice, M. Schneider-Hufschmidt, T. Kühme, and U. Malinowski, (eds.). 1993, North-Holland: Amsterdam.
14. PAPI. Public and Private Information (PAPI), Draft 6 Specification.
15. Rich, E. (1989): Stereotypes and User Modeling. In A. Kobsa and W. Wahlster (eds.): User Models in Dialog Systems, pp. 35-51. Springer, Berlin, Heidelberg.

A New Tool for Managing Students Self-Evaluations in Traditional and Distance Education Courses

Juan Contreras-Castillo, Arthur Edwards Block

Facultad de Telemática Universidad de Colima, México

Abstract

This paper describes a web-based question-answering system called E-teacher that can be used in both traditional and distance learning courses to review academic contents. E-teacher is a self-editing template-based system which consists of a set of PHP scripts that generate the HTML code dynamically, or "on the fly." The entire E-teacher is managed through an ACCESS database located on a Web server and data are stored and recovered upon request. E-teacher was developed to assist students review course content and reinforce the knowledge gained during traditional or distance learning courses. E-teacher will be piloted in English courses offered at the Facultad de Telemática of the Universidad de Colima.

Introduction

Since the early 90's teachers have recognized the potential of the World Wide Web (WWW) as an instructional tool (Crossman, 1997). As a consequence of this, they have created different types of educational materials to be exploited on the WWW, including text documents, multimedia presentations, etc. Unfortunately, this medium (online teaching) does not allow interactivity with instructor and class materials in the same manner as face-to-face contact permits. Even though the importance of these types of interaction (student-contents and student-interface) has been highlighted by Moore (1989) and Hillman (1994). This shortcoming often represents a major disadvantage when reviewing class content for self-evaluation purposes; because as Barker (1994) mentions, interactivity in learning is a necessary and fundamental mechanism for knowledge acquisition and the development of both cognitive and physical skills.

With this difficulty in mind, we developed a prototype of a Web-based question-answering system, called E-teacher, to complement online and traditional courses in facilitating students' self-evaluations and review course materials.

E-teacher is a template-based system which is managed though an ACCESS database (http://www.microsoft.com), where data are captured and retrieved upon request. The system will be integrated into distance education courses offered by the Facultad de Telemática of the Universidad de Colima (FT), in Colima, México (http://telematicanet.ucol.mx). E-teacher is composed of nine activities that can be used as independent modules or in combination and can be easily integrated within online courses

E-teacher will be piloted by English as a Second Language (ESL) professors at the FT as a complementary tool in their face-to-face courses. The implementation of this Web-based question-answering system will make student self-evaluations and the interactivity with the course materials easier and more efficient. In contrast to other simple strategies for handling student questions, such as bulletin boards, newsgroups, listservs, and e-mail, this system has a set of modules to increase the interactivity of students with course materials. For instance, E-teacher has a module that rates the performance of each individual student, based on random exercises and exams for their personal use without recording any data about the results. The activities for students within this system and their full descriptions are listed on table 1.

Activity	Description
WordScramble	The system randomly misarranges the letters within a response, which students must appropriately order to reproduce the correct answer.
SentenceScramble	The system randomly misarranges the syntax of a sentence or phrase, which students must appropriately order to reproduce the correct answer.
MatchCols	The system produces two columns which students must correctly correlate.
Fill	The system produces sentences or paragraphs with spaces which students must complete with the correct response.
SingleChoice	The system produces multiple choice questions with between two and ten options with a single correct choice.
MultiChoice	The system produces multiple choice questions with between two and ten options with an equal number of possible correct choices.
Dialog	The system misarranges elements (dialogs, processes, etc.) within two columns which students must correctly order.
Random	The system accesses the database of the type of exercise the student chooses (Fill, MatchCols, etc.) to randomly produce exercises from all the categories contained within that specific database.
Exams	The teacher selects a maximum of 20 questions from the 7 different question-type databases (Fill, MatchCols, etc.). Students then select any number of practice tests the teacher has previously captured.

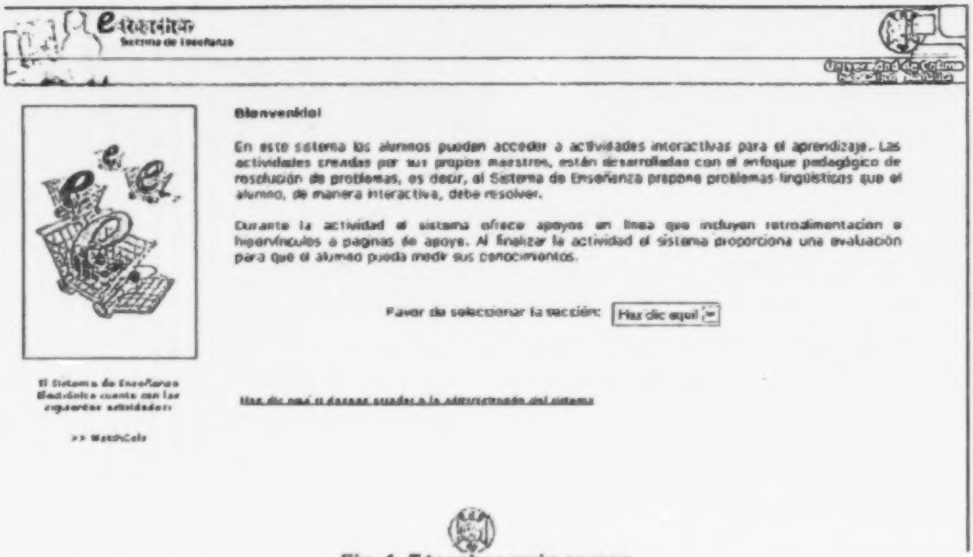
Table 1. Different type of activities on e-teacher

Description of the question-answering system

The E-teacher system consists of a set of PHP files that generate all the HTML code dynamically. This PHP code handles all the operational tasks. The files reside in an Apache Web Server operating in a Windows 2000 server with a PHP module version 4.0. In addition, the system is also installed on a pc running under the Linux operating system. The database that handles all the files can be accessed transparently through ODBC in any platform that supports this open database connectivity. The system consists of student, teacher and administrator modules.

The E-teacher is an open system for students. Any student can access the system to review course materials independently of the topic or teacher. Teachers, however, must be registered by the system to add, modify or delete review materials. In figure 1. we show the main screen for the E-teacher system.

It is important to mention that students can not modify the contents, graphic interface or functionality of the system. This can only be done by the teacher(s) who possess the access code previously authorized by the administrator of the system.



Bienvenido!

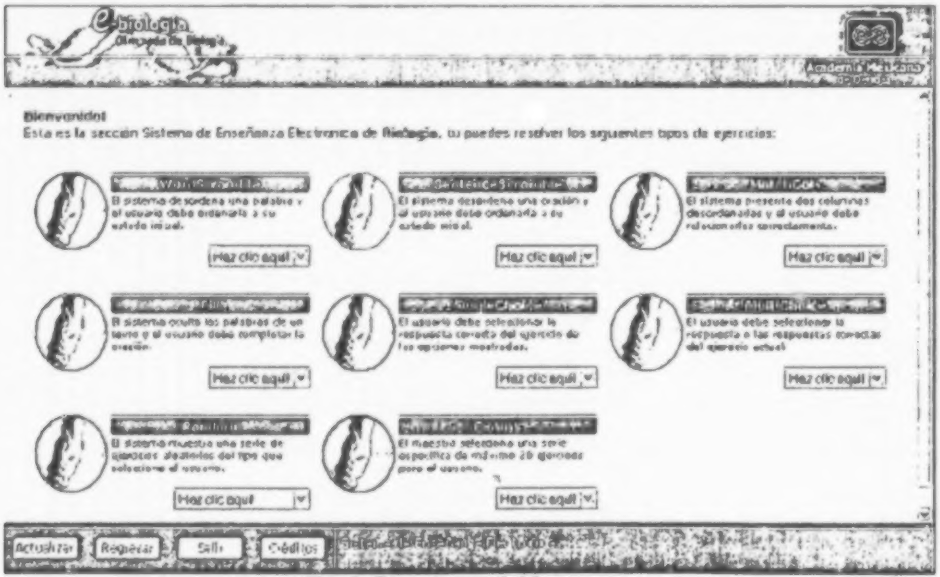
En este sistema los alumnos pueden acceder a actividades interactivas para el aprendizaje. Las actividades creadas por sus propios maestros, están desarrolladas con el enfoque pedagógico de resolución de problemas, es decir, el Sistema de Enseñanza propone problemas lingüísticos que el alumno, de manera interactiva, debe resolver.

Durante la actividad el sistema ofrece apoyos en línea que incluyen retroalimentación e hipervínculos a páginas de apoyo. Al finalizar la actividad el sistema proporciona una evaluación para que el alumno pueda medir sus conocimientos.

Favor de seleccionar la sección: Haz clic aquí

Fig. 1. E-teacher main screen

In the main screen, students can select the review material they want to access. As a test, we offer two different courses, English and Biology. Once they select the review material, the activities screen for that material is displayed as previously personalized by the teacher. This is shown in fig 2. In this Figure the topic the student selected was Biology. Once the student accesses the activities page, he can select among the options the instructor has previously developed (the different options are mentioned in table 1), as well as the individual exercises or exams he wishes to practice. Again, as a test we offer review material about the Cell. Within each activity, students have several standard and optional selections. Each of the standard options and its description is listed in table 2. In table 3 we list the optional selections, depending on the additional information teacher wish to provide.



Bienvenido!

Esta es la sección Sistema de Enseñanza Electronica de Biología, tu puedes resolver los siguientes tipos de ejercicios:

Fig. 2. E-teacher activities screen

BEST COPY AVAILABLE

Option	Description
Menu	Returns students to the activities main screen.
Instructions	Provides specific instructions on how to resolve the item
Review	Provides feedback about the degree of accuracy of the response
Next Item	Provides student with a new item
Resolve	Provides the correct response.

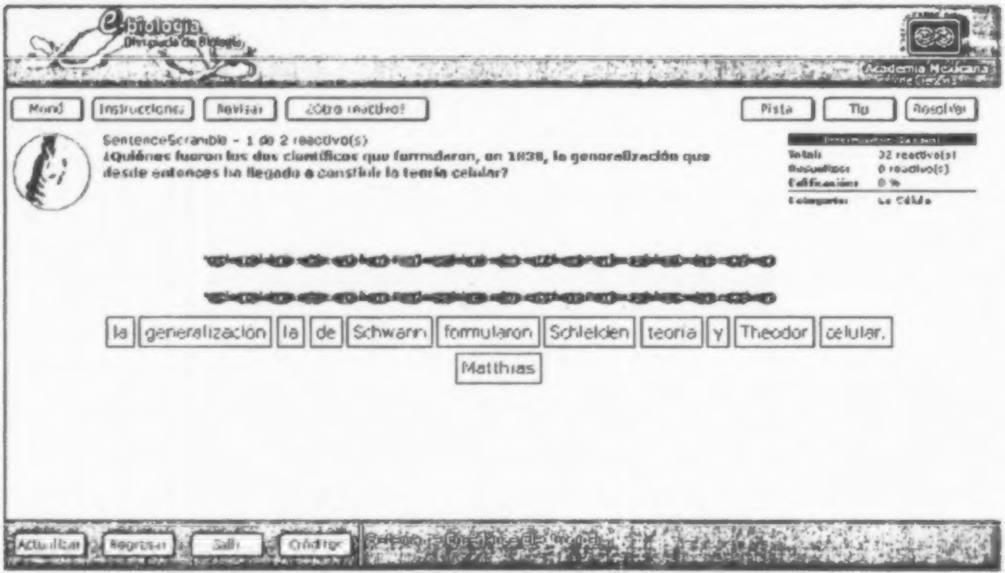
Table 2. List of standard selections for students.

One important characteristic is that teachers can provide students with several levels of difficulty depending on whether or not they wish to incorporate the optional selections. Teachers can incorporate these options in the teachers' main screen. Table 3 shows the different optional selections available to teachers:

Option	Description
Hint	Presents additional information to assist students resolve the item
Tip	Offers the next correct step needed to solve the item
Lesson	Provides a hyperlink to relevant pages related to the contents of the review material.

Table 3. List of optional selections for students

In figure 3, we show the SentenceScramble activity to review material about the Cell. In this activity, students have to select the correct word and place it in the correct syntactic order. As they order the phrase, they can ask the system for help, pressing the "Hint", "Tip", or "Resolve" buttons. Depending on how many times they press these buttons, the system calculates an average score for each answer and, upon finishing the activity, provides a total score.


e-biología
Divulgación de Biología
Academia Mexicana
Menú
Instrucciones
Revisar
¿Otro reactivo?
Pista
Tip
Resolver
la
generalización
la
de
Schwann
formularon
Schleiden
teoría
y
Theodor
celular.
Matthias
Actualizar
Regresar
Salir
Créditos

SentenceScramble - 1 de 2 reactivo(s)
¿Quiénes fueron los dos científicos que formularon, en 1838, la generalización que desde entonces ha llegado a constituir la teoría celular?

Total: 32 reactivo(s)
Resueltos: 0 reactivo(s)
Calificación: 0 %
Categoría: La Célula

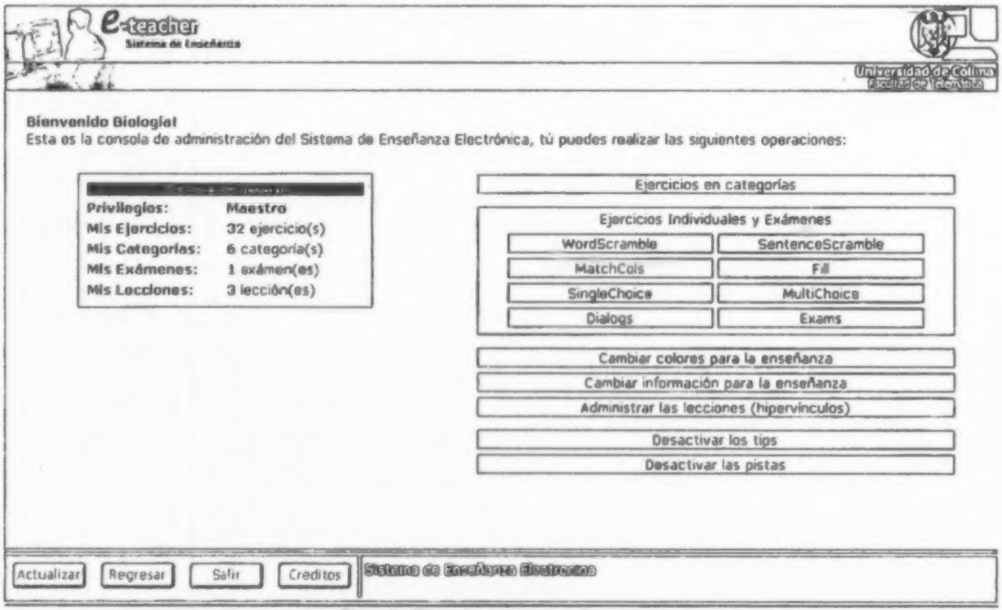
Fig 3. SentenceScramble review material for Biology topic: The Cell.

In table 4, a brief description of the options that teachers can select for a specific activity is shown. In Fig. 4 we show the graphical view of these options.

BEST COPY AVAILABLE

Option	Description
General Information	Displays the general information and the summary of lesson exercises incorporated by the teacher and his privileges
Exercises categories	Creates the databases needed to present the review activities as a coherent suit.
Individual Examinations and Exams	Creates individual activities that can be included in the Random and Exams databases for either review or inclusion in practice tests.
Change Colors for Instruction	Suggests a variety of color combinations teachers can use as backgrounds for their activities.
Change Interface Information	Individualizes information within the system, according to teacher requirements
Administer Lessons (hypertexts)	Creates a hyperlink database where the teacher can select hyperlinks to provide additional information (i.e. readings, diagrams, etc) to help students solve items, provide additional information or otherwise promote leaning.
Activate/Deactivate Tips	Allows the teacher to activate or deactivate the tips captured in the database, allowing for different degrees of difficulty.
Activate/ Deactivate Hints	Allows the teacher to activate or deactivate the hints captured in the database, allowing for different degrees of difficulty.

Table 4. Different options that appear on the teacher main menu


e-teacher
Sistema de Enseñanza
Universidad de Colima
Facultad de Telemática
Ejercicios en categorías
Ejercicios Individuales y Exámenes
WordScramble
SentenceScramble
MatchCols
Fill
SingleChoice
MultiChoice
Dialogs
Exams
Cambiar colores para la enseñanza
Cambiar información para la enseñanza
Administrar las lecciones (hipervínculos)
Desactivar los tips
Desactivar las pistas
Actualizar
Regresar
Salir
Creditos
Sistema de Enseñanza Electronica

Bienvenido Biologia!
Esta es la consola de administración del Sistema de Enseñanza Electrónica, tú puedes realizar las siguientes operaciones:

Privilegios:	Maestro
Mis Ejercicios:	32 ejercicio(s)
Mis Categorías:	6 categoria(s)
Mis Exámenes:	1 exámen(es)
Mis Lecciones:	3 lección(es)

Fig. 4. The teacher main menu

Conclusions

The fast and increasing development of distance education courses via the World Wide Web has made the development of computer systems that increase the interactivity of students-contents and students-interface necessary. With this goal in mind, we have developed a system based on a set of PHP scripts and templates to help students review materials and to realize self evaluations with a high level of interactivity with the course content. It is our hypothesis that this system will help students increase their cognitive and physical skills on the material they review.

BEST COPY AVAILABLE

To prove this, our future work, will consist in piloting the system with several English as a Second Language courses that are taught at the Facultad de Telemática of the Universidad de Colima in México to evaluate the system within an actual educational context and determine any possible improvement in the development of language skills in first year students.

In addition, we are also considering the addition of a new student-student, teacher-student interaction module that will permit students in online courses to interact among themselves and help increase the community feeling for this type of courses.

References

Barker, P. 1994. Designing interactive Learning. In T. de Jong & L. Sarti (Eds), Design and Production of Multimedia and Simulation-based Learning Material. Dordrecht: Kluwer Academic Publisher.

Crossman, D. M. 1997. The evolution of the World Wide Web as an emerging instructional technology tool. In *Web-based Instruction*. ed. B.H. Khan, 19-24. Englewood Cliffs, NJ. Educational Technology Publications, Inc.

Hillman, D.C.A., Willis, D.J., & Gunawardena, C.N. (1994). Learner-interface interaction in distance education: An extension of contemporary models and strategies for practitioners. *The American Journal of Distance Education*, 8(2), 30-42

Moore M. G.1989. Three types of interaction. *The American Journal of Distance Education*. 3 (2). 1-6.

Considerations for Building a Common Platform for Cooperative and Collaborative Authoring Environments

Alexandra Cristea[1], Toshio Okamoto[2] and Mizue Kayama[3]

[1]Faculty of Mathematics and CS, Technical University Eindhoven, The Netherlands
a.i.cristea@tue.nl
[2]Graduate School of IS, University of Electro-Communications, Japan
okamoto@ai.is.uec.ac.jp
[3]Senshu University, School of Network and Information, Kanagawa, Japan
kayama@isc.senshu-u.ac.jp

Abstract: This paper reports on considerations about the common basic functions and components for building a collaborative authoring environment. We aim to specify and systematize the technological issues towards the future standardization of such environments, based on our previous research experiences. Standardization includes many difficult aspects, however it will extend and widen the field of applications possible within the collaborative and cooperative authoring paradigm, and will enable the usage of the fruits of years of research and individual implementations of the concept of collaborative, but mostly, cooperative authoring. In this paper, we try to set a systematic basis for a common collaborative authoring platform.

Introduction

Cooperative and collaborative authoring (C^2A) are fundamental authoring forms that become more important with the paradigm shift towards re-usage and cooperation in the current authoring technology. The objects of C^2A are the *collaborative mutual interdependence* relations and the *group-implying activities* (Okamoto et al 2000; 2001).

Simply put, in pure *collaborative authoring*, each author takes over (an) authoring sub-task(s). When each author accomplishes the sub-task(s), the group goal is reached and collaborative mutual interdependent authoring is achieved.

In the wider spread *cooperative authoring*, authors just re-use each other's materials, (teaching) style, learning goal settings, dictionaries, linking and sequencing, etc.

Distributed C^2A is a type of collaborative authoring that can take place in the network environment, etc., with multiple authors virtually far from one another (comparable to the situation in O'Malley 1994). A virtually distanced setting can mean remote physically (geographically), but also covers cases where direct interaction and dialogue among participants is not possible due to other reasons. Distributed C^2A support is a pioneering research domain that tries to find out ways to support the cooperation and collaboration (C^2) of multiple authors on the network.

Computer Supported C^2A (CSC^2A) is directly connected to distributed collaborative learning (CSCL - Computer Supported Collaborative Learning) (ISO/IEC), in cooperative curriculum-related activities, according to the used Learning Technology (IEEE LTTF), on one hand, and to CSCW (Computer Supported Cooperative Work) (Conklin & Begeman 1988; Malcolm & Crowe 1994; Winograd & Flores 1986) on the other. Compared to CSCW, CSC^2A has the same direct goal, i.e., *working efficiency*, in the sense of authoring achievement efficiency combined with the recognition or meta-recognition of the subject field. At the same time, CSC^2A has as a final goal *the student learning* *achievement efficiency*, borrowed from CSCL (Dillenbourg 1999; Okamoto et al 2001).

The regular CSC^{2}A-management software implementation should provide therefore two types of activity space: a *private working space* and a *collaborative working space*. The first is, unlike in collaborative learning (Okamoto et al. 2001), just a space for processing the material into a final form, to be copied into the collaborative space. In pure collaboration this private space practically disappears, as authoring becomes an iterative, peer-feedback dependent process. Here, authors can exchange information in a synchronous, but mostly, asynchronous manner. Many researches are studying these two types of activity spaces for learning environments (Okamoto 2000; Okamoto et al. 2001;Synnes et al. 1999), but not enough studies focus on authoring purposes. We now propose to analyse the case of the C^{2}A Environment (C^{2}AE) (Cristea et al. 2001), by mapping it over the previously proposed collaborative learning environment case (Okamoto et al. 2000) and extracting analogies.

CSC^{2}A can be organized at many levels, starting with the selection of the appropriate knowledge representation and inference mechanism (Dicheva et al. 2002). Our current paper goes one step further and focuses on the interaction activities, the structural model they imply and the interfacing of these structural component objects. As this framework is aimed at covering the need of coordination and facilitation of authors working together towards one/more common/disjunctive authoring goal(s), we use the adjective 'collaborative' for describing both objects and activities, as being more powerful and restrictive than its counterpart, 'cooperative'. Mainly, if collaboration is possible, cooperation results implicitly. Moreover, by removing some of the features and restrictions, the collaborative environment can become a cooperative one.

Primitive Activities and Required Resources in C^{2}A

In this section, we describe the primitive interaction activities among participants in C^{2}A, from a macro-granulation perspective. From a technological viewpoint, every CSC^{2}A should provide appropriate tools ensuring a flexible, viable selection of these activities. Here we list them in their order of priorities: *Planning/ Execution/ Creation; Coordination / Control; Initiative/ Supervision; Observation / Suggestion; Data / Idea sharing; Dialogue (with Interaction).*

Surprisingly, compared to collaborative learning (Okamoto et al. 2000) only *Turn Taking* doesn't appear as a primitive activity, and supplementary to pure Execution, *Creation*, as a higher level execution form - implying new knowledge addition - appears. To perform these activities, the following resources are required in C^{2}A environments: *Personal Workplace; Shared Workplace (shared object space); Dialogue Channel (implicit or explicit); Technologically mediated remote communication (audio, visual)* – latter optional for cooperative environment. Furthermore, more refined cognitive tools are desirable for facilitating group collaborative authoring, such as, e.g., concept mapping tools (Cristea et al. 2001), etc. Therefore, we consider that an essential condition for CSC^{2}A systems is that the common platform/ infrastructure should have at least the above-mentioned resources built-in.

C^{2}AE Structural Model

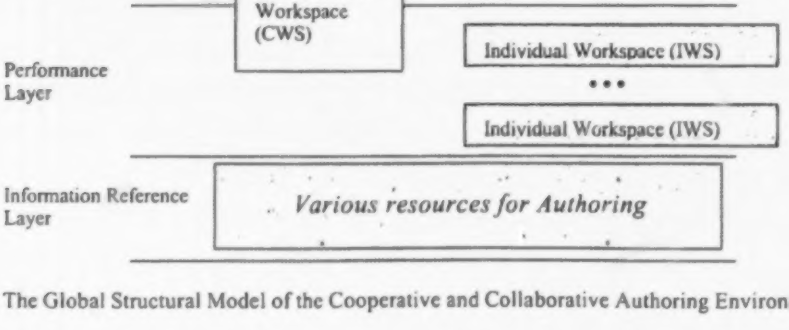

Dialogue Layer
Collaborative Workspace (CWS)
Individual Workspace (IWS)
Performance Layer
•••
Individual Workspace (IWS)
Information Reference Layer
Various resources for Authoring

Figure 1: The Global Structural Model of the Cooperative and Collaborative Authoring Environment

BEST COPY AVAILABLE

Figure 1 displays the C^2A concept from the point of view of the author behavior and the resource usage. We can differentiate between *author-to-author dialogue* (communication) and *other activities* (curriculum creation, etc.).

Note that we include the coordination activities in the latter category. The figure shows the layers for the C^2A goal and C^2 work, as well as the layer containing the various authoring resources to consult during C^2A. These include all possible resources to which the author has access during authoring in an Internet environment (e.g., authoring materials, all-purpose tools, specialized tools, authoring applications, various authoring data, etc.).

In C^2A an author can face an authoring task that s/he doesn't have either time or personal resources to fulfill and, by interactions with other authoring companion(s), or by consulting other materials, can exchange meaningful information and notice other ways of perception and teaching. As authoring efficiency has been shown to increase in C^2A situations (Dicheva et al. 2002), some systems try to encourage collaboration and especially re-usage with the help of computer implementations.

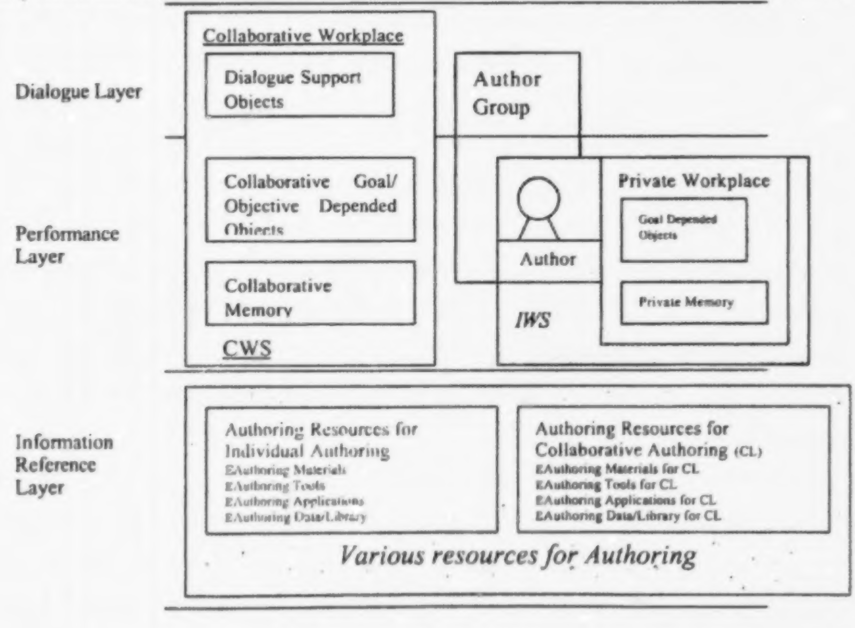
C^2AE Structural Components

Collaborative Authoring Model Elements

Figure 2 shows more details and various essential elements of the conceptual image of the C^2A model, where workplace and working subjects are brought together. Authors can belong to one or more groups, or none at all (pure re-usage, i.e., cooperation) and can be involved in curriculum creation projects or parts of projects together, therefore sharing that particular space (pure or partial collaboration) and work privately for the rest.

The C^2A shared (collaborative) workplace contains *dialogue support objects* for information exchange support, *collaborative work & goal objects* for authoring related support and the *collaborative memory*, for reference and information and end-product (course, etc.) accumulation (Fig. 2).

The private workplace contains the *work & goal repository* of the private working objects and the *private memory* for consultation and accumulation of information on private activities, notes, etc.


Collaborative Workplace
Dialogue Layer
Dialogue Support Objects
Author Group
Collaborative Goal/ Objective Depended Objects
Private Workplace
Goal Depended Objects
Performance Layer
Author
Collaborative Memory
Private Memory
IWS
CWS
Information Reference Layer
Authoring Resources for Individual Authoring
EAuthoring Materials
EAuthoring Tools
EAuthoring Applications
EAuthoring Data/Library
Authoring Resources for Collaborative Authoring (CL)
EAuthoring Materials for CL
EAuthoring Tools for CL
EAuthoring Applications for CL
EAuthoring Data/Library for CL
Various resources for Authoring

BEST COPY AVAILABLE

Moreover, the figure also details the information referencing layer that is shown to contain information oriented towards individual and collaborative authoring goals, authoring materials, various educational data, libraries, educational applications, all-purpose tools, market applications, etc.

Please note that both workplaces (private and C^2) are part of the respective workspace. In an analogy with the traditional classroom, we could say that, for a learning environment, the classroom itself is (part of) the collaborative workspace, while the collaborative workplace contains the blackboard, which is accessible and visible to everyone (and has a certain access policy, determined by the teacher agent).

C^2AE Structural Elements

There are six essential basic structural elements (objects) for building the C^2A environment. Due to lack of space, only the first hierarchical layer of definitions will be presented in this article.

1. C^2AE Representation: Many systems have already used the collaborative learning paradigm (Okamoto et al. 2000) and helped towards extrapolating the important structural points of a C^2AE (Fig. 1,2). To define the C^2AE, we need to define the following six concepts: *General structural model of the C^2AE; Essential structural elements of the C^2AE* and their *Attribute(s)* and *Relation(s); Dynamical model of the C^2AE (data transmission model); Dynamical mechanism of the C^2AE (data exchange mechanism).* These are shortly described in this paper.

2. Collaborative Workspace Representation: The collaborative workspace is an essential structural element of the collaborative part of the C^2AE that establishes a virtual space for collaborative activities for authoring groups and collaborating individuals, and ensures the continuity of these collaborative activities within that space (by activity related information recording, etc.). Moreover, this space also provides functionalities for the cooperative activities. The workspace definition requires the definition of the following terms below: *Structure of C^2A workspace*, its *Essential elements* and their *Attribute(s)* and *Relation(s).*

3.Authoring Resource(s) Representation: C^2A resource(s) have to be guaranteed for private activities, collaboration (screen sharing, operation sharing) and cooperation (repository sharing). Here we need to define: *Essential structural elements of the C^2A resource(s); Fundamental referencing model of resources* (e.g., Dicheva et al. 2002).

4. Collaborative Workplace Representation: The collaborative workplace belongs to the *collaborative workspace*, and is an essential component of the C^2 working environment, used in groups for collaboration, or, with respect to the outer world, in cooperation. Namely, the collaborative workplace is in a "use_of" relation with the group and the private author. This workplace is determined, as already mentioned in the previous sub-section, by the *collaborative communication (dialogue) support objects* for distant group members, by *C^2 work & goal objects* and by the *collaborative memory* that uses both previous object types for storage and retrieval. The defining of the collaborative workplace requires the definition of the terms below: *Collaborative workplace structure*, its *Essential elements* and their *Attributes* and *Relation(s).*

5. Collaborative Author Group Model

The group is defined within the collaborative workspace of the collaborative authoring environment. The group uses the collaborative workplace and pursues the collaborative authoring goal. This goal is defined as a set of individual achievements expected from the multiple members of the group. To define the author group model, the following elements and terms must be defined: *Group model structure*, its *Essential elements* and their *Attribute(s).*

6. Collaborative Memory Structure Representation

The collaborative memory (CM) is included in the collaborative workplace of the collaborative workspace. It serves to store the objects used for dialogue support and objects used and developed in C^2A. Moreover, it has the role to retrieve these objects and stored information at request (later on, the CM or a copy of it will have to respond to requests in relation with learning). To define the collaborative memory structure, the definition of the following terms is necessary: *Collaborative memory structure*, its *Essential elements* and their *Attribute(s)* and

Relation(s).

C^2AE Data Transmission Model and Interface Objects

Data Transmission Model in the C^2AE

Figure 3 shows the data transmission model in a C^2AE populated with authors and author group(s). The C^2A support system has to be able to send and receive, at the author's request, essential information regarding the C^2 and private workspace elements. Figure 3 illustrates our hypotheses by displaying a minimum of required relations. For example, a function has to be built that is able to fetch C^2 or private work objects requested by the group or privately from various resource(s), here represented by the *load_into* relation.

Interfaces

Five interfaces for the common objects can be defined, as briefly described below.

1. Interface between Authoring Resource(s) and C^2 Work Object(s)

The group performs collaborative activities by loading the C^2 work object(s) of the collaborative workplace from the authoring resources, for group and personal use. Authoring resource(s) are used by multiple groups or individuals. By activating a group request, a memory image of the requested authoring resource(s) is produced, and therefore the collaborative work object(s) of the group collaborative workplace come into being. For defining this interface and its regulations, the following must be defined: *Authoring resource(s) reference structure*, its *Essential elements* and their *Attribute(s)* and *Relation(s); Protocol between the authoring resource(s) agent and the collaborative work object agent.*

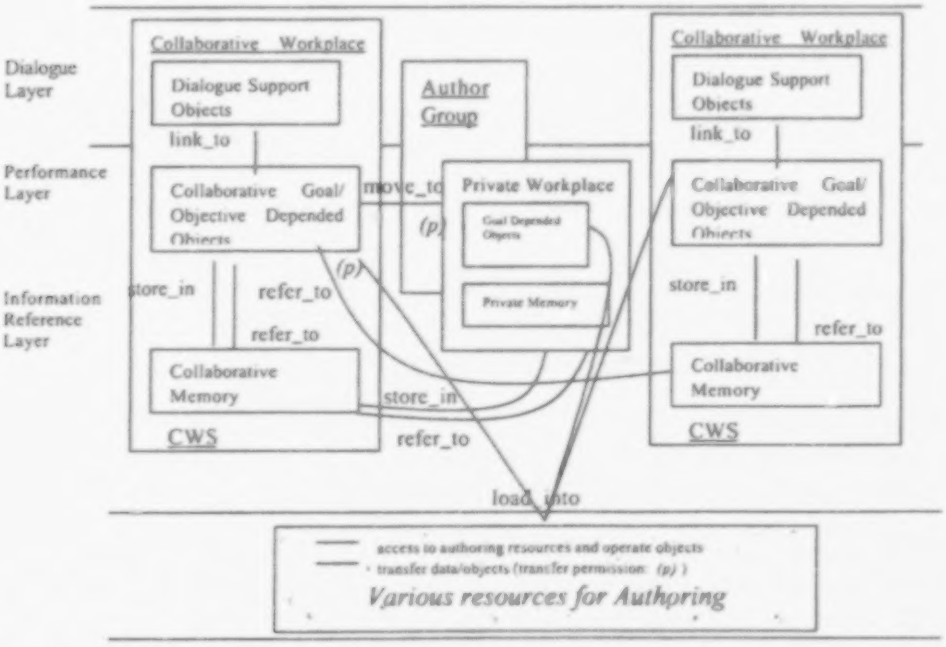

Dialogue Layer
Performance Layer
Information Reference Layer
Collaborative Workplace
Dialogue Support Objects
link_to
Collaborative Goal/ Objective Depended Objects
store_in
refer_to
refer_to
Collaborative Memory
CWS
move_to
(p)
(p)
Author Group
Private Workplace
Goal Depended Objects
Private Memory
store_in
refer_to
Collaborative Workplace
Dialogue Support Objects
link_to
Collaborative Goal/ Objective Depended Objects
store_in
refer_to
Collaborative Memory
CWS
load_into
access to authoring resources and operate objects
transfer data/objects (transfer permission: (p))
Various resources for Authoring

Figure 3: Data transmission model of the Cooperative and Collaborative Authoring Environment

BEST COPY AVAILABLE

2. Interface between Dialogue Support Object(s) and Collaborative Work Object(s)

The dialogue support objects enhance the information exchange between authors and manage the communication activity history. The role of the communication among authors is to support and smoothen the various authoring activities managed by collaborative work object(s). Namely, the communication that takes place in order to achieve the group-authoring goal is closely related to communication in collaborative work for problem solving. For the computer to understand the meaning of the communication, it is necessary to link the output of the dialogue support object and the collaborative working object (proper ontological representation). For this purpose, the items below need to be defined: *Dialogue support object and collaborative work object output data structures*, their *Essential elements* and *Attribute(s)*.

3. Interface between the Private Workspace and C^2 Work Object(s) of the Collaborative Workplace

C^2A does not always take place in the collaborative workspace. A group member or an independent author can bring in work results from the author's private workplace to the collaborative workplace, or the work result from the collaborative workplace can be copied to the private workplace. Therefore, next to the definition of the C^2 work object input data, the definition of the output data of the private workplace is also necessary, as follows: *Private workplace output data structure*, its *Essential elements* and their *Attribute(s)* and *Relation(s)*; *Protocol between the private workplace agent and the collaborative workplace agent*; *Protocol between the collaborative workplace agent and the collaborative work object agent*.

4. Interface between C^2 Work Object(s) of the Collaborative Workplace and the Collaborative Memory

The C^2 work object output data is the authoring log data. The interface uniformity between the C^2 work object(s) and the collaborative memory within the collaborative workplace is ensured by the C^2A log exchange and the C^2 work object addition/deletion. By establishing a uniform representation of the C^2A log, the accumulation in and the reference to the collaborative memory can be implemented in an interoperable form. For this, the items below must be specified: *Relation between the essential elements of the collaborative workplace structure and authoring log structure*; *Storage request structure of the authoring log into the collaborative memory*, its *Essential elements* and their *Attribute(s)* and *Relation(s)*; *The reference request structure of the authoring log from the collaborative memory*, its *Essential elements* and their *Attribute(s)* and *Relation(s)*.

5. Collaborative Memory - Group Model Interface

The collaborative memory of the collaborative workplace stores various data developed during the group curriculum activities. This information is the ordered and managed information of the group model. Thereafter, the group model is registered. When some new group activity commences, the previous activity history and results from the group model are referred. Moreover, the collaborative memory stores data developed during public individual authoring activities. Therefore, the collaborative memory maintenance is necessary. For the correct reference of such information, the items below have to be defined: *Relation between the collaborative memory attribute(s) and the group model attribute(s)*; *Relation between the collaborative memory attribute(s) and the (independent, individual) author model attribute(s)*; *Output data structure from the collaborative memory into the group model and individual author model*, its *Essential elements* and their *Attribute(s)* and *Relation(s)*.

Data Exchange in the Collaborative Authoring Environment

Virtual Agent in the Collaborative Authoring Environment

One of the essential structural elements of the collaborative authoring environment is the virtual agent (as in learning environments – see Paiva 1996).

The information exchange between the other essential structural elements can be done via agent(s). The attribute(s) of the appropriate essential elements are stored in the collaborative memory as well as the authoring log developed during collaborative authoring. Furthermore, depending on the request from group member(s) and collaborative work object(s), agents refer the information in the collaborative memory and integrate the exchanged information into a defined form. The concrete function of agents is to cope with the behavioral differences of the essential structural elements. Moreover, the information exchange protocol content varies, according to the transmission source and reception destination, and according to the behavior or functions of the bi-directional structure of the essential elements. Therefore, agents are dynamic interfacing structural elements. However, the basis functions of the agents in the collaborative authoring environment are defined simply as the exchange, deletion, addition of essential structural elements.

Collaborative Authoring Agent

The technological issues to specify for the agents delimited by the above assumptions are represented by the 5 items below.

1. collaborative authoring environment agent(s) structure
2. collaborative authoring environment agent type(s)
3. essential elements of the collaborative authoring environment agent(s) structure
4. attribute(s) of the essential elements of the collaborative authoring environment agent(s) structure
5. relation(s) of the essential elements of the collaborative authoring environment agent(s) structure

Conclusion

The technological concept formation of the basic and common platform for building the cooperative and collaborative authoring environment (C^{2}AE) needs a collective effort and is an ongoing process. We have started in this paper from some considerations based on our experiences, and have gradually built specification items towards a future standardization. We have not followed the ramifications we have opened due to lack of space. To give just a flavor of next developments necessary, we mention here some further functions required by the C^{2}AE (Okamoto et al. 2001):

- *Coordination* (constrained and mediated by the external environment)
- *Reification* (material evidence in the external environment)
- *Illustration* (external representation)
- *Storage* (in later use, for the purpose of reflection)

Examples of general tools for supporting collaboration are as follows: *Concept Mapping tools; Editors for argumentation network; Work flow* (planning tool); *WYSIWIS* (What You See Is What I See). So far, we have integrated a few parallel projects with related goals (distance learning, life-long learning, re-usage of educational materials), under the name RAPSODY (Okamoto 2000) and RAPSODY-EXT (Okamoto & Cristea 2001).

In this paper, we have systematically elaborated, from an academic point of view, the fundamentals of the common functions and components for building a platform for a C^{2}AE for the future directions of standardization. However, these considerations and issues are only the first steps towards standardization, and our paper doesn't claim to be exhaustive on the matter. For further research, the presented standardization candidate items have to be refined further on, and their functionalities extended. Therefore, we need more investigations and discussions to persuade people about the importance of standardization for collaborative and cooperative authoring.

By using a common architectural, functional and technological basis and, moreover, by using other common concepts not treated in this paper, such as a common ontology for a static representation model, and a common dynamic model (e.g., in Petri net representation), real collaboration and cooperation within authoring environments for learning environment creation can be achieved.

References

Conklin, J. & Begeman, M.L. (1988): IBIS: A Hypertext Tool for Exploratory Policy Discussion, *ACM Transaction on Office Information Systems*, Vol.6, No.4, pp.303-331.

Cristea, A. I., Okamoto, T. (2001): Object-oriented Collaborative Course Authoring Environment supported by Concept Mapping in MyEnglishTeacher, *ETS journal*, 4(2) ISSN 1436-4522.

Dicheva, D. Aroyo, L. and Cristea, A.I.(2002): Collaborative Courseware Authoring Support, *WBE-CATE 2002*, Computers and Advanced Technology in Education, ISBN: 0-88986-332-6, 52-57.

Dillenbourg, P. and Self, J. (1994): Designing Human-Computer Collaborative Learning, *Computer Supported Collaborative Learning* (Ed.: O'Malley, C.), NATO ASI series vol. F-128, Berlin: Springer-Verlag, 245-264.

Dillenboug, P. (1999): *Collaborative Learning, cognitive and computational approaches*, Advances in learning and instruction series, Pergamon.

IEEE Computer Society Learning Technology Task Force (LTTF) http://lttf.ieee.org/

ISO/IEC JTC1Standards for Information Technology for Learning, Education, and Training (SC36) http://jtc1sc36.org/

ISO/IEC Joint Technical Committee 1(ISC/IEC JTC1): http://www.jtc1.org/

Malcolm, K. and Crowe (1994): *Cooperative Work with Multimedia*, Springer, ISBN3-540-58315-7.

O'Malley, C. (1994) (Ed.): *Computer Supported Collaborative Learning*, NATO ASI series Vol.F-128, Berlin: Springer.

Okamoto, T. (2000): The Distance Ecological Model to support, Self/Collaborative-Learning in the Internet Environment, *ISSEI 2000*, Bergen, Norway, Section V; Workshop no.: 511.

Okamoto, T. Cristea, A. and Kayama, M. (2000): ICCE 2000 Invited Talk, Towards Intelligent Media-Oriented Distance Learning and Education Environments, *ICCE 2000 proceedings*.

Okamoto, T. Cristea, A. (2001): A Distance Ecological Model for Individual and Collaborative-learning support, *Educational Technology and Society*, vol. 4, Issue 2 (April 2001), Special Issue on Developing Creativity and Large Mental Outlook in the Computer Age, http://ifets.ieee.org/periodical/vol_2_2001/v_2_2001.html

Okamoto, T., Kayama, M. and Cristea, A. (2001): Consideration of building a Common Platform of Collaborative Learning Environment, *ICCE International Conference on Computer in Education, Enhancement of Quality Learning through Information and Communication Technology*, Asian-Pacific Chapter of AACE, Seoul, Korea.

Paiva, A. (1996): Communicating with Learner Modeling Agents, *ITS 96, Workshop on Architectures and Methods for Designing Cost-Effective and Reusable ITSs*, Montreal.

Synnes, K., Parnes, P., Widen, J. and Schefstroem, D. (1999): Net-based Learning for the Next Millennium, *SCI/ISAS99*, Florida, USA.

The International Organization for Standardization (ISO): http://www.iso.ch/

Winograd, T. & Flores, F. (1986): *Understanding Computers and Cognition*, Addison-Wesley.

Acknowledgment

This study was inspired by the next generation-WG of collaborative authoring technologies in ALIC (Advanced Authoring Infrastructure Consortium: http://www.alic.gr.jp/), Japan.

ODL Education Environments based on Adaptivity and Adaptability

Alexandra Cristea and Paul De Bra
Technische Universiteit Eindhoven
P.O. Box 513, 5600 MB Eindhoven
The Netherlands
{acristea,debra}@win.tue.nl

Abstract: In the Information Society of the new millennium, the use of Information and Communication Technology (ICT) is becoming essential for the rapid dissemination of information. In this context, Open and Distance Learning (ODL) will have a growing role in effectively training people to have active roles in society. However, modern learners have a variety of backgrounds, with respect to knowledge, social environment, preferences, etc. Therefore, our main goal is to create the basis of a European platform of standards for user modeling-based adaptability and adaptation, towards individualization of the learning process. This paper reports about the birth of a new European project, ambitiously aiming at going one step further than plain user modeling (UM), by creating a common structure for the ODL systems' adaptive response to specific user needs, thereby creating a basis for modern European Education. The main goal of this paper is to highlight the importance of the standardization of the adaptive and adaptable techniques to the research community at large, and therefore find more external support for our efforts. Moreover, this paper presents some first background research to establish a starting point for this project.

Introduction

The society of the beginnings of the new millennium is also known as the new Information Society. Information and Communication Technology (ICT) is becoming increasingly essential for the information dissemination, and especially, for knowledge dissemination. With such premises, Open and Distance Learning (ODL - Blair 2000; Cristea & Okamoto 2001; Nkambou et al. 1998) has a growing role in effectively training people to have active roles in society, as a precondition of fostering a real equality among them. The main problem with ODL, noted by many researchers (Brusilovsky 1996; 2001; Marshall's University CIT; Oppenheimer 1997) is that it offers monotonous, uniform education to everybody.

However, with this expansion of the reach of education and creation of equal opportunities, as well as with the need of giving practical expression to the principle of lifelong learning, the need of handling cultural and linguistic differences, gender differences, the analysis of learners' attitudes and profiles, is increasing.

Our main research objective is to establish a *European platform of standards (guidelines, techniques and tools) for user modeling-based adaptability and adaptation*, in the sense of the new paradigm of intelligent human-computer interaction, based on the new generation of ODL tools, towards individualization of the learning process. Note that similar standardization efforts exist, for e.g., collaborative learning (Okamoto & Cristea 2001; Okamoto et al. 2001), or the Semantic web research, but in the area of adaptivity and adaptability there are no real efforts towards some unification of means and methods. In other words, the semantic web creates the basis on which the adaptivity and adaptability standards can be built.

Our two year long project's main contribution will be to go one step further than plain UM (Learner Model IEEE LTSC; Rich 1979), by creating a common structure for the ODL systems' adaptive response (Wu & De Bra 2001) to specific user needs, thereby creating a basis for modern European Education.

Motivation & Objectives

As previously stated, this project's main objective is to establish a European platform of standards for UM-based adaptability and adaptation, using methods and techniques of, among others, artificial intelligence (Cristea & Okamoto 1999) and neural networks (Cristea & Okamoto 1997), towards individualization of the learning process.

More concretely, the following objectives will be pursued:

***O1.** Identify a set of relevant good practices of (UM based) adaptation techniques for education; based on current technology.*

***O2.** Extract a minimal set of relevant and necessary features for adaptation techniques in education and for distributed (Internet) and multimedia environments.*

***O3.** Extract a supplementary set of relevant (but not necessary/ essential) features for adaptation techniques in education; also extract examples of irrelevant features (redundant techniques sets).*

***O4.** Based on O1-O3, define guidelines (minimal set of requirements) for an authoring system for adaptive techniques in education.*

***O5.** Build a prototype adaptive authoring tool [0] and, separately, one (or more) training system(s) based on the minimal set of relevant features, with possible addition of supplementary features.*

***O6.** Evaluate the adaptive prototype system on different target groups.*

O7. Disseminate and promote the results.

Target Beneficiaries

The primary beneficiaries of the project and research outputs are:

- *Students* of a large variety of disciplines that can profit from the pursued trans-disciplinarity and knowledge individualization envisaged by the project.
- *Teaching staff* from the institutions *participating in the project*, who can use the researched techniques for their own courses.
- *Researchers* in these disciplines, who will have a unitary basis to work upon.
- The larger *research community*, which can benefit from these results and will be able to integrate them into their own research.
- The *standards community*, which will be able to use our standard proposals.
- *Teaching staff at universities outside the project* that want introduce adaptive methods in their teaching.

Adaptability vs. Adaptivity

Adaptability

The lowest level of "intelligence" for the WWW is to have some adaptable features. I.e., *the user* (learner or teacher/ course designer, in our case) *can make some options that will determine some alterations to the aspect, contents or functionality of the Web material.* The simplest example is to have a button for changing colors. Another, more complex example, is to have alternative courses for students with disabilities: for instance, to read aloud the material for visually impaired students – or to simply provide a version with larger characters.

We group these static adaptable features under the name of adaptability.

Adaptivity

Adaptivity, on the other hand, is what one would expect from this term: *the actual capability of the system to adapt automatically to the new conditions* (usually deduced from a user model). This represents a more advanced step towards artificial intelligence, compared to adaptability.

In the following, some insight into the fundamentals of these techniques will be given. Adaptation and adaptability are approached here from the perspective of the person to whom the web site has to adapt to (or be adaptable for): the user. Both adaptation and adaptability can exist without UM. An example where this sometimes occurs is adaptive hypermedia (Brusilovsky, 2001). For the purpose of the project, all these aspects will be studied. However, the more personalized a website has to become, the more the *user model* and *UM* grows in importance (Fink et al. 1997).

For the purpose of this paper, we will therefore analyze some fundaments of user modeling. A more sophisticated model has to take into consideration the learner's cognitive styles – in this case, learning styles.

Adaptation Granularity

Another aspect to consider in doing user adaptation is the granularity of this adaptation.

- At the lowest level there are *direct adaptation techniques*, such as *adaptive navigation support* and *adaptive presentation*, as described by (Brusilovsky 1996), and implemented by such adaptive hypermedia systems as AHA. These techniques are usually based on threshold computations of variable-value pairs. They can be considered as the *low level adaptation techniques*.
- At a next level, we can envision more goal-oriented, or at least, domain-oriented adaptation techniques, based on a higher level language that embraces the primitive low level adaptation techniques (and serves as a wrapper to the former). These new techniques can form an adaptation language (as developed in Calvi & Cristea 2002), and can be considered *medium level adaptation techniques*.
- Finally, at the last level, we can include adaptation strategies, embracing and wrapping the layers above. These strategies are goal-oriented, although the same strategy could be, generally speaking, used for different goals. This layer is the *high level adaptation layer*.

In the following, we will shortly sketch some of the higher level features that can be included in adaptation techniques.

Learning Styles

The literature provides various definitions of cognitive styles (proposed initially by Allport in 1937) and learning styles (proposed initially by Herb Thelan in 1954), and often the two terms are used interchangeably. For our purpose, we are focusing on learning style, as the specific individual approach of each student to new knowledge acquisition (Cristea & Okamoto, 2001a). According to the student's learning style, the student is able to receive knowledge easier or not via a certain teaching style. The learning style is independent from the other abilities, which have direct sequels (the more, the better – Pham), whereas styles are controlling mechanism and define the internal preferences and value system.

Among the different cognitive/ learning styles, we are enumerating some of the more important in the following.

Hill's Cognitive Style Mapping

Hill has built a cognitive style coefficient as a function of symbols and meanings (i.e., the preferred form in which an individual encodes information), cultural determinants (i.e., family, colleagues, etc.), modalities of inference (reasoning style, i.e., inductive, deductive, etc.) and a memory function.

It is interesting here to note that the cultural determinants, in the form of the influence of the country and cultural background on ones information processing style (learning style) have only recently been proposed for studying in the adaptive hypermedia community.

Kolb's Learning Styles

Kolb (1984) defined a 2-dimensional scale to represent learning styles, which leads to 4 extreme cases:

- *converger* (abstract, active): abstract conceptualization and active experimentation; great advantage in traditional IQ tests, decision making, problem solving, practical applications of theories; knowledge organizing: hypothetical-deductive; question: "How?".
- *diverger* (concrete, reflective): concrete experience and reflective observation; great advantage in imaginative abilities, awareness of meanings and values, generating alternative hypotheses and ideas; question: "Why?"
- *assimilator* (abstract, reflective): abstract conceptualization and reflective observation; great advantage in inductive reasoning, creating theoretical models; focus more on logical soundness and preciseness of ideas; question: "What?".
- *accomodator* (concrete, active): concrete experience and active experimentation; focus on risk taking, opportunity seeking, action; solve problems in trial-and-error manner; question: "What if?".

Dunn and Dunn's Learning Styles

Rita and Kenneth Dunn developed in 1974 a comprehensive learning style model on four axes:

- *environmental factors* (sound/noise level, light level, temperature, design setting)
- *emotional factors* (motivation, persistence, responsibility, structure)
- *sociological factors* (self-orientation, colleague orientation, authority orientation, pair orientation, team orientation)
- *physical factors* (perception, intake, time, mobility)

Although this model deals very little with the cognitive factor, this model is currently used in schools for pupils of grades 3-12 and a version has been developed for adults.

Herman Brain Dominance Model

Ned Herman classified in 1976 thinking styles into:

- *Quadrant A* (left brain, cerebral):
  analytical, logical, factual, critical and quantitative
- *Quadrant B* (left brain, limbic):
  sequential, structured, organized, planned, conservative and detailed
- *Quadrant C* (right brain, limbic):
  interpersonal, emotional, sensory, kinesthetic, symbolic and spiritual
- *Quadrant D* (right brain, cerebral):
  visual, holistic, innovative, conceptual, imaginative, artistic

His model classifies people according to their preferences (fig. 1), determining a dominant style (without excluding different preferences degrees for the remaining quadrants). Herman's model has some similarities to the Kolb model – such as the Converger could map approximately over the Quadrant A – but there is no complete one-to-one mapping.

Figure 1 shows an intuitive example of simple adaptability in a WWW distance learning model for classifying students into different cognitive styles (Cristea & Okamoto 2001a).

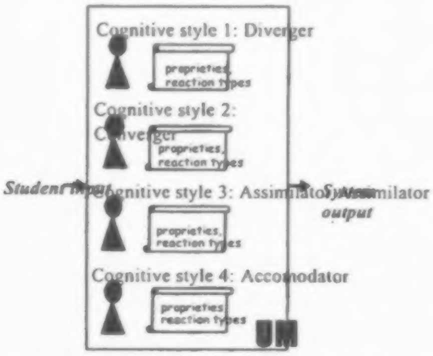

Cognitive style 1: Diverger
proprieties, reaction types
Cognitive style 2: Converger
proprieties, reaction types
Student input
Cognitive style 3: Assimilator
Assimilator
System output
proprieties, reaction types
Cognitive style 4: Accomodator
proprieties, reaction types
UM

Figure 1: I-O UM white-box of an educational system w. student separation by learning styles based on

Other Models

There are many other models, but among all those we would like to mention also the famous classification into:

1. *field dependent*
2. *field independent*

BEST COPY AVAILABLE

Field independence means the extent to which a person can perceive analytically and can distinguish the study object from the surroundings. Field dependent people, on the other hand, are dependent on external cues, and can, for instance, learn better if they have graphical support.

User Modeling

However, although very important in learning, the learning style is not the only prerequisite to be modeled for adaptivity and adaptability in WWW learning.

UM Layers

UM implies more layers, as depicted in figure 2 (Abou-Jaoude & Frasson 1999).

For instance, environmental factors (such as time, location, computing environment, network, physical handicaps, etc.) and the browsing behavior of a user should also be taken into account when generating and updating the information presentation and navigation structure of a hypermedia application.

A different perspective on studying the premises of user-modeling, and thus, the premises of adaptation and adaptability, is given by the MAO model (motivation – ability – opportunity: Hoyer & MacInns 2001), not presented here.

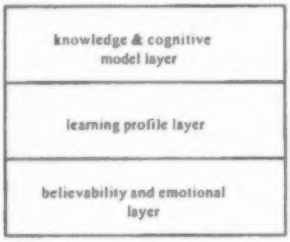

knowledge & cognitive model layer
learning profile layer
believability and emotional layer

Figure 2: Layers in student modeling

Considerations on UM

Building any model starts with the following:

- *feature definition,*
- *selection* and
- *extraction.*

As well known, this involves an iterative refinement process for achieving an efficiently working model, able to make predictions that meet reality, at least, statistically.

There exists no purely empirical approach to modeling. Even the definition of attributes/features and the selection of the relevant ones in a given context are actually theory driven, explicitly or not.

A prototype model of the learner can be used as a starting point that actually encodes some available general theoretical knowledge in the field of learning. Because of the large variability in human personality and in human behavior, and because the traits that are essential in various contexts are not the same, such a prototype model cannot be used directly in practice, without the penalty of being perceived as being rigid and biased. The model has to be customized by using empirical data – sets of examples collected for the given user, while interacting with the system.

If the features used to parameterize the initial model do not allow capturing specific detailed behavior, i.e., if the simple tuning of parameters cannot adapt the model to properly depict the user's profile, new features have to be extracted from the empirical data and added to the model.

The available collection of examples is never large enough to cover all possible classes in an unbiased manner, to avoid spurious correlation when elaborating a model. Small sets of exceptions may be poorly represented, or even ignored.

The combined use of theoretical knowledge and experimental results can offer the sought for solution, by allowing for incomplete and/or incorrect theoretic knowledge and for incomplete or noisy data. Such a system has the inherent capability to recover from errors. This is the reason why very new hybrid approaches emerged, based on AI (artificial intelligence) techniques, in particular NN (neural network) techniques.

Future Research Directions

The project's main outcome is to significantly contribute not only towards standardization of the new generation of ODL adaptation techniques and tools, but also to provide alternate styles of teaching and learning, optimally suited for ODL or a combination of ODL and traditional classroom teaching.

In particular, the project's output and products will follow the objectives and include:

- a set of relevant good practices of (UM based) adaptation techniques for education, based on current technology;
- as a byproduct of the above, it will generate counter-examples of sets of bad practices (or techniques) of (UM based) adaptation techniques for education, for a clear distinction from the above;
- a minimal set of relevant, necessary features for adaptation techniques in education. Generate typical features for distributed (Internet) environments, multimedia environments.
- a supplementary set of relevant (but not essential) features for adaptation techniques in education, as well as a few counter-examples of irrelevant features detected.
- Reports of the above, both internal (mid-stage), for partner's information and usage, and external, at conferences, workshops, etc. (e.g., AH, WebNet, ITS, UM, ED-MEDIA, CEC, etc.); final report will also be sent to standard bodies (IEEE, LTTF)
- a sample authoring system for adaptive techniques in education generated above;
- separately, one (or more) training system(s) based on the minimal set of relevant adaptive features, with possible addition of supplementary features
- evaluation, dissemination and promotion of results, especially focusing on the spread of understanding the innovative impact of the new issue of adaptivity and adaptability in the ODL, for classroom-based learning, distance learning modes or a combination of both and on the transferability to other domains.

Conclusion

This paper succinctly presents an emerging collaboration project of European dimension, with possible international significance. We clearly explain the necessity, at this stage, of a centralization of the accumulated knowledge on adaptivity and adaptability for WWW, especially in the domain of ODL (but also beyond). Moreover, we show that a unified standardization of adaptation techniques and technologies would benefit at first the European community, as this is a European project, but also the International WWW community, by establishing a common ground (vocabulary, ontology, methods, techniques, methodologies) towards more evolved UM techniques, and ultimately, increased user satisfaction. We start with a small group of experts in the field, but gladly invite specialists all over the world to join us in our effort towards improving and enhancing the Web and fully using the WWW potential. More information about this emerging project, officially starting autumn 2002, can be found at our local Minerva site.

References

Abou-Jaoude, S. & Frasson, C. (1999), Integrating a Believable Layer into Traditional ITS, *AI-ED99*.

Brailsford, T. et al. (2001), A Technical Overview of Whurle: an XML/XSLT Adaptive Hypermedia Learning Environment, *Hypertext conference*.

AHA, Adaptive Hypermedia for All, http://aha.win.tue.nl/

Brusilovsky, P. (1996), Methods and Techniques of Adaptive Hypermedia, *User Modeling and User-Adapted Interaction 6* , 87-129.

Brusilovsky, P. (2001), Adaptive Hypermedia, *User Modeling and User Adapted Interaction*, Ten Year Anniversary Issue (Alfred Kobsa, ed.) *11* (1/2), 87-110, http://kapis1.wkap.nl/oasis.htm/270983

Blair, J. (2000), Colleges, Education on the Web, Jan. 19, http://www.edweek.org/ew/

Calvi, L. & Cristea, A. (2002), Towards Generic Adaptive Systems: Analysis of a Case Study, AH 2002, *Adaptive Hypermedia & Adaptive Web-Based Systems*, LNCS 2347, Springer, 79-89.

Cristea, A. & Okamoto, T. (1997), Neural Network Knowledge Extraction, *journal Rev. Roumaine des Sciences Technique, Serie EE (Electrotechn. et Energ.), 42*(4), (Oct.-Dec.), 477-491.

Cristea, A. & Okamoto, T. (1999), The Development of a Sub-Symbolic Knowledge Eliciting Environment from Feedforward Networks, serving as an Education Process Assistant, *Journal of Educational Technology Research, JET soc., 21*, 15-24.

Cristea, A. & Okamoto, T. (2000), MyEnglishTeacher – A WWW System for Academic English Teaching. *ICCE 2000*, Conference on Computer in Education, Learning Societies in the New Millennium: Creativity, Caring and Commitments, Taipei, Taiwan.

Cristea, A. & Okamoto, T. (2001a), Considering automatic educational validation of computerized educational systems, IEEE International Conference on Advanced Learning Technologies, *ICALT2001*, USA,
http://wwwis.win.tue.nl/~alex/ConferencesICALT/ICALT.doc

Cristea, A. & Okamoto, T. (2001b), Object-oriented Collaborative Course Authoring Environment supported by Concept Mapping in MyEnglishTeacher, *Educational Technology and Society, 4*(2) (April 2001), Special Issue on "Developing Creativity and Large Mental Outlook in the Computer Age",
http://ifets.ieee.org/periodical/vol_2_2001/v_2_2001.html,

De Bra, P. & Calvi, L. (1998), AHA! An open Adaptive Hypermedia Architecture, *The New Review of Hypermedia and Multimedia*, 115-139.

De Bra, P., Brusilovsky, P. & Houben, G.-J. (1999), Adaptive Hypermedia: From Systems to Framework. *ACM Computing Surveys*, Symposium Edition. http://wwwis.win.tue.nl/~debra/public.html

De Bra, P. & Ruiter, J.P. (2001), AHA! Adaptive Hypermedia for All, *WebNet Conference*, 262-268.

Fink, J., Kobsa, A. & Schreck, J. (1997), Personalized Hypermedia Information Provision through Adaptive and Adaptable System Features: User Modeling, Privacy and Security Issues, *Intelligence and Services Networks: Technology for Cooperative Competition*, Eds.: A. Mullery, et al., Springer, 456-467.

Garzotto, F. & Thuring, M. (1995), Proceedings of the First Workshop on Evaluation Methods for Multimedia Applications, *ACM Multimedia '96 Conference*, S. Francisco, CA, Nov.

Garzotto, F. et al. (1996), *Hypermedia Design*, Springer.

W. D. Hoyer, & D. MacInns (2001), *Consumer behavior*, Houghton Mifflin Company, second edition.

Learner Model. IEEE LTSC Committee, http://ltsc.ieee.org/wg2/index.html

Marshall's University's Center for Instructional Technology, Comparison of Online Delivery Software Products, http://multimedia.marshall.edu/cit/webct/compare/comparison.html

Microcosm homepage, http://www.mmrg.ecs.soton.ac.uk/projects/microcosm.html

Millard, D. E., Davis, H. C & Moreau, L. (2000), Standardizing Hypertext: Where Next for OHP?, Springer.

Minerva project, http://wwwis.win.tue.nl/~alex/HTML/Minerva/

Nkambou, R., IsaBelle, C. & Frassoun, C. (1998), Supporting some pedagogical issues in a Web-based distance learning environment, *NTICF'98*, November.

Okamoto, T. & Cristea, A. (2001), A Distance Ecological Model for Individual and Collaborative-learning support, *Educational Technology and Society, 4*(2), April 2001, Special Issue on Developing Creativity and Large Mental Outlook in the Computer Age, http://ifets.ieee.org/periodical/vol_2_2001/v_2_2001.html

Okamoto, T., Kayama, M. & Cristea, A. (2001), Consideration of building a Common Platform of Collaborative Learning Environment, *ICCE*.

Oppenheimer, T. (1997), The Computer Disillusion, *The Atlantic Monthly*, http://www.theatlantic.com/issues/97jul/computer.htm

Pham, P.N., Learning Style, http://www.payson.tulane.edu/ppham/Learning/lstlyses.html

Rich, E. (1979), User Modeling via Stereotypes, *Cognitive Science, 3*(4), 329-354.

Self, J. (1996), The Development of the Computer Based Learning Unit: A Discussion Document, http://cblslca.leeds.ac.uk/~jas/discussion.html

Stock, O., Strapparava, C. & Zancanaro, M. (2000), Explorations in an Environment for Natural Language Multimodal Information Access in M. Maybur (ed.) *Intelligent Multimodal Information Retrieval*, AAAI Press, Menlo Park, Ca./MIT Press, Cambridge, Mass.

W3C Recommendation (2000): Authoring Tool Accessibility Guidelines 1.0,3 February 2000, http://www.w3.org/TR/ATAG10/

TeleTOP homepage, http://teletop.edte.utwente.nl/

Wu, H. & De Bra, P. (2001), Sufficient Conditions for Well-behaved Adaptive Hypermedia Systems, *Proc. Web Intelligence Conference*, Lecture Notes in Artificial Intelligence, 2198, Springer, 148-152.

Acknowledgment

This paper presents research to be founded by the European Community Socrates-Minerva grant (European cooperation in the field of open and distance learning (ODL) and information and communication technology (ICT) in education), project reference number 101144-CP-1-2002-NL-MINERVA-MPP.

AHA! Version 2.0
More Adaptation Flexibility for Authors

Paul De Bra[*], Ad Aerts, David Smits, Natalia Stash
Department of Computing Science
Eindhoven University of Technology (TUE)
PO Box 513, Eindhoven, The Netherlands
debra@win.tue.nl

Abstract: AHA! is a simple Web-based adaptive hypermedia system. Because of this simplicity it has been studied and experimented with in several research groups, see e.g. (Cini & Valdeni de Lima, 2002), (Calvi & Cristea, 2002), (Romero et al., 2002). This paper identifies shortcomings in AHA! and presents AHA! version 2.0 which tries to overcome the known problems with AHA! while maintaining its biggest asset: simplicity. We illustrate how different user modeling and adaptation aspects can be expressed in the new AHA! system (that would be difficult in the old system, and impossible in most other systems).

Introduction and Background

The development of the AHA! system started in 1996, when we created server-side software (CGI-scripts at that time) to add adaptation to an on-line course text on the subject of hypermedia. (For an introduction in the field of adaptive hypermedia, see (Brusilovsky, 2001). The AHA! software has been changed and extended somewhat over the years, resulting in what we will refer to as AHA! Version 1.0 in this paper, and which is described e.g. in (De Bra et al., 2000) and (De Bra & Ruiter, 2001). AHA! 1.0 is based on a simple architecture for an adaptive Web-based system:

- An application consists of a number of *concepts*. Some concepts represent Web-pages while others represent higher-level or abstract entities.
- The user model (for each user) consists of a *value* for each *concept*. The most common interpretation of this value is that the value means the *knowledge level* of the user with respect to the concept.
- Each time a user visits a page the *value* corresponding to that page is *increased*. In AHA! the author can define propagation rules that cause this increase to influence the value for other concepts. It is thus easy to define a structure of pages, sections and chapters, meaning that reading a page contributes to the knowledge of a section, and a knowledge increase for a section implies a (smaller) knowledge increase in the chapter. The propagated changes are arbitrary. It is also possible to register a *decrease* in knowledge of a concept by accessing a certain page.
- The author can define *requirements* for fragments of a page and for whole pages. Requirements are Boolean expressions over knowledge values for concepts. When the requirement for a fragment of the page to be presented is *true* the fragment is included in the presentation. (Otherwise the fragment is left out.) When the requirement for a page is *true* all anchors of links to this page are shown in a clearly visible color (typically blue or purple in AHA!). Otherwise the anchors are shown in *black*, meaning that they will be hidden in the text which is also black. (The black links are also *not underlined* to make them effectively hidden.)

As several researchers have pointed out, including (Calvi & Cristea, 2002), a consequence of the simplicity of AHA! is that it is only easy to create simple, straightforward applications. In this sense AHA! is in essence not very different from other adaptive systems like Interbook (Brusilovsky et al, 1998) which make it easy to develop one type of application, namely on-line courses. In (De Bra et al., 2000) we showed that it *is* possible to develop different types of applications in AHA! or to base adaptation on other user or browsing aspects than just knowledge. However, the examples that were given also showed that this development is difficult, and it was very clear that the user modeling and adaptation features of AHA! had to be "abused" in order to realize these alternative applications.

---

[*] Also at the "Centrum voor Wiskunde en Informatica" in Amsterdam, and the University of Antwerp, Belgium.

288

In AHA! Version 2.0 we address this problem through a richer user model structure and a domain and adaptation model with more advanced *requirement* and *generate* rules. The new features are based on the AHAM reference model (De Bra et al., 1999), which is an extension of the well-known Dexter reference model for hypermedia (Halasz & Schwartz, 1994).

The Domain Model / Adaptation Model in AHA! Version 2.0

AHA! deviates from the AHAM referemce model (De Bra et al., 1999) by not separating the *domain model* from the *adaptation model*. In AHA! the author defines *concepts*, along with *requirements* that determine under which conditions the user is "ready" to access the concept, and *generate rules* that specify how the browsing behavior of the user translates into user model updates. The *generate rules* are *condition-action rules* as used in active database theory (Baralis & Widom, 2000). We illustrate the AHA! concept structure with a continuation of the beer and chocolate example of (De Bra & Ruiter, 2001). AHA! 2.0 supports storing the concept structure in XML files or in a mySQL database. We use the XML representation in this paper. (There are some minor deviations between the syntax in this paper and the actual AHA! 2.0 syntax, for readability and simplicity reasons.)

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE conceptList SYSTEM ‘concept.dtd’>
<conceptList>
<name>Belgian Beer Example</name>
<concept>
  <name>de_koninck</name>
  <desc>first author’s favorite beer</desc>
  <resource>de_koninck.xhtml</resource>
  <req>beer.interest > 50</req>
  <attribute name="access" type="bool"
    isPersistent="false" isSystem="true"
    isChangeable="false">
    <default>false</default>
    <generateListItem isPropagating="true">
      <req>beer.interest < 100</req>
      <trueActions>
        <action>
          <concept>beer</concept>
          <attribute>interest</attribute>
          <expr>beer.interest + 10</expr>
        </action>
      </trueActions>
    </generateListItem>
    <generateListItem isPropagating="true">
      <req>chocolate.interest < 50 and
           chocolate.interest > 4</req>
      <trueActions>
        <action>
          <concept>chocolate</concept>
          <attribute>interest</attribute>
          <expr>chocolate.interest-5</expr>
        </action>
      </trueActions>
    </generateListItem>
    <generateListItem isPropagating="true">
      <req>beer.interest > 50</req>
      <trueActions>
        <action>
          <concept>de_koninck</concept>
          <attribute>knowledge</attribute>
          <expr>100</expr>
        </action>
      </trueActions>
      <falseActions>
        <action>
          <concept>de_konink</concept>
          <attribute>knowledge</attribute>
          <expr>35</expr>
        </action>
      </falseActions>
    </generateListItem>
  </attribute>
  <attribute name="knowledge" type="bool"
    isPersistent="true" isSystem="false"
    isChangeable="true">
    <default>0</default>
    <generateListItem isPropagating="true">
      <req>true</req>
      <trueActions>
        <action>
          <concept>beer</concept>
          <attribute>knowledge</attribute>
          <expr>beer.knowledge + 0.2 *
            _de_koninck.knowledge</expr>
        </action>
      </trueActions>
    </generateListItem>
  </attribute>
</concept>
<concept>
  ... next concept definition here ...
</concept>
  ... more concept definitions ...
</conceptList>
```

The above concept definition is linked to the page "de_koninck.xhtml". This page is considered "desirable" by the system if the requirement ‘`beer.interest > 50`" is fulfilled. For adaptation this means that links to the de_koninck page will have a blue or purple anchor only for users with a high interest in beer. (The link will be blue before the first visit to the page and purple afterwards.) Uninterested users will not easily see the links to a special

BEST COPY AVAILABLE

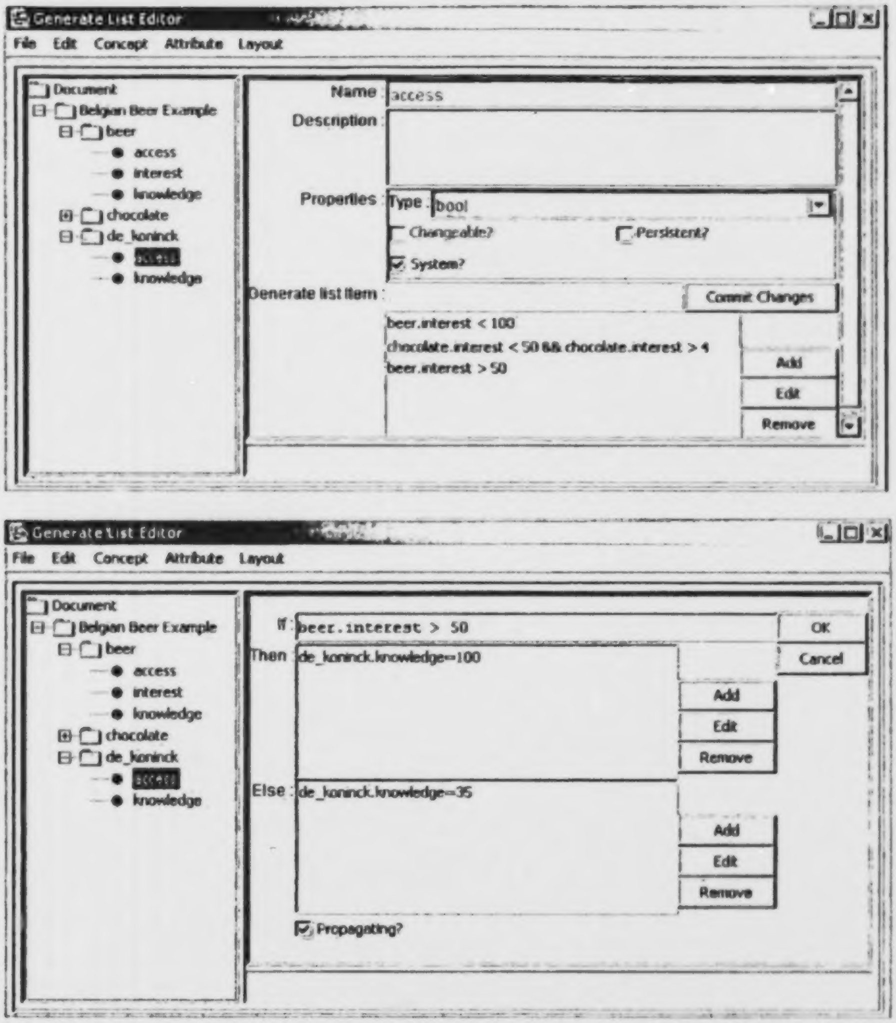
beer like "De Koninck" because the link anchors are hidden by making them black like normal text, and not underlined. When a user accesses the de_koninck page the attribute `access` *temporarily* becomes true. The attribute is a "system" attribute, meaning its value is changed by a system even, in this case the access of the page. The attribute is not persistent, meaning that its value returns to the default value after dealing with the access event. The event causes the three actions (or "generateListItem"s) associated with this attribute to be considered for execution. The first action increases the interest in beer, but only if this interest is not yet 100 or more. The second action decreases the interest in chocolate, but only if this interest is not yet known to be high (but high enough to not become negative after the decrease). The third action registers that for interested users the knowledge about de_koninck becomes 100 and for uninterested users (who happen to find the page even though the links to it are hidden) the knowledge becomes only 35. "`knowledge`" is a persistent attribute of de_koninck, meaning that it is stored in the user model. Initially the attribute has the value 0 (the "default"). The rule associated with the knowledge attribute means that any change to this knowledge affects the knowledge of the higher level concept "`beer`" as well. 20% of the *change in the knowledge* of de_koninck is transferred to "`beer`". The "_" is used to indicate that the *change* in the attribute value is used, not the *value* of the attribute itself. As one can see from the example, *accessing* the de_koninck page changes the *interest* in beer and in chocolate and raises the *knowledge* of de_koninck; this knowledge change triggers the rule for the knowledge attribute of de_koninck, which will then raise the *knowledge* of beer. The change in interest for beer and chocolate and the change in knowledge of beer may also trigger rules associated with these concepts and attributes but that cannot be seen from the example as the concept structure of beer and chocolate is not given.

The above example may seem excessively verbose for expressing a few fairly simple rules for updating the user model. The given XML file only shows a single concept, whereas even a small application will already consist of 100 concepts or more. Fortunately a simple (Java applet based) authoring interface hides this verbose syntax from the author. Also, most applications require only a few simple types of rules, like having the access of a page raise knowledge, and like having knowledge propagate through a concept hierarchy.

Adaptive applications are sometimes concerned with different aspects of users, including *knowledge*, *interests*, *goals*, *learning style*, etc., and they may also wish to perform adaptation to other circumstances, like differences in browser, window size, network bandwidth, location, the user's background and Web experience, etc. The big advantage of AHA! 2.0 over its predecessor is that each aspect can be represented through different concepts or through different attributes of concepts. This makes it possible to clearly distinguish adaptation aspects that are unrelated to each other. The use of attributes also makes it possible to "combine" related adaptation aspects such as *knowledge about* a concept and *interest in* that same concept.

AHA! allows each concept to have a different set of attributes associated with it, and different condition-action rules. Attributes can be of type Boolean, integer or string. Each rule execution can trigger other rules, as seen in the example above. It is difficult to predict in general how the rule engine will behave as a whole. We have studied the problems of *termination* and *confluence* in the past (Wu et al., 2001). However, we believe the easiest way to enable authors to oversee the potential problems is to have an "`isPropagating`" attribute per action that indicates whether this action is allowed to trigger other actions or not. This was also proposed in the AHAM model (De Bra et al., 1999). As the action indicates (in the assignment) which attribute of which concept is updated, it is immediately clear which rule propagation will occur. As in all such rule systems (Baralis & Widom, 2000) there is a danger that the rule execution through this propagation mechanism will not terminate. In the previous version of AHA! an arbitrary propagation constraint was introduced (De Bra et al, 2000) that guaranteed termination. Unfortunately the constraint could also be a source of results the author did not anticipate. In AHA! 2.0 this constraint is lifted. Rules are always allowed to trigger each other, provided that the "`isPropagating`" attributes are set to true. Furthermore, the author can control more precisely the conditions under which a rule is allowed to be executed. In (Wu et al, 2001) we indicate how potential infinite loops can be detected during the authoring process.

In Figure 1 we show a two screendumps of the Java-based authoring tool for entering the concept structure, and the rules for updating the user model that is used for creating the adaptive presentation. The first image shows that the concept "`de_koninck`" has attributes "`access`" and "`knowledge`", and that three actions or generateListItems are associated with this attribute. The interface shows the condition (`<req>`) of each rule. The second image shows how the third generateListItem is defined. While entering expressions (like "`beer.interest > 50`") the tool shows the expression in red until it is syntactically correct and uses only concepts and attributes that have been previously defined. This guarantees that the complete structure of concepts, attributes and generateListItems is sound.


Generate List Editor
File
Edit
Concept
Attribute
Layout
Document
Belgian Beer Example
beer
access
interest
knowledge
chocolate
de_koninck
access
knowledge
Name
Description
Properties
Generate list item
Commit Changes
Add
Edit
Remove
OK
Cancel

Name : access

Properties : Type : bool

☐ Changeable? ☐ Persistent?

☑ System?

Generate list item :

beer.interest < 100

chocolate.interest < 50 && chocolate.interest > 4

beer.interest > 50

If : beer.interest > 50

Then : de_koninck.knowledge=100

Else : de_koninck.knowledge=35

☑ Propagating?

Figure 1: AHA 2.0 authoring tool

The User Model in AHA! Version 2.0

The most common type of user model in adaptive hypermedia applications (Brusilovsky, 2001) is the *overlay model*. For every concept and attribute in the domain model of the application a concept and attribute is kept in the user model. AHA! 2.0 follows the same philosophy, albeit with two exceptions:

- Attributes (of concepts) in the domain/adaptation model can be defined *not* to be *persistent*. The `access` attribute is a typical one. When the *adaptation engine* runs (when a page is accessed) these volatile attributes are initialized using the "default" value, and any updates to these values are lost when the engine terminates. The access attribute for instance is *false* for all concepts, but it will be temporarily true for the concept (page) that is accessed.
- When a user logs in for the first time a special "concept" is created, called `personal`, which is used to store user-related aspects that are not about the subject domain of the application. This information includes a name, email, login-id, password, and any other information the application asks for during the

BEST COPY AVAILABLE

login process. For our on-line course on hypermedia this information also includes the student's university and major. Because this information is represented through a concept it can be used for adaptation. We can thus present different assignments to students from different universities for instance. (In AHA! 1.0 the login information was not available for adaptation purposes.)

Below we show a small part of a user model for the imaginary beer application.

```
<!DOCTYPE profile SYSTEM 'profile.dtd'>
<profile>
  <record>
    <key>personal.id</key>
    <type>string</type>
    <persistent>true</persistent>
    <value>debra</value>
  </record>
  <record>
    <key>personal.email</key>
    <type>string</type>
    <persistent>true</persistent>
    <value>debra@win.tue.nl</value>
  </record>
  <record>
    <key>personal.goodlink</key>
    <type>string</type>
    <persistent>true</persistent>
    <value>0000ff</value>
  </record>
  <record>
    <key>personal.badlink</key>
    <type>string</type>
    <persistent>true</persistent>
    <value>000000</value>
  </record>
  ...
  <record>
    <key>de_koninck.knowledge</key>
    <type>int</type>
    <persistent>true</persistent>
    <value>35</value>
  </record>
  <record>
    <key>beer.knowledge</key>
    <type>int</type>
    <persistent>true</persistent>
    <value>20</value>
  </record>
  <record>
    <key>beer.interest</key>
    <type>int</type>
    <persistent>true</persistent>
    <value>40</value>
  </record>
  <record>
    <key>chocolate.knowledge</key>
    <type>int</type>
    <persistent>true</persistent>
    <value>15</value>
  </record>
  <record>
    <key>chocolate.interest</key>
    <type>int</type>
    <persistent>true</persistent>
    <value>20</value>
  </record>
  ...
</profile>
```

Document (Page) Formats

AHA! applications consist of sets of *pages* with *links* between them. Currently (in both version 1.0 and 2.0) the basic format is HTML, because that is what browsers understand. In AHA! 2.0 there are three "variants" in which source pages can be written (and which AHA! translates to plain HTML before sending it to the browser):

- There are some XML tags that have a special meaning for AHA!. The first AHA! format consists of XML pages with these tags, combined with HTML. The most important AHA! tags are the <if> tag for the conditional inclusion of fragments, and the <a> tag for links. The output of AHA! is the HTML source page in which some fragments may be deleted, and in which the links are shown in different colors depending on the "desirability" of the page that is the link destination.
- Plain HTML documents can also be used with AHA!. In such documents links are adapted like in the first format. While HTML documents do not take full advantage of the possibilities of AHA! it is important to allow them in order to include *external* documents in an adaptive application. (AHA! 2.0 can serve pages it first retrieves from other servers.)
- Using *modularized DTDs*, (and the Xerces XML parser that supports them) pages can now also be written in a format that combines AHA! tags with XHTML. The AHA! engine only looks at the AHA! tags to perform its adaptation. As a result it will be easy to extend AHA! with the capability to serve other

document formats combined with AHA! tags as well. (SMIL is one of the formats we wish to experiment with in the future.)

AHA! does not enforce or provide any special page formats. We are using AHA! in an on-line course without using HTML frames, and in another course with frames, and also with Javascript.

Examples of AHA! applications

The use of AHA! for modeling and adapting to *knowledge* and *interests* has been shown in previous sections. The versatility of AHA! becomes apparent when one looks at the following two small illustrations of completely different adaptation:

- In one on-line course we wished to have two presentations: a terse one (like viewgraphs) and a verbose one (like full course text). By letting the user set a *verbosity* level (which can be implemented as an attribute of the "personal" concept) we could have the system select fragments to show and hide. Currently we provide only two levels (terse of verbose) in that course, but by using an integer attribute we could also introduce more levels, showing more and more details and longer explanations as the verbosity level is cranked up.
- Our course that uses frames has a "navigation bar" in the left frame, and shows the pages in the (larger) right frame. The navigation bar shows course topics, and can optionally show a submenu for each topic. When a page on a certain topic is shown the corresponding menu should be opened and other menus should be closed. We realized this by turning all the menus into fragments to be conditionally included. Each time a page is accessed it activates the corresponding menu. The activation is done through a one line Javascript program that tells the browser to reload the navigation bar. There are two ways to implement the menu system in AHA!. One way is to create a "menu" concept with an Boolean attribute for each menu. Each page access triggers a set of rules that open up the appropriate menu(s) and close the others. It is possible in this scheme to leave more than one menu open. A drawback of this solution is that when a new topic is added to the course a large number of rules must be added to close the menu for that topic whenever any page from any other topic is accessed. A second way is to create an integer or string menu attribute (for either the personal concept or a menu concept). Each menu is assigned a number or name, and each page sets the menu attribute to the number or name of the menu to be opened. This solution does not have a problem when new topics are added. A drawback of this solution however is that only one menu can be open at once.

Adaptation features like these two could already be expressed in AHA! 1.0 but that required playing tricks with the concepts and adaptation rules. In AHA! 2.0 one can define concepts and attributes with a specific special purpose in mind and the associated rules cannot be easily "mixed up" with concepts and attributes that are used to represent knowledge and interest. We consider the ability to clearly distinguish different subparts of the domain/adaptation model, each having a different purpose, to be the biggest advantage of our new AHA! version.

Conclusions and Future Work

With AHA! 2.0 we have provided a versatile user modeling and adaptation tool. We hope that AHA! will be suitable for many different types of applications. Our experience with using AHA! for on-line courses has shown that in addition to modeling knowledge and providing adaptation based on it, AHA! can also be used to provide adaptation to personal aspects of a user, including preferences (like color or verbose vs. terse text).

The presentation format in AHA! is completely up to the author. The structure with concepts and attributes can also be used to help in creating the presentation. We for instance showed how to create a navigation frame with menu and submenus.

While we are still gaining experience in using AHA! 2.0 we already have a wish-list for a future version. Linking in AHA! is page-based. We plan to allow links to a higher level concept in the future, along with the automatic selection of the best page to be shown when a user "clicks" on such a link. We also plan to allow more flexible page construction. Currently a page consists of a sequence of fragments that are conditionally included, in a fixed order only. For information retrieval applications we need to allow at least the sorting of fragments.

Acknowledgement

The development of AHA! was made possible through a grant of the NLnet Foundation. Apart from them we would also like to thank the many researchers who have studied our previous research and development on AHA! and some of which have even developed applications with AHA!. Their research and experience reports have been very valuable in deciding how to extend and improve AHA! so that more people will become able to use it to develop adaptive courses and possibly also other adaptive applications.

References

Baralis, E., Widom, J. (2000). *An algebraic approach to static analysis of active database rules*. ACM Transactions on Database Systems, 20:1, pp. 269-332.

Brusilovsky, P. (2001). *Adaptive hypermedia*. User Modeling and User Adapted Interaction, 11 (1/2) pp. 87-110.

Brusilovsky, P., Eklund, J., Schwarz, E. (1998). *Web-based Education for All: A Tool for Developing Adaptive Courseware*. Computer Networks and ISDN Systems (Seventh International World Wide Web Conference), 30, 1-7, 291-300.

Calvi, L., Cristea, A. (2002). *Towards Generic Adaptive Systems: Analysis of a Case Study*. Second International Conference on Adaptive Hypermedia and Adaptive Web-Based Systems, Springer Verlag, LNCS 2347, pp. 77-87.

Cini, A., Valdeni de Lima, J. (2002). *Adaptivity Conditions Evaluation for the User of Hypermedia Presentations Built with AHA!*. Second International Conference on Adaptive Hypermedia and Adaptive Web-Based Systems, Springer Verlag, LNCS 2347, pp. 490-493.

De Bra, P., Brusilovsky, P., Houben, G.J. (1999). *Adaptive Hypermedia: From Systems to Framework*. ACM Computing Surveys 31:4. (URL: http://www.cs.brown.edu/memex/ACM_HypertextTestbed/papers/25.html)

De Bra, P. & Calvi, L. (1998). *AHA: a Generic Adaptive Hypermedia System*. 2nd Workshop on Adaptive Hypertext and Hypermedia, pp. 1-10. (URL: http://wwwis.win.tue.nl/ah98/DeBra.html)

De Bra, P., Aerts, A., Houben, G.J., Wu, H. (2000). *Making General-Purpose Adaptive Hypermedia Work*. Proceedings of the AACE WebNet 2000 Conference, pp. 117-123.

De Bra, P., Ruiter, J.P. (2001). *AHA! Adaptive Hypermedia for All*. Proceedings of the AACE WebNet Conference, pp. 262-268.

De Bra, P., Houben, G.J. & Wu, H. (1999). *AHAM, A Dexter-based Reference Model for Adaptive Hypermedia*, Proceedings of the ACM Conference on Hypertext and Hypermedia, pp. 147-156.

Halasz, F., Schwartz, M. (1994). *The Dexter Hypertext Reference Model*. Communications of the ACM, 37:2, pp. 30-39.

Romero, C., De Bra, P., Ventura, S., de Castro, C. (2002). *Using Knowledge Levels with AHA! for Discovering Interesting Relationships*. Proceedings of the AACE ELearn'2002 Conference.

Wu, H., De Kort, E., De Bra, P. (2001). *Design Issues for General-Purpose Adaptive Hypermedia Systems*. Proceedings of the ACM Conference on Hypertext and Hypermedia, pp. 141-150.

Group and Task Experience: Implications for Computer-Mediated Groupwork in the Workplace

Christina Dehler
Department of Education
California State Polytechnic University, Pomona
United States
cmdehler@csupomona.edu

Abstract: Groupwork carried out via CMC are now a fact of life in the work place. This study investigates the effects of group membership and task experience on asynchronous computer-mediated groupwork. Groups acquiring task experience as groups during weeks 1 and 2 performed better on the final task at week 3 compared to groups in other treatment conditions. On measures of group process and group member reactions, participants acquiring group and task experience spent less time on the group task and expressed more satisfaction with, and confidence in, the final task solution. Implications for the workplace are that practice of computer mediated group tasks in stable groups is advisable. Training and work environments that expose work groups to computer-mediated tasks and provide opportunity and time to work on complex problems, would improve group performance. Subsequent training would focus on facilitating the transfer of skills and knowledge to new contexts.

Introduction

The prevalence of computer-mediated groupwork in organizations is such that group tasks carried out via CMC are now a "fact of life" in the work place. Two factors are identified in the literature as possible mediating factors in computer-mediated group performance, competencies and social experiences: Group membership stability and task experience. Groupwork research suggests that increased experience of a group as a group and increased experience of the group with a task both tend to improve the efficiency of the groupwork and overall quality of the work produced (Cannon-Bowers, Tannenbaum, Salas & Volpe, 1995; Hollingshead, 1998a and 1998b; Littlepage, Robison, Reddington, 1997; McIntyre & Salas, 1995; Wittembaum & Stassser, 1995). Such effects, however, have not yet been empirically studied in an asynchronous computer-mediated groupwork context nor systematically examined over a prolonged period of observation (McGrath, 1993). Therefore, this study investigates the effects of membership continuity and task experience on asynchronous computer-mediated groupwork. The group membership factor represents the two conditions under which groups may perform: Stable (unchanging) group membership and changing group membership. The task experience factor is determined by whether or not groups engage in task practice prior to the assessment of group performance.

Effects of group and task experience on computer-mediated groupwork

Group performance

Group members that acquire experience with each other and with a particular task benefit from the knowledge and skills gained, specific to both the task and the team (Cannon-Bowers, Tannenbaum, Salas, & Volpe 1995; Salas & Cannon-Bowers, 1997). As both individual- and group-level competencies develop, group processes are facilitated thereby resulting in better group performance. Recent research in the areas of team training (Cannon-Bowers, et al., 1995; Cannon-Bowers & Salas 1997; Cannon-Bowers, Salas, Blickensderfer & Bowers, 1998) and group practice (Hollingshead, 1998a; Hollingshead, 1998b; Salas & Cannon-Bowers, 1997; Littlepage et al., 1997; Moreland & Wingert, 1995) consistently shows that groups acquiring task-related experience as stable groups perform better than those whose members do not acquire this type of experience. The implication for the present research is that in order to effectively carry out a computer-mediated task requiring a high level of interdependence (i.e., a judgment task), groups acquiring task experience as stable groups will perform better. Taking the aforementioned into consideration, the following hypothesis regarding group performance is tested. *Hypothesis 1*: Groups acquiring judgment task experience as stable groups will perform better on the final judgment problem than groups in any other treatment condition.

Group process –time on task

Group process and interaction, consisting of communication and coordination skill dimensions, are required behaviours for effective task execution (Cannon-Bowers et al., 1995). Provided that the group membership, task type and groupwork context remain constant, the increase in experience that occurs over time allows the group to progressively re-adapt the group-task-context fit to take advantage of the increased predictability, reduced ambiguity and reduced coordination (Cannon-Bowers, et al. 1995; McGrath & Hollingshead, 1994; Hollingshead, McGrath & O'Connor, 1993; McGrath, Arrow, Gruenfeld, Hollingshead & O'Connor, 1993). As group norms of communication and task performance become established over time, group members require lesser amounts of time to complete the task effectively. Based on the aforementioned rationale, the following prediction is made. *Hypothesis 2*: Regarding time on task, individuals who did not acquire group or task-related experience will spend more time on the final judgment task.

Satisfaction with process

Recent research carried out by Benbunan-Fich and Hiltz (1999), Galegher and Kraut (1994), Straus and McGrath (1994), Warkentin, Sayeed and Hightower (1997), and Wilson, Morrison and Napier (1997), among others, affirms that groups carrying out collaborative work via CMC systems tend to be less satisfied with group process than their face-to-face counterparts. In short, results from comparative studies that don't extend beyond one data collection session suggest that computer-mediated groups must work harder to accomplish the same results as face-to-face groups (Galegher & Kraut, 1994). However, if group members given ample time to familiarize themselves and acquire experience with the communication technology, fellow group members, the task, and the groupwork context, previous findings about satisfaction may not entirely hold true. There is evidence that even minimal experience with group members and task work alters group process and performance (Burke & Chidambaram, 1999; Hollingshead, 1998a, 1998b; Littlepage et al., 1997; McGrath, Arrow, Gruenfeld, Hollingshead & O'Connor, 1993; Liang, Moreland & Argote, 1995; Moreland, Argote, & Krishnan, 1996). If these changes to group process and performance are of a facilitating nature, then it is reasonable to assume that member satisfaction regarding group process would also be positively affected by membership and task experience. Based on this reasoning, the following hypothesis about group member satisfaction with the computer-mediated group process is tested. *Hypothesis 3*: Regarding the final judgment task, individuals working in groups that acquired judgment task experience as stable groups will express higher levels of satisfaction with group process

Satisfaction with, and confidence in, group solution

If group members are satisfied with the computer-mediated group process of carrying out a group judgment task, it is reasonable to expect that group member satisfaction with the task solution will parallel this result. *Hypothesis 4*: With respect to the final judgment task, individuals working in groups that acquired judgment task experience as stable groups will express higher levels of satisfaction with the task solution.

Similarly, if group members are satisfied with the group task solution, it is reasonable to expect that confidence in the group solution will parallel this result. *Hypothesis 5*: Individuals acquiring judgment task experience as members of groups with stable membership will express higher levels of confidence that their group solution of the final judgment task is correct.

Method

Subjects and Groupwork Context

One hundred and sixty eight undergraduate students enrolled in Contemporary Business Thinking at Concordia University participated in this three-week study. Four treatment conditions were constructed using FirstClass whereby group membership and task experience conditions were created by varying participants' experiences during weeks 1 and 2, prior to the performance of the criterion judgment task at week 3. Groupwork took the form of asynchronous computer-mediated communication between group members in protected (group members only) conference areas. During weeks 1 and 2 of the study, subjects in the related task experience condition performed judgment tasks similar to week 3's task involving aesthetic or evaluative judgments for which there is no correct answer (McGrath, 1984; Wittenbaum & Stasser, 1996). Subjects in an unrelated task experience condition performed idea generation tasks during weeks 1 and 2. At week 3, all groups (i.e., all treatment conditions) performed the same judgment task (see Table 1 below).

Treatment conditions	Weeks		
	1	2	3
Stable membership with task experience	J_1	J_2	J_3
Stable membership without task experience	IG_1	IG_2	J_3
Changing membership with task experience	J_1	J_2	J_3
Changing membership without task experience	IG_1	IG_2	J_3

IG = Idea generation task
J = Judgment task

Table 1: Order of Task Assignment

Variables

Group membership consisted of two conditions—stable or changing. Similarly, task experience was operalitioned by two conditions—task experience and non-related task experience.

Group performance was measured by group solutions to the final judgment task, scored according to Straus' 1992 task scoring system of weighted values. Group process –time on task was measured with a single post-treatment item. Group members' social experiences were assessed with post-treatment questionnaire items inquiring about subjects' degree of satisfaction with the group process, group solution, as well as level of confidence in the group solution.

Experimental Procedure

Upon completion of a two-week FirstClass training and practice period, the three-week computer-mediated groupwork study began. Subjects were assigned randomly to conditions and to 3-person groups. Groups in the stable membership condition remained intact throughout the entire study (i.e., the same three people worked together). In contrast, groups in the changing membership condition were re-assigned to new 3-person groups at the start of every new week of the study such that no person worked with the same people more than once. At the start of Week 1, each subject was e-mailed his or her task with instructions on how to complete and submit it. Participants had two days to complete the task individually and submit a solution to the *Individual Submissions* conference area. Subjects then had the balance of the week to carry out the same task with their group. Upon completion of the group task, group solutions were submitted to a specified conference area, called *Group Submissions*, and each group member individually completed and submitted an online Week 1 Post-Task Questionnaire. During Weeks 2 and 3, subjects adhered to the same process described in Week 1 above, with subjects in the changing membership treatment condition being re-assigned to new 3-person groups. Upon submission of the final group solution at Week 3, subjects completed and submitted an online Post-Treatment Questionnaire and were given written debriefing of the study, via a personal e-mail message.

Results

A 2x2 between-subjects factorial design investigated the effects of group membership and task experience on group performance, group process and group members' social experiences. A total of 168 students participated in this research, forming a total of 56 three-person groups, 14 groups assigned to each treatment condition. The study was carried out over a period of three weeks with all four treatment groups (n=56) performing the same final judgment (criterion) task at week 3. Group performance was averaged across members in a group and assessed at the group level (n=56). All other dependent variables were based on data collected from the post-treatment questionnaire and were analyzed at the individual level (n=168). Analyses of all dependent measures were carried out via two-way analyses of variance (ANOVA) and a Pearson's correlation. In order to control for experimentwise type I error, the significance level for all F-tests was set at $p = .01$.

Group performance

Treatment mean scores for performance of the final judgment task (Task 3) reveal that groups acquiring judgment task experience as stable groups received higher task scores compared to groups in any of the other three treatment conditions (see Table 2).

Treatment	Mean	SD	N
Stable membership with task experience (SM/EXP)	7839.71	624.89	14
Stable membership without task experience (SM/NO EXP)	6721.36	1209.51	14
Changing membership with task experience (CM/EXP)	4823.57	1493.90	14
Changing membership without task experience (CM/NO EXP)	3230.00	1087.92	14
TOTAL	5653.66	2102.99	56

Table 2: Measures of central tendency for final task scores

A two-way ANOVA was carried out to confirm significant differences between these treatment means. As predicted, results show a main effect for membership ($M = 7280.53$, $M_{Changing} = 4026.78$), $F(1, 52) = 112.55$, $p < .01$ as well as a main effect for task experience ($M_{Experience} = 6331.64$, $M_{No\ Experience} = 4975.68$), $F(1,52) = 19.54$, $p < .01$. These results support Hypothesis 1.

Group process—time on task

Hypothesis 2 predicted that individuals who did not acquire group or task-related experience during weeks 1 and 2 would spend more time on the final judgment task. To test this hypothesis, subjects replied to the question "How much time did *you* spend on this assignment (in hours)?". A two-way ANOVA indicates a main effect for membership ($M = 2.66$, $M_{Changing} = 3.11$), $F(1,164) = 7.90$, $p < .01$, as well as a main effect for task experience ($M_{Experience} = 2.67$, $M_{No\ Experience} = 3.10$), $F(1,164) = 7.09$, $p < .01$. These results support Hypothesis 2.

Satisfaction with process

Post-treatment questionnaire item 22 "I felt pressured trying to complete the task in the allotted time" and item 23 "I felt our group needed more time to do a good job on this group task" were combined to yield a composite score of subjects' satisfaction with the process of carrying out the final judgment task. The coefficient alpha for the composite, calculated at the group member level, was .84. A two-way ANOVA showed a main effect for membership, with subjects assigned to groups with changing membership reporting higher levels of pressure to complete the task within the allotted time ($M_{Changing} = 4.13$, $M = 3.64$), $F(1,164) = 12.10$, $p < .01$. Unexpectedly, there was no main effect for task experience ($M_{Experience} = 3.77$, $M_{No\ Experience} = 4.00$), $F(1,164) = 2.60$, $p > .01$. Hypothesis 3 is partially supported.

Satisfaction with, and confidence in, group solution

Satisfaction with the group solution for the final judgment task was assessed with responses to item 21 of the post-treatment questionnaire "I am satisfied with the solutions my group came up with". Results of a two-way ANOVA showed a main effect for membership ($M = 3.90$, $M_{Changing} = 3.51$), $F(1,164) = 13.49$, $p < .01$ and a main effect for task experience ($M_{Experience} = 3.99$, $M_{No\ Experience} = 3.43$), $F(1,164) = 27.37$, $p < .01$. This results support Hypothesis 4.

Participants acquiring judgment task experience as members of groups with stable membership expressed higher levels of confidence in their group solution of the final task than individuals in any of the other three treatment conditions. An ANOVA on subjects' responses to item 19 "I am confident that the solutions our group came up with are correct" confirmed a main effect for membership ($M = 3.74$, $M_{Changing} = 3.27$), $F(1,164) = 20.10$, $p < .01$ and task experience ($M_{Experience} = 3.74$, $M_{No\ Experience} = 3.27$), $F(1,164) = 20.10$, $p < .01$. Hypothesis 5 is therefore supported.

Discussion and Implications for the Workplace

Results indicated that the more group members practice together as a group, the better they perform as a group on an asynchronous computer-mediated judgment task. The fact that groups acquiring judgment task experience in stable groups during weeks 1 and 2 scored substantially higher on the final task at week 3, compared to those who had not acquired these same types of experience, provides compelling evidence of the importance that gaining experience with a task as a stable group has on group performance.

Participants who became experienced with their group while carrying out judgment tasks reported spending less time on the final task. This suggests that subjects' accumulation of experience with computer-mediated judgment tasks as members of stable groups lead to a routinization of performance, thereby reducing of the amount of time required to carry out the final judgment task (McGrath, Arrow, Gurenfeld, Hollingshead & O'Connor, 1993). As group norms of communication and task execution became established over time, group members required lesser amounts of time to complete the final task effectively.

Reports of satisfaction with the process of carrying the task via asynchronous computer-mediated communication indicate that stable group membership positively affected subjects' level of satisfaction on this measure. Subjects assigned to groups with changing membership, regardless of whether or not they acquired judgment task experience, expressed lower levels of satisfaction with the process of completing the task. These participants, who, due to the lack of group familiarity, were not as adept at completing the judgment task, and generated the lowest group scores on the final task.

Group membership and task experience generated positive influences on subjects' levels of satisfaction with, and confidence in, the task solution. Significant correlations between these two measures and final task scores, $r = .79$, $p < .01$, provide further evidence that the computer-mediated group performance of tasks involving high levels of cooperation and conflict resolution is positively affected by group members' prior experience with the task and the group.

Computer-mediated groupwork in organizations is typically carried out among the same people, over a prolonged period of time and requires sustained interaction (Burke & Chidambaram, 1999). In this study, membership continuity positively affected group performance, time on task, and social reactions towards the group task. The implication for computer-mediated groupwork in organizations is that practice of tasks in stable groups would be an effective training method when the same group of people are going to be performing similar tasks in their jobs. Training and work environments that expose work groups to the general principles and procedures underlying computer-mediated tasks, that present them with a variety of relevant examples and give them the opportunity and time to work on several similar problems would likely lead to improved group performance.

To ensure that training does not compartmentalize people, skills and knowledge into specific task or group activities, this type of training should be used as a facilitative measure. Workers would first acquire job-relevant computer-mediated groupwork skills in stable groups so that much of the work required to carry out the assigned task is facilitated by group and task experience. Subsequent training would extend beyond the familiar groupwork context, incorporating new tasks and altering group membership so that knowledge and skills are further developed. The objective is to design training and job environments that facilitate the transfer of skills and knowledge to new contexts (e.g., new tasks, new people, new CMC systems) so that workers can easily adapt to a variety of computer-mediated groupwork situations.

References

Benbunan-Fich, R., & Hiltz, S.R. (1999). Educational applications of CMCS: Solving case studies through asynchronous learning networks. *Journal of Computer-Mediated Communication* [On-line], 4(3). Available: http://www.ascusc.org/jcmc/vol4/issue3/benbunan-fich.html

Burke, K., & Chidambaram, L. (1999). How much bandwidth is enough? A longitudinal examination of media characteristics and group outcomes. *MIS Quarterly*, 23(4), 557-580.

Cannon-Bowers, J.A., Salas, E., Blickensderfer, E., & Bowers, C.A. (1998). The impact of cross-training and workload on team functioning: A replication and extension of initial findings. *Human Factors*, 40(1), 92-101.

Cannon-Bowers, J.A., & Salas, E. (1997). A framework for developing team performance measures in training. In M.T. Brannick, E. Salas, & C. Prince (Eds.), *Team performance assessment and measurement. Theory, methods and applications*, (pp. 45-62). Mahwah, NJ: Lawrence Erlbaum Associates.

Cannon-Bowers, J.A., Tannenbaum, S.I., Salas, E., & Volpe, C.E. (1995). Defining competencies and establishing team training requirements. In R.A. Guzzo, E. Salas, & Associates (Eds.), *Team effectiveness and decision making*, (pp. 333-380). San Francisco: Jossey-Bass Publishers.

Galegher, J., & Kraut, R.E. (1994). Computer-mediated communication for intellectual teamwork: An experiment in group writing. *Information Systems Research*, 5(2), 110-138.

Hollingshead, A.B. (1998a). Group and individual training: The impact of practice on performance. *Small Group Research*, 29(2), 254-280.

Hollingshead, A.B. (1998b). Distributed knowledge and transactive processes in groups. In M.A. Neale, E.A. Mannix, & D.H. Gruenfeld (Eds.), *Research on managing groups and teams*, Vol. 1, (pp. 103-123), Greenwich, CT: JAI.

Hollingshead, A.B., McGrath, J.E., & O'Connor, K.M. (1993). Group task performance and communication technology. A longitudinal study of computer-mediated versus face-to-face work groups. *Small Group Research*, 24(3), 307-333.

Liang, D.W., Moreland, R.L., & Argote, L. (1995). Group versus individual training and group performance: The mediating role of transactive memory. *Personality and Social Psychology Bulletin*, 21(4), 384-393.

Littlepage, G.E., Robison, W., & Reddington, K. (1997). Effects of task experience and group experience on group performance, member ability, and recognition of expertise. *Organizational Behavior and Human Decision Processes*, 69(2), 133-147.

McGrath, J.E. (1984). *Groups: Interaction and performance*. Englewood Cliffs, NJ: Prentice Hall.

McGrath, J.E. (1993). Introduction. The JEMCO workshop – Description of a longitudinal study. *Small Group Research*, 24(3), 285-306.

McGrath, J.E., Arrow, H., Gruenfeld, D.H., Hollingshead, A.B., & O'Connor, K.M. (1993). Group, tasks, and technology. The effects of experience and change. *Small Group Research*, 24(3), 406-420.

McGrath, J.E., & Hollingshead, A.B. (1994). *Groups interacting with technology. Ideas, evidence, issues, and an agenda*. Thousand Oaks: Sage.

McIntyre, R.M., & Salas, E.(1995). Measuring and managing team performance: Emerging principles from complex environments. In R.A. Guzzo, E. Salas, & Associates (Eds.), *Team effectiveness and decision making* (pp. 9-45). San Francisco: Jossey-Bass Publishers.

Moreland, R.L, Argote, L., & Krishnan, R. (1996). Socially shared cognition at work. Transactive memory and group performance. In J.L. Nye & A.M. Brower (Eds.), *What's social about social cognition? Research on socially shared cognition in small groups* (pp. 57-84). Thousand Oaks, CA: Sage.

Moreland, R.L., & Wingert, M. (1995, May). *Training people to work in groups: The role of transactive memory.* Paper presented at the annual meeting of Midwestern Psychological Association, Chicago

Salas, E., & Cannon-Bowers, J.A. (1997). Methods, tools and strategies for team training. In M.A. Quinones & A. Ehrenstein (Eds.), *Training for a rapidly changing workplace: Applications of psychological research* (pp. 249-280). Washington, DC: American Psychological Association.

Straus, S.G. (1992). *Does the medium matter: An investigation of process, performance, and affect in computer-mediated and face-to face groups*. Unpublished doctoral dissertation, University of Illinois at Urbana-Champaign, Urbana.

Straus, S.G., & McGrath, J.E. (1994). Does the medium matter? The interaction of task type and technology on group performance and member reactions. *Journal of Applied Psychology*, 79(1), 87-97.

Warkentin, M.E., Sayeed, L., & Hightower, R. (1997). Virtual teams versus face-to-face teams: An exploratory study of a Web-based conference system. *Decision Sciences*, 28(4), 975-996.

Wilson, E.V., Morrison, J.P., & Napier, A.M. (1997). Perceived effectiveness of computer-mediated communications and face-to-face communications in student software development teams. *Journal of Computer Information Systems*, 38(2), 2-7.

Wittenbaum, G.M., & Stasser, G. (1996). Management of information in small groups. In J.L. Nye & A.M. Brower (Eds.), *What's social about social cognition? Research on socially shared cognition in small groups* (pp. 3-28). Thousand Oaks, CA: Sage.

Evaluation of a High-end Distance Delivery MBA Program

Dennis Dicks
Associate Professor of Educational Technology Faculty of Arts and Science
e-learning consultant John Molson School of Business
Concordia University Montreal

Abstract

The John Molson School of Business at Concordia University in Montreal has been addressing the need for new skills in aviation management for almost a decade through its International Aviation MBA, in partnership with IATA. the School set out in early 1999 to create a version of the program which could be largely delivered at a distance, anywhere in the world. This paper evaluates the technical and pedagogical decisions which formed the program, successfully launched in 2000, now graduating its first cohort and welcoming its third..
On the technical side, after evaluating a number of commercial templates and courseware purveyors, we chose to develop a custom-made approach with a local provider, *Hypermedia-Builder*. On the pedagogical side, drawing upon extensive experience in multimedia production, we have provided intensive support for faculty members, on both technical and pedagogical issues, as they develop and deliver their courses. Feedback from students and other data indicate that the these efforts enabled the program to achieve its academic goals Our experience suggests a need for innovative approaches to the problem of evaluating technology-supported instruction.

Context

For the past 10 years, the John Molson School of Business at Concordia University in collaboration with the International Air Transport Association (IATA) has offered an accredited MBA degree focussed specifically on aviation, responding to a growing demand for superior management skills in the industry. The International Aviation MBA (IAMBA) requires students, largely mid-level executives in airlines, airports, and civil aviation authorities, to be on campus for intensive study over a 13-month period. For students, the quality of the program must outweigh the substantial costs in tuition, accommodation in Montreal, and time away from their jobs. To overcome the latter 2 of these cost barriers, the School decided to create the Global version (GAMBA) of the IAMBA, as a primarily distance-delivered program. This paper documents the strategic and tactical decisions which led to an on-time, on-budget launch of this very rich multimedia programand evaluates the outcomes of these decisions.

Strategic and Tactical Decisions

Concordia has positioned itself as an urban university catering to the workplace in a number of senses: by offering programs that respond to market demand, classes outside normal working ours, flexible entry requirements, small classes and lots of contact with faculty. This is our niche, where we compete very well with older and more famous institutions; so abandoning it for large-scale off-campus delivery, via the web for example, would probably be a fatal mistake. Instead, we have experimented with teaching technologies within our niches, largely in support of on-campus courses. Since 1995, development of instructional technologies has been a key plank in the strategic plan of the John Molson School of Business. The plan took concrete shape not only in the development of the technical infrastructure, including a Centre for Instructional Technology, but also in the hiring of multimedia production staff, instructional designers to guide their work and that of faculty, and an educational technologist (Dicks) to lead the team (Dicks and Genova, 2000). Thereafter, major decisions like the ones reported below have crystallized from lengthy debate involving academic leaders, faculty, instructional designers and technical staff.

For our first major project, we decided to convert two well-established niche programs, the Executive MBA (EMBA) and IAMBA to Laptop U. format. As prestigious programs, operating outside normal constraints on hiring and tuition, we considered them the best vehicle for the School's flagship venture into teaching technologies.

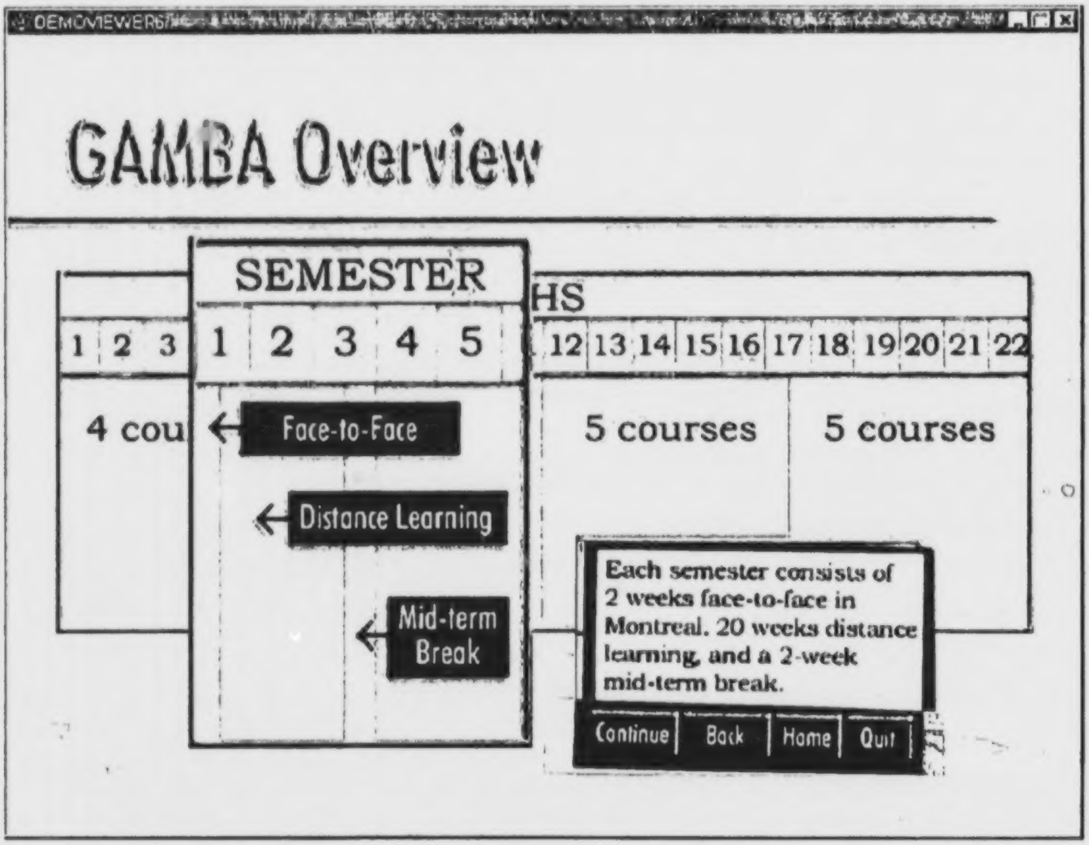
At the time, we imagined that laptop operation would simply mean converting to multi-media format the materials contained in each of the course binders which students received at the start of term. As it turned out the binders contained little more than what students typically receive at the start of any traditional class: an outline, some reprints, maybe some problems or cases. Not surprisingly, IAMBA/EMBA faculty were creating class

BEST COPY AVAILABLE

activities close in time to delivery, just as they do in other contexts. So at the outset the laptops, and the fully-wired intelligent classrooms we built for them, added little pedagogical value.

When we decided that we needed to reduce the accommodation and opportunity costs of the IAMBA by creating a distance version, we had to construct an entirely new strategy. Our target audience expected high-quality courseware commensurate with the substantial program tuition, and capable of sustaining their learning through a long period of remote study. We would have to put a lot of work into course materials so that as much as possible could be loaded onto student laptops before each term started. Our experience and analysis of the literature (e.g. Gibson, 1998) indicated that if we left students out on the end of the wire for excessive periods of time, they would become increasingly isolated and drop out. So we needed to balance the benefits of regular face-to-face contact with the costs of travel. Finally, if we planned to operate globally, ensuring students instant access to materials anywhere/anytime, we would want to reduce reliance upon potentially costly, slow, and unreliable telecommunications.

In view of these factors, we decided to distribute the program's 18 courses over 4 terms (Figure 1). Our plan called for students to visit the campus for two weeks of intensive classroom work, then return home to work on 20 weeks of material loaded onto their laptops.

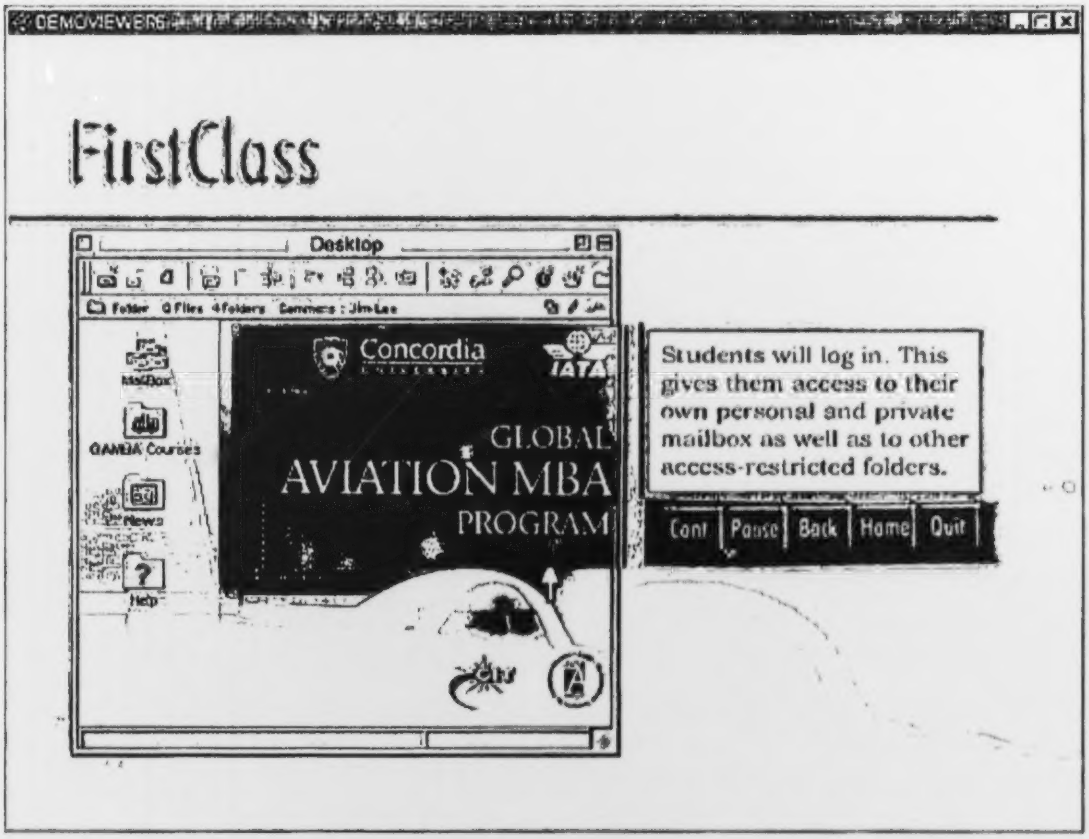


Each semester consists of 2 weeks face-to-face in Montreal. 20 weeks distance learning, and a 2-week mid-term break.

Figure 1. The Global version of the International Aviation MBA – 18 courses covered over 22 months, divided into 4 semesters. Superimposed is a typical semester which consists of 2 weeks on-campus followed by 20 weeks of study at a distance. This and subsequent figures are excerpts from our program demo on CD-ROM.

BEST COPY AVAILABLE

While off-campus, students would use our FirstClass groupware (Figure 2) to maintain contact, and to access or deliver assignments.



Students will log in. This gives them access to their own personal and private mailbox as well as to other access-restricted folders.

Figure 2. Desktop (in demo format) for the FirstClass groupware system, customized for the Global program. FirstClass is used for e-mail and chat communication, group work, assignments and instructor feedback.

To prepare, deliver and monitor courseware, we chose a hybrid technology which facilitates the creation of high-quality multimedia materials accessible on hard drive, CD-ROM or internet (Figure 3).

On the Pedagogical Side

In the run-up to our laptop projects, we conducted a number of pilot studies to experiment with different multimedia environments and development techniques. In this we were fortunate to have at Concordia one of the best Educational Technology programs in the world. Its Masters students are encouraged to complete their course projects and internships on real projects for real clients. Largely as a result of this practical experience, graduates go to work with prominent firms - Bombardier, the Canadian Space Agency, Soft Image, Nortel, Pfizer, Deloite Touche - as training developers, change managers, and so on. We engaged a half dozen of these students to develop prototypes for a distance course on Operations Research, and a web-based course on Personal Finance.

BEST COPY AVAILABLE

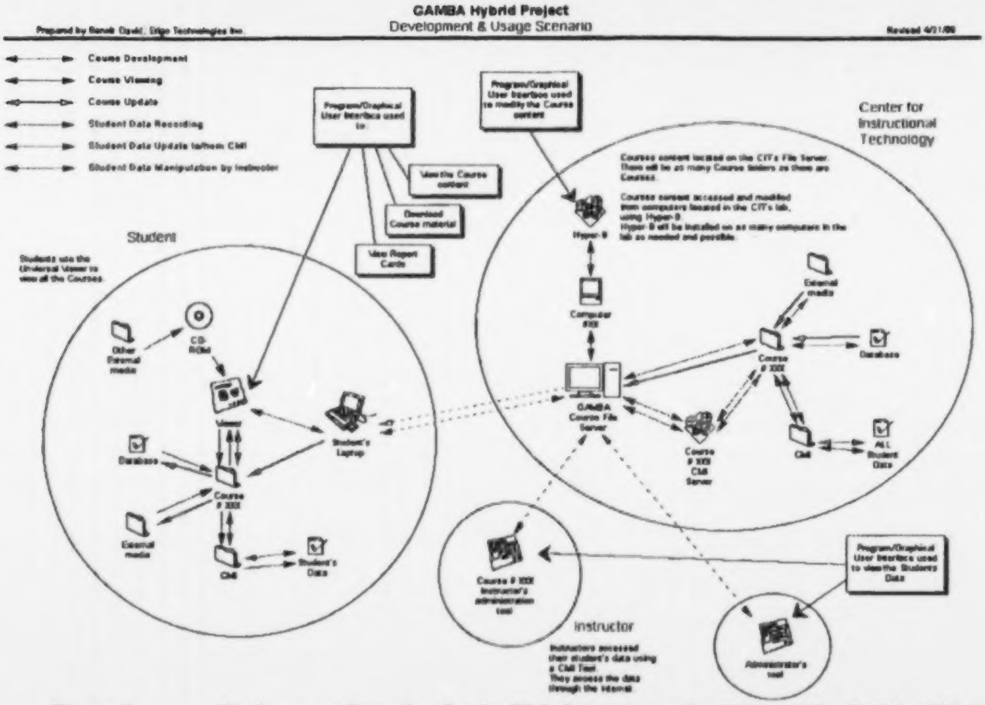

GAMBA Hybrid Project
Development & Usage Scenario
Prepared by Ergo Technologies Inc.
Revised 4/21/00
Course Development
Course Viewing
Course Update
Student Data Recording
Student Data Update to/from CMI
Student Data Manipulation by Instructor
Program/Graphical User Interface used to:
View the Course content
Download Course material
View Report Cards
Program/Graphical User Interface used to modify the Course content
Center for Instructional Technology
Courses content located on the CIT's File Server. There will be as many Course folders as there are Courses.
Courses content accessed and modified from computers located in the CIT's lab, using Hyper-B
Hyper-B will be installed on as many computers in the lab as needed and possible.
Hyper-B
Computer
External media
Database
Course # XXX
GAMBA Course File Server
Course # XXX CMI Server
CMI
ALL Student Data
Student
Students use the Universal Viewer to view all the Courses.
Other External media
CD-ROM
Viewer
Student's Laptop
Database
Course # XXX
External media
CMI
Student's Data
Course # XXX Instructor's administration tool
Instructor
Instructors accessed their student's data using a CMI Tool. They access the data through the internet
Program/Graphical User Interface used to view the Students Data
Administrator's tool

Figure 3. Hardware configuration for the Global program, using Hypermedia-Builder. The large circle on the right represents the course development and management component; the smaller one on the left represents the student laptop loaded with course materials but also in contact with the management component.

On the pedagogical side, these pilot studies taught us the value of providing a rich learning environment for students working at a distance; and we discovered the difficulties of getting faculty to generate the required material. Anyone familiar with corporate training program development knows that one of the most challenging tasks for the developer is creating a good working relationship with the subject matter expert (SME) so that information flows accurately and on time from expert to curriculum. Not surprisingly, this task can be just as difficult with that archetypical SME, the faculty member. In traditional university teaching, faculty work within a very flexible framework, adding, subtracting or modifying materials and methods on the fly. Like other SMEs, they are accustomed to developing and delivering their wisdom in familiar formats and time frames which typically do not match those imposed by an independent materials developer (Rickard, 1999). In contrast, multimedia production demands that instructional design be made explicit, that content be finalized long before delivery, in close collaboration with a multiskilled team (Dicks, 2000).

Our pilot projects and previous experience in industry convinced us to strengthen the SME-developer relationship by matching each faculty member with an experienced instructional designer. For this we hired, on contract at market rates, graduates of our MA Educational Technology program with a good mix of creative and social skills. Faculty, as part of their course contract, were paid a development stipend - an additional 40% of the regular on-campus fee. These teams began awkwardly, with faculty asking "what can the technology do?" and instructional designers starting from the opposite pole: "what do you want to teach?" But they quickly warmed to close, creative partnerships. As we grew more practiced, we also created a course-bidding process to locate faculty with the interest and ability to work in this challenging new environment.

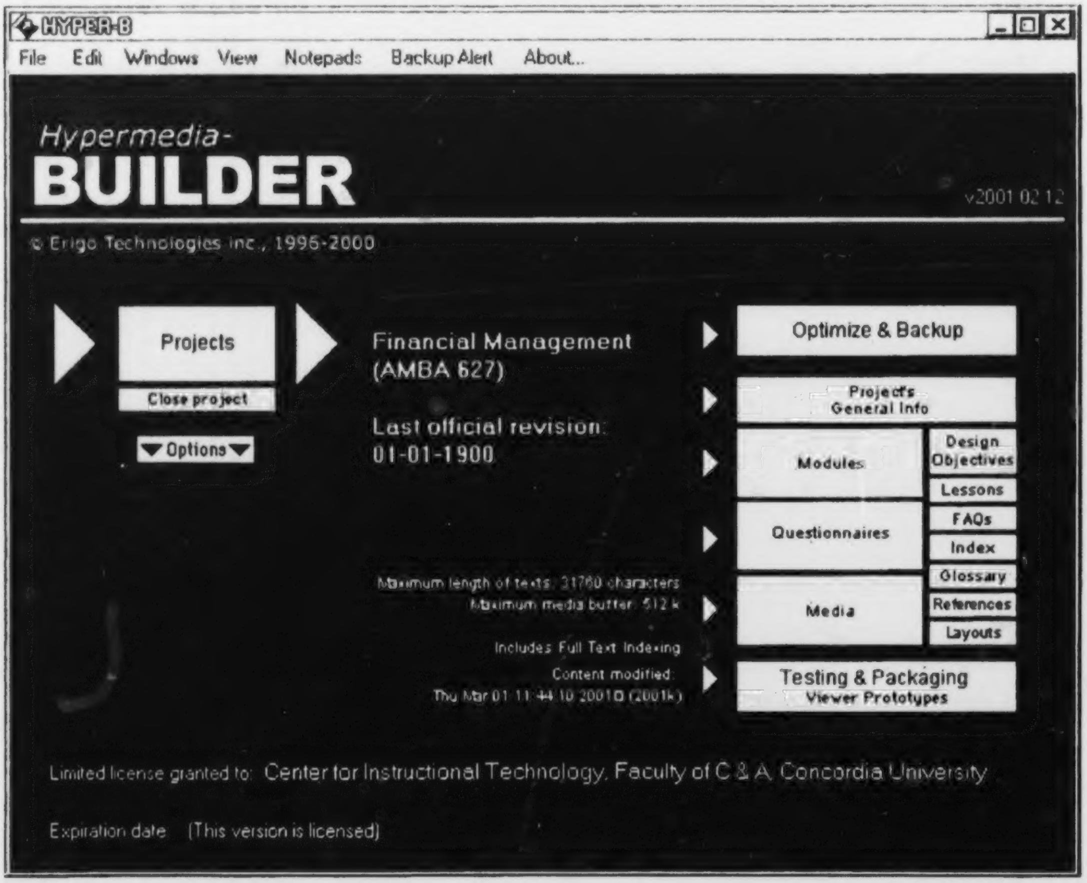
On the Technical Side

BEST COPY AVAILABLE

On the technical side, having an established laptop program proved a great advantage: from the start we were able to define our students' off-campus computing environment. One of our key goals in the pilot projects was to create a seamless interface, so students would be able to participate in a variety of pedagogical activities without worrying about the underlying software. Our experiments uncovered some glitches in this respect with Web-CT, a platform favoured by the University's central information technology establishment.

Accordingly, we looked at a very sophisticated, expensive design and delivery tool called *Hypermedia-Builder* (Hyper-B; Figure 3), from Erigo Technologies Inc., Montreal. Hyper-B was developed by another of our Educational Technology graduates in response to technical and logistic problems he had encountered in designing multimedia teaching materials. Adopting a customized local product would entail much higher risks and costs, and lower compatibility compared with an off-the-shelf platform like Web-CT. However, our technical and pedagogical experts agreed that the risks were offset by Hyper-B's advantages. First it is designed for use by instructional designers, as its interface shows (Figure 4).

Instructional designers can learn its basic functions in a half-day, and input most material directly into a wide variety of formats. Second, the interface operates on a database, so that existing materials can be re-assembled, re-used, or revised with minimal effort. Third, the database is accessed by a Viewer (Figure 5) which functions much like a browser; materials can be recast as a new instructional package by simply changing the features of the Viewer. Fourth the database permits exceptional navigation and search features (Figure 5). Fifth, the upside of customization is that Hyper-B gives our program an exclusive panache, a more sophisticated image than available from standard course templates.


HYPER-B
File
Edit
Windows
View
Notepads
Backup Alert
About...
Hypermedia-
BUILDER
v2001 02 12
Projects
Close project
Options
Optimize & Backup
Project's General Info
Modules
Design Objectives
Lessons
Questionnaires
FAQs
Index
Glossary
Media
References
Layouts
Testing & Packaging
Viewer Prototypes

© Erigo Technologies inc., 1996-2000

Financial Management
(AMBA 627)

Last official revision:
01-01-1900

Maximum length of texts: 31760 characters
Maximum media buffer: 512 k

Includes Full Text Indexing

Content modified:
Thu Mar 01 11:44:10 2001D (2001k)

Limited license granted to: Center for Instructional Technology, Faculty of C & A, Concordia University

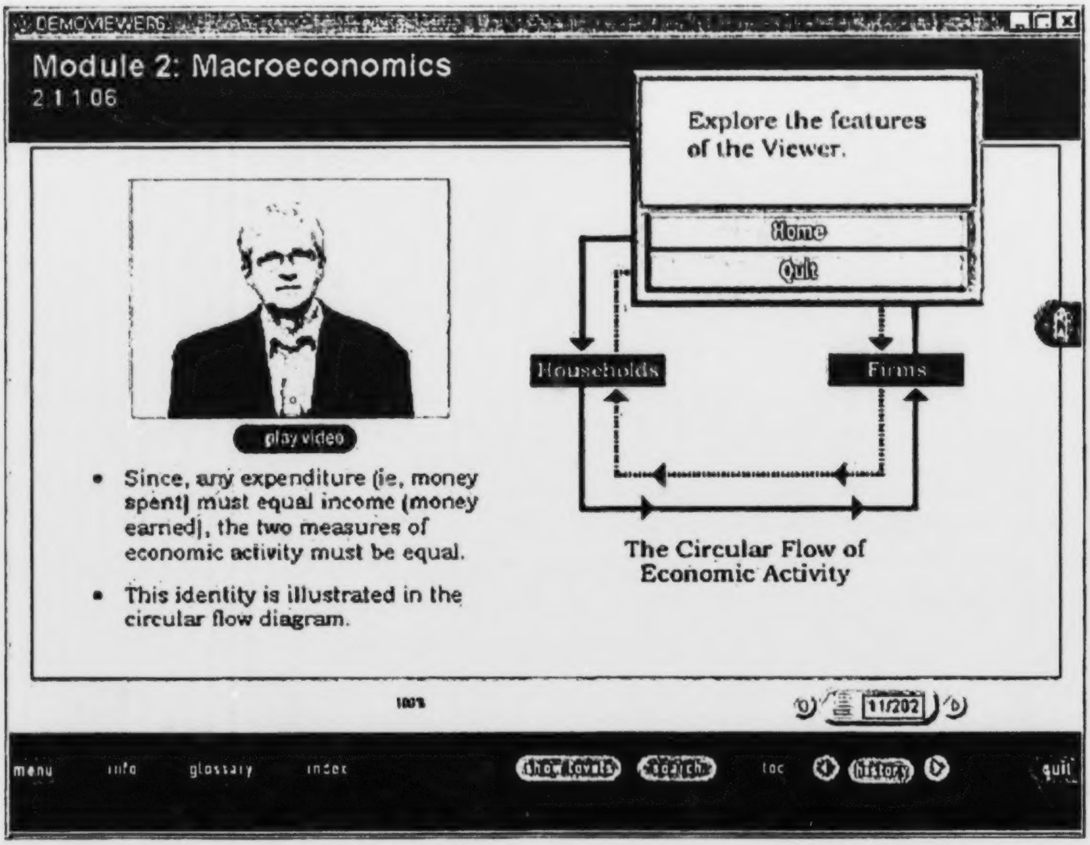
Expiration date (This version is licensed)

Figure 4. Main menu for Hypermedia-Builder, course development and delivery software specifically tailored for instructional designers.

BEST COPY AVAILABLE

Last but hardly least, Hyper-B offers exceptional flexibility in configuring course delivery. Initially we leaned towards a web-based course along the lines offered by other platforms. This would potentially create line-cost and reliability problems if students lived outside North America, worked at home, or traveled; we expected a global program to encounter all these constraints. And so we opted for the configuration which loaded the course materials on the laptops, but still permitted remote updates of everything, and interactive course management as well (see Figure 3).

Faculty and instructional designers established their own modus operandi with an objective of completing the courseware to meet a strict deadline, so that alpha and beta testing could be conducted before delivery. Our schedules allowed them about 4 months from start to delivery for testing, and another month for revisions. After that, a semester's worth of courses would be loaded onto the laptop hard drives, together with any supportive software. The on-campus session for first term was extended to include distribution of the computers, plus hardware and software training. We designed the face-to-face session to establish an esprit de corps which, with regular communication via our FirstClass groupware, would help sustain students through the long distance-delivery session. Once they returned home, the students maintained weekly contact with their instructors for the next 20 weeks by means of FirstClass groupware. In addition, we hired one of our senior instructional designers to coordinate the flow of communications. We also used FirstClass to send and receive assignments and tests. Finally, to handle complex nomenclature, we provided each student with a hand-held scanner driven by the laptop with which they could submit handwritten exercises.



Module 2: Macroeconomics

2.1.1.06

Explore the features of the Viewer.

- Since, any expenditure (ie, money spent) must equal income (money earned), the two measures of economic activity must be equal.
- This identity is illustrated in the circular flow diagram.

The Circular Flow of Economic Activity

Figure 5. Sample screen (in demo format) from the Economics course, showing a video component, text, graphic and extensive navigation tools accessed by buttons at bottom of screen.

BEST COPY AVAILABLE

Courseware Production

.On average, preparation of a single course required 50 days of an instructional designer's time and somewhat less faculty time. From the outset, courseware design varied considerably with the content and faculty teaching styles. Our first four courses, covering the basics (Accounting, Economics, Human Resources and Statistics) relied heavily on text and textbook; and we overestimated the volume of weekly exercises required to keep students moving. Subsequently, we lightened the assignment load, and started to vary courseware format as the whole team gained confidence and skill. Now, with 18 courses completed, our repertoire ranges from a simple wrap-around (text-based design supplementing a textbook), to wrap-around enriched with interactive activities, to videotaped lectures reinforced with interactive commentaries. The content of the courses varies widely over different disciplines, different types of knowledge, skills and activities. We have learned to adjust our pedagogical approaches to this variety by applying appropriate technological support (the Viewer, FirstClass, audio and videoconference) instead of trying to hammer everything into one template.

Evaluating our Experience

We started the program with a deliberately modest cohort of 15 students, 13 of them men. They came from 10 different countries, from Ecuador to New Zealand, and most were already working in the aviation sector. They are a remarkably diverse, talented and enthusiastic crowd; probably as a result, we have had no dropouts for academic reasons (two have interrupted studies due to the impact of September 11 events on the industry). This cohort is now graduating ; a second cohort has completed first year; and a third is just beginning.

From the outset we have conducted formative evaluations on the courseware, technology, and pedagogy, as well as summative evaluations of faculty performance. Feedback on courseware and pedagogy has been very helpful in making improvements for instructional design in general, and specifically for courses now being offered for the second and third time. As we anticipated, our students expected the program to provide much more than a one-way flow of information. Consequently, they reacted best to course designs which provided some choice in activities and pacing, interaction with the instructor, and what the course coordinator has called 'proactive counselling'- friendly inquiries about their progress and problems (McBryde, 2002). This reinforces a personal observation that the key feature of the program may be 'just-in-time' instruction. The real value of our sophisticated courseware development and delivery technology may well be that it provides in one place just what the student needs, just when needed.

Our technology performed extremely well, with the few initial glitches easily corrected through the internet with our built-in update function. In fact, after the first two terms we dropped technological issues from our evaluative questionnaire because the effort outweighed the information gained. During the first term, students, faculty and the course coordinator all rapidly learned to deal with different roles played by their laptops, the Viewer, FirstClass, the scanner. Both the Viewer and FirstClass proved to be remarkably user friendly. Ironically, hardware-specifically the laptop hard drive- has been the component most prone to failure (McBryde, 2002).

Conclusion

As a late entrants into distance education, we in the John Molson School of Business have drawn upon the experience of others to plan carefully. Our teaching technology strategy does not target the mass market, but rather a very specific niche. It does not depend upon the initiatives of individual faculty members to supply the range of skills required to program or even fill and modify templates, but rather requires close collaboration of dedicated team members with differentiated expertise. Its time lines are neither open nor flexible. Course preparation has to be completed long before term starts, even though revisions can in fact be made anytime thereafter. Faculty have to provide agreed materials on an agreed schedule, and sign off on completed materials by agreed dates. Our technology is not low-cost off the shelf but tailored to our needs at substantial expense which must be recovered in added value. Part of that added value lies in special features - a sophisticated image, impressive functionality. Part lies in more tangible benefits, like ease of revision, portability of materials to other applications, and the almost complete elimination of the programmer role, thus considerably reducing the risks of inaccurate or untimely communication in the production phase.

Have we succeeded? We can answer in several ways. First, we have no dropouts for academic reasons in the first cohort, in spite of a very mixed clientele. Esprit de corps is such that the first cohort has even asked that we add a final visit for graduation. Secondly, students, faculty and instructional design teams are generally pleased with the quality of the courseware and instruction. Thirdly, we have attracted a second and third cohort. Finally, if 'just-in-time' delivery is indeed a key feature in the program's success, we should be examin ing the role of opportunity cost- rather than amount or speed of learning for example - when we evaluate technology supported instruction.

For all the participants, this has been a very risky enterprise, in time, money and effort. Especially for faculty who have invested their time disproportionately to master new design skills which will affect the way they teach, whether they use technology or not.

References

Dicks, D.J. Changing the Way We Teach: Redefining the Pedagogical Environment for Faculty, **Educational Technology Conference,** Concordia University, 1-3 November 2000.

Dicks, D.J. and Genova, M. (2000). Incorporating a Multimedia Support Centre into Exisitng Learning Initiatives, Invited Presentation, Multimedia Online Learning Conference, **International Quality and Productivity Centre,** Toronto, 11-14.

Gibson, C.C. (Ed.) (1998). **Distance learners in higher education: Institutional responses for quality outcomes.** Madison, WI: Atwood Publishing.

McBryde, J. (2002), GAMBA Course Coordinator, personal communication.

Rickard, W., Technology, Education and the Changing Nature of Resistance, **Educom Review,** 1999. (www.educause.edu/lr/library/html/erm9915.html).

Developing Online Emergency Room Case Study Role Play For Medical Students

J.A. Gilles Doiron[1] and Dr. John R. Isaac[2]

[1]Centre for Development of Teaching & Learning
[2]Department of General Surgery Faculty of Medcine
National University of Singapore
10 Kent Ridge Crescent, Singapore, 119260

ABSTRACT

In the face of panic and life-threatening situations in a hospital emergency room (ER), doctors must rely on well-defined procedures to assess the situation and respond appropriately. Since decisions to act must not only be timely, but also ingrained and swift, practice and experience in a wide range of situations is essential. This paper outlines the analysis, design and prototype development phases of a web-based role-play scenario in which the students of surgery can add to their repertoire of experience in ER medicine. Examples of existing online case study and role-play activities for clinical and ER training were studied. The instructional design decisions took into consideration the desirable attributes of these examples, but more importantly addressed their shortcomings. The prototype features an interface that enables the student to make many decisions at one time while proceeding to stabilise and diagnose the patient. After completing the procedure, the student's report is posted to an online discussion site for peer analysis and critique. The development of a future prototype is also discussed.

KEYWORDS

online role-play, case study simulation, e-learning, web-based learning, WBL, academic emergency medicine

INTRODUCTION

In medicine, the use of information technology (IT) for teaching and learning began with the digital revolution of the early 1980s and the introduction of affordable personal computers for schools. The evolution of IT for the medical curriculum went from computer-based learning, such as the early low-graphics resolution tutorials, to computer controlled interactive videotape and videodisc, to immersive virtual reality simulations.

Today, the advent of the World Wide Web has added a new technology dimension: synchronous and asynchronous communication, and ubiquitous access. Slotte et al (2001) report that a 1999 survey showed that most medical school graduates in the USA "...used email (96%), medical information databases (92%) and the worldwide web (85%), especially for health care information". Unfortunately, as Turchin A. & Lehmann (2000) point out "...currently existing WWW-based medical educational applications seldom venture far beyond the boundaries of traditional curricula. Most of them serve as information depots, not offering significant qualitative improvement compared to a regular well-indexed textbook".

Concurrently, research and evaluation of technology in education has been examining the instructional design approaches for producing effective learning materials. Instructional design is a systematic approach to course development that ensures that specific learning goals are accomplished. Traditionally, instructional design models are based on behaviourist origins that stress the need for learning objectives, feedback and reinforcement to achieve a particular change in the learner. More progressive models of instructional design are now being fostered through a constructivist view of learning: the belief that individuals learn best from meaningful, self-directed and contextually relevant experiences. These models tend to use computer-mediated communication for peer-to-peer critique and collaborative learning activities, and have less emphasis on the teacher's role.

Bearman et al (2001) examined computer assisted instruction design approaches involving "virtual patients", where the student role-plays a doctor as he/she goes through scripted interactions with a "simulated" patient. The virtual patient design may range from the simple web-based to resource-intensive productions, but its instructional approach is either problem solving or narrative. The Interactive Patient (http://medicus.marshall.edu/medicus.htm) presenting a series of interactions over time with a coherent story line is an example of the narrative. While a repository of trauma cases (http://www.trauma.org) is an example of the problem solving approach.

Information and communication technology provides a new foundation for building what we now term as Internet enabled learning or e-learning. Looking for a feasible approach to provide a more meaningful online learning experience, the authors researched how an online role play simulation strategy, a variation of the problem solving approach in a virtual patient setting, could meet the needs of the surgical training program.

THE RATIONAL AND GOALS OF THE PROJECT

There are close to two hundred students in the fourth year of the medicine program, and ER medicine is part of their training. Students have a three-week posting to an emergency department of a teaching hospital where they receive basic cardiac life support training. They experience the management of trauma patients in the ER by observing and assisting the attending physicians. Concurrently the students take the American College of Surgeons Advanced Trauma Life Support course where in addition to attending lectures, they execute dry and wet simulationskills practice, and role-play on mock up (actors) patients.

BEST COPY AVAILABLE

Because of the number of students involved and the time allotted to role-play, each student gets very limited case simulation experience. Access to online role-play would enable each student to handle more scenarios, and even accrue some level of experience before their hospital posting. A more varied experience would translate to better management of real trauma cases during their posting.

The instructional design approach for this program reflects a pragmatic mix of strategies for teaching and learning. Our primary goal is to help the students self-assess their knowledge of related clinical procedures and laboratory tests needed to quickly stabilise and diagnose a trauma patient. While behavioural strategies are used to reinforce the basic airway, breathing and circulation (ABC) procedures critical to ER cases, constructivist learning strategies aim to encourage students to reflect on the processes involved and the experience gained. The constructivist strategies include framing the case study in a contextual experience and online discussion and debate to substantiate and compare their explanations with peers.

WHAT'S ON THE WEB NOW

An in-depth search of the World Wide Web yielded few sites dedicated to academic ER medicine. E-learning for ER medicine is not a common practice and the existing web sites have varying levels of sophistication in design. For most, the interface is limited to hyperlinked information, whether as additional data about a case or as feedback to multiple-choice questions (MCQs). None of the sites were designed to reinforce the ABC procedure for trauma cases. Some were no more than hypertext versions of print-based case studies.

Some simple case presentations can be found at Emergency Medicine Bulletin Board System (EMBBS) (http://www.embbs.com/ccc/ccc.html), including Clinical Reviews In-Depth and Academic Emergency Medicine's clinical pearls. Although they provide a convenience of access to information, these examples have no manner of learner interaction with the case. They are the equivalent to printed case studies. Others like the "CyberPatient Simulator" (http://www.mdchoice.com/cyberpt/cyber.asp) are slightly more sophisticated. Using basic web features, they present the case study as a series of decisions. As the learners proceed from one decision point to another, they get information about the case while responding to a sequence of questions. This design is linear with minimal interaction between the learner and the case. However, it still creates a presentation style where the learner can reflect on the information presented before viewing the consequences of any decision.

The Cases In Emergency Medicine web site of the University of Virginia School of Medicine (http://www.med.virginia.edu/med-ed/em/) makes use of more advanced web features. Dr. Stephen Huff has developed several web-based case simulations as scripted encounters with patients. Students progress through the case by selecting the appropriate sequence of investigation. Students get information about the case as they select to "Stabilise" the patient, get "History" and do a "Physical". Relevant questions about the case lead the student to selecting the appropriate "Action" to undertake.

This design is not only a more challenging experience to the learner, but it also features a set mode for presenting any case. Doctors can develop new cases by following the established sequence of presentation, making it easy to script and storyboard, and easy to program. But although this template is simple to use for content experts and programmers, it provides only basic user-interaction with the case simulation. A greater fidelity to real life experience, like enabling the student to indicate how procedures are accomplished, or make multiple decisions at one time is desirable.

THE DESIGN OF THE PROTOTYPE

Although many students in the Faculty of Medicine have Internet access from their homes, very few have subscription to wide band services such as ADSL or cable-modem. Therefore so called "video over the Internet" would have to be set-up for low bandwidth delivery. Since this configuration is woefully inadequate i.e. the size of the image is small and video image freezing is common due to network congestion, the prototype would not have video sequences. As well, because of the need for greater efficiency in developing future ER role-play simulation scenarios, the prototype would serve as a template for authoring subsequent cases. To produce new cases, content experts would only need to replace content (e.g. text and photos); the sequence and the structure of interaction remain the same.

In this prototype a mentor character, the chief of ER medicine, will set the stage for the trauma case and spell out his expectations for efficient handling of the case. The student will role-play the attending physician in ER under the watchful eye of the expert. As the strategy of role-play in this ER trauma case simulation is a student centred activity, the mentor's role is to provide feedback. Rather than observing or being prompted by the mentor, students need to practice applying their knowledge of ER procedures and diagnostic investigation.

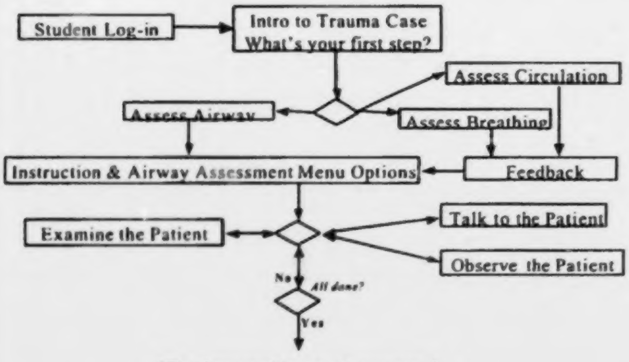

Student Log-in
Intro to Trauma Case
What's your first step?
Assess Circulation
Assess Airway
Assess Breathing
Instruction & Airway Assessment Menu Options
Feedback
Talk to the Patient
Examine the Patient
Observe the Patient
No
All done?
Yes
(Continue to Airwav Assessment)

Fig. 1 Program Flowchart - Assess Airway Segment

The fundamental ABC sequence of attending to ER trauma is the first item to reinforce. Then, depending on the circumstance of the case, the attending physician (the student) must decide on which clinical and lab tests to perform at each stage of the ABC procedure. The student may also need to observe the patient or ask him some questions. These options are indicated in the program flowchart (Fig. 1). After being introduced to the case and selecting "Assess The Airway", the student can "Observe The Patient", "Talk To The Patient" or "Examine The Patient".

BEST COPY AVAILABLE

The Observe The Patient option hyperlinks to a medium close-up photo of the patient with comments on his breathing rate and alertness i.e. what would be evident if the observation were real-time or on video. The Talk To The Patient option hyperlinks to a selection of questions to ask the patient, and his response is heard as an audio file. The Examine The Patient option hyperlinks to new screen showing a clipboard with a selection of clinical tests. The student must select the appropriate tests to perform during the "Assessing The Airway" stage of the ABC procedure.

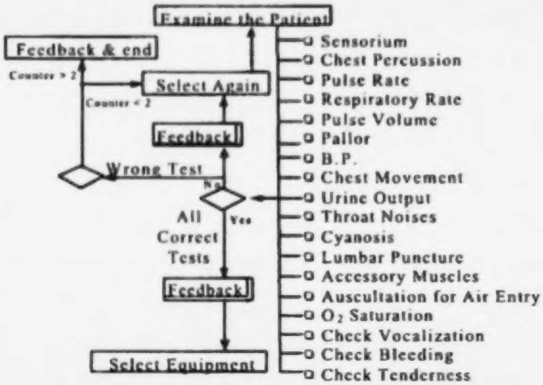

Examine the Patient
Feedback & end
Counter > 2
Select Again
Counter < 2
Feedback
Wrong Test
No
All Correct Tests
Yes
Feedback
Select Equipment
Sensorium
Chest Percussion
Pulse Rate
Respiratory Rate
Pulse Volume
Pallor
B.P.
Chest Movement
Urine Output
Throat Noises
Cyanosis
Lumbar Puncture
Accessory Muscles
Auscultation for Air Entry
O_2 Saturation
Check Vocalization
Check Bleeding
Check Tenderness

Fig. 2 Examine the Patient - Clinical Tests Flowchart

At this point the student must select all the appropriate clinical actions to perform. If some of the required actions have not been selected, the student will be asked to think it over, and complete the selection until all have been identified (see Fig. 2). If the student selects more than three clinical procedures that are not required, the simulation is terminated and the student is encouraged to study the ABC procedure before logging-on again. This aspect of the program will be examined during the prototype testing, and the number of errors allowed and the feedback messages presented will be addressed to reduce ambiguity and provide guidance for learning.

Having selected all the clinical tests to conduct, the student will then be asked to request the equipment needed to carry them out. The observations and results of clinical tests are posted in a "Clinical Notes" folder. Next the student is requested to select the appropriate laboratory tests or other investigation procedures. As in the clinical tests, in order to complete this section the student must select all the appropriate actions at this stage in the ABC procedure. Similarly, making too many inappropriate selections will terminate the simulation.

After selecting all of the appropriate lab tests and procedures such as x-rays and CT scans, the results are posted in the "Clinical Notes" folder, and the program hyperlinks to the next stage of the ABC procedure. The same interaction between the student and the program is repeated until the student has completed the "Assessing The Circulation" stage of the ABC procedure. Throughout, the Clinical Notes" folder is accessible by the student, and he/she can type comments at any time. It will therefore hold, in its sequential order, all the information gathered from observing and talking to the patient, and all the results of the procedures and

BEST COPY AVAILABLE

tests carried out. The student can use the information in this folder to support his/her diagnosis and recommendation for treatment.

The final element of this program will assign students to small online groups of 3 to 5 students. The diagnosis and recommendation for treatment that each student typed after completing the ABC procedure is automatically posted in a discussion forum type of environment, and students are asked to critique each other's findings. Since no names are shown on this site, weak or erroneous bogus reports can be inserted for the students to critique. After the students have agreed on the wording of a final report, it is emailed to the lecturer for a final review and feedback.

CONCLUSION

The development of the prototype for this case simulation role-play is underway. Formative evaluation is planned and will certainly modify, to some extent, the existing design. The goals, however, will not change. Students will experience learning in a relevant context and proceed through the ABC stages of trauma patient management. They will make decisions for stabilising and diagnosing patients in unique true-to-life cases and conclude by discussing, debating and substantiating their decisions. Students will learn to instinctively apply fundamental procedures that they will soon play out in real life.

The media selection for this prototype is based on circumventing the technology constraints of today's World Wide Web, but in the future ubiquitous access to streaming media will serve to complement and enhance the realism of the simulation. This, in fact, can be researched using our university wide-band Intranet and is expected to be featured in our next prototype design. More important is the need to examine the learning paradigm of online case simulation role-play and other student centred learning approaches. It is hoped that the implementation of a program based on this prototype will encourage research in the pedagogical implications and consequences of using this approach.

REFERENCE

Bearman, M., Cesnik, B., & Liddell, M. (2001). Random comparison of "virtual patient" models in the context of teaching clinical communication skills Medical Education. Medical Education, 35 (9), 824-834

Slotte, V., Wangel, M., & Lonka, K. (2001). Information technology in medical education: a nationwide project on the opportunities of the new technology. Medical Education, 35 (10), 990-998

Turchin A. & Lehmann C. U. (2000) Active Learning Centre: design and evaluation of an educational World Wide Web site. Medical Informatics and the Internet in Medicine, 25 (3), 195-206

Evaluating assessment using n-dimensional filtering

Jon Dron (University of Brighton, UK), Chris Boyne (University of Brighton, UK), Richard Mitchell
(Inferdata, US)

Abstract

This paper describes the use of the CoFIND (Collaborative Filter in N Dimensions) system to evaluate two assessment styles. CoFIND is a resource database which organises itself around its users' needs. Learners enter resources, categorise, then rate them using "qualities," aspects of resources which learners find worthwhile, the n dimensions of CoFIND. Categories and qualities are created by CoFIND's users, so the system sculpts itself to a group's expressed needs.

We contrast two uses of CoFIND where students added and rated their own Web based assignments. The first of these provided useful material to help the students with further learning goals, while the second let them use skills they had acquired in a concrete setting. The use of qualities in each instance was very different, reflecting the students' different needs in each case.

Based on our results we suggest how virtual ecologies of self-organising groups of learners might be encouraged to thrive and grow.

Introduction

This paper describes an unusual approach to the evaluation of the effectiveness of assessed coursework provided for a group of graduate students at the University of Brighton, UK. It makes use of metadata exposed and created by the students to discover common values and attitudes to the work that they are required to perform. These metadata are the product of a Web-based system known as CoFIND (Collaborative Filter in N Dimensions).

About CoFIND

CoFIND has been described elsewhere and we present a relatively brief description of it here by way of foundation. The main focus of this paper is to examine the different kinds of metadata generated by the students and to draw some conclusions about how this relates to their perceptions of and attitude towards assessment tasks.

CoFIND is a self-organising resource database for learners. Resources (usually in the form of URLs, although the system can also take free text entries describing any object or which are themselves resources) are entered into the system by learners, who may have created the resource or have found it useful and wish to share it. Learners are encouraged to classify resources using existing classifications (following conventional usage we describe these as *topics*) or new ones which they enter themselves, collaboratively giving the system a functionality not dissimilar to that of a Web directory such as Yahoo or Newhoo.

One of CoFIND's unique features is its use of a form of metadata which we characterise as *qualities*. Qualities are those aspects of resources which learners consider important when choosing to use them. They are thus statements of value about a resource and might typically consist of words and phrases like *good for beginners*, *funny*, *comprehensive*, or *simple*. Qualities are used to give ratings to resources which provide potentially richer and subtler indications of the value of a resource than those of other collaborative rating systems or collaborative filtering engines such as NetPerceptions (www.netperceptions.com), DBLens (dblens.sourceforge.net), or MatchPoint (www.triplehop.com). Qualities are the n dimensions of CoFIND, providing a multi-faceted collaborative view of the system relevant to and generated by its users.

Through a combination of metrics based on the way that users interact with the system which include ratings, usage, and the frequency with the system is used, CoFIND arranges the presentation of topics, qualities and resources dynamically. It is designed to respond to individual local interactions such as rating a resource or selecting a quality to produce a self-organised system without a central designer.

CoFIND has been put to a range of different uses, including helping learners to find appropriate Web-based resources for their learning needs (Dron et al. 1999; Dron et al. 2000b; Dron et al. 2000a; Dron, Boyne & Mitchell 2001) and collaboratively discovering what makes a website good (Dron et al. 2000c). The studies discussed in this paper describe the use of CoFIND to enrich the process of student assessment, a side-effect of which is to allow us to find out some useful information about how students perceive the work that they are asked to perform.

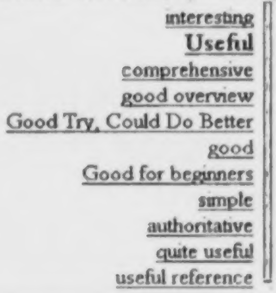
A learning ecology

CoFIND's qualities are used to rate and discover resources which are not only appropriately classified as belonging to a particular topic but which fulfil specified needs described by the qualities. Resources classified as belonging to a particular topic are returned in a list ordered by their ratings for a selected quality. As ratings are given to resources, so their position in the list for that particular combination of topic and quality changes.

Learners may add new qualities if those which are already available do not seem appropriate to their needs. Unfortunately, a newly added quality will not have been used to rate any resources and so will be of little use in retrieving useful lists of resources. This could lead to a vicious circle, an example of the cold start phenomenon which affects most collaborative filtering systems (Harney 2000). The phenomenon occurs because the system only becomes useful once sufficient ratings have been given, but ratings are only given if the system is used, which is unlikely because there are insufficient ratings to make it useful. To help overcome this, when adding new qualities learners may allow them to inherit ratings from one which already exists. For example, a user adding the quality "simple" may allow it to inherit votes from "good for beginners." Like much of what underlies CoFIND, this borrows heavily from mechanisms which drive evolution in natural systems.

Qualities are presented as a list of hyperlinks, potentially in various different font sizes, dynamically ordered. Figure 1 shows one such list.

The size of each quality is proportional to the number of times the quality has been used to rate resources within the selected topic, compared with other qualities. Larger quality labels imply that more useful results will be found if the learner follows those links. The order of qualities in the list is partly determined by use (qualities which are most frequently selected), partly by votes cast using those qualities to rate resources within the selected topic, and partly by a weighting based mainly on the age of the quality. To cater for a potentially large number of qualities of low value to other learners, qualities may "die," dropping off the list entirely. This prevents inappropriate qualities from retaining a foothold in CoFIND's ecology. Qualities of little use get smaller, drop down the list and eventually disappear. Again, this process is inspired by natural evolutionary processes.



interesting

Useful

comprehensive

good overview

Good Try, Could Do Better

good

Good for beginners

simple

authoritative

quite useful

useful reference

Figure 1 – competing qualities

Stigmergy

The use of varying font sizes and dynamic ordering of the list returned is designed to make use of a positive feedback mechanism found widely in natural and human systems known as *stigmergy*, a kind of indirect communication via the environment (Heylighen 1999). Examples include the formation of ant trails, the construction of termite mounds or the emergence of forest footpaths. In stigmergic systems, each individual's actions affect its environment which in turn influences the actions of others. For example, ants returning to a nest with food leave a trail of pheremones. Ants which otherwise wander relatively aimlessly are more likely to follow a trail of pheremones. The stronger the trail, the greater the likelihood that others will follow it. As more ants return with food, the trail gets stronger. When the food eventually runs out, the scent dissipates and the trail vanishes. Within CoFIND, learners are more likely to select qualities in a larger font and/or higher up the list. Likewise, because learners are more likely to visit resources which are highly rated, they are more likely to provided ratings for resources which have already been rated, which (if the resources are considered worthwhile) means that the position of qualities on the list and their size is further enhanced.

Self-organisation

Without constraint, stigmergy could lead to what complexity theorists describe as a Stalinist regime (Kauffman 1995), a system locked into a fixed pattern of behaviour where novelty has no chance to take hold. We would equally wish to avoid what the same complexity theorists call a Red Queen Regime, where change is so frequent that no stability is ever reached and the system descends into chaos. CoFIND's algorithms are tuned to create a dynamic system balanced at the edge of chaos, with sufficient stability to create structure but with sufficient adaptability to cater for learners' changing needs. Driven by the positive forces of learners' needs and stigmergy, evolutionary forces act on the results, constraining growth through the survival of the fittest. This can result in a self-organised learning ecology of potentially high complexity and variegation, with different species of quality fitting different ecological niches which relate to the different and contextually situated needs of learners. Through their combined individual interactions, a clear structure to the available resources emerges without the intercession of a teacher or instructional designer.

The use of topics in the studies which this paper describes was intentionally constrained so we will not discuss the mechanism in detail here. In normal use topics are generated by students and are self-organised using a stigmergy and evolutionary processes to help to provide a guided path through a subject area. We have discussed this elsewhere (Dron et al. 2000a; Dron, Boyne & Mitchell 2001).

Through the use of qualities, CoFIND provides a unique glimpse of a group of learners' view of what is important in a learning resource. It becomes a mirror of the needs, aspirations and motivation of the learners who use it, whatever those needs may be. It is this aspect of the system which we make use of in the following studies.

Using CoFIND- two example case studies

Description of the case studies

Both of these studies involved the same group of 35 students studying for an intensive one-year conversion Masters degree in Information Systems. All of the students had previous degrees in subjects unrelated to Information Systems. The intensity of the course and its group-orientated ethos typically results in a very close-knit community of highly motivated individuals.

Both studies presented here relate to a stream of the course which teaches networking and Internet technologies, from low-end protocols through to Web application building. The networking and Internet technologies stream straddles two semesters. At the end of each semester is a traditional unseen examination preceded by a two-week personal assignment. These studies primarily look at the use of CoFIND as a support and evaluation mechanism for the work produced in these personal assignments.

The first assignment

The first assignment given at the end of the first semester required students to produce Web pages written using XHTML to provide tutorials on technologies related to the module. The students were allowed to choose any network-related topic which interested them, including but not limited to any topic taught on the stream. For some, this provided an opportunity to revise or clarify work already covered, which was therefore of interest to the entire cohort and would be perceived as useful preparation for the examination they were shortly to sit. For others, it was an opportunity to explore areas on which they were writing a 12,000 word dissertation due in the second semester. All students selected a topic related to one of these two functions. Given the intensive nature of the course this is to be expected, as the students needed to make the best use of the time available to achieve their main goal of gaining an MSc and did not wish to investigate a topic out of simple curiosity.

At the end of the assignment, the students were required to add references to their pages to CoFIND. They were also required to look at and rate at least three of their colleagues' tutorials, with a small penalty (a total of three percent of the marks) being applied to those who failed to do so. There was no need to implement this penalty, as all students rated more than three sites. Following discussions with the course leader it was decided that the students' own assessments of each other should not contribute to the formal mark received.

The students were already familiar with CoFIND as since the start of the stream it had acted as a resource base providing references which both they and the tutor had found and rated. It is significant that although the system had been used by all students leading to a database of nearly one hundred relevant rated resources, the level of activity and especially rating had not been very high, averaging around 10 ratings per week over the course of the semester.

The second assignment

The second assignment given at the end of the second semester required students to produce a Web-based application implementing some of the functionality of a system which they had already been analysing, designing and programming for other streams of the course, based on a rich case study designed to give a moderately authentic experience of working on an IT project. Crucially, the assignment was therefore perceived as an activity giving summary evidence of the skills which they had been learning during the latter half of the stream. The assignment was based on a fictitious company called *Stowaways* offering holidays on the rivers and canals of England.

Like the first assignment, students were required to enter links to their work into the CoFIND system with the threat of marks being deducted from students for failing to rate at least two of their colleagues' sites. Like the first assignment, there was no need to apply this penalty, although most students *only* rated two sites. Again, the course leader advised against allowing the students' own assessments to contribute to their formal mark for the module.

Results

Over three times as many ratings were given for the first assignment as for the second (288 for the first, 88 for the second). This did not seem to be unduly affected by other factors such as learning or boredom as, apart from during the period of the assignments and troughs during vacation periods, use of the system for sharing resources remained consistent throughout both semesters.

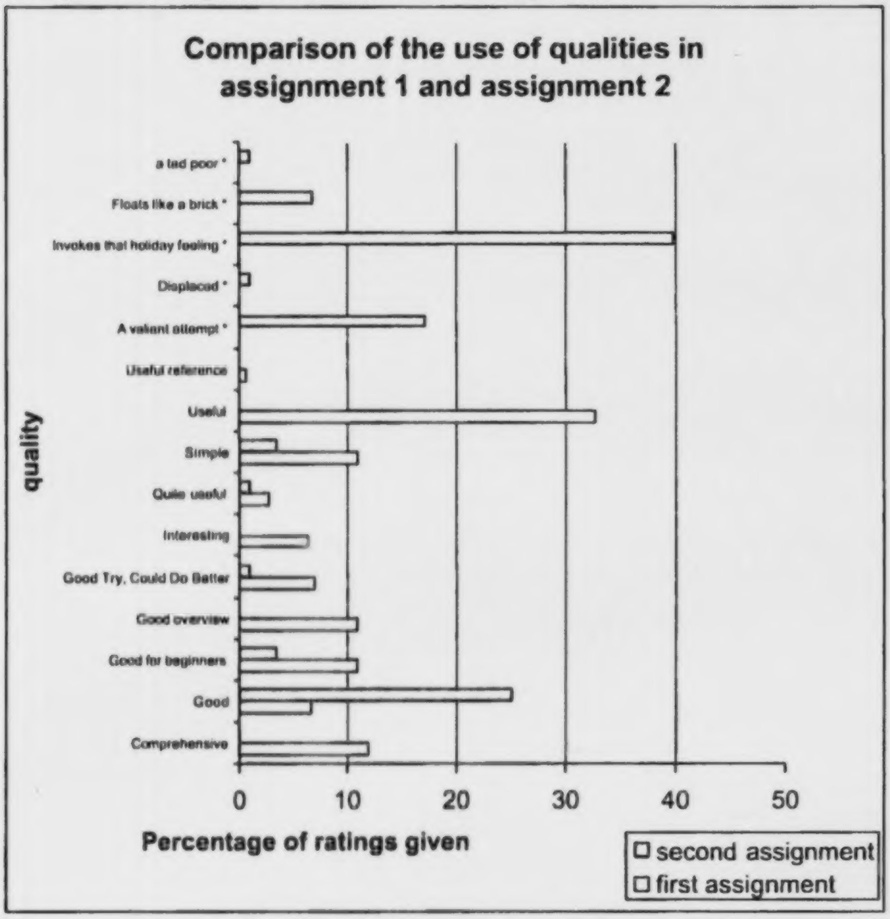


Figure 2 – comparison of use of qualities for the two assignments

As may be seen from figure 2, there is very little similarity between the use of qualities in the two assignments. Although new qualities were available and were added during the second assignment, all of the existing qualities used in the first assignment had survived the evolutionary process and were still available for the students to use. A closer look reveals that, in order of popularity, the top five qualities for the first assignment were *Useful, Comprehensive, Simple, Good for beginners, Good overview*. Three of these (including the top two) were not used at all for rating work supplied for the second assignment, and even those that were (*Good for beginners* and *Simple*) achieved less than five percent of the votes cast. By contrast, the top five qualities for the second (*Stowaways*) assignment were *Invokes that holiday feeling, Good, A valiant attempt, Floats like a brick*, *Good for beginners* and *Simple* (joint fifth place). Both assignments showed the traditional bell-curve in grades achieved, without any clear difference in the distribution of marks.

Discussion

Qualities as aids to learning

The qualities used by the students for the first assignment are broadly those that would be helpful in finding resources from which to learn and to revise for exams. They are the sort words which a teacher might use to describe resources from which a student might learn, whether explicitly or implicitly. If a teacher suggests that students read a particular resource it is by definition because he or she feels that the students would find it useful (the most popular quality for the first assignment). The teacher might then go on to explain why it is useful (for instance, it gives a comprehensive view of the subject, it is simple, good for beginners or it gives a good overview) which would help to match that resource to the needs of a particular student or group of students. One of the charms of the CoFIND system is that the students themselves are likely to have a better idea of how particular resources match their own needs than the teacher, at least when averaged, and the use of qualities in the first assignment seems to be a clear an expression of those needs.

By contrast, with the exception of the last two qualities in joint fifth place, there is nothing in the qualities for the second assignment which suggests any value at all as a learning resource. Instead, the qualities used are variants on the single dimension of good to not-good which is used in virtually all collaborative rating systems on the Web. In fact, interviews with students indicate that the last two qualities are not exceptions at all, but were supplied by the overly modest students who added the resources themselves, not as a description of their educational value but as a way of drawing attention to their inadequacy. Given that the second assignment was based around holidays on waterways the fact that two of the most popular qualities were humorous variations on the theme is noteworthy, again giving clear evidence that the students were not concerned with the outcome of their voting, merely that it was seen to be done.

Term ambiguity

Term ambiguity of the sort seen in the differing uses of *good for beginners* and *simple* is a difficult problem which affects any classification system (Lakoff 1987). It is primarily for this reason that CoFIND has been targeted squarely at small, tightly focussed cohorts of learners with clear and well defined needs, on the assumption that they would in general share a vocabulary and world view. As this study shows, even within such a constrained environment such world views are dynamic and transient things, shifting with the needs of the learners. Learning changes people and the qualities which they choose to assess learning resources provide a clear indication of this. How this affects the way that learners later perceive resources rated using an earlier world view has yet to be shown, but will make an interesting subject for further study.

Frequency of rating

The relevance to the students of the output of the two assignments is clearly demonstrated in the number of ratings given in each instance. The fact that the results of the second assignment were of no apparent further use resulted in the minimum of ratings being given, driven almost entirely by the extrinsic motivation of not wanting to lose any marks, but without the intrinsic motivation provided by the first assignment of wanting to help to build a collaborative resource of further use to the learning needs of the cohort.

Justifications for assessment are often given on the grounds that they help to provide focus and motivation for students, as well as providing a basis for much of the formative process essential to learning (Bruner 1966; Gagne 1985). They are also an interface between examining institutions and the outside world, giving an indication of a student's worth to potential future employers. However, at the same time they are often obstacles to learning, parts of a system which feeds on itself at the expense of the needs of its users, whose primary motivation we would wish to be to learn, rather than to achieve a qualification (Whitehead 1929; Illich 1971; Holt 1977). Our findings provide some evidence that, when used purely as an extrinsic motivator, assessments are far less significant to the students than when those assessments contribute directly to that learning process. This is entirely in keeping with the model of engaged learning proposed by Jones et al (1995) who state firmly that assessment should involve a performance or demonstration, usually for a real audience and useful purpose, as well as having meaning and purpose for the learner. In this case there is a second layer of indirection at work, inasmuch as from the students' perspective the most useful function served by the results of the assessed task in the first assessment was to feed the their needs in addressing a further assessment (the end-of-semester examination).

Possibilities

We can imagine a scenario where CoFIND might be used to collaboratively generate an entire course in higher education. The course could be constructed from a set of assessments, each building on the last, each leading to collaboratively generated further knowledge with direct relevance to the next task. More controversially, It is possible that such a system might be formed without the direct intercession of a teacher in the design process. If students were to be given sufficient resources (including static materials, reactive support from subject experts and suitable infrastructure for communication) and aimed very roughly in the right direction, the most highly rated student resources could provide the input for the next wave of assessment. A teacher or other arbiter (perhaps the students themselves) could take up the most popular themes, topics and areas and set them as the focus of another CoFIND-mediated investigation. The process would continue until the students felt that they had learned enough or an external arbiter (with full access to student work and opinions about it through CoFIND) considered that learning had been demonstrated. In this way a self-organised system of learning might be formed, with learning resources (being generated by the students themselves) naturally falling within Vygotsky's zones of proximal development (Vygotsky 1978). The approach would best be suited to a subject with a large body of knowledge mapped to a loose and flexible body of theory, as found in the medical and computing professions, where knowledge is achieved as a gestalt more than being assembled from sturdy foundations.

Conclusions

CoFIND is intended as a tool to aid collaborative learning, but it is clear from the example of these two small studies that in order for it to be effective it needs to be considered as part of a larger system. Simple application of technology is not enough to bring about useful collaboration, even where that technology is explicitly designed to replace some of the mediation role of traditional teaching.

CoFIND has shown itself to be a useful research tool which can form an image of the collective attitude of a group of students towards a body of work. In the studies we have looked at, CoFIND has helped to bring the attitudes of a group towards assessment tasks into sharp relief, demonstrating something we should have known already, that authentic tasks designed which have applicability to student needs are more likely to be useful to them than those which do not. Viewed from students' own perspectives, such needs may be quite different from those which we as teachers believe them to be. The second case study presented here was a well-intentioned and carefully designed integrated assignment providing what the teaching staff saw as an authentic grounding in the subject of study. However, the system of assessment and examination controls and determines the students' priorities and goals far more than the promise of some distant set of learning objectives (Dewey 1897). The success of the first assignment lies not in the success of the students in achieving the desired learning objectives but in its relevance to their immediate needs, consequently providing greater long term value than that of the second. With students benefiting from each other's work, gaining the benefits of "teachback" (Pask 1976) through explaining a subject to others all within a framework which reflects their own conceptions of what is of value in a learning resource, it is possible to conceive of systems incorporating tools like CoFIND, where the role of the teacher may dissolve further into the background as an instigator, a helper and a validator rather than a provider of knowledge.

Bibliography

Bruner, J. S. 1966, *Toward a Theory of Instruction*, The Belknap Press of Harvard University Press, Cambridge MA.

Dewey, J. 1897, 'My Pedagogic Creed', *The School Journal*, vol. LIV, no. 3, pp. 77-80.

Dron, J., Boyne, C. & Mitchell, R. 2001, 'Footpaths in the Stuff Swamp', in *WebNet 2001*, AACE, Orlando, Florida.

Dron, J., Mitchell, R., Boyne, C. & Siviter, P. 2000a, 'CoFIND: steps towards a self-organising learning environment', in *WebNet 2000*, ed. Gordon Davies & Charles Owen, AACE, San Antonio, Texas, pp. 146-151.

Dron, J., Mitchell, R., Boyne, C. & Siviter, P. 2000b, 'Towards a Self-Organising Learning Environment', in *WWW9*, Foretec Seminars Inc, Amsterdam, pp. 118-119.

Dron, J., Mitchell, R., Boyne, C. & Siviter, P. 2000c, 'Website Evaluation System: Collaboratively Discovering what makes a Website Good', in *WebNet 2000*, ed. Gordon Davies & Charles Owen, AACE, San Antonio, Texas, pp. 685-686.

Dron, J., Mitchell, R. & Boyne, C. W. 2001, 'Getting out of the Stuff Swamp Alive', in *UKAIS*, eds. Roberts, M., Moulton, M., Hand, S. & Adams, C., Zeus Press, Portsmouth, pp. 341-350.

Dron, J., Mitchell, R., Siviter, P. & Boyne, C. 1999, 'CoFIND- an experiment in n-dimensional collaborative filtering', in *WebNet 99*, ed. Paul de Bra & John Legget, AACE, Honolulu, Hawaii, pp. 301-306.

Gagne, R. 1985, *The Conditions of Learning*, 4th edn, Holt, Rhinehart & Winston, New York.

Harney, J. 2000, 'IT self-help', In *Knowledge Management*.

Heylighen, F. 1999, 'Collective Intelligence and its Implementation on the Web: algorithms to develop a collective mental map', *Computational and Mathematical Theory of Organizations*, vol. 5, no. 3, pp. 253-280.

Holt, J. 1977, *Instead of Education: Ways to help people do things better*, Penguin, Harmondsworth.

Illich, I. 1971, *Deschooling Society*, Harper & Row, New York.

Jones, B., Valdez, G., Nowakowski, J. & Rasmussen, C. 1995, *Plugging in: Choosing and using educational technology*, Council for Educational Research and Development, and North Central Regional Educational Laboratory, Washington DC.

Kauffman, S. 1995, *At home in the Universe: The Search for Laws of Complexity*, OUP, London.

Lakoff, G. 1987, *Women, Fire and Dangerous Things*, The University of Chicago Press, Chicago.

Pask, G. 1976, *Conversation Theory- applications in education and epistemology*, Elsevier.

Vygotsky, L. S. 1978, *Mind in Society*, Harvard University Press, London.

Whitehead, A. N. 1929, *The Aims of Education and Other Essays*, The Free Press, New York.

A Framework for Evaluation & Selection of E-Learning Solutions

Deniz Eseryel
Instructional Design, Development, & Evaluation
Syracuse University
United States
deseryel@syr.edu

Abstract: This paper presents a comprehensive evaluation framework for a variety of organizations that wish to find the perfect fit between the needs of the organization and the online solutions they adopt. The framework described in this article is an outcome of a collaborative effort between the department of Instructional Design, Development, and Evaluation (IDD&E) of Syracuse University and one of the leading companies in North East that provides training and development for large and mid-size corporations.

Introduction

In the last years of the twentieth century, the world of education has changed. Use of the Internet has grown dramatically in training and education. Internet and related technologies have changed the way we communicate and have provided unprecedented access to information. It has also changed our expectations of education – how, when, where, and in what form we expect to access opportunities for learning. As a result, educational institutions are now faced with tough decisions about which learning technologies to adopt. Not only educational organizations but also business and industry are struggling to select the online training solution that fit their organizational and technical requirements.

On the other hand, when speaking of online learning environments, one often begins to feel lost. Vendors of e-learning related products employ a variety of terms to describe their products. Moreover, different vendors do not necessarily mean the same thing when they use the same terms. Many terms are used interchangeably, and sometimes one term is used to mean different things. With so many terms, it is difficult to distinguish the different types of learning environments. An organization wishing to select an environment that is appropriate to its needs often finds itself in the situation of comparing apples and oranges, as the products and features being compared really have little in common. In an attempt to ease the process and to provide some basis for comparison, a number of different evaluation frameworks have been proposed. However, existing frameworks either do not provide tools for a spectrum of different online learning environments or they have simply stayed behind of the new developments in the field.

The aim of this paper is to present a more comprehensive evaluation framework for a variety of organizations that wish to find the perfect fit between the needs of the organization and the online solutions they adopt. The framework described in this article was developed as a result of a collaboration project between the department of Instructional Design, Development, and Evaluation (IDD&E) of Syracuse University and one of the leading companies in North East that provides training and development for large and mid-size corporations.

The following section provides a brief overview of the eLearning project. Then the different dimensions of the proposed evaluation framework are discussed. The paper concludes with the description of the utilization of evaluation framework followed by discussions on future directions.

The eLearning Project

The eLearning project is an outcome of an initial understanding between a leading provider of training and development for large and mid-size corporations and the department of IDD&E at Syracuse

University. As a response to demands from business and industry, this company felt the need to extend its services by consulting in the area of online training. The resulting project, i.e., the eLearning project, called for a collaborative engagement between a higher education institution and the industry. The task as set out was to identify and evaluate existing online learning products so that the company would be able to recommend the best blend of online learning solutions to its customers.

The initial project proposal was for seven months starting in June 2001. The effort was broken into six cyclical phases:

1. Project management
2. Identification of existing e-learning products
3. Initial review of e-learning products
4. Categorization
5. Evaluation
6. Reporting and dissemination

Internet is heavily utilized during the second and third phases, where we identified an overwhelming amount of e-learning related products and a number of Web sites that provide information about them. As each product was identified, the project members reviewed the demo version of the product as well as the information at the product's Web site and at the other Web sites. This initial review phase resulted with a report including the following information for each product identified:

- Product name
- Vendor information
- URL
- History
- Trends Info
- Learning approach
- Functionality
- Standards
- Experiences with demo version

During the initial review, it became obvious that there was a need for a comprehensive evaluation framework that could take into account the diversity and richness of e-learning related products. Such a framework needed to be constructed so that it allowed comparison of similar products for the purposes of selecting the best possible solution given organization's online training needs. Many Web sites offer information about the features available in different e-learning products; however, any sort of categorization is usually lacking. Using such Web sites for the purposes of selecting an online learning solution means comparing the features of a series of random systems. We, on the other hand, were trying to develop a system that helps the organizations select the best blend of online learning solutions that meets their organizational and technical requirements. Therefore, the first dimension of the proposed evaluation framework deals with categorization of e-learning related products. This is discussed in the following section.

Categorization of E-Learning Related Products

From the initial review of existing e-learning products, two things were most evident. First of all, many terms were used interchangeably, and sometimes, one term was used to mean different things. With so many terms, it was difficult to identify the different types of e-learning products. This terminology problem showed itself in the discourse of researchers and practitioners in the field. Therefore, in identifying different product categories, our first challenge was to examine different uses and definitions of the terminology in the field.

The second problem also concerned the use of terminology. This one, however, was related to how vendors viewed and marketed their products. In an attempt to distinguish themselves from each other, vendors used rather fancy terminology while describing their products. For instance, a product marketed as a total online learning solution was not providing a total solution at all. Broadbent (2001) argues the similar point when she notes the different terms that vendors of Learning Management Systems (LMS) use to market their products. Some examples of these terms include learning portal, best-of-breed technology, an end-to-end solution, an e-learning solution, a truly blended e-learning solution, an integrated learning and management system, a breakthrough Learning Management System, revolutionary elearning tools, one powerful solution, a complete turnkey private distance learning solution, a global learning management solution, a learning solution, e-learning infrastructure technology, open learning environment, and of course, the total solution (Broadbent, 2001).

E-learning products display a great deal of diversity with respect to their capabilities and features. Any organization wishing to select an e-learning solution that is appropriate to its needs would find itself in the situation of comparing apples and oranges. It is significantly more profitable to compare similar products from a specific category of products that may meet organization's needs than to compare the features of a series of random products. Therefore, it was important for us to distinguish the different types of e-learning related products in order to provide some basis for evaluation and comparison. Therefore, the first dimension of the proposed evaluation framework concerns the categorization of elearning related products.

There are a number of categorization schemes proposed in the literature. A review of existing categorization schemes suggest that there is a need to develop a new categorization scheme. The reason is three-folds. First of all, due to rapid consolidations in the elearning product market any categorization schemes that are more than two years old face the danger of being outdated. Especially, in the last few years, many product categories have disappeared due to consolidation or market forces. On the other hand, existing products' capabilities and features have greatly been expanded, therefore, necessitating new product categories.

Secondly, some of the existing categorization schemes are not useful for the purposes of comparison and selection. For instance, a categorization scheme based on the origin of the system may be an interesting study but it does not aid decision-making of organizations.

The third problem we observed with existing categorization schemes is that some of them do not suggest mutually exclusive categories. In such a categorization scheme, it is possible to place the same product in more than one category. As a result, CuseeMe, which is an online conferencing tool with no other features may sit beside Authorware, which is a multimedia authoring tool, and WebCT, which is an online course creation and delivery system. This is definitely not a desirable situation for the purposes of comparison.

Nevertheless, some of the existing categorization schemes were useful for they offer organizational and technical criteria that remain valid in the selection process. Also, existing categorization schemes helped us identify the terminology researchers use. After a careful analysis of the capabilities of nearly one hundred e-learning products, following categories are proposed:

1. Synchronous Learning Systems
2. Course Management Systems
3. Learning Management Systems
4. Total Solutions
5. Delivery Support Tools
6. Development Support Tools
7. WWW Publishing Tools
8. Media Creation Tools

Synchronous Learning Systems (SLS) are those that provide environments where learners and instructors interact in real time, often at a scheduled event, usually through audio- or video-conferencing. Some of these systems may also provide limited asynchronous capabilities as well as student management and progress tracking tools. An example of a synchronous system would be Centra Symposium.

The category of *Course Management Systems* (CMS), on the other hand, include those products whose primary focus is the development and delivery of asynchronous learning environments. CMS typically target educational institutions, offering lower cost and built-in content-creation tools. They generally offer varying levels of student management and progress tracking functionality. They rarely support third party software. Examples of CMS include Blackboard, WebCT, and TopClass.

The third category, *Learning Management Systems* (LMS) includes those environments whose primary focus is the management of learning. They do not provide content development tools but they do support third party courseware. They are extremely scaleable, and content is usually stored in an enterprise-class SQL database. They are relatively expensive and are generally directed towards corporate clients. Examples of LMS include Docent and Saba.

The category of *Total Solutions* includes systems that are indeed complete online learning packages. These include a learning environment hosted by the vendor. In addition, the vendor may provide content or work with the organization's subject matter experts to develop content. The packages are tailored to meet the needs of each individual organization. Examples of Total Solution providers include eCollege, Embanet, and Convene.

Delivery and *Development Support Tools* are products that are not online learning environments. Rather, these are used to support either the delivery or the development of content. These include tools such as threaded discussion boards, online tests, chat or messaging systems. Examples of Delivery Support Tools include TeamScape, NetSynergy, WebTeach, NetMeeting, WebBoard, and Hot Potato online testing tool. Examples of Development Support Tools include ToolBook II Assistant, and Designer's Edge, an online instructional design support tool.

The category *WWW Publishing Tools* includes products that are used to create Web sites such as FrontPage and Dreamweaver.

The final category *Media Creation Tools* include graphic creation tools such as Photoshop, animation tools, audio and video tools, and virtual reality tools.

Evaluation Levels

During the fourth phase of the eLearning project, nearly one hundred products were categorized using the scheme described in the previous section. The next step was to develop the evaluation criteria for each category. After a through literature review coupled with the knowledge of product types in each category we adapted the evaluation scheme proposed by (Landon, 2001) so that it can be applied to the products in all categories.

The resulting evaluation scheme has three levels: (i) The learner support; (ii) the instructor/designer support; and (iii) the technical specifications.

The *learner support* level concerns with the tools and features available to learners. These include the evaluation of system's capabilities to support learners, such as tools for web browsing, asynchronous sharing, synchronous sharing, and learner management.

In similar fashion, the *instructor/designer support* level focuses on the tools and facilities available to instructors and course designers. These include system's capabilities to support instructors and course designers manage the overall course, lessons, the student data and administrative tasks.

The third level focuses on the *technical specifications* of the systems. These include server platform, client platform, limitations, and exit considerations, as well as pricing policy. All of these evaluation levels contain sub-categories into which the evaluation criteria are organized (Figure 1).

Figure 1. Three level of evaluation proposed for e-learning related products

Level I:
The Learner Support

1. *Web Browsing*
   a. Accessibility
   b. Bookmarks
   c. Multimedia
   d. Security

2. *Asynchronous Sharing*
   a. E-mail
   b. BBS file exchange
   c. Newsgroups

3. *Synchronous Sharing*
   a. Chat
   b. Voice chat
   c. Whiteboard
   d. Application sharing
   e. Virtual space
   f. Group browsing
   g. Teleconferencing
   h. Videoconferencing

4. *Study Support Tools*
   a. Self assessing
   b. Progress tracking
   c. Searching
   d. Motivation building
   e. Study skill building

Level II:
The Instructor/Designer Support

1. *Course*
   a. Course planning
   b. Course managing
   c. Course customizing
   d. Course monitoring

2. *Lesson*
   a. Instructional designing
   b. Presenting information
   c. Testing

3. *Data*
   a. Grading online
   b. Managing records
   c. Analyzing
   d. Tracking

4. *Resource*
   a. Curriculum managing
   b. Building knowledge
   c. Team building
   d. Building motivation

5. *Administration*
   a. Installation
   b. Authorization
   c. Registering
   d. Online Fees Handling
   e. Server security
   f. Resource monitoring
   g. Crash recovery

6. *Help Desk*
   a. Student support
   b. Instructor support

Level III:
Technical Specifications

1. *Server Platform*
   a. RAM
   b. Disk space
   c. Windows NT server
   d. Apple server
   e. Unix server

2. *Client Platform*
   a. Minimum level
   b. Target Level

3. *Pricing*
   a. Start-up cost
   b. On-going cost
   c. Technical support

4. *Limitations of Package*
   a. IMS compliance
   b. Number of courses
   c. Number of students
   d. Number of connections
   e. Other limitations

5. *Extra Considerations*
   a. Options
   b. Exit considerations

Utilization of the Evaluation Framework

During the eLearning project, around one hundred e-learning related products were organized into eight categories described earlier. The products in each category were then evaluated in all of the three evaluation levels. Table 1 provides a sample evaluation table for a few Course Management Systems (CMS). As seen in the table, each CMS is evaluated whether or not it possesses or supports certain functionality. Three possibilities exist:

1. The check mark (v) means, "Yes, the product possesses the feature"
2. An empty cell means, "No, it doesn't possess the corresponding feature nor does it support it"
3. 3rd means, "No, it doesn't provide that functionality but integration of that feature is possible via third party integration."

Table 1 provides a good overview of the results of evaluation of all of the products in the same category. It allows comparison of the products in each category at a glance. Yet, for the purposes of selecting a particular product, one may need more information on how the product supports certain functionality. That is why, the evaluation table is supplemented by a second table that provides detailed review along the categories in the evaluation scheme (see Table 2). This table allows more detailed comparison of the products.

The next step in eLearning project is to develop a Web-based Decision Support Tool. We will also continue to evaluate elearning related products as they become available. Certainly, we may need to update the products already in the database as new versions become available.

PRODUCTS CRITERIA	CMS 1	CMS 2	CMS 3	CMS 4	CMS 5	CMS 6	CMS 7	CMS 8
	LEVEL I: LEARNER SUPPORT							
Web Browsing	**CMS 1**	**CMS 2**	**CMS 3**	**CMS 4**	**CMS 5**	**CMS 6**	**CMS 7**	**CMS 8**
Accessibility	v	v	v	v	v		v	v
Bookmarks	v	v	v	v	v	v	v	v
Multimedia	v	v			v	v	v	v
Security	v	v	v	v	v	v	v	
Asynchronous Sharing	**CMS 1**	**CMS 2**	**CMS 3**	**CMS 4**	**CMS 5**	**CMS 6**	**CMS 7**	**CMS 8**
E-mail	v	v	v	v	v	v	v	v
BBS file exchange	v	v	v			v	v	v
Newsgroups	3rd	v	v	v	v	v	3rd	v
Synchronous Sharing	**CMS 1**	**CMS 2**	**CMS 3**	**CMS 4**	**CMS 5**	**CMS 6**	**CMS 7**	**CMS 8**
Chat	v	v	v	v			v	v
Voice Chat		v	3rd				v	v
Whiteboard	v	v		v	v	v	3rd	v
Application Sharing	v	v		v		v		v
Virtual Space	v	v			v			
Group Browsing	v	v		v	v	v	v	v
Teleconferencing	v	3rd	v		v	v		v
Videoconferencing	v		v		v	v	3rd	v

Table 1. Sample evaluation table for Course Management Systems Category (names of the CMS are not disclosed)

BEST COPY AVAILABLE

FEATURES/TOOLS	CMS X
	LEVEL I: LEARNER SUPPORT
Web Browsing	
Accessibility	Content can be developed in text -only version
Bookmarks	You can add web pages to your favorites list
Multimedia	Instructors and students can control synchronized multimedia courseware created in Asymetrix Toolbook and Macromedia Authorware. The multimedia authoring tools can be used to create courseware, which contains audio clips, video clips, animations, simulation, learning exercises and tests.
Security	There are two forms of security. Log-in security and class room security.
Asynchronous Sharing	
E-mail	Upon registration student can enter email. Not a requirement
BBS file exchange	Can add files onto Virtual Campus to load files.
Newsgroups	Virtual Campus can be used to share information
Synchronous Sharing	
Chat	Incorporates a text chat
Voice Chat	Voice chat is possible via integration of NetMeeting
Whiteboard	Objects and text from any Windows supported application can be pasted in to the whiteboard and shared by everyone in class. The floor holder can highlight, add, delete, or edit the whiteboard contents. Whiteboard contents can be saved or printed by everyone in class. In addition, instructor scrolling in whiteboard is synchronized on all student screens.

Table 2. Sample detailed review table for a Course Management System

Discussion

In this paper, a comprehensive evaluation framework for evaluation of e-learning related products was presented. The proposed framework had two dimensions. The first dimension concerns the categorization of e-learning related products. A total of eight, mutually exclusive categories were proposed: (i) synchronous learning systems; (ii) course management systems; (iii) learning management systems; (iv) total solutions; (v) delivery support systems; (vi) development support systems; (vii) WWW publishing tools; and (viii) Media creation tools. These categories do not only serve as the basis to evaluate and compare similar products but they also support the selection process. For instance, if an organization is rather small and do not have Web design and instructional design teams available, they should not base their online learning solutions on the last four categories. Rather, they should go for ready-made systems in the first four categories. However, if an organization do not have a large budget but do have web design and instructional design support then they may choose to go with the last four categories. The advantage with not using ready-made systems is the flexibility of creating a custom solution for organizational needs. They are cheaper but can prove to be more time-consuming. The analysis of the organizational and technical requirements and capabilities is important in making the initial decision on what kind of online learning solution the organization needs. This solution may come from a specific category as well as a blend of several categories.

The second dimension concerned the evaluation of the products in each category. Three evaluation levels were proposed: (i) the learner support level; (ii) the instructor/designer support level; and (iii) technical specifications. Each level contained a number of subcategories around which the evaluation criteria are organized.

The evaluation framework presented in this paper was developed to support the organizations in selecting the best blend of online learning solutions that meets their organizational and technical

BEST COPY AVAILABLE

requirements. There is no one 'right' answer but there are simply better or poorer choices based on how well online learning solutions are selected to match both organizational and technical requirements (Jackson, 2001). The basic premise of the proposed evaluation framework was that organizations can make better choices in selecting online learning solutions if they evaluate and compare their options more accurately.

References

Broadbent, B. (2001). *Selecting a learning management system* [Online document]. Retrieved July 31, 2001, from the World Wide Web: http://www.e-learninghub.com/Selecting_an_LMS.html

Jackson, R. H. (2001). *Web-based resource library* [Online document]. Retrieved August 30, 2001, from the World Wide Web: http://www.outreach.utk.edu/weblearning/

Landon, B. (2001). *Online educational delivery applications: A web tool for comparative analysis* [Online document]. Retrieved September 1, 2001, from the World Wide Web: http://www.c2t2.ca/landonline/

Acknowledgements

Financial support for work reported was provided by College Center of the Finger Lakes (CCFL). The author would especially like to thank to Robert Kasprzycki for his continuous support during the eLearning project.

Supporting E-knowledge -building in teacher education: The use of computer-mediated communication

Brian Ferry, Julie Kiggins, Garry Hoban and Lori Lockyer
Faculty of Education, University of Wollongong - Australia
Northfields Avenue, Wollongong, N.S.W., Australia 2522.

Tel: 61 2 42213571, Fax: 61 2 42213892
Email: bferry@uow.edu.au

Abstract

This study investigated the use of various forms of computer-mediated communication (CMC) to support the formation of a knowledge-building community (KBC) in teacher education. A KBC involves students working in small and large groups to solve 'real world' problems, and in the process develop skills of negotiation, communication, and collaboration. Emphasis is placed on authentic problems that are linked to a school context.

The findings showed that the students preferred to use forums available to all participants. Also they used the forums in ways that were not anticipated by the authors. Many students made use of other modes of CMC such as e-mail and synchronous forums downloaded from the Web. Also many of the skills we used in mediating face-to-face discussion could be transferred to the on-line situation.

Key words: computer-mediated communication, knowledge-building community, teacher education

Introduction

Once Universities operated on the assumption that information would be stored centrally and scholars would come to this central store of knowledge and collaborate to produce more information but modern, digital information storage and telecommunications allow scholars to access information from any location connecting to the Internet. When information comes to people there are many benefits such as: direct access to a broader range of information; access to learning environments outside normal lecture and tutorial times; greater opportunity for experiencing a variety of instructional strategies including small group discussion and collaborative projects; and exposure to a forum for expressing and sharing ideas (Lockyer, Patterson & Harper, 1999). Some researchers claim that education that is entirely based on such technology contributes to a loss of community. For example, Besser and Bonn (1996) assert that it is difficult to build collaborative relationships among students, but Bonk and Cunningham (1998) showed that technology allows for genuine conveyance of human communication and learners can develop relationships regardless of the reduced cues associated with computer mediated communications.

This study contributes to the research by providing research evidence regarding the effectiveness CMC to foster the development of preservice teacher understanding of the values, norms, and habitual ways of seeing which belong to the teaching profession. This learning process relies on the integration of learners into a community of practice (i.e. the teaching community) and is facilitated through immersion in the discourse of the teaching community (Schon, 1983; Vygotsky, 1978). Such learning processes are "grounded in talk" and can stimulate higher order thinking skills by providing a context and mechanism for explanation, justification and reason (Duffy & Cunningham, 1996, p.181; Oliver, Omari & Herrington, 1997).

A knowledge-building community (KBC) in teacher education

The KBC project provided students enrolled in an initial teacher education course with an alternative pathway to professional socialisation by forming a Knowledge-Building Community (KBC). Such professional socialisation occurs through the transmission of values, norms, and habitual ways of seeing which belong to particular occupations and shape the way that people conduct their work and establish themselves in the larger social world (Schon, 1983; Bowen & Marton, 1998). Some educators claim that distance education technologies cannot support such a process (Weedman, 1998), but we argue that distance education technologies *can support* this process *provided* it occurs within a defined knowledge-building community.

Berieter and Scardamalia (1993) describe a 'knowledge-building community' (KBC) as a group of people who investigate problems. Members work as groups and are engaged in progressive discourse in an iterative process of knowledge building. The Faculty of Education at the University of Wollongong wanted to use collaborative technologies to support the formation of a KBC and the model we adopted consisted of three interacting sources of learning:community-learning (CL) which involved students, university and school facilitators sharing knowledge as a community; school-based learning (SL) which involved the students in authentic school contexts; and problem-based learning (PBL) which involved students working in groups to investigate problems.

Using Computer Mediated Communication to support a KBC

The current study contributes to the understanding of how the students used the available CMC to support problem-based learning and their understanding of the teaching profession. Also, it investigated whether students were prepared to experiment with other forms of CMC if it better suited their purposes. We believed that CMC supplements face-to-face teaching by providing discussion forums that are non-threatening. CMC tools also allow individuals to maintain links with their community of practice and to take advantage of the scaffolding that is provided by a dynamic social context. Such links allow for legitimate peripheral participation (Lave & Wegner, 1991).

The Role of Problem-based Learning in the KBC

Problem-based learning (PBL) is a curriculum development and an instructional strategy designed to challenge students (Finkle &Torp, 1995). Originally developed for medical schools, it provides advantages for both acquisition of knowledge and development of problem solving skills in patient care (Barrows & Tambly, 1980). PBL challenges students to take charge of their education by involving students in small groups to solve 'real world' problems. Emphasis is placed on 'real world' problems that are 'ill-structured' (Gallagher, Stepien & Rosenthal 1992). Such problems: require more information to understand the problem, change as new information is added, require many perspectives to interpret information, and have no absolutely 'right' answer.

The Faculty of Education at the University of Wollongong decided to use a PBL approach to respond to studies that followed-up graduates of teacher education courses. Some studies reported that many students left university with feelings of being under-prepared for life in classrooms and confused by what confronted them when they arrived at schools (Armour & Booth, 1999; Ramsey, 2000). Others reported that schools which employed new graduates reported that a majority were unaware of how school and classroom cultures operated (MACQT, 1998; Ramsey 2000).

The literature about socialisation to the professions (eg Weedman, 1998, p1) contends that "professional socialisation is a complex and variable form of learning, highly collaborative in nature." It involves the transmission of social constructs, language, belief systems and symbolic lives that are unique to the profession (Schon, 1983). Brown and Duguid (1993) argue that this type of learning makes use of knowledge that must be "stolen" - the most important knowledge is that which cannot be taught and students must find ways to steal it from their educational environment.

The approach taken to the KBC course was influenced by financial constraints. One constraint was that we only had sufficient resources to offer the KBC course every alternate semester. Thus the KBC course was not offered students followed the 'mainstream' university course.

The first semester of our KBC course had two parts. The first part ran for five weeks and was designed to prepare students to work in a learning community amd they also developed teamwork skills as they acquired problem-solving skills. Another goal of the first part of the course was to prepare students to be what was called a 'teaching associate'. A 'teaching associate' supports a classroom teacher's work and may help teachers to; prepare and teach lessons, mark written work, read to children, have children read to them, run excursions, conduct sports training, supervise the school yard as well as a host of other functions that emerged as we gained experience with the program.

The second part of the KBC course ran for nine weeks. During this time students attended their host school for two days per week and attended university for one or two days per week. When they were in schools they had two main roles. One was to be an effective teaching associate and the other was to be what we called 'an educational anthropologist'.

The role of an educational anthropologist was to 'live' within the school community and to 'steal knowledge' (Brown & Duguid, 1993) that would help them to develop an understanding of the culture of their schools and of the actions of the children and teachers that they observed. Thus they needed to work with a number of teachers and allied professionals who acted as 'informants' about their profession and the culture of the school. As they gathered this information they would share it with others in their community.

Purpose of the study

The purposes of the study were:

1. To understand how members of the knowledge-building community made use of CMC to developed their understanding of the professional role of primary school teachers;
2. To describe the role that the lecturers took in mediating on-line discussion among members of the knowledge-building community.

The following research questions were posed:

1. How were the available forms of CMC used to develop an understanding of the professional role of primary teachers?
2. What were some of the limitations associated with the use of these communication technologies?
3. Did the members of the KBC use any other forms of CMC?
4. What role did the lecturers play in mediating the on-line discussions?

Participants

This initial study conducted in (1999) was limited to a group of 22 year one primary education students who were enrolled in the KBC course. The age of the students ranged from 18 years to 45 years and gender composition was three males and 19 females. All participants in this cohort were taught to use an asynchronous discussion space (DISCUS) during the 2^{d} week of the session. During the next week they had two additional one-hour training sessions that focused on the use of a private, small-group discussion space and an open forum (public discussion space). DISCUS could be accessed from their home computer, a group of 5 computers available in their university home room or from any of the computers connected to the university network.

Methods

Data were gathered from two sources: student interviews held half-way through the session and at the end of the session; and text downloaded from the various communication technologies used. The original criteria for classifying interview transcripts and downloaded text were based upon the three elements of the KBC community: community learning; school-based learning and problem-based learning.

Data pertaining to the lecturers' role in mediating on-line discussion came from post-session interviews with lecturers and analysis of text that students contributed to the discussion spaces. Names of students have been changed for the purposes of reporting findings.

Results and discussion

The results are organised under the following headings: community learning; school-based learning and problem-based learning. Under each heading the contribution of each mode of CMC is discussed. Finally, the ways in which the CMC were used and the roles the lecturers played in facilitating on-line discussion are described.

Community learning

Community learning (CL) was designed to support students as they embarked upon the other two sources of learning (PBL & SBL). Team building workshops were designed to engage students in learning experiences that allowed members to learn to work effectively with all members of their cohort. To enhance the community learning students were housed in a special 'home room'.

The asynchronous forum (DISCUS) was used to support community discussion. This allowed for individual discussion, intergroup, and intragroup discussion as well as lecturer input.

By the end of the preparation phase the students learnt to use the asynchronous discussion space (DISCUS) and e-mail and Kime and Karen commented.

> *It's been great. I have loved working in groups. I have had the best time. I have found that by working in a friendly environment you learn more.* Kime 31.3.99

> *I don't think I am learning and then I go home and all this stuff comes out. I think where did that come from? We talk. If we have a problem we talk. One of my initial concerns about this course was that my friends weren't doing it and I thought that I would be on my own but just the opposite has happened.* Karen 1.4.99

Several themes emerged. First, it appeared that friendship and community support assisted their learning because they felt comfortable in their environment and learnt through participation in face-to-face as well as via electronic conversation, and KBC class activities. Second, they were making effective use of the communication technology. They said that they had time to think and compose a response rather than quickly react as they often did in face-to-face interactions. Third, students preferred the community discussion space because everybody could contribute and follow all of the threads of the conversations. In response we removed access to the restricted discussion space.

School-based learning

After three weeks in schools the students were beginning to understand that teaching was a much more multifaceted and complex role than they first thought. Lisa discussed her views on the forum and said:

> *I had no idea of the preparation, organisation and behind the scenes work that teachers had to*

do. I have had a respect for the work teachers do during the day, in school hours, but even in this I wasn't aware of the full extent of it ... Lisa 5.5.99

Susan, the most prolific user of CMC commented:

Teachers talk so much in the staffroom about different topics; it really is a collegial atmosphere. It's usually focused on different activities that are happening during the day and how they're going to coordinate them all. They all help each other out with the stuff that's going on. I was never aware of the intense preparation months before hand. My mentor was describing what they do to prepare for their program - all the infants' teachers get together before term starts and work out what they are going to do EACH day for the rest of the term! Each day, so far ahead! I kind of thought you worked it out the night before! Susan 12.5.99

The quotes indicate an increased awareness of teachers' work and similar views were expressed via different modes of CMC. It appears that in a short space of time the students were beginning to appreciate and witness the complex and multi-faceted roles of a teacher. Also, they could access a variety of modes of communication to express these ideas.

In addition students became aware that teaching requires high-level skills and practice is need to develop these skills. Importantly, students were gaining insights that teaching is a life-long commitment and requires life-long learning.

Problem-based learning (PBL)

The function of PBL was to extend student understanding of the professional role of teachers. PBL requires a great deal of honest and open communication and the preparation phase was used for this purpose. As Lave and Wenger (1991) assert the community does not necessarily have to be warm and effusive; instead it can be diffuse, fragmented and contentious and this was the case with several groups involved in this study. The following e-mail from Julia illustrates this point.

Initially I thought that we were unable to communicate effectively, as some people dominated the discussions while other people had good ideas that were not listened to... 14.5.99

Our inexperience in developing suitable problems for students also contributed to some confusion and general intellectual unrest. The first problem developed focused on the teaching of literacy skills to children (5 to 9 year olds). In retrospect we acknowledge that we suggested too many learning outcomes and this contributed to the silence that befell the room when we issued the first problem package. We needed to rethink our approach when we prepared our second problem which focused on the development of multiple intelligences in young children (Gardner, 1987).

Students who were reticent to voice their real opinions in class were more forthright in voicing their concerns through the discussion forum and via e-mail. For example, Susan said:.

I'm slowly dying. I am just so tired that I cannot think anymore. I am a zombie. This whole literacy thing is just so enormous. I hate assignments and I am so sick of this problem.
Susan 14.5.99

The combination of several new factors for the students (i.e the role of a teacher associate combined with the problem assessment task) prompted us to modify the problem so that we covered less material but to a greater depth and Julia's final e-mail about the second problem illustrates this point.

We were able to accomplish the second problem better as we had more knowledge of how to go about it, it wasn't as big as the first one. Julia 28.6.99

The role of computer-mediated communication

During the first three weeks, students made two to three entries per week. Of these, 13 used on-campus computers and the remainder used their home computers. The prolific users were those who had home computers and five owners of home computers were contributing up to 10 times per week. We allowed students continuous access to the forum during session breaks and into the next year. The rate of use remained much the same even though the students were no longer working as an 'official' knowledge-building community.

Students also made use of group and individual e-mails, but the asynchronous discussion space was the main means of electronic communication. It contained a total of 572 entries by the end of the first teaching session (13 weeks). During the session entries were printed and read by a research assistant who classified them into temporary categories. These categories were discussed with the research team who looked at the examples provided by the research assistant and made further suggestions. The process was repeated two more times and by the end of our final meeting all members of the team agreed with the categories. As a result the entries were classified as problem-related, school-related, group-related or personal. A large number school-related entries (95) were about how the students or their mentor teachers managed their classes. This finding appears to support the research reporting that beginning teachers are very concerned about classroom management during their initial teaching experiences (MACQT, 1998; Ramsey, 2000).

One group that were widely separated in terms of distance decided to use a synchronous discussion space that they downloaded from web (ICQ). The following quote shows the general tone of their conversation on this forum was about organising group tasks and group meetings.

Being a leader isn't that involved it just means keeping people on task....We'll see what we can get done on Thursday, I feel we need to focus and brainstorm etc and we need a peaceful place to do that. Fiona 4.5.99

At this stage we feel that the following comments can be made about the how students and the lecturers used the forum. However, caution is needed as the current use the forum represents a particular stage in our use of the technology and we acknowledge that this will change, as students and lecturers become more familiar with the PBL process and the technology.

The generalisations that we felt that we could make were:

1. The tone is one of communication about the problem, the school, the groups or assessment;
2. Controversial comments were delivered anonymously. For example one entry on the discus space said:

It is really a shame to see many people being all secretive and competitive. Please make an effort to try to limit the competition. We are all filling the vessel of information together..Anonymous 7.5.99

One member of the lecturing team was 'lurking' in the background and he took the opportunity to mediate the discussion. His entry follows:

...I think that it is healthy that we have a vehicle (discus) to express our comments publicly be anonymous or not. It is good that there are different perspectives on what we are doing and it is important that we stay open minded to hear these perspectives. Hoban 11.5.99

3. Without direction little deep knowledge-building happens through these modes of communication. We soon learnt that monitoring wasn't enough and that we had to contribute regularly, otherwise the discussion would go off at 'tangent' and deal with peripheral rather than core issues. Further, we feel that the strategies we used (e.g. encouraging contributions through positive reinforcement, allowing the debate to run until the discussion was peripheral, re-directing discussion, summarising points of view) mirrored those that we would normally employ in a face-to-face situation;

4. Initially, access to the technology at home restricted students as at least one person from each school group was not connected to the Internet at the start of the session. At the end of the year all had a home connection to the Internet;

5. CMC was a support and a catalyst for other modes of communication such as small group face-to-face meetings (formal and informal), large face-to-face groups (formal meetings at university) and numerous telephone conversations (informal).

Conclusion

We feel that the KBC concept supported by computer-mediated communication has contributed to the professional socialisation of students by addressing four issues. First, it has helped students to define the profession in which they will work and to realise that they are responsible for the development of the knowledge and skills needed to become a member of the teaching profession. Second, they have developed an understanding of the professional life of teachers and the nature of teachers' work. Third, they have come to realise that there is a body of knowledge that they need to access in order to be educated about the profession, and finally they have developed a sense of professional identity.

The combination of learning from three interacting sources of information of a Knowledge-Building Community (KBC): community learning; school-based learning and problem-based learning have enhanced the process of professional socialisation. Also the evidence from the forum, written assignments, interviews and school visits suggests that the KBC process helped students to develop an understanding of the following: norms of service, specialised 'teacher' knowledge, teacher autonomy in exercising professional judgment, teacher autonomy in setting educational requirements and standards of service, and the existence of a code of ethics of the profession. They have also learnt about the professional life of teachers - the language of the profession, belief systems, symbolic lives. Also by performing a professional role in schools they have developed some sense of professional identity.

We also learnt that when students use computer-mediated communication in a KBC they can be very creative and forthright in sharing opinions and ideas. However, like face-to-face conversation, they can deviate from intended pathways and lecturers need to continually monitor the discussion and provide input at appropriate moments – just establishing the community forum is not enough.

References

.Armour, L. and Booth, E. (1999) *Analysis of a questionnaire to primary educators at schools accepting students for the six week extended practicum.* Report by Faculty of Education: University of Wollongong.

Barrows, H. S. & Tamblyn, R. M. (1980). *Problem-Based Learning: An approach to medical education.* Springer Publishing Company, Inc. New York.

Bereiter, C. & Scardamalia, M. (1993). *Surpassing ourselves.* Open Court. Illinois.

Besser, H. & Bonn, M. (1996). Impact of distance independent education. *Journal of the American Society of Information Science* 47, 817-883.

Bonk, C. J., & Cunningham, D. J. (1998). *Chapter 2: Searching for learner-centered, constructivist, and sociocultural components of collaborative educational learning tools.* In C. J. Bonk, & K. S. King (Eds.), Electronic collaborators: Learner-centered technologies for literacy, apprenticeship, and discourse (pp. 25-50).Mahwah, NJ: Erlbaum.

Bowen, J. & Marton, F. (1998). *The university of learning: Beyond quality and competence* London: Kogan Page.

Brown, J. S. & Duguid, P. (1993) Stolen knowledge. *Educational Technology.* 33, 10-15.

Duffy, T. M. & Cunningham, D.J. (19960. Constructivism: Implications for the design and delivery of instruction. In D. H. Jonassen (Ed.) *Handbook of research for educational communications and technology.*pp 170-193. New York: Macmillan Library Reference.

Finkle, S. L. & Torp, L. L. (1995) Introductory Documents. Available from the Centre for Problem-based Learning. Illinois Mathematics and Science Academy. Available at URL: http://www.udel.edu/pbl/others.html

Gallagher, S. A. Stepien, W. J. & Rosenthal, H. The effects of Problem-Based Learning on Problem Solving. *Gifted Child Quarterly.* (1992) Vol 36. No. 4.pp 195-200.

Gardner, H. (1987). *The Mind's New Science.* New York: Basic Books.

Hoban, G. H. (1999). Using a metacognitive framework to guide experiential learning in teacher education classes. *Journal of Experiential Education.* 22 (2), 104-111.

Lave, J. & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation.* Cambridge: Cambridge University Press.

Lockyer, L., Patterson, J., & Harper, B. (1999). Measuring effectiveness of health education in a Web-based learning environment: a preliminary report. *Higher Education Research & Development.* 18(2), 233-246.

MACQT, (1998). Teacher preparation for student management: Responses and directions. *Report by Ministerial Advisory Council on the Quality of Teaching, October, 1998.* Sydney: NSW Department of Education and Training.

.Oliver, R., Omari, A. & Herrington, J. (1997). Exploring interactions in collaborative World Wide Web learning environments. *Proceedings of Educational Multimedia/Hypermedia and Telecommunications.*(pp. 812-817).Calgary, Canada: Association for the Advancement for Computers in Education.

Ramsey, G. (2000). *Quality Matters: Revitalising teaching: critical times, critical choices.* Report on the Review of Teacher Education, NSW. Sydney: Department of Education and Training.

Reeves, T. C., & Reeves, P. M. (1997). The effective dimensions of interactive learning on the WWW. In B. H. Khan, (Ed.), *Web-based instruction* (pp. 59-66). Englewood Cliffs, NJ: Educational Technology.

Schon, D.A. (1987). *Educating the reflective practitioner.* San Francisco: Jossey-Bass.

Vygotsky, L. S. (1978). *Mind in Society.* Cambridge, MA: Harvard University Press.

Weedman, J. (1998*) Burgular's tools: the use of collaborative technology in professional socialisation.* Paper presented at ASIS Midyear'98 Proceedings. Available at URL: http://www.asis.org/Conferences/MY98/Weedman.html.

The Lord Kelvin Project: Middle School Science for the 21st Century

Sebastian Foti, Ric Ledbetter, Fred Taylor, Ebraheem Al-Kazemi
The Athena Group, Gainesville Florida

Abstract This paper introduces and reports upon lessons learned during the development phase of the Lord Kelvin Middle School Science Program. For the past two years, we have been developing a set of tools to help middle school students learn science in a way that uses the full power of today's technology. Lord Kelvin is a robust collection of science activities, organized in modules, that incorporates probeware, sophisticated simulations, multimedia support for instruction, multiple assessment components, and comprehensive reporting tools. The activities bridge the gap between traditional and high tech science. The project, funded by the National Institute of Health joins the talents of a high tech engineering firm with experienced instructional designers to produce a unique learning experience for middle school students.

Introduction

Everyone envisions a future in which workers will use electronic tools to help them carry out the tasks for which they have been employed. It is often difficult to predict what these electronic tools will look like, yet educators feel obliged to establish curricula designed to develop students' technological skills. We believe that this is the wrong approach. Rather than focusing on technological skills, the Lord Kelvin Experience *assumes* the technology, while helping students learn how to learn. This is easy to say, but how is it accomplished? All learning involves gathering information, organizing the information, and operationalizing the information, that is, bringing the newly acquired knowledge to bear on a task. Living in the information age means that information will be (and is) coming to us rapidly from multiple sources - TV, radio, text books, expert commentary, our friends, in multiple ways - video, audio, text, word-of-mouth, first hand experience. Collecting, organizing, selecting and reporting information and the knowledge distilled from it is a formidable task. The Lord Kelvin interface is designed to optimize student performance in these areas. The interface provides a consistent, predictable system to manage multiple sources and channels of information and experience for students as well as teachers. The interface also allows the level of learning to be customized so that students can "ramp up" to more challenging modes of inquiry. Although it is very sophisticated, in a very short time the interface becomes transparent, allowing the student to focus on content and process issues.

The development of the Lord Kelvin Science Program, which has been funded by the National Institute of Health, has been guided by some basic pedagogical beliefs and principles:

> Through a tight interaction between a knowable curricular structure and a consistent user-interface, a learning environment can support inquiry from multiple perspectives using multiple learning models.
>
> Though students may require different levels of guidance, they can understand and relate to the complexity inherent in the study of modern science.

> Assessment of student accomplishment should be multifaceted and relate to context sensitive information as well as global scientific principles and educational standards.
>
> Teachers can and should take an active role in modifying and/or developing the educational tools their students use to learn. Since teachers are under severe time constraints, powerful editing tools should be at their disposal.

Development began by isolating specific science topics addressed by the National Science Standards but not adequately addressed by current science programs. We then began work collecting, selecting, and developing educational components, or *modules*, centered on the following aspects of each topic:

Background Information
Learning methodologies in three dimensions: a step-by-step model, a guided model, and a task specific free-inquiry model
Hands-on experimentation
Simulated experimentation
Multiple types and levels of assessment
Video and audio clips related to instructional aspects of the component
Multimedia clips related to content

Simultaneously, we began designing and developing an interface (see Appendix) that would provide consistent access to each of the above elements, in a way that would follow and expand upon current usability principles for educational software.

Structure of the modules

The Hook. Each module contains a "hook" or question to motivate and stimulate the student to carry out the investigation. For example, we introduce the debate about cell phone radiation by investigating exactly when cell phones produce radiation.

The Challenge. The challenge is a more specific goal statement. The challenge sets up the investigation and provides motivational cues to help the student get started.

Background information. Each module contains a variety of information related to the concept, and larger scientific principles related to the core concept. The information is organized in a context sensitive way, and relates directly to the investigation at hand, but also offers the student a chance to explore the concept in depth. A typical background session might involve reading about generic science strategies, investigating core content, browsing selected readings and examining other resources related to the core concept.
Methodology. The investigation is conducted using one of three models depending on which learning strategy has been chosen by the instructor. In the step-by-step approach, a "cookbook" methodology is presented for the experimentation. In the guided approach, a less specific

procedure is specified. Finally, in the inquiry approach, statements related to the goal state are given which motivate students to conduct the investigation

Experimentation. To carry out this investigation, students rely on a system of probeware we have developed which measures radiation in the 2.4 Gigahertz range. Each module has probeware associated with it, which has been specifically designed for this program. The probeware is programmable, and over the course, students should begin understanding how to interact with programmable electronic tools. Data collected by the probe may be displayed in a variety of formats, selectable by the student. Students may also use a simulation that simulates the use of the probe. When using the simulation, the data output is collected in precisely the same way as the as the output from the probe.

Assessment. The assessment element includes multiple approaches to assessment and addresses misconceptions, content and process knowledge, and application. Wherever possible, student assessment is encouraged, and student's assessment abilities are developed throughout the program using a variety of strategies.

Other Features. The Lord Kelvin environment contains an elaborate glossary. Any word found in the glossary appears to be "hot" in any system window. Clicking on the word delivers the glossary, and in addition, a series of games designed to reinforce memorization of vocabulary are available. Modules often contain videos that illustrate how to conduct an experiment, or show some application of the concept. Of course, diagrams, charts and other activities are used to explain, analyze, and compare data in a variety of contexts.

Brief overview of the interface

One of our self-imposed prime directives in interface development was to reduce or minimize the cognitive load placed on the student when accessing our materials. In other words, we were anxious to develop an environment in which windows didn't "pileup" requiring the student to move, close, manipulate and otherwise tend to the clutter on the desktop. We decided to create a series of fixed windows that would slide into place when information was requested. We have integrated the windows with the content by using specific windows for the same type of information across modules. When students request to see a module's *Challenge* component, it always appears in the same window. Each window has a set of context sensitive tools relating to activity in that window. Thus, a student can copy, print or save information in the window as well as apply tools such as rulers or stopwatches to the activity in the window. The student requests to view a window through the use of a "Personal Study Instrument" or what we call a PSI tool. The PSI tool always appears in lower right of the screen, and is a control center that allows a student to direct the flow of information to the screen and within the learning environment.

The PSI Tool not only helps the student navigate from one learning experience to another, it provides a motivated teacher with a concise, straightforward approach to designing lesson modules. To a teacher, the PSI tool represents an organizer, an interactive table of contents for each lesson module. Each lesson component will be "launched" from the PSI tool. If a teacher feels that a component of a module is inappropriate for his or her students, using the PSI tool editor, they may "inactivate" that access button from the PSI menu, thereby removing the button from the PSI tool. If the teacher prepares additional information about a lesson module, the teacher may "link" that information to the lesson by creating a new button in the PSI tool. In this way, teachers can customize Lord Kelvin modules. In fact, using the PSI tool editor, teachers can assemble entirely new lesson modules from materials they have previously prepared.

Any teacher who desires to create new Lord Kelvin modules can do so by creating a PSI tool to address the various aspects of the module being designed. Doing so, the teacher combines lesson planning with lesson material documentation. Creating buttons and button sets for the PSI tool gives the teacher a new metaphor for thinking about lesson support. In addition, the PSI tool provides a method to differentiate content that supports different learner groups. Even if the teacher chooses not to author modules, modules may be customized. All packaged Lord Kelvin modules, for example, support learners at three levels: (1) Cookbook - a step by step approach to science investigations (2) Guided - a mode which includes a clear statement of the problem along with ideas about how to solve it, and (3) Inquiry - a mode involving a more ill-structured problem statement, and challenges that may have no cut and dry solution. The teacher can easily choose which level is appropriate for his or her class, group or individual student.

We decided to develop program graphics, media, and simulations using a photorealistic model. Although some early research (Dwyer (1978), Travers & Alvarado (1970)) showed that realistic representations contained too many irrelevant details that interfered with learning, others (Berry, L.H. (1991), Hannafin (1987)) believe complexity to be a crucial factor in the visual learning process, and that photorealism supports it. Although Heim (1998) suggests that computer users are polarized about photorealism vs. pure fantasy in virtualization, initial reactions to our photorealistic simulations were more positive than reactions to two-dimensional models. The project will generate a doctoral study related to this decision, as well as to others in our design.

Interaction between module components

In Lord Kelvin, a learner examines a concept or elements of a concept from many perspectives. While it is sometimes true that in the Lord Kelvin environment the same content will be addressed using different information channels (text-based readings and video, for example), it is equally likely that the same content will be addressed in a different context or learning mode. For example, since middle school students often have trouble choosing appropriate graphing strategies, Lord Kelvin modules incorporate activities that address graphing both implicitly and explicitly. In addition to a text-based reference about graphing, students will have to make decisions about graphing types when doing real experiments and when doing simulated experiments. The decisions about graphing interact with the students understanding of how data is received from a probe, and in many cases how they have calibrated the probe. The interplay between math and science concepts and between the various elements of the module strengthens understanding. Simulations combined with real-experimentation offer students the opportunity to explore a wider range of variables more rapidly.

In some cases, the simulations used in our program are virtual representation of hands-on experiments, in other cases; the simulations are unrelated to the hands-on experiences of the student. Pedagogical decisions about the content (interacting with technical capabilities, of course) have guided our choices in this regard.

Other constraints placed on this interface development, besides our prime directive to keep it simple, involved scalability issues and a desire to be able to deliver the environment in a web context. These issues required much attention, but as the development process continued, the congestion issue reemerged several times and we had to remain vigilant about maintaining simplicity in the interface. It was difficult not to add new windows, or new components that would clutter the student's learning environment. Our commitment to simplicity in the interface has carried over to teacher-centered environments involving module editing, document construction and network activity.

Though out the design and development process, we have witnessed, and promoted a strong interaction between interface elements and learning goals and objectives. In the development of learning software, issues of usability must be coupled with strong pedagogical convictions. In our case, we have promoted inquiry along multiple inquiry paths, from multiple perspectives, in ways that incorporate many approaches to learning. Students are given both mastery and performance oriented goals, similar to those outlined in Pintrich, P. R. (2000). The strength of the learning experience is based on the consistent application of systemic self-imposed usability rules coupled with robust lesson development. Students will be offered a consistent, comfortable learning environment in which to explore complex scientific relationships. It is our hope that the students' performance will be augmented by the software based inquiry tools and consistent environment we have constructed for them.

Summary

The Lord Kelvin Experience encourages scientific inquiry by involving the learner in several activities that address a single concept from multiple perspectives. For example, a typical module might include a virtual investigation employing a simulator, a hands-on investigation using a state-of-the-art probe with a video segment explaining how to set up the experiment, a reading with comprehensive background information, a glossary with context sensitive help in the form of educational games, a motivational "hook" delivered by a computer agent to get the student started, and eight or nine assessment tools designed to help the student and the instructor assess prior knowledge, conceptual understanding, process and technological skills, and potential applications of the core concept. In order to carry out a robust examination of the concept at hand, the student must be able to navigate within the module from one activity or information source to another, sometimes compiling information, making graphs, and collecting data along the way. The PSI Tool, or Personal Study Instrument allows the student to navigate freely within a Lord Kelvin module. At any point, the student can employ the Notepad to save pertinent information about the concept being studied. Ultimately, the student may transfer and edit the information gathered to make a persuasive final report. Sophisticated reporting tools make this task easier.

The student working in the Lord Kelvin environment is able to employ, apply, and interact with powerful learning tools that help augment the study process at all levels. Teachers working with Lord Kelvin can freely modify any learning activity and is encouraged to create new activities within the environment through the use of built in editors.

Our goal was to develop a robust teaching and learning environment that would replace dozens of software tools in a way that would allow a short learning curve. Further, we wanted to bring the study of science into alignment with the science principles that students interact with everyday. Although we have included some traditional experiments in the project, many of the inquiries involve modern electronic and scientific curiosities, such as cell phone radiation and laser applications. As students become familiar with interactive, programmable probeware, they will begin to understand how to align their tools with their investigative requirements and goals to augment their performance. By working with simulations, they will interact with the variables affecting their results. It is our hope that students investigating modern phenomena using modern tools will recapture the wonder and curiosity upon which every true scientific investigation builds.

Bibliography

Berry, L.H. (1991). Visual Complexity and Pictorial Memory: A Fifteen-Year Research Perspective. In: Proceedings of Selected Research Presentations at the Annual Convention of the Association for Educational Communications and Technology

Dwyer, F.M. (1978) Strategies for improving visualized instruction. University Park, PA: Learning Services.

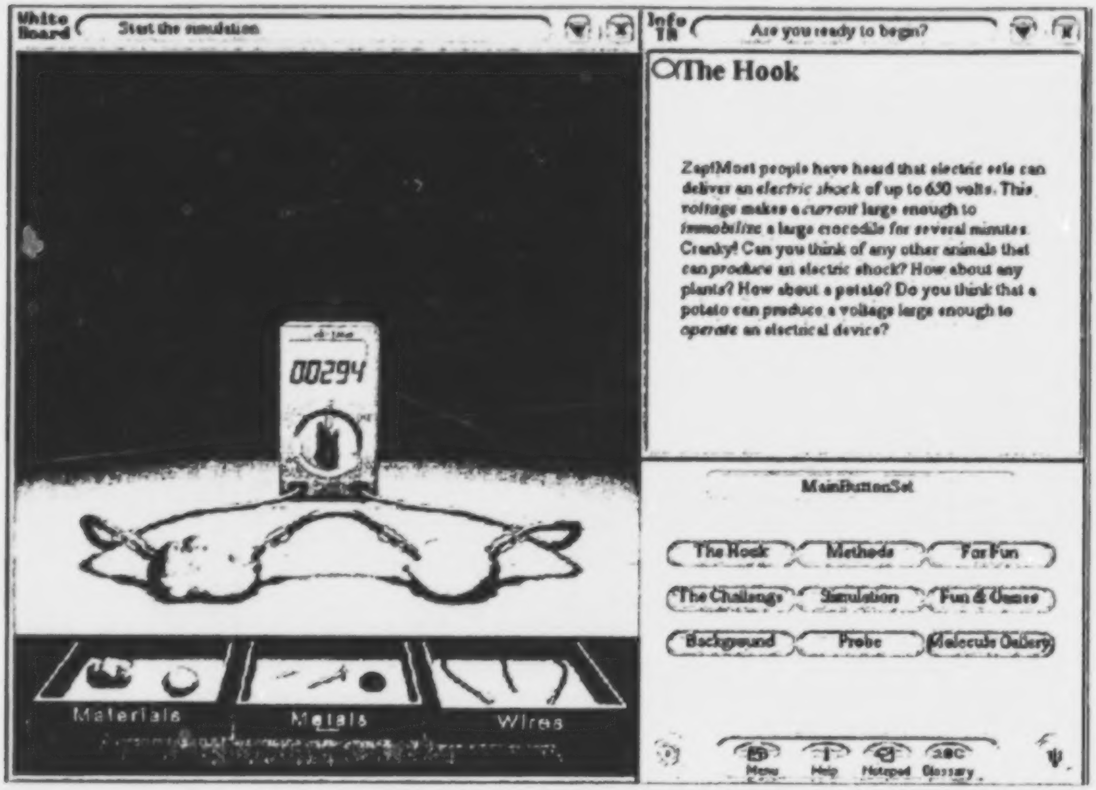
Hannafin, M.J. (1987). Perspectives in the design of interactive video: Beyond tape versus pics. Journal of Research and Development in Education 21(1), 44-60.

Heim, M. (1998). Creating the Virtual Middle Ground. TECHNOS; v7 n3 p15-17 Fall 1998

Pintrich, P.R. (2000) Multiple Goals, Multiple Pathways: The Role of Goal Orientation in Learning and Achievement. Journal of Educational Psychology; v92 n3 p544-55 Sep 2000

Travers, R.M., & Alvarado, V. (1970). The design of pictures for teaching children in elementary school. AV Communications Review, 18(1), 47-64.

Appendix


White Board
Start the simulation
00294
Materials
Metals
Wires
Info
Are you ready to begin?
MainButtonSet
The Hook
Methods
For Fun
The Challenge
Simulation
Fun & Games
Background
Probe
Molecule Gallery
Menu
Help
Notepad
ABC
Glossary

The Hook

Zap! Most people have heard that electric eels can deliver an *electric shock* of up to 650 volts. This *voltage* makes a *current* large enough to *immobilize* a large crocodile for several minutes. Cranky! Can you think of any other animals that can *produce* an electric shock? How about any plants? How about a potato? Do you think that a potato can produce a voltage large enough to *operate* an electrical device?

Sample screen from the Lord Kelvin Project: *Simulation, Hook and PSI Tool*

BEST COPY AVAILABLE

Aligning Theory and Web-based Instructional Design Practice with Design Patterns

Sherri S. Frizell and Roland Hübscher
Department of Computer Science and Software Engineering
Auburn University, USA
{frizess, roland}@eng.auburn.edu

Abstract: Designing instructionally sound web courses is a difficult task for instructors who lack experience in interaction and web-based instructional design. Learning theories and instructional strategies can provide course designers with principles and design guidelines associated with effective instruction that can be utilized in the design of web-based instruction (WBI). However, it can be difficult, especially for novice course designers, to operationalize these theories and apply them to the design and development of specific web courses. Effective design methods for WBI that focus on student learning are needed. Design patterns have emerged as a means to capture design knowledge and present design solutions to designers. We believe design patterns can be used to effectively support novice designers of web-based courses. This paper discusses how design patterns that capture pedagogical principles and good design strategies can be used to support educators in designing instructionally sound web-based courses. A design framework for WBI is presented and the resulting pattern language is introduced.

Introduction

The World Wide Web (WWW) has become one of the fastest-growing mediums for the delivery of distance education. With entire degree programs now being offered online, instructors from a variety of academic areas are developing instructional materials for distance learning programs. Many of these instructors are novice web designers and have received no training in interaction and web-based instructional design (Braxton, 2001; Tennyson 1995). The need for design support is a major issue in the design of web-based instruction (WBI) as the poor design of courses is one of the key problems with learning from the Web (Bork & Britton, 1998; Kessler, 1999). Hirumi (2002) found that novice course designers find it difficult to incorporate the types of meaningful interactions needed in distance learning courses. As a result, courses are often developed by posting large text documents to the Internet, which may present students with a lot of information, but are not effective for student learning (Kessler, 1999). Furthermore, widely used web course management systems like WebCT and Blackboard are indeed just that, course management systems. They provide little support, if any, for effective design of web-based instruction.

The instructional design of course materials directly affects learning effectiveness (Clark 1994; Jonassen, 1988). This is especially true for web-based instruction due to the mere nature of the Internet and the type of interaction it provides. Practices that a good and experienced teacher might automatically encourage in the traditional classroom setting have to be purposefully designed for and supported via the proper design of the web-based course. Discussions in small groups or recognizing the fact that some students are confused by way of their facial expressions are features that are not automatically or trivially supported by a website. To promote effective instruction, web-based courses must be designed with a focus on the opportunities and capabilities afforded by the Web in relation to instructional design and learning theories (Khan 1997, Hannum 1998). However, the theories are abundant and end-users have difficulties in their application to online course materials.

Support for novice course designers through design methods grounded in sound instructional and educational theory are needed. We propose that using design patterns as a mechanism for capturing pedagogical strategies and good design practices can assist educators in designing instructionally effective web courses. Whereas theories can be abstract and difficult to apply, patterns are more procedural and present design knowledge in a way that can be adapted and re-used. Design patterns have traditionally been used to provide design support to novice designers in the fields of architecture (Alexander 1977, 1979) and software engineering (Gamma, 1995), and are now being explored within the human-computer interaction (HCI) community (Borchers, 2001; Tidwell 1999).

This paper presents our approach for providing design support to novice course designers using design patterns. We begin with an overview of design patterns and examine their use for WBI. We then discuss how research from learning and instructional theory can be used to provide an appropriate design framework that supports the development of design patterns. Finally, we describe our efforts towards the development of a pattern language for web-based instruction and present an example pattern from the language.

Design Patterns

A design pattern can be defined as an approach for capturing and presenting design knowledge to solve problems. They act as a design aid to dissimilate expert knowledge to novice designers. Design patterns usually exist within a language with other patterns addressing design problems in that same domain. Although the format can differ, patterns usually contain many sections:

1. The **Pattern Name** identifies the pattern and provides a way to communicate about the pattern.
2. The **Problem** describes when to apply the pattern explaining both the problem the pattern is trying to solve and the context surrounding it.
3. The **Solution** describes the elements that make up the design explaining to the user how to solve the problem.
4. The **Forces** describe the results and trade-offs of applying the solution.

Other elements that are often included in a pattern include an *example* of the solution, a list of *related patterns*, and a *rational* section explaining how or why the solution solves the problem. The information contained in a pattern is not new or invented. This information comes from looking at examples of successful design solutions or at expert design knowledge and experience. Patterns provide a way to represent this knowledge in a form that supports inexperienced designers. Although patterns are of great benefit for novices, they are still very useful to experts as patterns can be used to communicate interesting design ideas to other experts.

Patterns were first used in the field of architecture (Alexander 1977, 1979) to support the design of modern architectural structures. This work resulted in a pattern language consisting of 253 design patterns that present solutions to problems encountered in architectural design. The patterns range in scale from patterns for the distribution of towns and neighborhoods to houses and rooms. An example is the *Bus Stop* pattern, which addresses problems concerning the design of a bus stop. The *context* is any town who public transportation is based on buses, and some of the *forces* are that bus stops need to be easy to recognize and people waiting there should feel safe. The *solution* suggests to the designer to build bus stops so that they work together with other activities in the area such as a newsstand or coffee shop. An illustration of the solution is also provided for the designer. The goal of this work was to support both architects and the general public in designing quality towns, neighborhoods, and homes.

Building upon this work, design patterns have been used within software engineering to document design experience for less experienced software developers in the areas of object-oriented technology (Gamma et al., 1995). These patterns have also been used as an educational tool to teach computer science curriculum and to document successes in teaching object-oriented technology to undergraduate students (Gelfand, 1998; PPP 2000).

Design pattern usage is a relatively new idea in the field of HCI to support the design of user interfaces and usable systems (Borchers, 2001; Tidwell 1999). Traditionally, design guidelines have been used to capture design knowledge to support designers within this domain. However, guidelines have come under scrutiny on their ability to actually solve design problems. Mahemoff (1998) contends that guidelines are not very useful in solving specific design problems because they are too abstract to apply to specific design projects. Others point out that with guidelines, it is difficult to see the actual problem addressed by the guideline, whereas a pattern makes both the problem and the context explicit (van Welie, 2000). In addition to solving problems, pattern languages are also useful for helping a designer to find problems within his design by helping to raise the designer's awareness of potential problems. This can be a powerful design and training aid for a novice designer.

Design Patterns for Web-based Instruction

Sound pedagogical practices are not often integrated into the web-course design and authoring process (Hannafin, 1997; Janicki 2001). The difficulty lies in operationalizing the guidelines and principles from the various theories into the design and development of instruction. Principles such as "design courses that are motivating" or use "exploratory-based instructional strategies" are quite abstract and difficult to apply to the design of specific courses. Trying to use and apply principles such as these suffers from of the same type of problems as guideline usage within HCI design. Design patterns can provide a mechanism for capturing pedagogical strategies and good design practices in a way that supports novice course designers in designing instructionally sound web-based courses. A pattern-based design approach to WBI can support the alignment of educational theory with actual design practices. With design patterns, we can utilize a theory-supported, but problem-solving approach to the design of web-based courses.

Towards a WBI Pattern Language

We have been working towards the development of a pattern language for web-based instruction. Our goal is that this pattern language will support novice web instructors in the design of quality distance learning materials for students. As a foundation for the language, we use learning and instructional theories to develop an appropriate design framework for WBI. Research from this body of literature identifies a number of principles associated with effective instruction that can be utilized in the development of design patterns that solve web-course design problems. The resulting design framework shown in Table 1 merges key design concepts from both behavioral and cognitive theories on learning (see Kearsley, 2001 & Mergel, 1995) with research from web-based instructional design models (Duchastel, 1997; Kearsley, 1999). As advocated by Morrison (2001), we adopt a view that it is good to incorporate both behavioral and cognitive approaches to learning in the design of web-based instruction in order to reap the benefits of each to address diverse student populations.

- Provide Structure to the learning process
- Provide a Foundation for learning
- Specify Learning Objectives
- Encourage Student Participation
- Give Feedback and Guidance
- Provide Support Aids
- Encourage student Expression and Reflection
- Design for Interactivity
- Build Learning Communities
- Include Authentic Content and Activities
- Provide Problem Solving Activities
- Provide Multiple Perspectives and Representations

Table 1: WBI Design Framework

We have an initial language of about twenty design patterns that embody the design philosophy represented by the framework described above, but from a problem-solving perspective. The language addresses design problems from overall course presentation to specific student learning activities As shown in Figure 1, we have chosen a categorization for the design problems in WBI based on three elements: *content*, *learning activity*, and *learning support*. This model or categorization for design problems in web-based instruction builds upon the model presented by Oliver (2000) for the design of WBI based on principles from situated learning theories. Patterns in the content category help with the presentation and structure of the learning process. Learning Activity Patterns provide solutions to problems concerning activating and enhancing student learning. Learning Support Patterns address problems with proving support to web students.

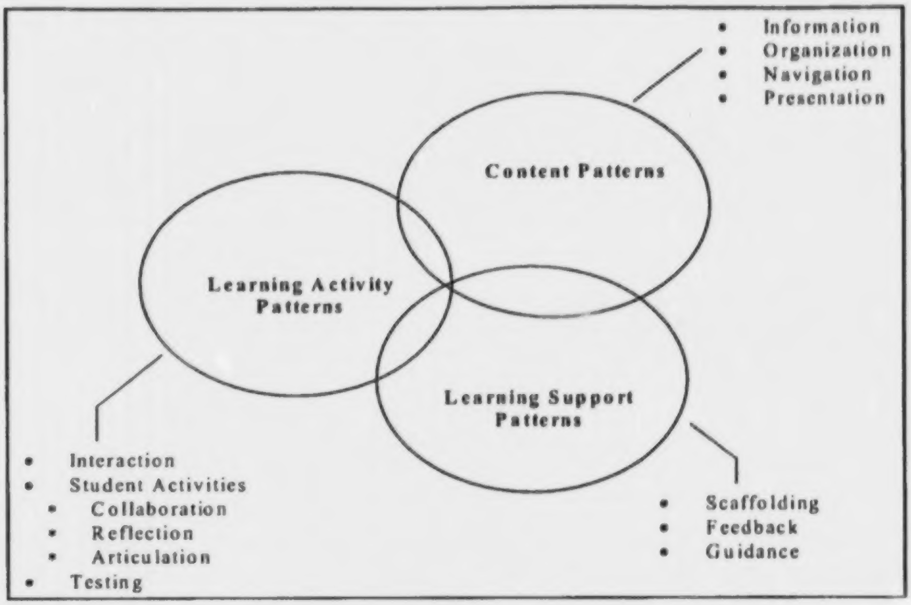

Information
Organization
Navigation
Presentation
Content Patterns
Learning Activity Patterns
Learning Support Patterns
Interaction
Student Activities
Collaboration
Reflection
Articulation
Testing
Scaffolding
Feedback
Guidance

Figure 1: WBI Problem Space

The format used for writing the patterns contains the standard pattern elements such as *problem*, *context*, *solution*, and *forces*, in addition to a *rational*, *related patterns*, and *reference* section. The reference section is used to validate the information contained in the pattern and to give the designer additional resources. An abbreviated pattern from the language is provided in Figure 2. This pattern named "*FAQ*" addresses how to handle students' problems or questions. The solution given by the pattern is a strategy for providing immediate feedback for student inquiries. Although not shown here, patterns also contain an example of the solution given by the pattern. Space does not permit us to present each pattern in detail. However, the following few pattern names and descriptions are provided to give an idea of the range of problems addressed in the language.

> *Learning Community:* Addresses the isolation problem experienced by some web-based students. The problem is how to facilitate a sense of community for online students. The pattern's solution supports the creation of collaborative learning communities.
>
> *Discovery Orientation:* Addresses the disorientation that can be experienced by students in courses that provide little organization and link to many additional web sites. The problem is how to help students orient themselves within the learning space.
>
> *Teamwork*: Addresses the problem of coordinating teamwork over the web for group projects and assignments. The pattern solution's encourages the instructor to take the role as facilitator to assist students.

BEST COPY AVAILABLE

Pattern Name: FAQ

Problem: Students have problems and questions that necessitate quick responses.

Context: Any web-based course consisting of students whose location may be different from that of the instructor's location or who are novice web students.

Forces:

- Emails from students can quickly fill up an instructor's email account.
- Multiple students may have the same question.
- The time involved in answering questions can be substantial.
- Student's work hours may be different from instructor's hours.
- Students want quick responses.

Solution: Create a document in the course that contains a list of questions along with the answers. Include questions that have been already asked by students and if you have taught the course before, you can include common questions from previous students. It would also be beneficial to include any questions that you anticipate students may have. To insure that students utilize this document, encourage them to refer to it as a resource tool for them to address many of their concerns.

Example: *(Omitted)*

Rationale: It is frustrating for students to have questions and not be able to get immediate answers to them. FAQ provides a mechanism for handling student questions that gives them immediate feedback.

Related Patterns: *Feedback-Loop*

References:
Dick, W. & Reiser, R. (1989). *Planning Effective Instruction*
Gagne, R. (1985). *The Conditions of Learning and Theory of Instruction*
Khan, B. (Ed). (1997). *Web-Based Instruction*
Shaw, R. (1996). *The FAQ Manual of Style.*

Figure 2: WBI Design Pattern

A pattern language for WBI stills allows for some creativity in the design of instruction, as they do not remove the role of the instructor from the instructional design process. As Vlissides (1998) points out, design patterns do nothing to remove the human from the creative process of design. Design patterns serve to support a possibly inexperienced, but otherwise capable person. Our goal is that novice web-course designers will become better course designers by using the pattern language.

Conclusion

Design patterns have emerged as a way to capture knowledge to present design solutions to novice designers. We have presented our efforts towards the development of design patterns and a resulting pattern language for web-based instruction to support novice web-course designers. We believe a pattern language for WBI based on principles from instructional design and learning theories can support the design of instructionally effective web-based courses. We have coupled this pattern language within a design environment for web-based instruction that scaffolds the process of finding, selecting, and applying patterns to course design problems (Frizell & Hübscher, 2002).

References

Alexander, C. (1979). *The Timeless Way of Building.* Oxford University Press, New York.

Alexander, C., Ishikawa, S., Silverstein, M., Jacobson, M., Fiksdahl-King, I. and Angel, S. (1977). *A Pattern Language*. Oxford University Press, New York.

Borchers, J. (2001). *A Pattern Approach to Interaction Design*. John Wiley & Sons.

Bork, A. and Britton, D.R. (1998). The Web is Not Yet Suitable for Learning. *Computer*, 31(6), 115-116.

Braxton, S. (2000). Empirical Comparison of Technical and Non-Technical Distance Education Courses to Derive a Refined Transactional Distance Theory as the Framework for a Utilization-Focused Evaluation Tool. Dissertation, Graduate School of Engineering and Applied Science, The George Washington University.

Clark, R.E. (1994). Media will never influence learning. *Educational Technology Research and Development*, 42, 21-30.

Duchastel, P. (1997). A Web-based Model for University Instruction. *Journal of Educational Technology Systems*, 25(3), 221-228.

Frizell, S. and Hübscher, R. (2002). Supporting the Application of Design Patterns in Web-Course Design. *Proceedings of the World Conference on Educational Multimedia, Hypermedia, and Telecommunications*. Denver, CO.

Gamma, E., Helm, R., Johnson, R. and Vlissides, J. (1995). *Design Patterns: Elements of Reusable Object-Oriented Software*. Addison-Wesley.

Gelfand, N., Goodrich, M., and Tamassia, R. (1998). Teaching Data Structure Design Patterns. *SIGCSE*, ACM Press.

Hannafin, M., Hannafin, K., Land, S. and Oliver, K. (1997). Grounded Practice and the Design of Learning Systems. *Educational Technology Research and Development*, 45(3), 101-117.

Hannum, W.H., Web Based Instruction Lessons: The Uses of Web-based Instruction http://www.soe.unc.edu/edci111/8-98/index_wbi2.htm

Hirumi, A. (2002). The Design and Sequencing of e-Learning Interactions: A Grounded Approach. *International Journal on E-Learning*, 1(1), 19-27.

Janicki, T. and Liegle, J. (2001). Development and Evaluation of a Framework for Creating Web-based Learning Modules: A Pedagogical and Systems Perspective. *Journal of Asynchronous Learning Networks*, 5(1).

Jonassen, D.H. (1998). *Instructional Designs for Microcomputer Courseware*. Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.

Kearsley, G. (2001). Explorations in Learning & Instruction: The Theory Into Practice Database. Available at: http://tip.psychology.org/

Kearsley, G. and Shneiderman, B. (1999). Engagement Theory: A framework for technology-based teaching and learning. Available at: http://home.sprynet.com/~gkearsley/engage.htm

Kessler, G., Rosenblad, K., and Shepard S. (1999). The Web Can Be Suitable for Learning. *Computer*, 32(2), (pp. 114-115).

Khan, B.H. (1997). Web-Based Instruction (WBI): What Is It and Why Is It? In B.H. Khan (Ed.), *Web-Based Instruction*. Englewood Cliffs, NJ: Educational Technology Publications.

Mahemoff, M. and Johnston, L. (1998). Principles for a Usability-Oriented Pattern Language. In Calder, P. and Thomas, B. (Eds.), *OZCHI'98 Proceedings*, pp. 132-139. Los Alamitos, CA.

Mergel, B. (1995). Instructional Design and Learning Theory. Available at: http://www.usask.ca/education/coursework/802papers/mergel/brenda.htm

Morrison, G., Ross, S., and Kemp, J. (2001). *Designing Effective Instruction.* John Wiley & Sons.

Oliver, R. and Herrington, J (2000). Using situated Learning as a Design Strategy for Web-based Learning. In B. Abbey (Ed.), *Instructional and Cognitive Impacts of Web-Based Education.* Idea Group Publishing.

PPP. (2000). The Pedagogical Patterns Project, Successes in Teaching Object Technology. Available at http://www-lifia.info.unlp.edu.ar/ppp/

Tennyson, R. & Elmore, R. (1995). Integrated Courseware Engineering System (ICES), In R. Tennyson & A. Barron (Eds.), *Automating Instructional Design: Computer-Based Development and Delivery Tools.* Springer-Verlag Berlin Heidelberg.

Tidwell, J. (1999). Common Ground: A Pattern Language for Human-Computer Interface Design. Available at: http://www.mit.edu/~jtidwell/interaction_patterns.html

van Welie, M., van der Veer, G., and Eliens, A. (2000). Patterns as Tools for User Interface Design. *International Workshop on Tools for Working with Guidelines.* Biarrite, France.

Vlissides, J. (1998). Pattern Hatching: Design Patterns Applied. Addison-Wesley Longman, Inc.

The Methodology for Reuse of E-Learning Resources

Takashi Fuji, Takeshi Tanigawa
Faculty of Business Administration and Information Science
Hokkaido Information University
Japan
fuji@do-johodai.ac.jp, kt@do-johodai.ac.jp

ABSTRACT: This paper describes a domain-specific repository based on the methodology for e-learning systems development. The methodology, which is based on information engineering and object-oriented technology, is used to support navigation for courseware development, designing the curriculum of e-learning components, and e-learning resources management. A repository-based approach is key to support of e-learning development and reuse of e-learning resources such as application frameworks and components. Through the structure of the repository such as meta-model / model / object-base and by use of object-oriented modeling, it is constructed for reuse by systems analysts and subject matter experts. Systems analysts can build new models by reusing meta-model and models for their target system. Subject matter experts can develop their courseware by reusing models and object bases for their e-learning. And, by using CORBA architecture, we developed the distributed e-learning systems development environment.

1. Introduction

The reuse of instructional materials is developed by some projects such as ARIADNE (ARIADNE , 2001) and SCORM (SCORM, 2001). The purpose of this paper is to present the methodology for the reuse of e-learning resources such as components (included instructional materials) and application frameworks. For the systems analyst, Repository-Based Environment for Computerized Courseware Analysis (REBECCA) (Fuji 1997) enables the reconstruction of e-learning systems by reusing application frameworks such as Audio Visual and Adaptive Learning system by Oneself in Network (AVALON) (Fuji *et al.*, 1994) and Collaborative and Multimedia Environment for Learners on Teams (CAMELOT) (Fuji *et al.*, 1996). For the subject matter expert, WWW-based Curriculum Authoring with Thesaurus (WEB-CAT) (Fuji and Hoshihara, 1997) enables the construction of the intended curriculum with collaborative work through WWW, while REBECCA provides a means of course navigation, the reuse of instructional material, and target system generation.

There are two learning styles incorporated in e-learning systems: individual learning environment, and collaborative learning environment. We have developed prototypes of an application framework, AVALON (for the individual learning environment) and CAMELOT (for the collaborative learning environment). These application frameworks are constructed by use of object-oriented technology, and are stored in the domain specific repository called REBECCA for reuse. Repository-based methodology is derived from information engineering (Martin, 1989). With regard to the components in e-learning systems, there are instructional material, curriculum, and pedagogy. We have developed a prototype called WEB-CAT for developing curriculum through collaborative work with a domain specific repository and WWW. And, as the REBECCA is constructed by an object-oriented technology, it is easy to adapt Common Object Request Broker (CORBA). E-learning components and e-learning frameworks of the distributed REBECCA correspond to a CORBA application object, and these components use CORBA services for searching for distributed object reference by name or for creating new objects.

This paper is organized into two sections: Section 2 outlines the framework in e-learning systems; Section 3 describes the distributed e-learning systems development environment with CORBA architecture.

2. Framework and Component for E-Learning

The reuse approach is based upon and relies on the concepts that reusable software components are produced and stored in a repository. There are two main types of object-oriented components:

(1) solution-based inheritance hierarchies, and
(2) domain-based frameworks

This framework is based on domain-based frameworks such as CAI systems, and we use a framework in the sense of a skeleton application that the developer can adjust with it. The term "component" is often used interchangeably. The software component is a physical packaging of executable software with a well-defined and published interface (Hopkins, 2000). The following definition of "component" will be used in this section: "core elements that compose an application framework."

2.1. Methodology for E-Learning Systems Development with Repository

In software engineering, structured techniques are applied to one project, whereas in information engineering, structured techniques are applied to the enterprise as a whole or to a large sector of the enterprise. Information engineering techniques encompass those of software engineering in a modified form. Information engineering has been defined with reference to automated techniques as follows: an interlocking set of automated techniques in which enterprise models, data models and process models are built up in a repository and are used to create and maintain data-processing systems. The repository is a key technology in information engineering, and it steadily accumulates information relating to the planning, analysis, design, construction and, later, the maintenance of systems.

The field of instructional design was initiated by the United States Department of Defense during World WarII to improve the efficiency of certain types of high level technical training programs such as pilot training (Reiser, 1987). The systems approach is a step-by-step procedure for solving problems. It has been applied to educational problems at all levels, from education in general, to training for a specific target population. In instructional design, the systems approach is sometimes referred to as instructional systems development. There are numerous models demonstrating this approach. Although the models differ in detail, such as the number and sequence of steps in which specific components are grouped, the common basic steps are grouped into the following five categories: analysis, design, production, implementation, and evaluation.

The methodology of REBECCA is based on that of information engineering and instructional design. The characteristics of this methodology are as follows.

- Object-oriented repository for managing e-learning systems resources
- Reuse for e-learning systems framework
  individual learning, collaborative learning
- Reuse for e-learning systems components
  instructional material, curriculum, pedagogy
- Navigation for courseware development
  analysis, design, construction

2.2. E-Learning Frameworks

The e-learning frameworks used are: AVALON for the individual learning environment and CAMELOT for the collaborative learning.

AVALON

The AVALON e-learning framework is a multimedia intelligent tutoring system. The system provides adaptive instructional units and pedagogy suited to the individual learner's understanding. The system also provides multimedia instructional units, such as video, voice, text, and image data, suited to each individual learner's characteristics. This framework, composed of pedagogy, a learner model and instructional material information, was used as a base. In order to adapt the following two functions, i.e., a function for dynamic representation of multimedia instructional material corresponding to the comprehension level of each learner and to the media characteristics, and a function for interactive response to questions from learners, we developed an instructional object in which the multimedia instructional material and knowledge expression of instructional material were encapsulated as an instructional object.

CAMELOT

The CAMELOT e-learning framework is a collaborative learning support system. The learning process is based on a nominal group technique. The system facilitates collaborative learning navigation, group discussion, and remedy of collaborative work solutions. The pedagogy is a combination of rule based reasoning and case-based reasoning. The system can remedy learner's basic mistakes using rule-based reasoning. And also case-based reasoning can present analogous solutions to learners for deeper understanding. In the business systems design environment, there may be more than one solution to any given problem. For example the data model will be different depending on the perspective of each individual leaner.

Thus, collaborative learning systems are very effective in this domain. By using CAMELOT, each learner learns how to analyze through case study and how to cooperate with his or her group in problem solving. Learners come to a deeper understanding from using CAMELOT than from studying independently, because of shared discussion, tips from other learners, and examinations, and review of one another's works.

2.3. E-Learning Components

As domain specific components in elearning systems, there are the instructional object, curriculum object, and pedagogy object that compose e-learning application framework.

Instructional Object

An instructional object is an extended instructional unit. An instructional object is composed of a multimedia object and a knowledge object. A multimedia object incorporates multimedia instructional material, such as text, image, voice, and video. A knowledge object incorporates the knowledge representation of instructional units, such as semantic network, rule-based reasoning, and case-based reasoning. An instructional object is used for components when subject matter experts design courseware.

Curriculum Object

A curriculum object is related to instructional objects and selected by pedagogy objects. A curriculum object is structured using a thesaurus. This object is composed of a superordinate concept, a subordinate concept, and related concepts.

Pedagogy Object

A pedagogy object is composed of three tiers such as planning strategy, learning strategy, and action objects for strategy. The basic concept of the learning strategy is based on Gagné's accumulated learning model (Gagné, 1985). The learning strategy is composed of "problem solving", "rule learning", "concept learning", "multiple discrimination learning", "verbal association", "chaining", "stimulus-response learning", and "signal learning". Subject matter experts can design their pedagogy for CAI systems by combining these pedagogy objects.

3. Distributed Environment with Repository

Since the Internet is used worldwide, the global learning environment is also changing to incorporate use of the Internet. In many types of organizations, such as universities and private enterprises, subject matter experts are developing various types of courseware; each site can be connected to the network and they can find a variety of courseware. However, they are not able to use courseware for reuse, because the various types of courseware are developed and executable from different platforms such as Pentium, PowerPC, SPARC, and so on. For the common use of the courseware through the Internet, the distributed heterogeneous development environment is required.

3.1. Utilization of Distributed Object Technology

CORBA is an industry-wide standard for creating distributed object systems. It is a standard that is accessible from many different languages and allows interoperability on various platforms. Using CORBA, a client object can transparently invoke a method on a server object, which can be on the same machine or across a network. CORBA intercepts the call and is responsible for finding an object that can implement the request, pass on to it the parameters, invoke its method, and return the results. The client does not have to be aware of where the object is located, its programming language, or its operating system.

From these characteristics of CORBA, we developed a distributed development environment REBECCA using CORBA. CORBA provides the following benefits in development of distributed development environment:

- CORBA supports many programming language mapping
- CORBA supports distributed computing and object orientation
- CORBA provides interoperability between different vendor's ORBs

3.2. Distributed Repository Using CORBA

As the REBECCA is constructed by an object-oriented technology, it is easy to adapt CORBA. Object Management Architecture (OMA) has four major components, ORB (Object Request Broker), CORBA services, CORBA facilities, and application objects. ORB is a communication infrastructure between distributed objects. CORBA services are a set of system service interface, and include the naming service and the persistent service.

CORBA facilities represent specifications in great detail for the construction of the distributed system. E-learning components of the distributed REBECCA correspond to a CORBA application object, and these components use CORBA services for searching distributed object reference by name or for creating new objects. E-learning frameworks (such as AVALON and CAMELOT) correspond to CORBA facilities that provide domain dependent services. At each site, there is a repository object stored e-learning component such as instructional objects, curriculum objects, and pedagogy objects. The repository object manages the other objects and communicates with the repository object of another site in order to obtain information from and access to resources at another site (Figure 1). The distributed REBECCA with CORBA provides the following functions:

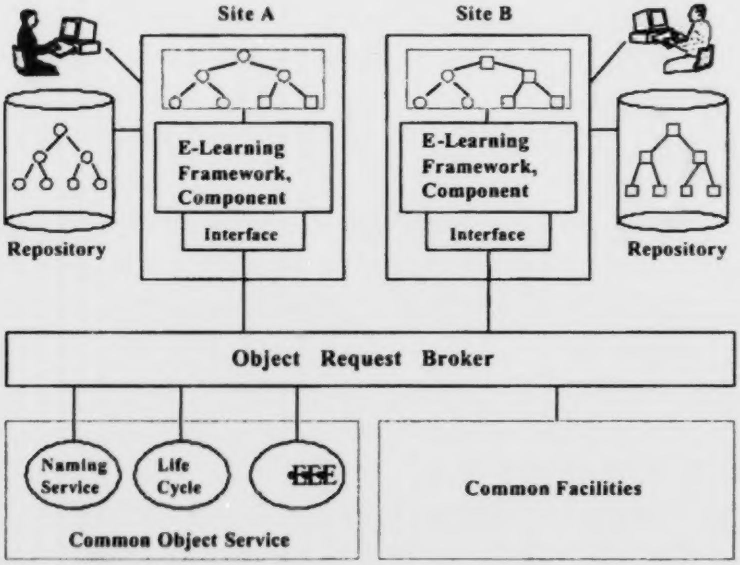


Figure 1: Distributed Development Environment with CORBA

Enables the reuse of heterogeneous and distributed e-learning components

The distributed REBECCA provides methods to treat heterogeneous distributed e-learning components uniformly, so that subject matter experts are able to reuse these e-learning components in developing courseware. E-learning systems can provide adaptive instructional objects on the network.

BEST COPY AVAILABLE

Appropriate site of e-learning components

In using CORBA environment, implementation of e-learning components is encapsulated and can be placed at the distribution site, according to the characteristics of each e-learning component. Therefore, e-learning components can be placed in the appropriate sites. For instance, an instructional object that includes simulation material, which requires a large amount of computer power, is placed at a high performance computer site, and the pedagogy object that requires high inference performance is placed at a computer site with high performance engine for inference.

Management for distributed e-learning components

The distributed repository manages each e-learning components stored in each server site. The distributed e-learning components are able to maintain consistency by means of a global instruction manager (Tanigawa *et al.*, 1998).

4. Conclusion

In this paper, we have described a methodology for e-learning systems development and a domain specific repository for reuse of e-learning framework and e-learning component. The repository is the key to supporting e-learning systems development and reusing e-learning systems resources. Using a three-level structure, such as meta-model, model, object-base, and using object-oriented modeling, REBECCA provides for ease of reuse for systems analysts and subject matter experts. It further enables construction of a distributed e-learning systems development environment using CORBA architecture.

Acknowledgement

This research is partly supported by the Japan Society for the Promotion of Science under Grant-in-Aid for Scientific Research No. C-2-13680246.

References

ARIADNE, 2001, The Alliance of Remote Instructional Authoring and Distribution Networks for Europe, (http://www.ariadne-eu.org/).

Fuji, T., Tanigawa, T., Hoshihara, K., Fujii, K., Kozeni, M. and Saegusa, T., 1994, Development of Intelligent Multimedia CAI with Hyper-frame, In *Proceedings 1994 Informatics Symposium*, IPSJ, pp.133-141.

Fuji, T., Tanigawa, T., Kozeni, M., Inui, M. and Saegusa, T., 1996, A Case-Based Approach to Collaborative Learning for Systems Analyst Education, In *Proceedings ITS'96*, (Springer-Verlag), pp.177-186.

Fuji, T., 1997, A Repository-based Approach to Reuse Educational Systems Resources, In *Proceedings ED-MEDIA & ED-TELECOM97*, pp. 378-383.

Fuji, T., Tanigawa, T., Inui, H. and Saegusa, T., 1997, Using Case-Based Reasoning for Collaborative Learning System on the Internet, In *IEICE Transactions on Information and Systems*, Vol.80-D, No.2, pp.135-142.

Fuji, T., Hoshihara, K., Kozeni, M. and Saegusa, T., 1997, Developing a WWW-based Support System for Designing the Curriculum, In *IPSJ Journal*, Vol.38, No.11, pp.2370-2381.

Gagné, R.M., 1985 *The Conditions of Learning (4^{th} edition)*, (New York: Holt, Rinehart, and Winston).

Hopkins, J., 2000, Component Primer, In *Communications of the ACM*, Vol.43, No.10, pp.27-30.

Martin, J., 1989, *Information Engineering Book I Introduction*, (Prentice-Hall).

Reiser, R. A., 1985, Instructional Technology: A history, pp.11-48, *Instructional Technology: Foundations* (Gagné, R. M.), (Hillsdale: Erlbaum Associates).

Rumbaugh, J., Blaha, M., Premerlani, W., Eddy, F. and Lorensen, W., 1991, *Object-Oriented Modeling and Design*, (Englewood Cliffs: Prentice Hall).

SCORM, 2001, Sharable Content Object Reference Model Version 1.2, (http://www.adlnet.org/).

Tanigawa, T., Fuji, T. and Saegusa, T., 1998, A Developing of Distributed Learning Systems Using CORBA, In *IPSJ Journal*, Vol.39, No.7, pp.2380-2390.

Adaptive User Model for Web-Based Learning Environment

John Garofalakis[1, 2], Spiros Sirmakessis[1, 2, 3], Evangelos Sakkopoulos[1, 2], Athanasios Tsakalidis[1, 2]

[1]Research Academic Computer
Technology Institute
Internet and Multimedia Technologies
Research Unit
61 Riga Feraiou Str. 26110 Patras, Greece
http://www.ru5.cti.gr/

[2]University of Patras
Computer Engineering & Informatics
Department
26500 Patras, Greece
http://mmlab.ceid.upatras.gr/

[3]Hellenic Open University
84 K Palama Str.
26442 Patras, Greece
http://www.eap.gr

{garofala, syrma, sakkopul, tsak}@cti.gr

Abstract. We present the design and implementation of an adaptive user model in a web-based virtual university learning environment. It includes techniques that provide personalization features to the educational topic and the exchanging information. In this way it customizes the educational process, served by any virtual university to the personal characteristics of the user. Its distinctive functionality is that encompasses combined adaptation between educational material and well-known communication facilities. In fact the user model consists of different layers that make the environment personalized in two axes. Firstly adaptation is performed separately per activity (member of the profile's higher level) and subsequently knowledge of the different levels is shared through the common lower level and provides further personalization in a more global sense. Personalization obsolescence is also included in the user model in order to prohibit outdated adaptation or intelligence to keep loading the user interface. Furthermore curriculum sequencing provides guidance to the user's learning procedure. Most interesting educational pages for the users -based on their profile- are selectively delivered to them, according to the collaborative filtering method. Finally special care has been taken for the categorization of incoming data streams handled by content and property based filtering.

1. Introduction

A number of virtual educational environments have become available over internet in the past years [24], [22], [23]. Such an infrastructure is also known as "virtual university". It does not have traditional facilities such as campus, classes or library; instead there are web-based services that provide richer functionality and features than their physical analogs [18]. A typical hypermedia application serves the same pages and the same set of link to all users. In order to improve usability, adaptive web-based applications make it possible to deliver personalized views of a hypermedia document to the users with diverse needs and knowledge backgrounds gaining access to the system [19], [22]. A virtual university environment that adopted intelligence in content providing is the Electronic Education Environment [3]. However, these adaptation techniques are focused to a specific service (e.g. educational content delivery or presentation, document topic filtering) and therefore work completely independently in an environment that is supposed to cover a broad set of needs towards the common target of usability and learning improvement. The fruitful design and successful correlation of adaptation capabilities simultaneously for educational material and accompanying supportive services is a task not as simple as one may guess.

In this paper, we describe the design of an adaptive user model and its implementation in an advanced web-based Virtual University environment that encompasses combined and synchronized adaptation between educational material and well-known communication facilities The Virtual University environment has been implemented to support a postgraduate course. It aims to cover the fundamental needs of a student, which is wide range of automatically renewable educational material on any subject chosen under the umbrella of a powerful set of supportive tools homogenized with the user's topics of interest.

The environment at the moment provides training on Internet and Multimedia technologies coupled with a range of supportive tools like communication facilities and common shared workspace. The environment supports personalization features to the educational topic and the exchanging information flow in order to customize the educational process to the learning curve of the student. This is accomplished by acquiring each user's learning model and activity choices. The educational profile is first developed for each student based on a questionnaire and continuously evolves according to the student's choices and activities within the virtual university framework.

BEST COPY AVAILABLE

Key features are the curriculum adaptation [6] and the communicational information filtering [17]. According to the user's knowledge state and interests the former adapts the educational topics' presentation and interconnection, while the latter categorizes the exchanging streams of communicational data items creating this way a corresponding archive for each topic mostly interesting the user.

This paper is organized as follows; section 2 presents an overview of the virtual university framework. The user model is described in section 3. The adaptation mechanisms are the theme of section 4. Section 5 outlines intelligent filtering in data. Results are summarized and future work is presented in section 6

2. Overview of the Virtual University Framework

The Virtual University Environment has been designed as a hypermedia environment addressing users with a vast variety of knowledge backgrounds and targets. Educational material at the moment comprises a variety of courses on the Science of Fine Arts and on Internet technologies. The environment is optimized to include any web-based course that might be available. The courses on all directions are available for every student. In fact it is possible to take any of the courses at every possible combination. However in order to clarify the scale of difficulty for each course there is a short description and a grade (starting from one grading up to four for the most advanced topics) indicating the complexity and the demanding know-how of each one of them. Introductory topics address to novice students and will cover introduction of the Internet, introduction in computer assisted multimedia design etc. Advanced topics cover areas such as advanced web application development, advanced 3-dimensional modeling, etc.

Due to the diversity of the students all courses are personalized and delivered differently to groups of students with common characteristics. An educational profile is developed for each student based on a questionnaire that the student is asked to fulfill after choosing his/her first course to attend. The stereotype of the user evolves while the student performs activities in the Virtual University environment (such activities are the specific course flow that is followed and the students' achievements in tests and projects).

As a sequel the stereotype of the student is used in order to support the system's curriculum adaptation model [6]. In this case adaptation is used in order to perform at first a fundamental pedagogical curriculum sequencing – set by the curricula author -, but, which is most, automatic information pushing of the most appropriate online resources for every student based on its profile. Complementary the technique of link deactivation is used in order to deliver specialized dictionary help for keywords throughout the corpus of a course.

On the other hand an intelligent cognitive filtering is performed, in conjunction with the web based educational material collaborative filtering, to unify the popular communicational (email) and workspace (share space) support within the Virtual University framework, in full parallelism with the fact that every university gives its students an email and some electronic space to utilize with the classes. The communication services in our framework take into consideration the activities of the user in its educational journey within the courses, by deriving some key notions, in order to make a categorization of the information flowing into his/her mailbox. As a result it makes use of the students profile to selectively filter out and categorize its incoming data stream delivering them to proper activity-based topics together with older relative information creating in this way a personal archive.

3. User Profile Model

The user profile records information concerning the user and his knowledge state [4], [1]. This information is vital for the system's operation according to the user's needs and preferences. The method used is an implicit collection of user's actions and it requires minimum user involvement [10]. However, such data is quite difficult to gather because it is not easy to represent the user's knowledge abilities. Moreover, the nature of the Web imposes certain constraints on the system's perception of the user. For the time being, it is difficult and time-consuming to record every user action. In the environment at hand it has been chosen to keep track of the users' traversal path for every visit, the courses', topics' and subjects' keywords and analytical scores in tests, projects and all given grades in general (every user- student has a personal history list of achievements and grades just like all students).

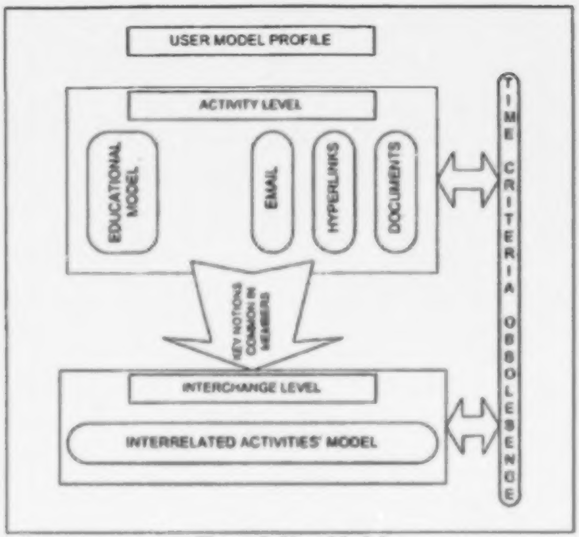


Figure 1: User Model

3.1. Different Levels in the User Model

Due to the variety and diversity of the possible activities of a single user in the Virtual University there is a need for differentiation in the profile itself. In this model the profile contains different levels that represent each activity and a common layer that interconnects the behavior of the user within all the activities together. As a result the profile of each user is both a learning model for the educational procedure and activity representation for the rest services. Specifically the educational procedure is being monitored for the choices (e.g. courses, topics and key notions selection) and the progress (e.g. tests, questions and project achievements). To the other end information exchange within the whole set of communication tools is also recorded (e.g. topics in emails exchange, titles in file exchange and hyperlink exchange). In this way the method creates a set of characteristics (e.g. keywords) that best describe and therefore represent each user's activity.

In the sequel the profile's higher level members are examined for similarity in the characteristics. Each member of the activity level delivers to the interchange level the properties that describe it. In this common pool best-matched properties are considered interconnected and therefore of common interest. These notions that are found common in more than one profile member in the activity level are stored in the interconnection member of the profile in the lower layer. They are used to improve the usability of the environment by interconnecting the activities that they describe in a dynamic sense personalized per user.

The different levels in the profile of the user model make the environment personalized in two axes. Firstly specialized adaptation is performed per activity member of the profile's higher level and subsequently knowledge of the different levels is shared through the common lower level and provides further personalization in a more global sense. The multi-layered profile covers the gap between interrelated adaptive services transforming them to services that associate adaptive techniques towards usability and learning improvement.

Such a case of inner profile information exchange happens whenever a student chooses to attend a course. As a result of this he/she has to perform communication activities for this course. The environment captures the user's educational activity and, after the profile's levels exchange knowledge, it adapts to the new keywords the filtering properties for all communication activities, as email, file and hyperlink exchange. Specifically it redirects the information flow into a new "course" email folder and accordingly makes changes for all activities. Moreover it represents this adaptation within the course environment by activating appropriate link for each course-specific archive.

3.2. Additional Time-based Criteria in the User Model

In order to prevent forgotten and obsolete notions to be maintained in the multileveled profile, it is designed to support short and long-term distinction in users' reactions. The properties that have not been used for a period of time longer than two academic seasons become disabled (though kept in the

BEST COPY AVAILABLE

users profile) indicating that perhaps the user has nothing more to do with this keyword. In the third subsequent season these keywords are being deleted as out-dated for the user. The property obsolescence can be easily transformed so as to be based on the hypothesis that a uniform distribution of property appearance over time is more valuable than others [2]. Although this approach has been neither proved nor disproved, the mere influence of time is a subject of high effect.

3.3. Educational User Model

A learning model that used quite often in the past by other educational systems and which is used in our frame is the overlay model [7]. In this model, the user's knowledge is considered to be a subset of the knowledge perceived by an expert in the learning field. Using this representation, the system presents the educational material to the user so that in the end his/her knowledge will match the expert's knowledge. Another way of modeling the user's knowledge is to use Bayesian networks [14], [21]. These networks probabilistically reason about the student's knowledge state concerning the various knowledge concepts.

4. Curriculum & Course Adaptation

The Virtual University environment consists of an educational framework that uses a curricula adaptation based firstly on the stereotypes, created with the registration's questionnaire, and subsequently mixed with personalization features for each user.

4.1 Curriculum Sequencing

It is recommended that a Web-based educational environment should offer some sort of guidance to the user by presenting the next best course units to be learned [20], [15]. The used type of curriculum sequencing involves the selection of the most appropriate section or topic to be presented next. This selection is made according to the concepts learned by the user indicated in his/her profile. If the user has not learned yet all the outcome concepts of the current subsection (section) then the system will select the topic (subsection) with the least unknown prerequisite concepts. This goes on until the user learns the outcome concepts of all sections of the specific course.

4.2 Collaborative Filtering

The users receive key characterization in the educational profile level according to their interests deriving from their topic accesses. Once a topic (typically a web page) is updated with new material concerning a specific topic, the users who had with certain frequency expressed interest on it in the past are informed about the changes. Thus instead of making the users go after recently updated web pages, it is desirable to have information selectively flowed to them. This is called information filtering [10]. In our case we address the collaborative filtering method, which is the filtering of information based on the advice of others [12]. The users are not only informed of the recently updated topics that they have visited quite often in the past, but also for those topics that have been accessed with certain frequency by other users belonging in the same group of interest with the first ones. In particular, the profile of the users' information needs is captured through their classification in groups of interest.

The classification of the users into subsets according to their path traversal and page accesses will be achieved by using the spectral filtering method developed in [5], [8], [9], [11]. The initial motivation for the development of the method was the discovery of high-quality topical resources in hyperlinked corpora. The full power of the approach is visible when being applied on entities other than hyperlinked documents. In our paradigm we have two kinds of entities: web pages and users accessing them. The precise notion of "access" refers to frequency of access.

Following, we will only outline the method of spectral filtering, as it is applied in our virtual university environment (further details concerning the mathematical details of the approach see [5], [8], [9], [11]). Let S1 denote the set of users and S2 denote the set of web pages corresponding to a specific section. We associate with each ordered pair (i,j) of entities in S1 and S2, a non-negative real-valued affinity A[i,j]. Typically, we set A[i,j] to be a well-chosen function of the accesses user i performs on page j. The A[i,j]s constitute an n x m matrix A, each of whose rows corresponds to users and each of each column to web pages. The entries of the matrices AAT and ATA can be viewed as expressing the similarity between different users and web pages respectively (where the notion of similarity is deduced from similar patterns of accesses). The matrices AAT and ATA are both real and symmetric and their eigenvectors have only real components. Moreover they have the same set multiset of eigenvalues. Let xs1, xs2 be two eigenvectors of AAT and ATA respectively corresponding to the same eigenvalue. We can view the components of each eigenvector as assigning to each entity a position on the real line. We deem the entities with large positive values in an eigenvector to be a cluster, and the entities with large negative values to be a different cluster. Alternatively, we can examine the values in the eigenvector (in sorted increasing order). At the largest gap between successive values, we declare a partition into those entities corresponding to values above the gap, and those entities with values below. From the above discussion it follows that the eigenvectors xs1, xs2 provides us with two pairs of interrelated clusters (c1,c'1), (c2,c'2) where ci corresponds to a group of users with similar web-access patterns and c'i corresponds to the web pages that interest the users in the ci group.

Following the above partitioning process for all the non-principal eigenvectors enables us to group the users into subsets with similar preferences and to map the entities of each subset to the web pages that are of interest to them.

5. Intelligent Filtering in Communication Data

Cognitive filtering characterizes the contents of an incoming stream data and the information needs of potential topic specific pools of knowledge, and then using these representations to intelligently match data streams to pools [13]. Our approach is more a combined content-based and property-based filtering under [16] the common umbrella of the lower profile layer. Cognitive filtering in this environment lies in between filtering based on the content of the incoming streams of the communication data and filtering based on the properties that include more than areas of interest of the user. In this way the environment automatically transforms according to the user needs transparently to the user. The Virtual University performs categorization through filtering in a common sense manner by delivering relative information of data streams together in just one most suitable place per different activity.

In this way each educational course and topic is intelligently possible to be accessed from all topic relevant places within the environment. Adaptive presentation of hyperlinks interconnect all relevant resources such as emails (e.g. exchanged among student partners), files (e.g. shared or distributed by course responsible) and all sorts of hyperlinks from all sections of the Virtual University. It is possible to access all sorts of topic-specific knowledge pools from any of them. We imagined this like the best way to access an email from our own mailbox or have a look in a book from the course's library just while we attend a course (without having to look in all the email list or the library's citations).

6. Conclusions and Future work

In this paper an adaptive user model is presented, designed and implemented within a web-based Virtual University environment, n order to cover the real needs of the learning community. It covers the fundamental needs of a student in a virtual university environment; that is to provide a range of automatically renewable educational material on any subject chosen under the umbrella of a powerful set of supportive tools homogenized with the user's topics of interest. Its distinctive functionality is the interrelation of adaptation techniques used in different activities of the user within the environment, in order to create a picture of the users' behavior as a whole. In this way, it produces a unified characterization of the user. By utilizing this characterization the model extends the adaptivity methods that were used in each activity separately. The user model profile comprises multiple layers of personalization features that interconnect. Moreover time constraints prohibit the profile to become outdated.

Following the above, curriculum sequencing provides guidance to the user's learning procedure. Furthermore most interesting educational pages for the users -based on their profile- are selectively delivered to them, according to the collaborative filtering method. Special care has been taken for the categorization of incoming data streams handled by content and property based filtering.

Our future work aims to develop a dynamic object oriented hypermedia methodology that will incorporate our synthesized adaptive user model. The model will be refined and extended to handle more intelligent and adaptation techniques. A next step for is to be able to personalize more services for the virtual university user in order to attract different academic community members such as researchers. Finally we believe that an extension of our adaptive user model will try to cover the needs of alumni in a virtual university.

7. References

[1] Anderson, J. (1993). *Rules of the Mind.* New Jersey, Lawrence Erlbaum Associates.

[2] Arampatzis, A.T., van der Weide, T.P., Koster, C.H.A. and van Bommel, P.: 2000, *Term selection for filtering based distribution of terms over time, RIAO' 2000 Conference Proceedings, Vol. 2*, April 12-14, Paris, France, 1221-1237

[3] Barua, A., Chellappa, R. and Whinston, B., A.: An electronic infrastructure for a virtual university, *Communications of the ACM*, September 1997/Vol. 40, No 9.

[4] Beck, J., Stern, M., and Haugsjaa, E. *(1996) Applications of AI in Education*, ACM Crossroads.

[5] Bharat, K., and Henzinger, M. (1998) Improved algorithms for topic distillation in a hyperlinked environment. In *Proceedings of ACM Conf. Res. And Development in Information Retrieval*, pp.104-111.

[6] Brusilovsky, P.: Adaptive educational systems on the world-wide-web: A review of available technologies. In *4th International Conference in Intelligent Tutoring Systems*, San Antonio, TX, 1998

[7] Carr, B. and Goldstein, I. (1977). Overlays: a Theory of Modeling for Computer-aided *Instruction. Technical Report*, AI Lab Memo 406, MIT.

[8] Chakrabarti, S., Dom, B., Gibson, D., Kumar, S., R., Raghavan, P., Rajagopalan, S. and Tomkins, A. Spectral filtering for resource discovery. In *Proceedings of ACM SIGIR Workshop on Hypertext Information Retrieval on the Web*, Melbourne, Australia, 1998.

[9] Chakrabarti, S., Dom, B., Gibson, D., Kleinberg, J., Kumar, S., R., Raghavan, P., Rajagopalan, S. and Tomkins, A. Mining the Web's link structure. *IEEE Computer* 32 (8) pp.60-68, 1999.

[10] Hanani, U., Shapira, B. and Shoval, P.: Information Filtering: Overview of Issues, Research and Systems. User Modeling and User-Adapted Interaction, Kluwer Academic Publishers, Netherlands, 1999.

[11] Kleinberg, J., Authoritative sources in a hyperlinked environment. *Proc. ACM-SIAM Symposium on Discrete Algorithms*, 1998.

[12] Maes, P. and Kozierok, R.: Learning Interface Agents. *Proceedings of AAAI*, 459-465, 1993

[13] Malone, T., Grant, K., Turbak, F., Brobst, S. and Cohen, M.: 1987, Intelligent Information Sharing Systems. *Communication of the ACM* 30(5), 390-402.

[14] Martin, J. and VanLehn, K. Student assessment using Bayesian nets. International Journal of Human-Computer Studies, Vol. 42.

[15] D. McArthur, C. Stasz, J. Hotta, O. Peter, and C. Burdorf. Skill-oriented task sequencing in an intelligent tutor for basic algebra. *Instructional Science*, 17(4):281-307, 1988.

[16] Morita, M. and Shinoda, Y.: Information filtering based on user behavior analysis and best match retrieval. *Proceedings of the 17th NNUAL Intl. AACM SIGIR Conference on Research and Development, 272-281*, 1994

[17] Shapira, B., Shoval, P. and Hannani, U.: Stereotypes in information filtering systems, *Information Processing and Management* 33(3), 273-287, 1997

[18] Shih, K., T.: Software Systems for Virtual University Operations, *ACM Multimedia Conference*, 2001.

[19] Stern, M., Woolf, B. and Kurose, J. (1997). Intelligence on the Web?. Proceedings of the 8th World Conference of the AIED Society, Kobe, Japan.

[20] M. K. Stern and B.P. Woolf. Curriculum sequencing in a Web-based tutor. In B. P. Goettl, H. M. Halff, C. L. Redfield, and V. J. Shute, editors, *Intelligence Tutoring System (Proc. 4th Int'l Conf. ITS'98)*, pages 584-593. Springer, 1998.

[21] Stern, M., Beck, J. and Woolf, B. Naive Bayes Classifiers for User Modeling. *Proceedings of the Seventh International Conference on User Modeling*, 1999.

[22] Woolf, B. (1992). AI in Education. *In Encyclopedia of Artificial Intelligence*, 2nd Edition, S. Shapiro, Ed. NY: Wiley, 434-444.

[22] http://vu.org/

[23] http://www.kyvu.org/

[24] http://www.geteducated.com/vugaz.htm

The AVENOR VIRTUAL TRAINER PROJECT
a 3D Interactive Training Module on Energy Control Procedures : Development and First Validation Results

Max Giardina, Professor
Faculty of Sciences Education, University of Montreal
Montreal, Quebec, Canada
maxgiardina@hotmail.com

Abstract

This paper seeks to examine the implementation of 3D simulation through the development of the Avenor Virtual Trainer and how situated learning and fidelity of model representation become the basis for more effective Interactive Multimedia Training Situations. The discussion will focus of some principles concerned with situated training, simulation, interaction and immersion which will help to set a background about the defining attributes of new virtual training systems. Through the Avenor project we will focus on the instructional aspects of the technology and its importance in achieving a learning environment which challenges and supports effective training.

Introduction

Training has traditionally been considered in industry as a cost centered activity. It seems to be acquired that in short term, training consumes revenue. As main result, training is seen as the last response to some critical needs. While it is true that managers recognize that training is necessary to improve the human capital of an industry bringing employees to a level of proficiency that allows them to be more productive, the traditional concern keeping training at the absolute minimum remain prevalent.

In 1992, it has been estimated that American companies spent almost 30 billion per year on training (American Society for Training and Development, 1992). While this statistic could be impressive, it represents less then 1% of expenses on front-line workers. Moreover the traditional models of how educate and train does not reflect the evolution of the technology end emerging needs for different new kinds of skills.

Since then, an important reflection has emerged on new training models integrating new technologies and adopting more relevant design approaches. As a result of the introduction of advanced , computer-based training technologies compel companies, instructional designers, trainers and trainees to explore and adopt new learning models.

Much of the current research on learning and training in the context of formal training situations based their origins pointing out some depressing facts: employees, trainees, students in general are faced very often with a large amount of very complex skills, in sciences, mathematics, humanities. They can also successfully reproduce large amount of factual information on demand. They have enormous quantities of very precise knowledge. They can pass certifications, examinations successfully. But the main concern is that they are unable to show that they understand what they have learned. They are unable to build significant relationships among different kinds of information in order to apply and use them in an appropriate way depending on the context and specific needs. Interestingly, this problem is related on how and when a learner is acquiring new information to be transformed and integrated to become a new knowledge. Several studies stressed the importance of situated learning conditions while we are constructing new knowledge, letting the learner focus on real tasks in a problem solving situation.

Some studies already described this problem of "inert knowledge" which other researchers have further defined as knowledge that can usually be recalled when people are asked to do it, but it is not used spontaneously in a problem solving situation also if it relevant, because the way and conditions it has been learned (Cognition and Technology Group at Vanderbilt, 1990).

Interactive Multimedia as a technology in education seems to offer possibilities of allowing learners to participate in a more involving, meaningful and diversified learning situations, in which they can practice on real tasks and move from their status as a novice into the realm of an expert (Giardina and Brouillard, 1998).

In fact simulating a word in which the learner moves toward full participation, accessing the information according his specific needs, manipulating experiences and solving problems, should prove a powerful environment for understanding and also help with the transfer of concepts to new contexts.

Simulation training environments

As we already discussed, in contemporary theories of learning and instruction, learners are no longer considered as a person who merely reproduce knowledge or behavior that is presented to them by an instructional system, either instructor or technological environment, but more as active agent in his own learning process (Dede, C., 1995).This mind frame has led to new approaches to the design of instructional environments. One of these new approaches is scientific discovery learning or exploratory learning in which the learner is not given only direct instruction about the domain to be mastered, but he is invited to discover and apply the important concepts and relations in a domain by himself according with a given task (Jong., T. de, 1992).

The main assumption behind the exploratory learning approach is that knowledge discovered and refined by the learner will be based more precisely in the learner's attitude and knowledge configuration and have stronger links with learner's previous knowledge structures. The processes involved seem to be more intuitive and more qualitative in terms of relevant integration of new information in prior mental structures. In fact, the skills needed for the exploration itself are seen as important skills since they could help a person develop different strategies to deal with unfamiliar situations in more effective way.

These concerns have received a particular attention through the re-introduction of the Interactive training simulations as a powerful instructional device. As several studies already stressed, computerized simulations can fill in an important role as a training device for many reasons related as well to safety, economy, social reasons, as well to improve the possibility to access

BEST COPY AVAILABLE

invisible processes or let the learner to manipulate real phenomenon (de Jong and *al.*, 1992; Shute, 1993, 1997; Grimes and Wiley, 1990).

More important, is the fact that through the simulation approach we can focus on exploratory or discovery learning strategies since it represents a model of a real situation to be discovered by the learner.

Effectively computer simulations are quite popular in instruction, but there is no conclusive evidence of their effectiveness and efficiency. Some researches showing positive effects (Shute and Glaser, 1990; Faryniarz and Lockwood, 1992), and others stressing the failure to find significant advantages of simulations (Jong and de Vries, 1993).

Some possible reasons for the ineffectiveness of computer simulation approach is that learners for example, while interacting with a simulation encounter difficulties which they cannot overcome on their own. The lack of guidance or the adequate execution of exploratory processes, the lack of accuracy defining or analyzing a problem (Joolingen and de Jong, 1991), the switching between personal hypotheses and actions to be taken in the simulated environment, as well as all the concerns related with the regulatory processes and the learner modeling (Giardina and *al.*, 1997; Shute, 1996; Giardina and Brisebois, 1996; Zhang.and Norman 1994).

Other major concerns seem to be focused on the exactitude and completeness of the representation of the simulated domain as well as in terms of graphical representation (2D or 3D), and in the over-complexity or over-simplicity of the conceptual representation of the situation.

Several possible solutions for these problems seem to emerge, among them new directions focus on the design of three dimensional simulated worlds that can increase their complexity interacting with the learner and providing learners also with support to access the information in multiple ways in addition to pure simulation (Giardina and *al.*, 1997).

The Avenor Virtual Trainer try to bring new ideas of instructional model through the implementation of both dimension, the most appropriate graphical representation of a given task and the possibility to build a conceptual representation through diversified access modes to the information. The major focus of this paper is to deal with some of these typical problems concerning the design of instructional strategies for learning with computers simulations. We should remember that when a learner is interacting in an simulated environment, we need a new way of monitoring the interaction, because the initiative is shared between the learner initiative and the system response. The next following paragraphs will describe more precisely some of these concepts, and they will be followed by a section describing the solutions proposed in the Avenor Virtual Trainer.

Situated Learning in simulated environments.

There is a great interest in the ideas conveyed by the situated learning approach as drawn on several studies about the social dimensions of the learning process (Vygotsky, 1978). Effectively, situated learning could be defined as the activity in which knowledge is constructed and deployed is not separable from learning and cognition, but an integral part of what is learned. The learner build a significant meaning through his continuous participation and involvement in his own learning process using and understanding tools allowing him to simulate authentic activities. This concept is central to many other studies that defined the learning process in terms of a continuum in between a novice state of skills an knowledge to an expert state. The learner through his immersion and interaction in a simulated situation, gradually moves from a peripheral involvement (novice) to a deeper involvement and understanding. Several observations stressed already the fact that one of the key issue in learners motivation is the perception of their actions, the assessment requirements and the guidance on what and how they are learning (Giardina and *al.*, 1992).

One of the major issue for the learner is to have the possibility to refine his understanding, and his potential to become a more expert practitioners in a given domain, through the interaction with a responding and adaptive situation. Many dimensions seem to be related to this concern, and one of the emergent one is the possibility to use the landscape concept to develop useful options in learning in this kind of simulated environment.

Immersion is one of the new concepts, which already some studies on virtual reality pointed out (Dede, 1996; Giardina and Brouillard, 1997) as a major component for a deeper understanding of specific procedural skills. Immersion and its effects on the user is partly function of the engaging and realistic aspects of the learning experience by computers. It could be very simple or very complex depending on the completeness of the representation of the situation, from complete range of sensory experiences to much more simple combination of sound and pictures. It can be argued that training meaningfulness result mostly in the effective use of relevant instructional strategies then on the merely physical representation of a situation.

Many authors discussed the concept of immersion, stressing that there are at least two main aspects that should be considered in relationship with learner involvement : physical perception and cognitive perception. Effectively we spent a lot of energies on the physical aspects of possible interactions between a learner and a system, it is common to several virtual reality projects and it is strongly determined by the devices through which the user manipulate the environment .

Another direction is the design of particular systems , as Avenor Virtual Trainer, that can be given a set of attributes and defined rules about the task or activity represented where the learner can directly manipulate elements of the simulated environment , move around exploring this particular microworld and receive specific hints and feedback on the correctness of his actions. Another very important aspect of the immersion is the conceptual congruence between user's actions and their understanding of the knowledge embodied in the learning task. The importance of this concern is to make meaningful links between the decisions undertaken by the learner and the progress toward a possible solution. Early studies on simulation games clearly shown that the learner shouldn't achieve any significant progress only randomly selecting or making decisions completely on his own. We should be thinking in terms of giving him more simple to complex feedback, allowing him the possibility to select pre-established set of possible answers or some models of decisional path. More important within the interactive multimedia simulation the active involvement of the learner will lead to conceptual understanding directly about the situation in which he is working. This

BEST COPY AVAILABLE

is one of the major aspect that has been taken into account while designing Avenor Virtual Trainer (AVT). As we will see further , the AVT can allow different accesses to the same information, can provide several tools and diversified level feedback.

Fidelity of model representation

As we already stressed, in designing interactive simulation learning environments, one of the major concern is the domain model represented inside. Unlike in many traditional CBT learning environment , where the learner can only interact with some instructional design decisions carried by the system, within a simulation-based discovery system the model of the domain is represented, is executable and independent from the instructional strategy layer that could be added by the designer.

The interaction that results from this new kind of situations where learning complex skills relate to how the learner can move and manipulate objects efficiently in a three dimensional environments, has not been deeply explored. We argue that a novice that is attempting to process a large amount of knowledge trying to organize and integrate new information in his mental structure, he could be effectively involved if the domain model is realistic and allow him to operate as he was on the real situation. And this also if the simulation is implemented in a simple environment. By the nature of the interface and the three dimensionality of the interaction with this kind of context, learner cannot be passive, unlike in other learning situations that even implemented in a multimedia way present set of pre-established decisions in a very linear way. Effectively several study already expressed their doubts about a significant transfer of learning from a situation where the learner is not really stimulated to make decision on a realistic model to the real task.

Simulation models are designed to calculate the values of different variables from a given learner input. The potential of dynamic simulation is that a learner can manipulate these variables before or during on going interactions within the simulation seeing the results of his decisions. There is not a real problem, since the learner can focus on the single simulation and the system is only reactive to the learner actions and the procedural progression. A new challenge is when we want to add the instructional level as in a guided discovery environment (Dede, 1995, Dede and *al*., 1996), the learning environment needs to be aware of the state of the simulation, the progression of the learner and the state of the instructional events that could be dependant in a specific context. As the design of the interaction is mainly focused on a mixed-initiative between the system and the learner each of these state may be changing at every moment, by a learner decision or by an occurrence of a specific event in the simulation. The instructional events should be aware of these changing states and they should be able to change the kind of interaction and guidance during the learning process, intervening directly on the simulated model or giving hints to the learner.

Meaningful learning practice in a simulation environment: Avenor VT

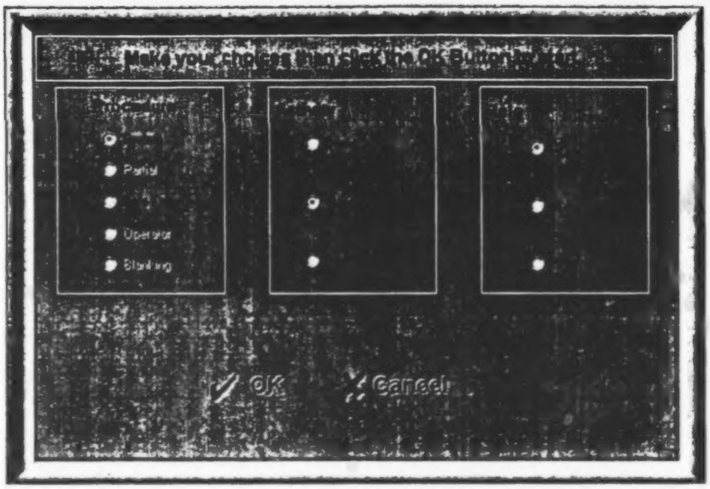
Several authors described crucial features related to way of thinking in a formal learning settings, focusing on the crucial aspects of situated learning and cognitive apprenticeship as powerful approaches to develop higher learning experiences. It has been argued that we should try to implement learning situations where we can observe, coach and practice to be effective. Where the novice-apprentice repeatedly observe a model mastering a given task or process, followed by an attempt of the learner to execute the task with a certain guidance (coaching) and ultimately reducing the participation of the system guidance (fading) as the novice can demonstrate the mastery of new skills. Furthermore, we should help the learners to articulate their knowledge, through reasoning or problem-solving process, enable the learners to reflect comparing their own problem solving process with those of an expert and finally but not less important, push the learners to explore more deeply in a problem solving mode on their own. We truly believe that we could rich a very meaningful learning experience through increased immersion, task realism, fidelity of representation and learner involvement Zhang and Norman, D.A., 1994).

Avenor Project Description

Interacting within the VT simulation

As we discussed previously, the learner at any moment can choose to interact in a different way and at different levels through the simulation. The main characteristic of Avenor VT, is that the learner can select to interact with different lockout procedures, from simple to more complex and he can learn, practice and refine these procedures playing different roles. He can switch from an *observer* learning strategy, watching *demonstrations* of TSL (Total System Lockout), PSL (Partial System Lockout), SEP (Safe Entry Procedure), and OL (Operator Lockout) Procedures, to a *practitioner* strategy through which he can *practice* performing TSL (Total System Lockout), PSL (Partial System Lockout), SEP (Safe Entry Procedure), and OL (Operator Lockout) Procedures.

For each Practice session, the learner can choose to play the role of the Operator (OP), the System Lockout Assistant (SLA), or the Person Performing Work (PPW). Naturally for each one of these different roles, the knowledge and skills to acquire and apply are different an complementary. The learner can analyze and define the task to be accomplished under different circumstances, in a different perspective and with several diversified constraints.



The feedback dimension during the interaction is very important, the learner depending the role and the procedure selected, receives contextual hints and feedback according to his actions and decisions. Object pop-up hints in the VR window are not provided during a Practice session to make things a little more challenging. However, the following feedback is provided:

1. Instructions are displayed in the *Status Bar* at the bottom of the screen. The learner can hide the instructions to simulate Practical Test conditions by clicking on the *Show Instruction* check box to remove the check mark.
2. A warning sound is played when the learner attempt to take an incorrect action.
   He cannot *fail* a Practice activity and his results are not recorded.

When the *Procedure* dialogue box will disappear the learner can start the practice activity.

When the practice starts, the *Play* button will change to a *Stop* button. At any time the learner can click on the *Stop* button to change the mode of interaction. Although, a practice activity cannot be paused, it must be completed from start to finish.

During a Practice session, the role the learner selected and the current role players will be displayed in the right-hand area of the screen. The selected role remains constant during the session, while the current role players will change as the situation changes.

For example, the picture shown below indicates that the learner has selected the Operator role and that the current role characters are the Operator and the System Lockout Assistant. In effect, this means that it is now time for learner (the Operator) to act because there is a match between the selected role player and one the current role players (figure 1).

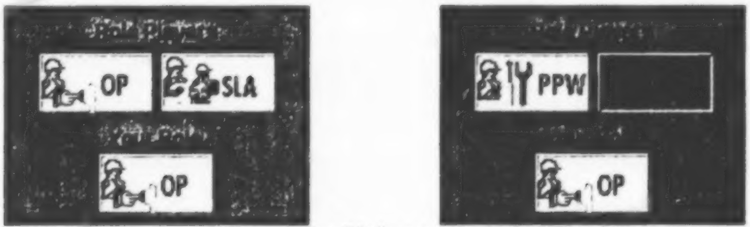


Figure 1: Possible learner roles in the VT environment

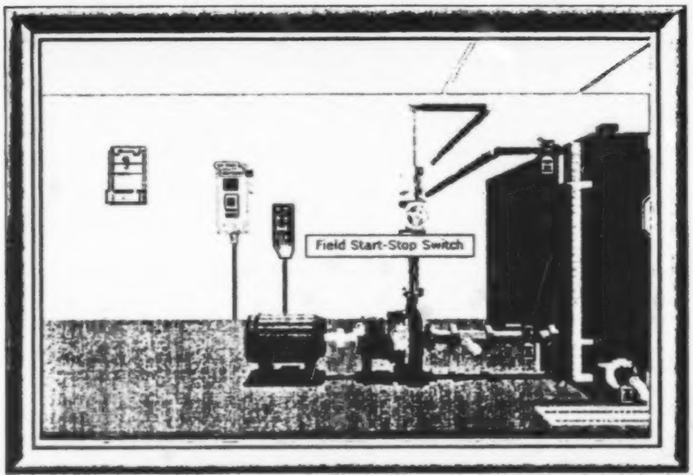
At times, the selected role player will not be one of the current role player(s). In these situations, the current role player(s) will act automatically and the learner will see a VR Movie of these actions.

For example, the picture shown below indicates that the learner has selected the Operator role and that there is only one current role player - the Person Performing Work. In effect, this means that it is not time for the learner (the Operator) to act because there is no match between the selected role player and one the current role players. Instead, a VT Movie will run which shows the Person Performing Work in action.

Other dimensions are also dispensable by VT when the learner immerse in the environment (fig.2). Some allows him to act as explorer, other as learner practicing some procedures or task.

BEST COPY AVAILABLE

Figure 2: VT environment when the learner is practicing some specific task



Note here that the pop -up hint appears beside the object to facilitate the associative process. It is help the learner to become more selective activating discriminatory processes.
Table I resumes the principles dimensions available in the VT environment.

Table I: VT principles dimensions

VT Dimensions	*Learners possible actions*
Access mode	- *Logging-in*: create user-defined administrators, training supervisors and trainees. - *Explore mode*: the learner can browse around the 3D environment. He can select any of available - *Procedure mode*: the learner can watch demos of Lockout procedures. Ha can also practice them and test his skills with a Practical Test.
Exploration and practice	- *Looking around*: Its allows the learner to rotate his viewpoint to right or left. The learner has a complete control to explore the environments and he will receive only descriptive feedback. Its allows him to built a declarative understanding of the situation. - *Finding object*: by moving the mouse, the mouse pointer changes to a hand shape and identify the objects as one that the learner can get a definition and a quiz question for. It allows learner to be more selective activating discriminatory processes. - *Selecting object*: selecting an object, an image appears in the Current Object panel giving the learner Object Name Panel and a Definition panel appears in the lower-left area of the screen. - *Manipulating objects*: the mouse pointer changes to a fist when it is over object. This means that the learner can manipulate the object by clicking on. By zoom-out moving the learner has the possibility to see better significant details of a particular elements and refine his action or decision. - *Getting the tools*: during the interaction, when the learner is in Procedure mode, he can practice and test his skills in performing an Energy Control Procedure. A feedback will be given in order to guide him to select the right set of tools. - *Applying the tools*: the learner is asked to manipulate a specific object adjusting to the right position. The interaction lead the learner to activate several learning process, observing, moving around the object, selecting the right procedures to be applied and manipulating more in detail the tool elements.

BEST COPY AVAILABLE

Formative evaluation	- *Taking the pre-test*: if the learner log-in as a trainee, he should first take the Pre-Test in order to determine his current level of knowledge about Energy Control Procedures. - *Taking a formative* quiz: in explore mode, the learner can identify his knowledge about an object or a specific task. The learner can choose a specific context in which he want or hi is acting. The feedback provided help with several hints and suggestions for further actions or decisions. - *Taking a practical test*: At the end of a series of manipulations for a given task, the learner can take Practical Test. If he takes an incorrect action, an information is provided about the action he attempted to take and the correct action that was required.

The user has other generic tools that can use at any time during his/her interaction within the system. As:

- Keeping a Diary
- Training Supervisors.
- Checking a Trainee's progress
- Training Management

Validation Methodology and some Findings

We had a three phases validation process: functional validation, pre-validation and validation.

During the functional validation, we have asked 5 Instructional Designer to interact with Avenor VT and take notes on a pre-designed matrix (Giardina and *al.*, 1997.. The main objective of this step was to verify the functioning of the Virtual Trainer situation and all its functions.

Several points arise from this preliminary validation and they could be summarized as follow :

- the importance of the availability of mapping tool, helping the user to not getting lost within the content and the simulated environment.
- the necessity of different color codes for different kind of possible manipulations during the simulated activities .
- the importance to focuses more on the activation of selective perception (visual and audio), by the integration of specific visual and audio hints.
- the importance to diversify several feedback levels focusing on the general problem solving process and on the very contextual action that is occurring.
- the importance to maintain a consistent language level within the several possible categories of textual and audio messages (ex. definitions, guidelines, helps).
- the necessity to integrate spatial hints to decrease the lack of orientation.

After this functional validation several changes have been incorporated into the Avenor Vt.

During the second phase, the pre-validation, we have asked 5 practitioners (target population) to interact with the system for at least one hour. During the interaction we have observed the interaction process with an observation grid designed to collect some attitudinal aspects (ex. curious, interested, nervous, serious, amused, concentrated) as well as some external verbal behavior (ex. exclamation, comments, questions on technical or navigational aspects, on learning activity). A trace has been also recorded by the system, keeping trace of some activities results, wrong or good answer, etc.

At the end of the interaction session (60 to 90 minutes) we collect some students' impressions with a structured interview . The design of each question was directed by our predictions about how simulated environments and realistic tasks impact learning process. We coded the responses using the following framework :

- General topics
- Navigational and Interaction tools
- Potential learning actions by the learner
- Coaching strategies by the systems
- Similarities with real tasks
- Multimedia content representations
- Motivational aspects.

As a very global synthesis of the results:

- the learners find the environment very challenging and stimulating.
- the learners find that their engagement within learning activities was as well and reach as in the real environment, sometimes also better.
- they pointed out the multiplicity of content representation as one of the major factor, as well as the possibility of several manipulations during the activity.
- the learners consistently rated this experience to be most like real work, or real on the job training situation.
- they characterized positively the possibility to manipulate directly making errors, seeing immediately the consequences and having the possibility to refine their decision.
- the learners seemed to prefer an audio comment while they were manipulating an element.
- they justified the audio preference by an increased concentration on the task.
- the challenge and the complexity of the activities seemed to maintain the learners interest.
- the fact that all the students tried very hard to accomplish all the tasks solving the different problems presented to them, suggest that the learners were truly engaged in the activity.

- the learners stressed the importance of the very situated feedback they received, as a key factor to maintain and increase their confidence.
- our data suggested also that diversifying and increasing the realism and the complexity of the activity in a real engaging and meaningful process, can increase the student learning expectations.

After this pre-validation step, we reformulated some questions of the structured interview that were to much answer-inductive and we refined some question items based on some emerging unexpected points. (ex. redundancy between textual and audio messages, possibility to personalize several parameters during the learner interaction, ex. time., risk, etc.).

During the validation phase we asked 18 operators (target population) to interact with Avenor VT and we used the same revised collecting tools (observing grid, trace and structured interview) as in the pre-validating phase.

Analyzing, condensing and presenting the data, we observed several results :

- the users that have already a better understanding of the task they perform better during the simulation
- the users that have more refined mental model of the simulated environment they interact in a deeper way and they try more complex activities.
- the users that have no mental model of the simulated environment or task they get lost much easier and more frequently.
- the users' ability to refine or build such mental model depend on the time spent to interact with the system.
- the possibility to access multiple representation and manipulation of an activity seems to reduce considerably the time to build a more precise mental model of the task.
- the possibility to make errors during the activity, see the realistic consequences and have the possibility to readjust our decision seems to have a direct impact on the learning time.
- the possibility to choose different role to play during the interaction with the system, seems to bring a deeper understanding of the problems related to the real task.
- the majority of the users mentioned the importance of the feedback dimension and stressed the necessity to improve it, situating and diversifying more the messages.
- most users have employed the demo state of the system before the practice.
- the majority of the users seemed to use the formative quiz as a learning tool during the interaction, to self-assess the lack of understanding during interaction with the system.
- the interaction through a reactive simulated training environment seems to build a deeper confidence for the learner to solve complex situations.

Conclusion

Within the Avenor Virtual Trainer project, we tried to integrate the new potential of both the technology and learning strategies to improve the possible understanding during the learning process.

Of course we related in this article only a synthesis of some findings that we think could give some interesting directions of reflections .

Effectively the project has been designed to improve the access to an information simulated environment through several different tools and dimensions provided to the learner by:

- Elaborating accessible and useable tools to allow the learner to meaningfully interact within a multimedia representation of a situation.
- Providing an adaptive textual and audio feedback and coherent navigational and information metaphor which requires minimal explanation for the learner to understand and manipulate it.
- Supplying several problems and tasks to solve based on the information embedded in the simulation.
- Providing a formative evaluation dimension along the all learning process as well as a pre and post test evaluation to have some indications in terms of learning gain.

It seems to us that this study on Interactive Simulated Training Environments let emerge the importance of continuing the research and development on the pedagogical integration of new technology within the learning process. Already some concerns related to this experience seem to suggest that learning strategies such as exploration, simulation , problem solving, personalized feedback among others, if they are systematically designed and implemented in a realistic mediated situation can have an important impact on cognitive and affective dimensions of the learning process.

Bibliography

Dede, C., (1995). The Evolution of Constructivist Learning Environments: Immersion in Distributed, Virtual Words. *Educational Technology, 25*(9), 46-52.

Dede, C., Salzman, M.C. and Loftin, R.B. (1996). Sciencespace : Virtual realities for learning complex and abstract scientific concepts. Proceedings of IEEE Virtual Reality Annual International Symposium. New York : IEEE Press, 246-253.

Faryniarz, J.V. and Lockwood, L.G. (1992). Effectiveness of microcomputer simulations in stimulating environmental problem solving by community college students. *Journal of Research in Science Teaching, 29*, 453-470.

Giardina, M. and Brouillard, J. (1998). Concevoir l'activité d'apprentissage dans un environnement immersif de réalité virtuelle. In L. Sauvé (Ed.) *Partenaires de la technologie éducative: université, milieu scolaire et entreprises*. CIPTE,: Université du Québec, Téle-Université Québec, Canada.

Giardina, M. and Brisebois, A. (1996). La modélisation de l'apprenant, analyse des diverses composantes pour l'élaboration d'un métamodèle. In L. Sauvé (Ed). *La technologie éducative en réseau : réseaux technologiques, réseaux humains*. CIPTE : Téle-Université, Québec, Canada.

Giardina, M.; Dassa, C. and Meunier, C. (1992). The Integration of Multimedia Learning System and Intelligent Dimension Through Knowledge Representation, Learner Model and Diagnostic Evaluation Design Issues. *Proceedings of Orlando Multimedia '92*, Salt, 116-174.

Giardina, M. and Laurier, M. (1999) Modélisation de l'apprenant et interactivité. *Revue des sciences de l'éducation, 25*, (1), 43-66.

Grimes, P.W. and Wiley, T.E. (1990). The effectiveness of microcomputer simulations in the principles of economics course. *Computer & Education, 14*, 81-86.

Jong, T. de, Hoog, R. de, and Vries, F. de (1992). Coping with complex environments : The effects of navigation support and transparent interface on learning with computer simulation. *International Journal of Man-Machine Studies, 39*, 621-639.

Jong, T. de, Joolingen, W.R. van, Scott, D., Hoog, R. de, Lapied, L. and Valent, R. (1994) SMISLE : system for multimedia simulation learning environments. In T. de Jong and L. Sarti (Eds.) *Design and production of multimedia and simulation-based learning material*. Dordrecht : Kluwer, 133-166.

Shute V. (1996). SMART: Student Modeling Approach for Responsive Tutoring. *User Modeling and User Adapted Interaction*. Special Issue, p. 57-72

Shute, V.J. and Glaser, R. (1990). A large scale evaluation of an intelligent discovery world : Smithtown. *Interactive Learning Environments, 1*, 51-77.

Shute, V.J. (1993). A macroadaptative approach to tutoring. *Journal of Artificial Intelligence & Education, 4*(1), 61-93.

Shute, V. (1994). Regarding the I in ITS : student modeling. Paper at *ED-MEDIA-94*, Vancouver.

Zhang,J. et Norman, D.A. (1994). Representations of distributed cognitive tasks. *Cognitive science, 18*, 87-122.

Acknowledgements

This project was developed in collaboration with IDGroup Enterprise, its president Richard Bouchard and deeply involvement of all his team.

Playing Teacher

Juan E. Gilbert[1]
Auburn University
Computer Science & Software Engineering
107 Dunstan Hall
Auburn, AL 36849 USA
gilbert@eng.auburn.edu

Abstract: The acceptance of animation technologies into our culture is growing within the up coming generations. Video games such as Sony PlayStation (SONY 2002) have become part of the culture for young people from kindergarten through undergraduate school. Animation technologies have been implemented into educational systems in the form of animated pedagogical agents (Johnson 2000). The research described here aims to take advantage of this wide spread acceptance of animation technologies by introducing animated pedagogical agents as teachers in an adaptive instruction environment called Adam.

Introduction

Gilbert (1999) discussed the implementation of an adaptive instruction system called Arthur. In this paper, Gilbert introduced the Many-to-One (M-1) instructional model. The M-1 instructional model refers to the relationship between educators and learners. In this model, there are many educators per learner. In order to fully understand this model, some terminology must be introduced. In this paper, courses are composed of many lessons. As an example, on a typical syllabus, there are many lessons listed that will be discussed through out the course. Lessons can be further divided into one or more concepts. Concepts are the smallest unit of instruction. These concepts are called instructional units through out this paper. An instructional unit has two subsections, instruction and assessment. In other words, each instructional unit has instruction, which is followed by an assessment for that instruction. Figure 1 gives an illustration of the M-1 instructional model.

In figure 1, there are three educators, Lopez, Brown and Smith, that teach the same course. This course has five instructional units. The rows represent a single course that is taught by the educator on the left. Therefore, figure 1 contains three implementations of the same course taught by three different educators. Each educator uses his or her own pedagogical methods to deliver instruction. The columns in figure 1 represent instructional units. Each instructional unit consists of instruction and an assessment created by the instructor at the top of the column. This implementation is how the M-1 instructional model begins. Another way to conceptualize the M-1 instructional model is to imagine a single learner in a classroom full of educators that teach the same subject, but each educators teaches the subject using a different pedagogical approach. In the physical implementation, the M-1 instructional model is not feasible. Using technology, such as the internet, it is possible to implement a representation of the M-1 instructional model. This implementation will be called Adam.

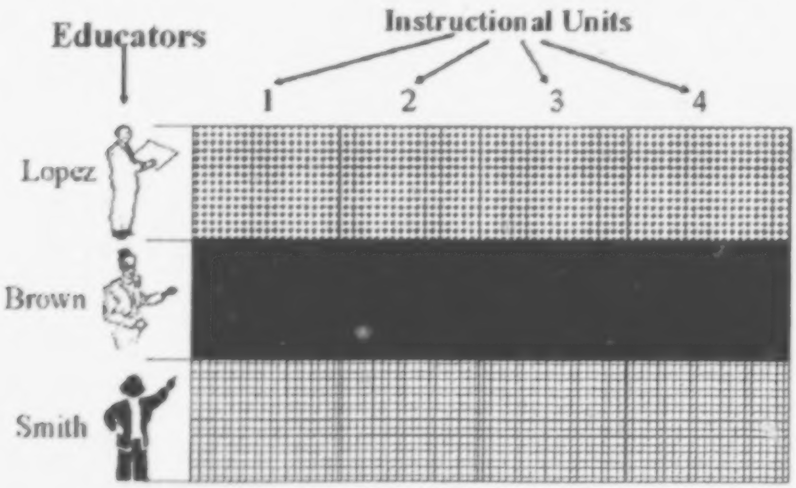


Figure 1: Many-to-One Instructional Model

BEST COPY AVAILABLE

Architecture

The physical architecture of the Adam environment begins with a web server and an instruction repository. This web server is the agent server. The agent server will host all of the instructional units that were described in the previous section. The instructional units are stored in an instruction repository. Each instructional unit is maintained as a web deliverable, instructional screenplay. The instructional screenplays will be discussed in further detail in the instruction creation section below. Instructional meta data such as the instructional unit's name, description, author's contact information, etc. will be stored in the repository for each instructional unit. This data comes alive when it is accessed by one of the delivery systems.

Delivery Systems

Delivery systems can exist on different web servers or they can reside on the agent server. Delivery systems select instructional units from the instruction repository. This process is called instruction method selection, which is discussed in further detail in the instruction delivery section. Recall that each instructional unit is composed of instruction and assessment. The instruction has been created by an educator using his or her own pedagogical style(s). When a learner uses Adam, the learner will be assigned an instructional unit from the instruction repository. The process of selecting an instructional unit, instruction method selection, occurs inside of the delivery systems. Figure 2 gives an illustration of how delivery systems interact with the agent server and the learners. Notice that there can be more than one delivery system.

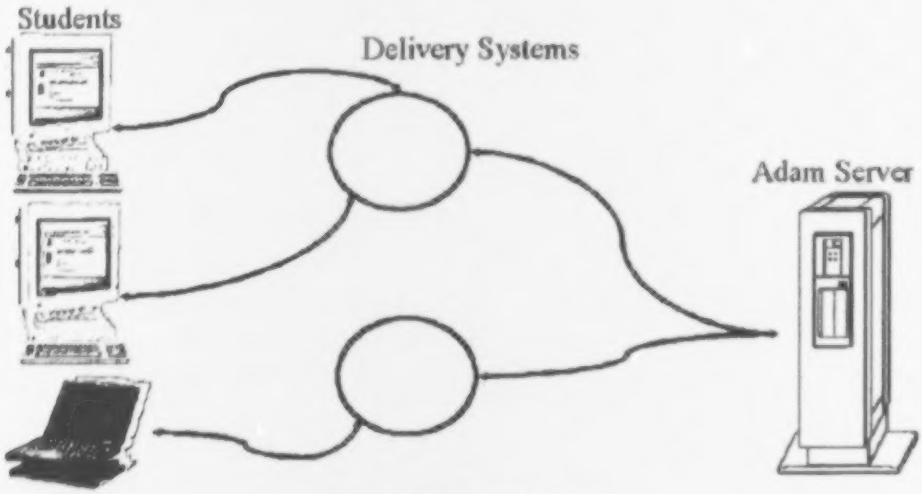


Figure 2: Adam Architecture

This is due to the fact that instruction method selection may vary. For example, in figure 1 the instructional units are numbered 1 through 4. The sequence for selecting these units may be 1, 2, 3 and 4 for a specific delivery system. For another delivery system, the sequence may be 2, 1, 3 and 4. This is an example of curriculum sequencing, which is the order in which instructional units are selected. Curriculum sequencing is just one variable that distinguishes delivery systems. The other variables will be discussed in the instruction delivery section. The server side of Adam has been discussed in this section and the user interface or client side follows.

User Interface

The user interface can be divided into two sections, navigation and content. Figure 3 has an illustration of the user interface layout. On the right hand side of the user interface there is a navigation frame. The navigation frame consists of a control panel and an animated pedagogical agent (Johnson 2000). The control panel allows the learner to start and stop a session, submit a question, logout, change the teacher's persona and to review previously seen instructional units. When the learner starts a session, the agent will begin to deliver instruction by speaking and manipulating web pages and/or objects in the content frame. The content frame is where all manipulatives used during instruction will appear. The agents used in this environment are implemented in the form of a web browser plug-in. This plug-in was developed by Haptek (2002). The

BEST COPY AVAILABLE

Haptek plug-in is downloadable and works on windows based machines. The plug-in performs text to speech in English and Spanish. It also provides voice manipulation and face animation. The face animation controls allow the developer to manipulate the agent's emotions in real time. The agent plays the role of educator in an elaborate educational screenplay.

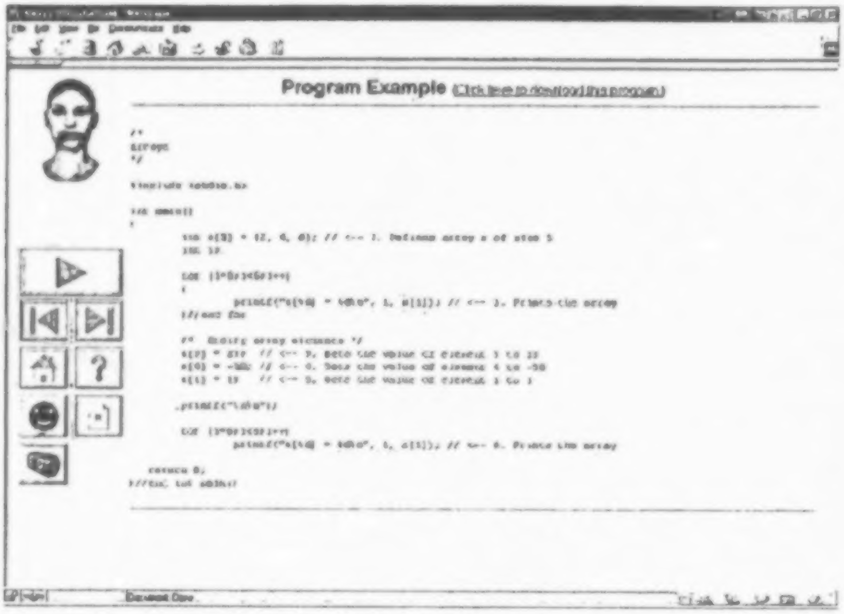


Figure 3: User Interface Layout

Instruction Creation

Before learners can use Adam, instruction must be created and implemented into Adam's architecture. The process of instruction creation is very tedious in its current state. The output of the instruction creation process is an educational screenplay that stars animated pedagogical agents. The process begins with real educators. In the current implementation, educators are video taped in a tutoring environment. The materials and all other manipulatives used during the tutoring session are collected when the session ends. Each session is focused on a specific concept. Recall, that concepts are later transformed into instructional units. The educators are also asked to create an assessment in the form of a quiz for each session. The goal of the assessment is to determine if the learner understood the concept(s). This process will be executed for a number of concepts with different educators. Once all of the concepts and assessments have been collected, the conceptual level of a Many-to-One instructional model can be implemented. In figure 1, there are three educators and four instructional units. Those instructional units would have been captured on video tape and the assessments created by each educator for those concepts will be collected as well. After all the concepts have been video taped from each educator and all the assessments have been collected, the instructional units will be created in the form of screenplays.

Creating Screenplays

The video tape of the tutoring sessions will be used to extract the educator's words as a digital audio file, .wav format. The .wav files of the educator's instruction will be transformed into compressed digital audio files that contain face animation information using Haptek's People Putty product. The output of this process is a .ogg file. In addition, each manipulative that the educators used will be transformed into a web deliverable format, i.e. html, video, Java, Flash. For example, everything that an educator writes or manipulates during the tutoring session will be transformed into a web compliant format. Next, the .ogg files and all the web deliverable materials will be placed along a conceptual timeline. This timeline is a reenactment of the tutoring session minus the physical presence of the educator and the learner. For example, an educator begins the tutoring session with a verbal introduction of a concept. This introduction may last 20 seconds. At that time, the educators writes a couple of sentences on a piece of paper or a chalk board. These actions would be replicated along

BEST COPY AVAILABLE

the conceptual timeline. Once the audio and materials have been conceptually synchronized, the educational screenplay will be stored in the instruction repository.

Storing Screenplays

The educational screenplays are stored in the instruction repository as instructional units. Recall, that instructional units are composed of instruction and assessment. From each tutoring session with a real educator, instruction is captured in the form of digital audio and web deliverable materials along a conceptual timeline. The assessments are also collected and converted into a web deliverable quiz. The instruction repository will house the digital audio/.ogg files, web deliverable materials and the conceptual ordering of the two together. The location or web address of the web deliverable materials is stored in the database on the agent server. This allows each web deliverable manipulative to be accessed via its web address, or url. This instruction creation process is very time consuming and labor intensive. In an effort to automate this process, an authoring tool is being developed.

Instruction Delivery

After the instructional units have been created and stored as screenplays with assessments, learners will be given access to them. When a learner uses Adam, the first task presented to the learner will be the educator selection screen. Figure 4 has a sample educator selection screen.

In figure 4, there are six different animated agents that can play the role of educator. Each agent has a different persona. Each agent has a unique persona that separates it from the others. Personas can differ in appearance and facial expression. Educator selection is similar to persona selection seen in popular video games such as Sony PlayStation (SONY 2002). In the video games, each player selects a team or person to represent him/her in the game. In Adam, the learner selects a teacher to provide instruction. The instruction behind the agent is stored on the agent server in the form of instructional units. Once the learner selects an agent educator, an instruction unit will be selected from the instruction repository.

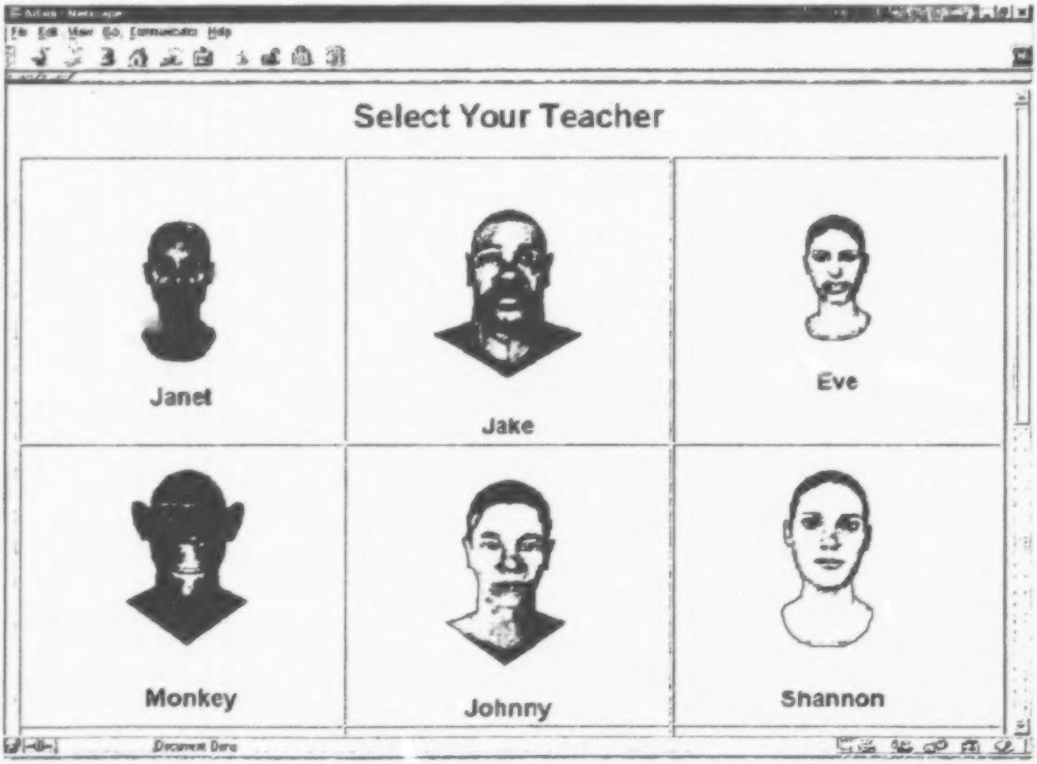


Figure 4: Educator Selection

BEST COPY AVAILABLE

Instruction Method Selection

The process of selecting an instructional unit from the instruction repository is called instruction method selection. Instruction method selection occurs at two distinct points within Adam, entry and after assessment. The first is the point of entry. When the learner selects an agent teacher, instruction method selection must occur. For example, learner Kristian logs into Adam. When Kristian enters Adam, a delivery system will be assigned to his course. Next, Kristian is presented with the educator selection screen in figure 4. He selects the first agent, Jake, along the bottom row to be his teacher. The system will refer to the instruction repository and select instructional unit number 1 from figure 1. Because Kristian is new to Adam, the first instructional unit will be selected at random. Notice that in figure 1, there are three different instructional unit number 1s. Assume Ms. Boykin's, the teacher in the middle, instructional unit 1 was selected. After the instructional unit has been selected, the interface will change and Kristian will be presented with the interface seen in figure 3 with Jake as the teacher. When Kristian presses the Play button on the control panel, Jake will begin to speak the transcribed text recorded from Ms. Boykin's tutoring session. The content in the right frame, figure 3, will change and display the web deliverable versions of Ms. Boykin's materials. This is the educational screenplay of instructional unit number 1 modeled after Ms. Boykin's tutoring session taught by Jake. Upon completion of instructional unit number 1, Kristian will be given the assessment created by Ms. Boykin for instructional unit number 1. After Kristian completes the assessment quiz, instruction method selection will occur again.

The completion of each instructional unit is marked by an assessment quiz. If the learner performs well on the assessment quiz, then the learner is presented with the next logical instructional unit using the same educator. For example, if Kristian performs well on the assessment quiz for instructional unit number 1, then he will be presented with instructional unit number 2, the next logical instructional unit, created by Ms. Boykin. In general, performing well is observed when the learner scores above a certain threshold. This threshold can be called the performance threshold. This may vary across delivery systems. For example, Gilbert [4] used a performance threshold of eighty percent for his studies. In other words, the learners had to score eighty percent or higher on their assessments before they could move onto the next logical instructional unit. Eighty percent was selected based upon mastery learning theory (Bloom 1976), where an eighty percent score determines mastery of a subject. Other delivery systems may set the performance threshold higher, i.e. ninety percent, or lower, i.e. seventy percent. In either case, the performance threshold must be met or exceeded before the learner can proceed onto the next logical instructional unit. If the learner scores below the performance threshold, then the learner will receive corrective instruction, which requires instruction method selection. Corrective instruction can be viewed as instruction that covers the same concept, but it is explained a different way. Therefore, the same subject is taught using a different instruction method. This process of providing corrective instruction when the learner falls below the performance threshold is called adaptive instruction.

Adaptive Instruction

Adaptive instruction refers to the process of adapting the instruction method in order to provide the learner with a personalized instructional experience. In some cases, adaptive instruction aims to accommodate learning style (Dunn 1978). In either case, adaptive instruction requires that an instruction method will be selected from a pool of varying instruction methods as seen in figure 1. Gilbert(2000) used a form of case-based reasoning to provide adaptive instruction in his studies. Each assessment quiz was defined as a case in those studies. All the cases consisted of similar attributes such as title, number of questions, number of questions answered correctly, etc. When a learner performed poorly on an assessment, the learner's assessment quiz would be transformed into a case. This case would be compared to previous learner cases. If a previous learner has performed in a similar manner as the current learner on the same assessment quiz, then the system would assign the current learner an instruction method based upon the previous learner's experience. This concept is based upon the premise that learners that perform similarly on the same assessments, may have similar learning styles. Therefore, establishing assessment quizzes as cases affords the ability to compare learners' assessments. For example, assume Kristian scored a seventy percent on the assessment quiz for instructional unit number 1 where the performance threshold was set to eighty percent. This quiz consisted of ten question and Kristian missed questions 5, 9 and 10. Also, assume a previous learner, Deborah, scored seventy percent on the same quiz, but she missed questions 5, 8 and 9. In the database, there is a case for Deborah and Kristian. Deborah's case contains information that shows she later passed instructional unit number 1 using Mr. Gabriel's instructional unit. Therefore, the system would assign Kristian Mr. Gabriel's instructional unit number 1 because Kristian and Deborah's assessment cases are closely matched and Mr. Gabriel's instructional unit number 1 worked well for Deborah. Adaptive instruction can occur throughout the learner's travel through Adam. An end result once the learner completes a course will be a learner map. The learner map represents all of the various instructional units selected by Adam. It is possible to compare learner maps at the end of the course in order to identify similarities between learners.

Conclusions

With the acceptance and integration of animation technologies into society, Adam has the opportunity to make a significant impact in providing universal access to alternative forms of instruction. As technology integrates further into the common household, tools such as Adam will give access to instruction from educators that would normally be out of reach. Adam has the ability to provide culturally responsive instruction to learners where their culture is not represented. For example, rural communities will be given access to instruction created by educators from across the globe. The demographic limitations of instruction are broken down by Adam.

Adam is part of an extensive research study that is supported by the National Science Foundation. Adam's instruction repository is currently being populated with instruction. The first prototype of Adam is being tested using introductory level computer science programming. On the instruction creation side, an authoring tool will be developed that will allow educators to create educational screenplays online. This tool is being called Eve. The tool will feature an animated pedagogical agent that plays the role of instructional designer. The agent will assists educators during the creation of their instructional units as screenplays. Educators will record their voice for instruction, which will be spoken during the screenplay. The educators will also have the ability to type in text that will be displayed on the screen and upload other web deliverable objects, i.e.: images. All of their materials will be stored on the agent server. The agent instructional designer will guide the educators through this process. It is estimated that Eve will be implemented within the next two years.

References

1. Bloom, B.S., *Human characteristics and school learning*. New York: McGraw Hill, 1976.
2. Dunn, K., and Dunn, R., *Teaching students through their individual learning styles: A practical approach*. Reston, VA: Reston Publishing, 1978.
3. Gilbert, J.E. and Han, C.Y. Adapting Instruction in Search of "A Significant Difference". *Journal of Network and Computing Applications, 22, 3.* (1999), 149-160.
4. Gilbert, J.E. and Han, C.Y. Researching Adaptive Instruction. Brusilovsky, P., Stock, O. and Strapparava, C. (eds.), Lecture Notes in Computer Science , 1892, *Adaptive Hypermedia and Adaptive Web-Based Systems*. pp. 409-414, 2000.
5. Haptek. Available at http://www.haptek.com/.
6. Johnson, W.L., Rickel, J.W., and Lester, J.C. Animated Pedagogical Agents: Face-to-Face Interaction in Interactive Learning Environments. *International Journal of Artificial Intelligence in Education 11* (2000), 47-78.
7. SONY PlayStation North America. Available at http://www.scea.com/.

[1] The research of this author is supported under the National Science Foundation grant #EIA-0085952.

Mobile Lessons

Lessons Based on Geo-Referenced Information

Sylvain Giroux
Département de mathématiques et informatique
Faculté des sciences
Université de Sherbrooke
2500, boul. Université,
Sherbrooke, Qc
Canada, J1K 2R1
e-mail: sylvain.giroux@dmi.usherb.ca

Claude Moulin , Raffaella Sanna, Antonio Pintus
CRS4 (Centre for Advanced Studies, Research and Development in Sardinia)
VI Strada OVEST, Z.I. Macchiareddu
C.P. 94, 09010 Uta (CA) – Italy
e-mail: {moulin, raffa, pintux}@crs4.it

Abstract: We coined the term "mobile lessons" for lessons held outside of "artificial" environments as classrooms. During these lessons, all actors are mobile and must move to do the required tasks. Themes tackled in such lessons may be as varied as geography, history, ecology, dialects in linguistics... Mobile lessons are not a new teaching strategy, but new mobile devices may render it more efficient and more attractive. The aim is to place students in conditions germane to the ones in which experts work. We implemented in Java a software for creating and using mobile lessons and for monitoring students on the field. Contents and questions are in XML. Using this software, teachers of a high school in Sardinia (Italy) developed and experimented a mobile lesson on the archaeological site of Nora. Under the light of this experiment, a wireless, distributed and more sophisticated version of the software is under development.

Introduction

We coined the term "mobile lessons" for lessons held outside of a classroom, a science laboratory or any room situated inside the school. During such lessons, all actors are mobile and must move to perform the required tasks. Themes tackled in such lessons may be as varied as geophysics and mineralogy in geography, monuments in history, trees and ecosystems in biology, distance measuring in physics and geometry, or dialects in linguistics... Mobile lessons are not a new teaching technology or strategy, but new mobile devices may render them more efficient and more attractive. We believe that students better build their knowledge by going on the field, looking for information and by observing the real phenomenon. In other words students are put in conditions germane to the ones in which experts work. They feel more involved and must behave autonomously.

To integrate mobile devices in our constructivist "on the field" approach to learning, we designed and implemented a software we called `MobileLessons`. This software helps teachers to create lessons capitalizing on mobile devices. It also enables students to perform them on the field and finally provides tools to teachers to monitor students on the field in real-time. The implementation is in Java. Lesson contents and questions are specified in XML. The whole implementation relies on e-mate[1] (Giroux et al., 2001). E-mate is a framework for the delivery of mobile personalized geo-referenced services over many channels (PCs, personal digital assistants (PDAs), cellular phones…) and using multi-modality (text, image, sound…). The platform provides distributed services over the Internet. Most of them are accessible either from a computer, a personal digital assistant (PDA), or a cellular phone. A very interesting feature of e-mate is the generation on the fly of a usable interface for any device. Some services may be either written from scratch, or may result as a composition of others. Three scenarios are illustrating the possibilities of the e-mate platform. This paper focuses on the one we called "mobile lesson".

---

[1] E-mate stands for Multi-modal Architecture for Telematics Environment. The E-mate project began on January 2000 and must go on till July 2002. It is held at the Centre for Advanced Studies, Research and Development in Sardinia (CRS4) and is funded by the Italian Ministry of the Universities and Scientific Research.

The first release of `MobileLessons` was experimented in 2001. In the paper, we first describe the experiment of a mobile lesson, based on the exploration of a Roman archaeological site in Sardinia, Italy. In this experiment students used laptops connected to GPS. Then we present the concept of personalized course based on geo-referenced data, showing their preparation, their execution and their exploitation. Next we show how pedagogical strategies can be developed based on these lessons. Under the light of this experiment, a second release more powerful and more sophisticated of `Mobile Lessons` was developed. We present the second phase of the development of the mobile lesson infrastructure where students will use personal digital assistant connected to GPS system. In this second release, a mobile lesson is implemented as a set of distributed components called services, accessible through internet connection. We also describe briefly the system architecture which allows such services to be reached from different devices.

Experimentation

Using `MobileLessons`, teachers of a high school in Sardinia (Italy) developed and experimented a mobile lesson for the archaeological site of Nora[2]. This site is very interesting from an historical perspective because it contains both Punic and Roman ruins. The lesson was performed in June 2001 with a class of 12-13 years old students.

In the preparation of the lesson we followed two axis. The pedagogical axis addressed the lesson content itself, but also its prerequisites. In our case, some courses on the Roman civilization were necessary. These arguments were part of the pedagogical program of the class chosen for the mobile lesson. The software axis led us to build an application for both the edition of the lesson content and the management and monitoring of the students' work on the field.

While preparing the mobile lesson, teachers identified first zones of interest , then a set of hot spots for each zone (Figure 1). Hot spots correspond to precise location. Knowing the exact position of a student enables to ask precise questions on what she can see. So teachers first went to the chosen site with a GPS system and pointed out the coordinates of each hot spot. The objective was to bring students to discover these points once on the field. The information given by the GPS and associated with a position is a 2-tuple like East, 38° 59' 3,80'' ; North, 09° 00' 59,72''.

Each hot spot was then associated with other information. First a label like "the roman theatre" gives its name. Obviously, the students have to find a significant place, the theatre, and not a GPS position. But this is not enough, because the theatre is indeed a squared area whose side is more than forty meters long. The students must find the right position picked up by the teacher, near the theatre. Why the teacher chose this precise point is a question they have to answer. When some difficulties occur to find the right place, explanations, help and hints are supplied progressively. Their form may be as wide-ranging as the teacher's imagination can sustain: charade, riddle, description, etc.

Once on the field, teams of two or three students using laptops connected to a GPS system (United States Department of Defence, 1995) had to discover the significant hot spots previously identified by the teachers. They can wander wherever they want. Since the site is fenced, letting them free was not an issue. When students thought they were at the right location, the one identified by teachers, they asked the `MobileLesson` for confirmation. The current GPS position is then compared to the GPS position taken by the teacher. If the current GPS position is close enough, students have access to questions related to it. They may be general questions about the reached place but often they are questions about what the students can see from this precise location. Students have only to turn or move slightly to observe the place and discover or infer the right answers. A score was associated to each hotspot and each questions to motivate the students and to give them the feeling of a game. If the position was wrong, more information about the place is supplied. Receiving it, students have to move and ask again the software if they are at the right place or not.

---

[2] http://www.nora.it/.

We used latitude and longitude to represent a GPS position. For convenience, it might be possible to transform them into UTM coordinates (Carnes, 2002) expressed in meters using a specific algorithm but for our purpose, it was not necessary. We made many tests about the precision of GPS data and we accepted a position as right with an eight to ten meters uncertainty.

What Are Geo-Referenced Data?

Mobile lessons —and the other scenarios explored within e-mate— raised for us the question of what is a geo-referenced data and they should be modelled and implemented with repect to our purposes. Geo-referenced data are information associated to a location. Data and locations may be stored in various ways, for instance in geographic information systems (GIS), in relational or XML databases, but whatever the organisation is, it must be possible to find a location from data and conversely to find all data associated to a location. For our purposes, we distinguish two types of locations: "quantitative" and "qualitative".

A quantitative location corresponds a point on the earth. For that purpose, GIS are using various kind of coordinates, but numeric values are always required. That may be a global position system (GPS) location made of two data: longitude and latitude. Longitude and latitude are angles associated with a direction. For example, the roman theatre of the archaeological site of Nora situated in the Sardinia island is located at latitude East, 38° 59' 3,80'' and longitude North: 09° 00' 59,72''.

A qualitative location is associated to a place. The concept of place depends on the semantic context. The same word may represent different places in different contexts. It may represents a sector, a city, a region, a country or anything else. For example, "Cagliari" may stand for the city, the province of Sardinia, or the island of Italy. Locations are associated with properties or predicates. The nature of the predicate depends on the location type. We can say that two GPS positions are close or not according to a precision, that a position is situated to the south of another. We may say that a city is situated in a region or not, that a country contains a region. In this sense, data and location are basically and intrinsically associated.

It is often necessary to exploit geo-referenced data to give an appropriate response to a request. The answer true or false is never enough. For instance, for the request "I am in front of the town hall of the city of Cagliari and I would like to eat a pizza", an information system must answer by a list of restaurants where pizzas are supplied and which they are located in this quarter of the city. In itself, the answer does not contain explicit information associated to locations but geo-referenced information must be exploited to get a relevant answer. If locations are associated with predicates, it is possible to make inferences based upon mathematic or semantic criteria. Naturally, it becomes necessary to organise concepts and predicates and to make inferences on them, so an ontology (Gangemi et al., 2001) is often useful to describe the semantic context of application domains.

Axis of a Mobile Lesson

Not surprisingly, mobile lesson are developed and organized along three dimensions: pedagogy, contents and technology. The next sections will describe these axis.

Pedagogical Strategies

A mobile lesson is not an isolate lesson but an element of a pedagogical sequence. It is based on previous lessons and its outcomes have to be reused in successive ones. Part of the objectives is to integrate factors that help learners to build their knowledge in a constructivist way (Dalgarno, 1998). We believe that, when it is possible, going on the field, looking for information and above all observing the real phenomenon, therefore acting in a more personal and autonomous way, are fostering the effective construction of their knowledge by students.

Obviously, these factors have to be combined to other ones like adaptability or collaboration. More generally, it is important to understand some aspects of human expertise and teaching and how tutoring systems can exploit the expertise and teaching strategies (du Boulay & Luckin, 2001). Mobile personalised and geo-referenced systems (Giroux et al., 2001) seem to be a very appropriate mean to implement such expertises (Vérillon, 2000).

Preparing a mobile lesson, a teacher selects a zone and individuates there a set of hot spots. The objective is making the students discover these points when they are on the field. Each hot spot has an associated label. So, the students are knowing that they have to find a specific place. This label doesn't indicate a point but an area and the students have to find the right position picked up by the teacher (Figure 1). A set of advice under various forms must be supplied to help students to find the right place. They are proposed gradually after no succeeding tries. When near enough, students have still to test, whether there are at the right position. The student is then bring to rebuild the same reasoning process the teacher had.

Every step necessary for discovering the right point and the use of didactic transposition (Balacheff, 1994) helps students to remember and reuse knowledge in other contexts. Generally, on an archaeological site, documentation panels are describing interesting place with many details. In order to help students find some positions (maybe the first that students naturally think of), teachers may choose points near to these panels. For other hot spots, it is better not to do so because the interesting view on the place is elsewhere or because increasing the difficulty or yielding perplexity may give an extra motivation to students.

Once found an hot spot, students have to answer questions about the place they are. It is possible for a teacher to indirectly integrate the local documentation in the course of the lesson. Students have to observe all kind of details around them for giving good answers. Mixing general questions with observation questions leads students making deduction about the behaviour of people from antic civilisation, their scientific level, their art, etc. It is also an occasion to use more than one discipline and build links between them.

Obviously, an decisive mean to motivate students (Bunt & Conati, 2001) is by making the lesson like a game. Scores are associated to discovery of hotspots and answers to questions. The less attempts are made to find a hotspot, the higher the score is. When students observe that the software decreases the value of a right answer with respect to the number of wrong attempts, a group of students is encouraged to discuss and come to a general agreement before making a proposal.

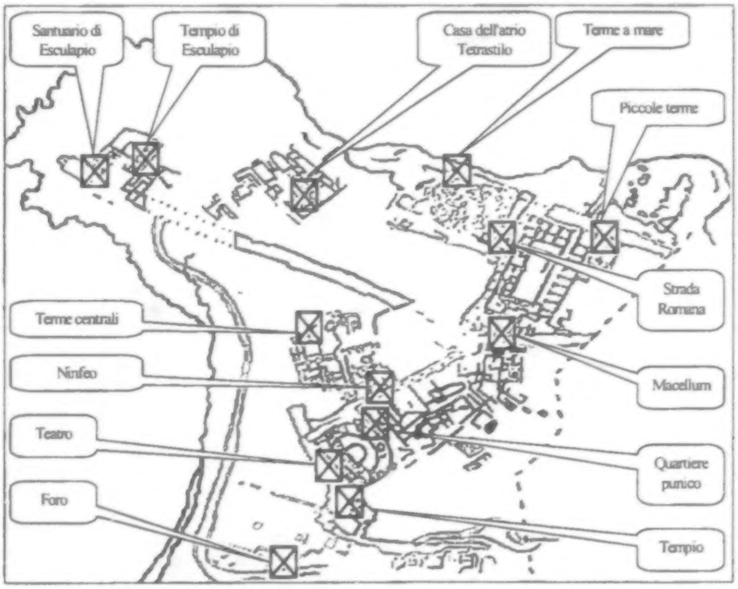


Figure 1 Hotspots chosen by teachers for the Nora mobile lesson

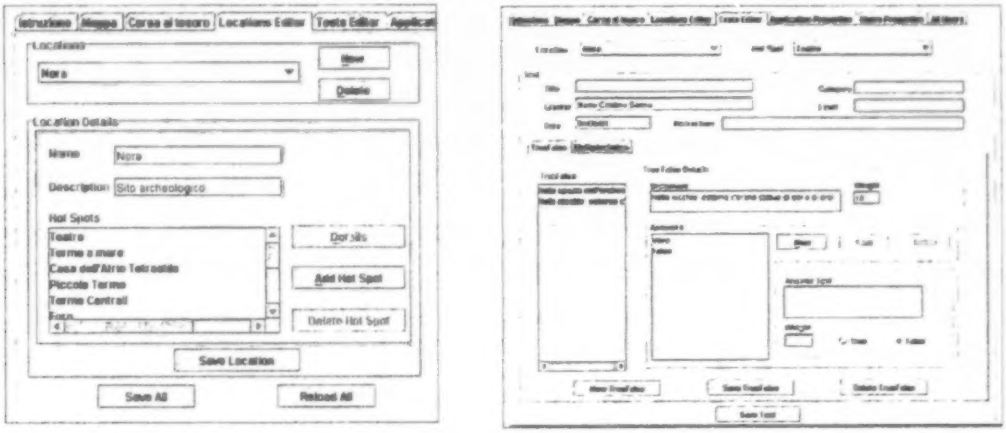
BEST COPY AVAILABLE

Lesson Organization

Content of a mobile is at the center of the four steps of the lifecycle of a mobile lesson: design, presentation, execution and exploitation.

First step: design of the lesson.

Obviously first teachers design the lesson and prepare the pedagogical material. A synopsis is made defining the theme and the objectives. A site is identified. Then teachers go on the site and identify important places and prepare location-based questions (Figure 2). They use `MobileLessons` running on a mobile computer (laptop, PDA, or mobile phone) equipped with a GPS system and connected to Internet if necessary. Finally, teachers prepare help and hint that students might receive and complete lesson description. During this step, documentation is built and referenced and a scenario that describes the tasks to complete is elaborated.



Locations: Nora

Name: Nora

Description: Sito archeologico

Hot Spots:
Teatro
Terme a mare
Casa dell'Atrio Tetrastilo
Piccole Terme
Terme Centrali
Foro

Figure 2 Hotspot editor and questions editor.

Second step: presentation of the lesson.

Once the lesson is ready, teachers present it to the class. They show the map of the site, present the tasks to do, and show also how to manipulate the devices and software. They also have to build the students' groups. The lesson is made in teams of two or three students.

Third step: lesson execution.

Then students go on the field under the responsibility of teachers. They have to follow the lesson scenario and find the places pointed out by teachers (Figure 3). They may have to find them following a precise order (different for each group) or not. Depending on the lesson theme, they have to observe monuments or site details, take notes, find minerals or vegetal, answer to questions using the help of documentation, take photo, etc. They may also have to measure things on the field as if they were scientists in a real context. If software allows it, teachers can follow the path of every group on the site map (Pfoser & Jensen, 2001). It is possible to track them if every computer sends regularly its position to a remote service.

BEST COPY AVAILABLE

Fourth step: course exploitation.

The class analyses data picked up on the field and reports can be done. Teachers may add also every kind of explanations and give general synthesis.

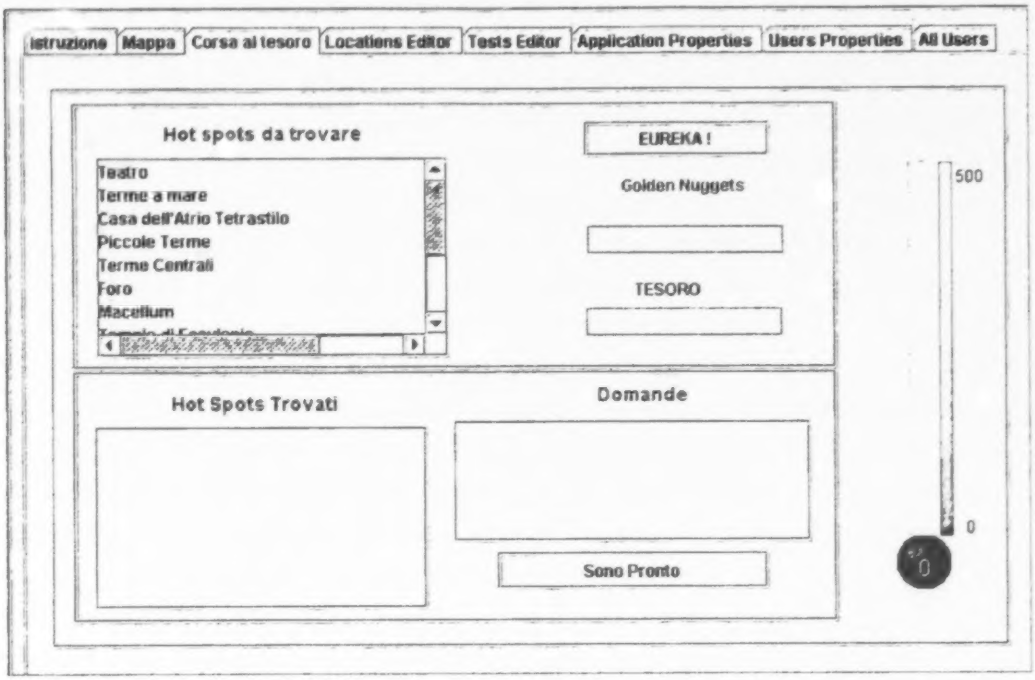

istruzione
Mappa
Corsa al tesoro
Locations Editor
Tests Editor
Application Properties
Users Properties
All Users
Hot spots da trovare
Teatro
Terme a mare
Casa dell'Atrio Tetrastilo
Piccole Terme
Terme Centrali
Foro
Macellum
EUREKA !
Golden Nuggets
TESORO
500
0
Hot Spots Trovati
Domande
Sono Pronto
0

Figure 3 : Panel that the students use to participate to a mobile lesson.

Technology

For the experimentation describes in this document, we prepared an autonomous software for supporting the lesson. We built an unique application installed locally on each laptop used by students. Lesson data were also stored on computer. The main problem for students is to move on a sunny site with a device which is a bit heavy, that requires many precautions and upon which it may be difficult to read due to the sun. Nevertheless, this experimentation was absolutely necessary for testing all elements of the lesson.

Encouraged by this success we designed the mobile lesson as a scenario of the e-MATE project. It uses the general infrastructure we built to deliver on-line services. Software and devices used on the field are completely different but the content itself of the lesson remains the same. We also integrated results of the experimentation and comments of all actors involved in the process to improved the way of presenting data and we added modules not implemented previously. Students on the area of the lesson, are now using a PDA. Only a part of software is installed on it and assures all connections with the school web site and the remote part. The PDA is equipped with a GPS system that automatically gives its position coordinates. This position is transferred to the remote architecture and so the service can detect if a student is facing an hot spot of the lesson or not.

We can define the mobile lesson e-learning service as a distributed software application, that delivers an adapted geo-referenced information on request. Figure 4 gives the architecture of the system that support the mobile lesson. Only a part of the service is loaded on it, the terminal tier. As several PDA

BEST COPY AVAILABLE

are simultaneously connected an HTTP server is required to manage for each device the remote tier of the service. It find its resources in the application server that deployed it. The HTTP server itself finds the remote tier of services required by the users in the service portal where the application server has published them after their deployment. Data exchanged (Zhang, 2000) between PDA devices and the HTTP server is contained in an XML document (XML, 2000).

E-mate architecture is a software architecture aimed to support the development of Mobile Personalised Location based Services (MPLS). It defines a model of services and provides a framework that facilitates the deployment of new position-aware services available through multiple channels. Distributed systems supply for a conceptual framework for building efficient and secure distributed services (Coulouris et al., 2001). E-mate addresses both the heterogeneous nature of access and the management of user sessions.

The architecture contains three main elements: The application server, the service portal and the service viewer. The application server deploys new services and publish them into the service portal. Deploying new services means launching the server session of a service. It is a part of a service which runs on the same workstation that the application server and even if no users are connected to the service. The application server also publishes services. It consists in storing a piece of each service into the service portal, the part that moves dynamically to any client that requires the service (the remote tier in the above example).

The service viewer is the user entry point in the system. For personal computer, it is an autonomous application that runs on it. For PDA, it is composed of two parts, due to the fact that they cannot dynamically load code: a local one and a remote one. After the user identification, it looks for the services published on the service portal. Then the user chooses the service with which working.

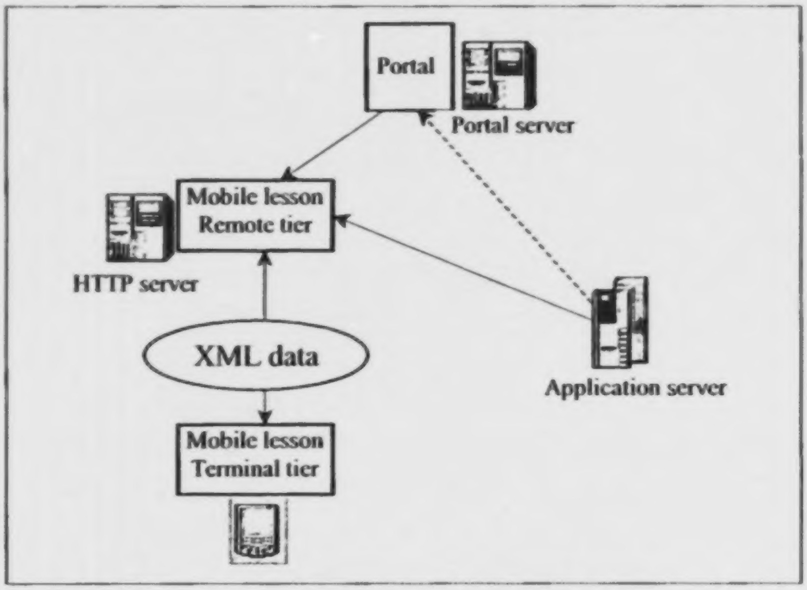


Figure 4 Communication in the case of distributed architecture.

Conclusion

A mobile lesson is the combination of three complementary axis: pedagogy, content and technology. Teachers are in charge of the preparation of the lesson itself and its contents, and computer scientists are responsible for the preparation of software to support the lesson on the field. Our experimentation proved the feasibility and the interest of mobile lessons. The involvement of teachers in the preparation of the lesson and pedagogical documents was critical and we are very grateful to them. The application we built for editing documents and for the execution of the lesson itself, was robust enough to avoid any problem on the field. The satisfaction of everyone and the desire of going more deeply in the experience tell us that it was a success. Besides its first objectives, a mobile lesson such as the one we described in this paper lead students to develop their own learning strategies. As our main conclusion, we can claim that associating various types of information, proving, succeeding, failing and trying to understand why, in a playful and motivating way, are surely among the best ways to acquire knowledge.

Acknowledgement

This project would not have been possible without the full support and participation of the Scuola Media Statale no 2, Assemini, Italy. In particular, the collaboration of the teachers Mrs Maria-Cristina Sanna and Mrs Giovanna Arru was invaluable. They were so generous of their time, their experience and their enthusiasm. All our thanks also to the students who participated to the lessons at Nora. Finally the Preside Mr. Pier Enrico Carta made everything needed to bring this project to reality in his school.

References

Balacheff, N. (1994) La transposition informatique, un nouveau problème pour la didactique. In: Artigue M. et al. (eds) *Vingt ans de didactique des mathématiques en France* (pp.364-370). Grenoble : La Pensée Sauvage éditions.

Bunt, A. & Conati C. (2001). *Modeling Exploratory Behaviour*, In M. Bauer, et al.(Eds.) Proceedings of User Modeling 2001, 8th International Conference, Sonthofen, Germany, July 13-17.

Carnes, J. (2002) *Using the UTM map coordinate system*, http://www.maptools.com/UsingUTM/index.html

Coulouris, G., et al. (2001) *Distributed Systems: Concepts and Design*, Addison-Wesley.

Dalgarno, B. (1998). *Choosing learner activities for specific learning outcomes: A tool for constructivist computer assisted learning design*, in C. McBeath and R. Atkinson (eds), *Planning for Progress, Partnership and Profit*. Proceedings EdTech '98. Perth: Australian Society for Educational Technology.

du Boulay, B. & Luckin, R. (2001) *Modelling Human Teaching Tactics and Strategies for Tutoring Systems*, IJAIED volume 12.

Gangemi, A., Guarino, N., Masolo, C. & Oltramari, A. (2001) Understanding top-level ontological distinctions, Proceedings of IJCAI 2001 workshop on Ontologies and Information Sharing.

Giroux, S., Moulin, C., Paddeu, G., Carboni, D., Demontis, R., Sanna, S. & Stara, E. (2001) *Mobilité, Personnalisation, et Information géo-référencée*, in proceedings of the JFIADSMA, Montreal, November.

Pfoser, D. & Jensen, C. S. (2001) *Querying the trajectories of on-line mobile objects*, Second ACM international workshop on Data engineering, Santa Barbara, California, United States, pp. 66-73, 2001.

United States Department of Defence, (1995). *Global Positioning System Standard*. Positioning Service Signal Specification, 2nd Edition, June.

Vérillon, P. (2000). *Revisiting Piaget and Vigotsky: In Search of a Learning Model for Technology Education*, in the Journal of Technology studies, volume XXVI, number 1, Winter/Spring 2000.

XML (2000). Extensible Markup Language (XML) 1.0. *W3C Recommendation*, October 6th 2000. http://www.w3.org/TR/REC-xml.

Zhang, J., Javed, M., Shaheen, A. & Gruenwald, L. (2000). *Prototype for wrapping and visualizing geo-referenced data in a distributed environment using XML technology*. Proceedings of the eighth ACM symposium on Advances in geographic information systems, Washington, D.C., USA, pp. 27 – 32.

The VITAL Project
(Virtual Instructional Training for the Advancement of Literacy)

http://www.mun.ca/educ/vital/index.html

Dr. Marc S. Glassman
Professor
Faculty of Education
Memorial University of Newfoundland
glassman@mun.ca

Abstract

The **VITAL Project (Virtual Instructional Training for the Advancement of Literacy)** is a multi-faceted, dynamic and evolving web-based professional development (PD) project. The central focus of this project is the provision of current and relevant information and knowledge in literacy education to primary grade teachers, along with the inclusion of an interactive forum among these teachers. As an asynchronous knowledge-support and mentoring PD program, the VITAL Project provides a complimentary "tool" for teachers in their attempts to help students attain the "expected outcomes" as outlined in the English Language Arts Curriculum for the Province of Newfoundland and Labrador.

OVERVIEW

The Province of Newfoundland and Labrador is currently at a crossroads as far as its educational system is concerned. A unique situation confronts the Department of Education, a majority of the 11 provincial school boards, and teachers throughout the province. With approximately 66% of the public schools being classified as "rural", the resources and logistics necessary for providing continuous, relevant and up-to-date professional development (PD) to all teachers in this province is, at best, a challenging but necessary task. However, the uniqueness of the situation stems from the fact that schools throughout Newfoundland and Labrador are, for the most part, "wired" for Internet access. Thus, while it may appear to be a daunting task to provide needed PD to teachers throughout a Canadian province that is three times the size of the state of California, there is a sense of potential in every challenge. The task of providing professional development in the area of literacy education might be accomplished, in part, with the creation of an in-service program delivered on-line to any teacher in the province, regardless of locale, on an "as needed/where needed" basis. Factors such as school closures for "PD days", or attempting to secure substitute teachers to replace regular classroom teachers so that these regular classroom teachers might avail themselves of needed professional development, are, in part, eliminated with the provision of asynchronous and synchronous computer-mediated on-line training. One undertaking in the provision of professional development in the area of literacy is the VITAL Project (http://www.mun.ca/educ/vital/index.html).

THEORETICAL RATIONALE

The concept of "telementoring", in a virtual sense, is not new. Wighton (1993) discussed the potential benefits of this form of professional development with the creation of an "educational network" of teacher mentors in the Canadian province of British Columbia. He envisioned a network where "...a cadre of experienced telecomputing teachers would be recruited to provide educational support" for other teachers within the province. He envisioned an on-line network with mentors being proactive in the identification of novice teachers, as well as being reactive with the on-line support they supply to the questions posed by their "mentees". "The support would be primarily pedagogical in nature, focusing upon helping teachers to use telecomputing activities within the curriculum".

Wright (1996) posed an interesting position regarding the "adjustments" that teachers needed to make in the use of technology. His position provided a needed note of caution in the creation of this form of "high technology" instruction. Wright contended that just as certain teachers had to undergo a "paradigm shift" in their implementation of computer technology within the curriculum, others had to "...adjust their paradigm to accept non-technology oriented users." There needed to be a sort of balance and accommodation between the needs and abilities of "technology-oriented teachers" and "non technology-oriented teachers".

McKenzie (1997) also raises a note of caution for those who utilize technology within the confines of "knowledge industries"(i.e., universities, colleges and public schools). He contends that a "shift" is needed away from the notion of "imparting information" to a "focus upon learning". This "shift" must take into account the background knowledge and experiences of the learners, be they students or the teachers of these students. As well, the learning necessary to undertake this new form of education will come from various resources in a variety of formats. Thus, a "dramatic shift" in the basic focus and specific purposes of education and learning might be undertaken utilizing the technological benefits of computer-mediated instruction and learning. "Sources will no longer be static and fixed. They will be dynamic, open and available."

The proliferation of computers in primary grade classrooms has also created a shift in how reading and writing are both taught and learned. Labbo, Reinking, and McKenna (1998) asserted that the use of computer technology would cause dramatic changes for both students and teachers. Primary grade students would have greater access to computers, which was once reserved for students in the secondary schools. As well, the preparation of teachers would need to change to help pre-service teachers understand the role that computer technology might play in the classroom of today. For the in-service teacher, staff development needed to focus on the needs of teachers who had various levels of expertise and competence with the use of computers in a literacy classroom.

In 1998, within a report submitted to SchoolNet / Rescol by TeleLearning Network Inc., a major review on the effective uses of online electronic resources and tools in the classroom was undertaken by Bracewell, Breuleux, Laferrière, Benoit and Abdous (1998). They sought to document the emerging contribution of on-line resources and tools to classroom learning and teaching. Of the many trends that they documented, two were of significance for the theoretical rationale underlying the VITAL Project. One of these trends was the "...emergence of a new mixed mode of learning: face-to-face and online learning activities." They viewed this trend as significant in that the role of the teacher was changing from one of "transmitter" to that of being a "facilitator". Learners went from a situation of "low access" to the utilization of technology in the classroom context to one of "high access", where this form of technology became at intricate aspect of their total academic context. A second trend viewed by Bracewell, et al, was that access to information was becoming "...more direct, interactive and flexible". Curriculum content went from being pre-organized, with a scope and sequence of codified curriculum-centered objectives, to a learner-centered curriculum, constructed to meet the needs and abilities of students. Free access to on-line materials was supported by the teachers as a means of helping students attain a sense of ownership of certain aspects of their own learning.

Bruce (1999) states that many academics have defined schooling as "...the activity that occurs within a certain space, the classroom, and a certain time, the school day." However, he contends that this notion of traditional education is changing as we see the shift in the "center of learning" from a fixed "bricks and mortar" site to one in a virtual context. "The concept of learning freed from the constraints of time and space is thus curiously reduced to learning confined within a new frame of asynchronous communication." He urges professional educators to become knowledgeable in this form of asynchronous instruction and learning, so as to maintain the role of proactive facilitator to this changing paradigm, rather than being a mere reactor to the changing times.

Educational improvements, according to Cooley (2001), need to come about through "...planned, coordinated and ongoing staff development", focusing upon the enhancement of a teacher's instructional "skills" and methodologies. He proposes a staff development model based on the concept of utilizing "teachers as trainers". His four-phase model on the procedures and pedagogy necessary to implement this form of staff development is well documented in a theoretical and practical manner. "When systematically implemented, these steps provide a powerful grounding for educational change."

Carlson (2001) sees the need for renewed "educational partnerships" to help build "...a systemic infrastructure to provide access for all teachers." From her contention that "collaborations empower individuals", she proposed that there is a need to "re-invest in human potential" through experiences aimed at teacher training and pedagogical renewal in the area of the skills and uses of technology. It is her belief that all those interested in education need to encourage "those willing to innovate" in the development and delivery of "grassroots initiatives" to help make this collaboration, training and renewal possible.

The VITAL Project is an example of this form of grassroots initiative.

PROJECT HISTORY

As a professor in the Faculty of Education (http://www.mun.ca/educ/) at Memorial University of Newfoundland (MUN), the project coordinator had the opportunity to develop and implement seven web-based courses in the area of literacy education. Since the winter semester of 1997 until the fall semester of 2002, these two graduate and five undergraduate courses have been offered a total of 30 times to 535 university students. Students from Canada have come from every province other than Quebec, as well as two of our three territories. In addition, students have attended these classes, in a virtual sense, from three countries outside of Canada (e.g., the United States, England and Venezuela). However, not every student taking these courses was enrolled in either an undergraduate or graduate program at MUN. As of this semester (i.e., Fall of 2002), 39 of these non-program students took one or more of these MUN web-courses and transferred the credit to their home university towards an degree program in education, or for certification credit with a particular provincial or state department of education. Interestingly, 13 teachers across Canada took various web courses on-line for university credit, although they already had a Master's degree in education. Their rationale for taking certain of the literacy web courses was for professional development. This serendipitous experience gave rise to the idea of attempting to create an online professional development web site to bring needed PD in the area of literacy to teachers in the province of Newfoundland and Labrador.

A proposal was by the project coordinator to the Newfoundland and Labrador Teacher's Association (NLTA) for a Centennial Fund grant of $5000. This money was to be utilized for hiring a web designer to help bring the web site on line. As the coordinator and main writer on this project came from a university environment, it was important to include literacy specialists from within the school system. The decision was made to focus the prototype for the VITAL Project in two of the 11 school districts within the province of Newfoundland and Labrador. The coordinator then approached the literacy specialist in the Avalon West School Board and the primary/literacy program coordinator for the Vista School Board. Together, this team concluded that an ideal target group for this project would be the K-3 primary grade teachers in the two aforementioned school boards, especially given the reality that our province was in the process of implementing new curricula in the area of primary literacy. Also, both of these boards were geographically large, with a majority of their primary/elementary grade schools located in rural locations. These locales are difficult to access by road in the winter months, but would pose no problems for the delivery of a virtual PD program in the area of literacy.

Carpe Diem

Phase One of the VITAL Project, currently online at http://www.mun.ca/educ/vital/, was the writing of the basic structure of the web site, which consisted of literacy theories, innovative and practical instructional strategies, and the inclusion of hyperlinks to various web sites pertaining to primary grade literacy. The winter of 2002 was the period designated for this creation and initial implementation.

Phase Two of this project will involve the primary grade teachers in the two aforementioned school boards viewing the web site in an asynchronous non-linear manner, and providing specific feedback and comments to the project team. An on-line questionnaire will be created to help facilitate this interaction. Specific topics pertaining to literacy theory and/or pedagogy that are requested by any of the participating teachers shall be created by one of the project team members and included in the next phase of the project. As well, specific school board centered PD topics will be created by each of the two literacy/primary specialists and included in the web site. This will enable these specialists to conduct certain aspects of PD in their districts in a virtual manner. The fall term of 2002 is the period designated for this phase of the project.

Phase Three of this project, to begin in the winter of 2003, will involve the implementation of the requested additions to the initial web site, as well as an interactive forum. The SiteScape Forum or Web CT will be utilized to undertake this form of asynchronous interactions between the members of the project team and the participating teachers. As well, asynchronous interactions will be facilitated for on-line discussions among the participating teachers.

SUMMARY

With the onset of curricular changes in the area of literacy, professional development of in-service teachers has been a component of the continuing education of all educators for the past 30 years. The conceptual framework that serves as a virtual "scaffold" for this project is created with an integration of self-perceived professional needs and an on-going interaction between and educated learner and mentors. The "virtual" aspect of this project is contained within the asynchronous on-line experience in which teachers may partake. The "instructional" component is both indirect and self-paced, with interactions not only between the web-facilitators (i.e., mentors) and the participating teachers, but also among teacher across the province. The "training" component is on a "when needed/where needed" basis, and is determined by each teacher upon their own personal reflections of their individual needs and abilities. The "advancement" comes about with the provision of professional development on a continuous basis in the crucial curricular area of expressive and receptive language across the curriculum. From the experience of actively participating in each phase of this project, individual teachers may enable themselves to effectively and realistically affect professional change.

References

Bracewell, R., Breuleux, A., Laferrière, T., Benoit, J., & Abdous, M. (1998). The emerging contribution of online resources and tools to classroom learning and teaching
Report submitted to SchoolNet / Rescol by TeleLearning Network Inc. [Online]. Available:
http://www.tact.fse.ulaval.ca/ang/html/rev98es.html

Bruce, B. (1999). Education Online: Learning Anywhere, Any Time. *The Journal of Adolescent & Adult Literacy/Reading Online.* [Online]. Available:
http://www.readingonline.org/electronic/elec_index.asp?HREF=/electronic/jaal/May_Column.html

Carlson, P. (2001). Collaborations Empower Individuals and Ideas: A Grassroots Approach to Educational Partnerships. *T.H.E. Journal Online* 29(3). [Online]. Available:
http://www.thejournal.com/magazine/vault/A3690.cfm

Cooley, V. (2001). Implementing Technology using the Teachers as Trainers Staff Development Model. *Journal of Technology and Teacher Education*, 9(2), 269-284.

Labbo, L.D., Reinking, D., & McKenna, M.C. (1998). Technology and literacy education in the next century: Exploring the connection between work and schooling. *Peabody Journal of Education*, 73(3/4), 273-289.

McKenzie, J. (1997). Deep Thinking and Deep Reading in an Age of Info-Glut, Info-Garbage Info-Glitz and Info-Glimmer. *From Now On: The Educational Technology Journal.* [Online]. Available:
http://www.fno.org/mar97/deep.html

Wighton, D. (1993). Telementoring: An Examination of the potential for an Educational Network. [Online]. Available: http://mentor.creighton.edu/htm/telement.htm

Wright, T. (1996). Is Your Paradigm Shifting? *Technology Teacher*, 3(6), 3-4.

Using the Web to Teach Democracy

Ilia Goldfarb, Creative Director/Web Developer
The Spirit of Democracy Project, Faculty of Education
University of New Brunswick, Canada
goldi@unb.ca

Abstract: The Spirit of Democracy Project was initiated in 2000 by the University of New Brunswick, Canada, Faculty of Education in partnership with the Russian Association for Civic Education, and was made possible through financial contribution from the Canadian International Development Agency. The focus of the Project is the development of online citizenship education curriculum resources for use by teachers in Russia and Canada. The Canadian and Russian project teams are developing materials for similar topics based on local content. Researchers, on both sides, create learning opportunities using situations and springboards. The situations present democratic issues and concepts, for example the value of loyalty, or the meaning of privacy. An important role in the Project is assigned to visual materials and creative use of hypermedia. The Project led to close collaboration between Russian and Canadian social sciences researchers, teachers and students.

Introduction

The Spirit of Democracy Project began in the summer of 2000. The project was initiated by the University of New Brunswick, Canada, Faculty of Education, Citizenship Education Research and Development Group, in partnership with the Russian Association for Civic Education and Uchitelskaya Gazeta, and was made possible through financial contribution from the Canadian International Development Agency.

The organizing idea for this project was born several years ago during a meeting of two Canadian researchers, Andrew Hughes and Alan Sears in a discussion with colleagues from Argentina on the topic of helping to foster the emerging democratic culture in that country. The Argentinean colleagues said: "Don't teach us the structures of democracy, we know all about the structures of democracy; teach us the spirit of democracy" (The Spirit of Democracy 2002a). In the summer of 2000 Russian and Canadian teams for the Spirit of Democracy project met for the first time in Canada to discuss how they are going to teach "the spirit of democracy".

The goal of this project is to help Russian educators to develop a new dynamic approach to citizenship education in public schools. The main focus of the Project, from the beginning, was on the development of online curriculum resources on the "spirit of democracy" for use by teachers in Russia and Canada. The approaches used to convey "the spirit of democracy" include blended learning, situated learning, and creative use of Web media to effectively teach democracy on the Web. A lot of effort has been put into making the Project site a truly democratic learning environment, including links to national and international democratic sources.

Nurturing the Spirit of Democracy

Web-Based Situated Learning Approach

The Spirit of Democracy project is using the Web to deliver online resources: content, instructions, along with a discussion environment for teachers and students. These curriculum resources can be used as a complete set of materials or as individual lesson topics for different subjects such as Social Studies, History, Citizenship Education, etc. The Canadian and Russian project teams are developing project materials for similar topics based on local content. As a result, the information presented on the Canadian site is relevant to the lives of young Canadians, and the content on the Russian site may differ and is relevant to the lives of Russian students.

Web media by its nature is the most democratic type of media and is ideally suited for conveying the "spirit of democracy " idea. Web-based studies immerse students in an online learning environment that allows them to access all original materials, even those provided for teachers. The Web also serves as a unique source of "live" information. By providing hypertext links to government organizations, international organizations, educational Web sites, and online magazines, The Spirit of Democracy learning materials are always up-to date and offer information on recent important developments in the area of Citizenship and Social Studies in Canada, Russia and all over the world. In this paper the author is using the Web media definition from Huss (1999), where the Web media is defined as the use of the text, images, animations, sounds and video on the Web, supported by Hypertext Markup Language (HTML).

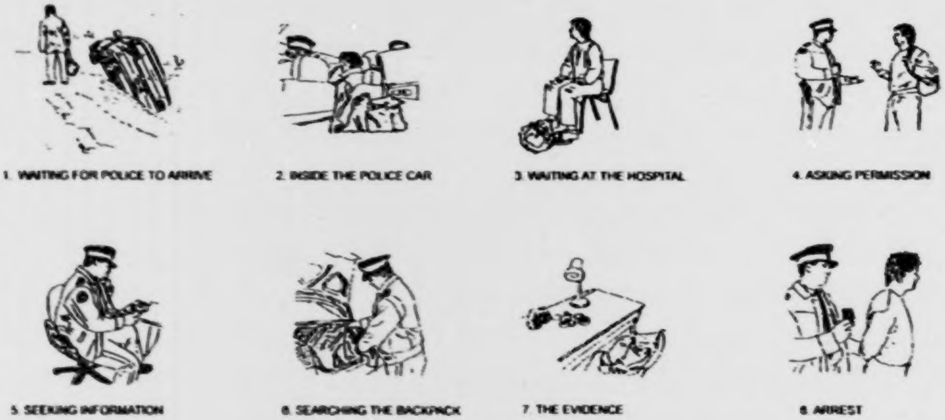
Combined with the creative use of multimedia and hypermedia Web based learning offers unique opportunities for educators. The Spirit of Democracy Project's learning approach is based on the ideas of Lev Semenovich Vygotsky who is widely known as "The Mozart of Psychology". Vygotsky, along with Piaget and Bruner developed the foundation for the concepts of Situated Learning and Anchored Instruction (The Spirit of Democracy 2002b). The Situated Learning approach is based on Situated Cognition Theory that suggests that learning is tied to authentic activity, context and culture (Brown et al. 1989). "An authentic context for citizenship learning must be a situation in which "real" citizens might be required to think and to act. It can be current, historical, or both; it can be near or far in both time and place" (Hughes et al. 2000). The Spirit of Democracy Project provides teachers and students with a wide range of "real life" situations. The Project is using a "blended learning" approach in which teachers use online materials in combination with conventional classroom training.

Use of visuals and Web media

Within The Spirit of Democracy Project, developers, on both sides, create learning opportunities using situations and springboards (anchors). The situations present democratic issues and concepts, for example the value of loyalty, or the meaning of privacy. The uniqueness of the approach taken by the Spirit of Democracy project is that researchers use authentic materials to involve students in learning and discovery. A very important role is assigned to visual materials. The situation is usually presented to students by showing a sequence of 8-10 pictures. The pictures should be descriptive enough to tell the story and appealing enough to draw the students in to a discussion about a particular topic. To achieve these results, the project illustrator has to work closely with researchers to portray the situations they want to use.

The topic of "Privacy" is a good example of such joint work between a researcher and an illustrator. One of the scenarios dealing with the topic of "Legal Aspects of Privacy" involves a discussion on the case of unreasonable search and seizure (Mr. Bagnell's case). In the learning activity "You Be the Judge" students need to learn all the details of the case and make a legal judgment (The Spirit of Democracy 2002c). The factual materials of the case are presented as a series of illustrations that lead students through the sequence of events of the actual case (Figure 1). One of the important conditions of this activity is to create a simulation of the court environment and help students experience the process of rendering a fair judgment. The use of visuals here is much more appropriate than the use of newspaper or magazine articles. Such articles usually contain judgmental opinions that may influence students' decisions one way or another. The researcher needed to spend a considerable amount of time working with the illustrator on the details of each scene, making sure that it properly presents all the facts of the case without any additional visual information that might influence students' opinion.

Along with the visual story presented through illustrations, the hypertext links allow students to learn the facts of the case and get additional supportive information, such as, excerpts from the Canadian Charter of Rights and Freedoms, the Controlled drugs and Substances Act, excerpts from precedents that deal with search and seizure cases and from the Privacy Act of New Brunswick, and a discussion of reasonable grounds. It is interesting to mention that our Russian colleagues are having a difficult time translating the word "privacy" as there is no equivalent in the Russian language. Currently in Russia people are using the English word "privacy" to convey the correct meaning of the concept. The idea of having a Privacy Commissioner is also something unheard of in Russian society.


1. WAITING FOR POLICE TO ARRIVE

2. INSIDE THE POLICE CAR

3. WAITING AT THE HOSPITAL

4. ASKING PERMISSION

5. SEEKING INFORMATION

6. SEARCHING THE BACKPACK

7. THE EVIDENCE

8. ARREST

Figure 1: Mr. Bagnell's case

Another set of illustrations was created for the "Images of Chile" springboard that is used to initiate students' discussion about "due process" and, in particular, human rights violations as one of the most important aspects of this concept (Figure 2). Working closely with a researcher, an illustrator portrays the story of a person missing after a confrontation with Chilean police. The visual story is supported by several hyperlinks to the Amnesty International Web site with articles about human rights violations in different countries such as Cuba, Guatemala, Bosnia and to the UN's Commission on Human Rights Web site.

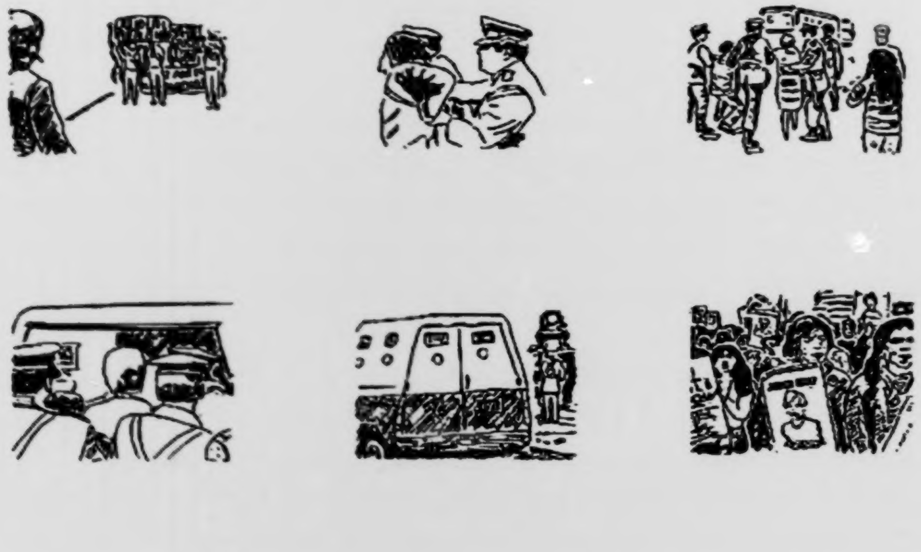


Figure 2: Images of Chile

BEST COPY AVAILABLE

Students are presented with images and asked to discuss what fundamental rights have been violated, how the due process of law could be properly applied in this situation, and what are the basic differences between a democratic country and dictatorial regime.

One more example of using images, creatively, to engage students in discussion about democratic issues, like "Freedom of religion", is an interactive presentation of the famous Russian painting "Boyarynya Morozova" by Surikov (The Spirit of Democracy 2002d). In this painting the artist depicts Feodosiya Morozova, who was an active supporter of the old-believer movement in the Russian church, and a crowd made up of vivid individuals. The image map of the painting is hyperlinked to the close-ups of the individual characters portrayed by the painter. During the class discussion the teacher can, using this interactive image, focus student's attention on different human faces in this complex masterpiece portraying a whole range of attitudes towards religion. This helps to initiate a class discussion about a real historical event and how different people with their own beliefs and values view this event.

The use of multimedia capabilities in this international project is heavily restricted by bandwidth limitations on the Russian partners' side. Russian schools, especially in rural areas, have very slow Internet connections. Due to these bandwidth limitations, in some cases video clips on springboards had to be substituted by a sequence of compressed images and songs were replaced by text. However, the Russian government is currently implementing reforms that encourage the use of modern telecommunications technologies (Filippov, 1999) and the above limitations will soon disappear, allowing a full range of multimedia capabilities.

Interface design and translation tools

It is important to mention a special approach in interface design utilized by The Spirit of Democracy Project. The majority of graphic navigation elements were intentionally designed as hypertext links and not as images. This approach allows the use of automatic translation tools to translate not only the content of individual web pages, but also the navigational elements, thus allowing international users access to the entire content of the Canadian Web site. In the future, with the development of the automatic translation technology, the content of the entire Project site, including Russian web pages, will be available for international users. However, even today, using the Web based automatic translation engine, we provide an option to translate Canadian pages into four languages such as French, Spanish, German and Italian.

The quality of the automatic translation is reasonable, for example the French translation was evaluated and found to be of acceptable quality. However, this is not the case with all languages. For example, when using the service in Spanish, the word "Spirit" in the phrase "Spirit of Democracy" gets translated to the word "alcohol". We believe that, in the future, with the development of better translation tools, these problems will be solved.

It is worthwhile to mention collaborative idea, used in the design a site map, for the Project Web site. In fact, there are two different site maps, for Russian and Canadian sections. Each navigational map provides hyperlinks not only to local pages, but also allows users to navigate the counterpart site, e.g. Canadian site map provides links not only to Canadian pages, but also helps Canadian users navigate the Russian content, and vice versa. This allows users with limited knowledge of a foreign language to explore content on the "foreign" Web site.

Cultural and Copyright issues

This International Web project did not escape certain cultural issues. Most of the issues were related to the Web site design and project logo. At the beginning of the project it was decided that both teams, Russian and Canadian, would develop their own content. In the first three moths of the project a question was raised about designing a logo. The process of logo design is a good illustration of the complex relationship between the two teams. The Project asked a Canadian graphic artist to design a logo for the Spirit of Democracy project. The artist created the first logo based on the existing Russian interpretation of democratic symbols (Figure 3, a). This logo was discussed during the meetings of the Canadian team and was rejected as being not a "true North American democratic symbol" and also having nothing to do with Russia. A second attempt produced a logo that used an image of the Russian "White House" (former parliament building) as a symbol of democracy (Figure 3.b). This logo was accepted by Canadian team, but strongly rejected by Russian team members. Russians argued that government buildings in Russian culture are not associated with symbols of democracy. Finally, the artist created the third version of the Project logo by removing all imagery and blending two national flags in one image with typography as a main graphic element (Figure 3, c). Both teams accepted this logo as a working draft.

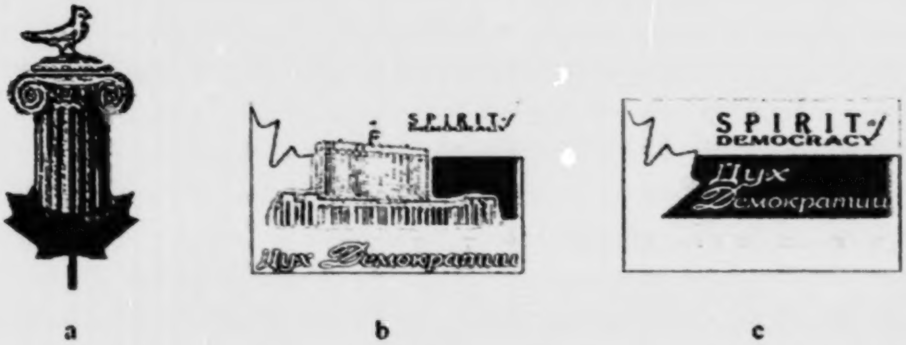


Figure 3: The project logo

Digital Copyright laws in Canada and Russia are different. It is a challenging issue for our Project. So far we are working under the model that all Canadian materials will conform to Canadian digital copyright law, and Russian materials will conform to Russian copyright laws. According to our Russian colleagues, Russian copyright law permits use of any digital materials for educational purposes. What if they decide to use some copyrighted North American materials on the Russian Web site? What copyright law will cover this case?

International collaboration

One of the advantages achieved during the current phase of the project is the creation of working links between Canadian and Russian researchers, teachers, and even students. The links between researchers and teachers, in both countries, began to develop as a result of seminars conducted by Canadian and Russian team members for teachers in Canada and Russia. During the seminars conducted by Canadian researchers in Moscow, Orel and Samara for a total of eighty Russian teachers in the summer of 2001, ten Russian teachers-leaders and their schools were selected for pilot participation in the project. These teachers will receive further training in Canada in the fall of 2002 and will be able to train others in the field of citizenship education. Specialized training, for Russian team members, in web site maintenance and development, will assure that Russian teachers will be able to build upon project outputs and online training materials. Teacher-leaders in the regions of Moscow, Orel and Samara have already conducted their own seminars for other new teachers and for regional school board authorities on the Spirit of Democracy, resulting in materials being incorporated into the curriculum in some areas.

Canadian teachers from all regions of New Brunswick attended a seminar at the University of New Brunswick in November of 2001 on the Spirit of Democracy's educational online materials. After this seminar, teachers of the Superior Middle School in Bathurst, New Brunswick became interested in learning about Russia and currently are working with their administration on development of an integrated curriculum unit that incorporates the study of Russia into all Grade 6 subject areas for one semester. As a result, a strong connection has developed between Bathurst Middle School in Canada and Zelenograd School #1194 in Russia. Canadian students became interested in learning more about Russia, and in exploring issues in the project and communicating with Russian students, and numerous students signed up

BEST COPY AVAILABLE

for the School's Human Right's Club. With the help of their teachers, students of both countries began to communicate with each other and exchanged photograph albums, drawings, and information about themselves and their communities (The Spirit of Democracy, 2002e). The design of the project Web site supports collaboration between students allowing them to participate in online discussions on the Project's discussion board on different topics related to democracy and citizenship. On the discussion board students can write messages in their own language and also follow threads in other languages. However, in order for the discussion board to be an active forum, day-to-day attention and monitoring are required, which was not anticipated in the initial funding proposal.

Conclusions

After two years we can already call this project a success – the Russian team, participating in the project, have developed and posted on the Project Web site more than 50 different topics related to citizenship and democracy, and the Canadian team posted about 30 such topics (The Spirit of Democracy 2002f). Researchers and schoolteachers develop these topics collaboratively. Project materials posted on the Web have already been successfully used by Canadian and Russian teachers in a classroom environment and received positive responses. Several participating Canadian and Russian schools are using project Web-based resources to conduct classes and educate youngsters on democratic values and the spirit of democracy. Currently both, Canadian and Russian teams continue to develop new cases and are planning to meet in the fall of 2002 to discuss their progress and plans for the second phase of the project.

References

Brown, J.S., Collings, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher*, 18 (1), 32-41.

Filippov, V. (1999). Laying the Foundations for Change, International Institute for Educational Planning, *IIEP Newsletter*, October-December 1999.

Hughes, A., S., Long, N., & Perry, M. (2000). Learning the Spirit of Democracy: The Project's Background and an Illustration. Proceedings of the Conference Citizenship 2020: Assuming Responsibility for Our Future, *McGill Institute for the Study of Canada*, Montreal.

Huss D. (1999). *Corel Photo-Paint 9: The Official Guide*. The McGraw-Hill Companies.

The Spirit of Democracy Project. (2002a). Home page. *http://www.unb.ca/democracy/Project/Project2.html*

The Spirit of Democracy Project (2002b). The Spirit of Democracy Learning Approach. *http://www.unb.ca/democracy/Project/IdeasInDemocracy/SituatedLearning/SituatedLearning1.html*

The Spirit of Democracy Project. (2002c). You Be the Judge. *http://www.unb.ca/democracy/Project/IdeasInDemocracy/privacy/LegalPrivacy/LegalPrivacy2.html*

The Spirit of Democracy Project. (2002d). Boyarynya Morozova. *http://www.unb.ca/democracy/Project/IncludeIdeas/RecentExamples/workshopFreedoms/FundamentalFreedoms.htm*

The Spirit of Democracy Project. (2002e). Student works. *http://www.unb.ca/democracy/russia/4workArea/rus/pic_kul.html*

The Spirit of Democracy Project (2002f). Splash page. *http://www.unb.ca/democracy*

Acknowledgements

The author would like to acknowledge the financial support provided for the project by the Canadian International Development Agency and the University of New Brunswick.

Technology Initiatives in Assessment: National Assessment of Educational Progress (NAEP) Projects in Assessment Design and Delivery of Results

Abstract

The purpose of this panel is to present technology initiatives of the National Assessment of Educational Progress (NAEP) - the only nationally representative and continuing assessment of what America's students know and can do in various subject areas. While NAEP has used technology for a number of different purposes, this panel will focus on two projects: one component of a Technology-Based Assessment project, designed to explore how technology can be used to add efficiency and innovation to the assessment of new and traditional subject matter, and the NAEP website, which uses a number of cutting-edge web-based tools to report assessment results to the public.

Background Context

As the only nationally-administered assessment program, NAEP plays a critical role in President Bush's No Child Left Behind national and state educational reform initiatives. Given NAEP's role in these initiatives, the assessment development, administration, scoring, and results dissemination processes are of increasing interest to state testing programs and educators.

Under current law, the Commissioner of Education Statistics, who heads the National Center for Education Statistics in the U.S. Department of Education, is responsible for carrying out the NAEP project. The National Assessment Governing Board, appointed by the Secretary of Education but independent of the Department of Education, governs the program.

NAEP does not provide scores for individual students or schools; instead, it offers results regarding subject-matter achievement, instructional experiences, and school environment for populations of students (e.g., fourth-graders) and subgroups of those populations (e.g., female students, Hispanic students). NAEP results are based on random national and state school and student samples.

The NAEP Website

The NAEP has taken a number of innovative steps to leverage the technology afforded by the WWW to make NAEP data on student achievement and background variables related to that achievement readily available to the public. In addition to extensive web pages that detail information about the program and specific assessment results, the site features complex web-based tools that allow users to access a complex "results" database, perform statistical significance tests on specific results, produce both tabular and Scaleable Vector Graphics (SVG) of assessment data, and view/print assessment questions, scoring guides and sample student responses.

The panel will discuss and demonstrate the following technology initiatives on the NAEP website

(1) Overall Architecture of Site - Program information, results pages, applications

(2) Applications

   a. The NAEP Data Tool: Comprehensive 50GB database of assessment results of 7 subjects and over 10 years of assessment data. (Civics, Geography, U.S. History, Reading, Mathematics, Science, Writing). We will demonstrate the following:
      - the process/challenge of making results web-deliverable
      - the role of the database as an underlying foundation of the NAEP website
      - how the database feeds? other applications on the site (State Profiles)
      - the introduction of SVG into the tool
      - Report -generator as the next step (natural language x)

   b. The NAEP Questions Tool

      - Demonstration of the web-based tool that allowers users to access and print released assessment exercises, scoring guides, student responses and questions-level data.

(3) Future Projects
   - State Reporter Generator
   - Data Mining

The Technology-Based Assessment Project: the Technology-Rich Environment Study

The Technology-Based Assessment (TBA) project is designed to explore the use of technology, especially the use of the computer, as a tool to enhance the quality and efficiency of the NAEP. To help understand how the ever-increasing use of computer technology in schools and the work place will impact NAEP assessments, the project is exploring the following key questions about TBA:

- What are the measurement implications for NAEP?
- What are the equity implications?
- What are the efficiency and cost implications?
- What are the operational implications?

- How can we best incorporate new technology into NAEP in both the short and long term?

The panel will begin with a general description of the TBA project and its goals, including a discussion of the Math Online and Writing Online projects, designed, respectively, to measure current NAEP math and writing content using a web-based delivery system. The panel will then focus on the Technology-Rich Environment Study, one component of TBA. The TRE project is designed to model possible ways NAEP can assess student abilities to solve complex problems using technology-based tools. To date, two model tasks have been created, one requiring students to solve a physics-based problem using a web-based simulation, and the other requiring students to search a quasi World Wide Web universe to find and synthesize relevant information about a physical science topic.

Pilots in New Jersey schools and pretesting of a national convenience sample have demonstrated that both tasks are viable and meaningful ways of assessing student's problem-solving skills using web-delivered technology.

The panel will discuss what each task intends to measure, describe the process of task development, demonstrate some part of each task, and conclude with a discussion of how student responses will be scored.

Presenters:

First, some background clarification about the organizational structure of the NAEP project. NAEP is funded by the Department of Education, under the auspices of the National Center for Education Statistics (NCES). Development, analysis and reporting of NAEP assessments are performed under contract with Educational Testing Service (ETS). ETS develops applications and content for the NAEP website and manages the day-to-day operations of the NAEP public website (http://nces.ed.gov/nationsreportcard)

Madeline Goodman is the Project Manager for the NAEP website. She has worked at NAEP for 5 years, as History and Social Science Coordinator before moving on to produce and manage the production of NAEP content on the web. Ms. Goodman has a doctorate in U.S. History. She has worked with programmers, research scientists, graphics artists and interface designers to coordinate numerous large-scale projects for the NAEP website. She has a working knowledge of all areas of the website and its role within the education and government communities. Madeline has worked at Educational Testing Service for 7 years.

Jeffrey Jenkins is the NAEP Webmaster, responsible for managing the technical side of the NAEP website. He has an extensive background in all areas of website management, including user-interface design, programming, content management/systems design and database management. He has worked on the NAEP project for three years and at Educational Testing Service for 10 years.

Hilary Persky is a senior Program Administrator at NAEP. She has worked at NAEP for 8 years on numerous projects, including History/Social Science assessments and the NAEP Arts and Writing assessments. Her current major responsibilities include overseeing and managing the NAEP Writing assessment and the Technology Rich Environment (TRE) portion of the Technology Based Assessment project. She had major responsibility for developing the content of the current TRE project. Ms. Persky has worked at Educational Testing Service for nearly 10 years.

Modules and Information Retrieval Facilities of the Human Use Regulatory Affairs Advisor (HURAA)

Arthur C. Graesser
Department of Psychology
University of Memphis
Memphis, TN 38152-3230
a-graesser@memphis.edu

Xiangen Hu
Department of Psychology
University of Memphis
Memphis, TN 38152-3230
xhu@memphis.edu

Natalie Person
Department of Psychology
Rhodes College
Memphis, TN 38112
person@rhodes.edu

Tanner Jackson
Department of Psychology
University of Memphis
Memphis, TN 38152-3230
gtjacksn@memphis.edu

Joe Toth
Institute for Defense Analyses
Alexandria, VA 22311
jtoth@ida.org

Abstract: The Human Use Regulatory Affairs Advisor (HURAA) is a web-based facility that provides help and training on the ethical use of human subjects in research, based on documents and regulations in United States Federal agencies. HURAA has a number of standard features of conventional web facilities and computer-based training, such as hypertext, multimedia, help modules, glossaries, archives, links to other sites, and page-turning didactic instruction. HURAA also has more intelligent features: (1) an animated conversational agent that serves as a navigational guide for the web facility, (2) lessons with case-based and explanation-based reasoning, (3) document retrieval though natural language queries, and (4) a context-sensitive Frequently Asked Questions, called *Point & Query*. This paper describes the major modules and features of HURAA and evaluates the performance of document retrieval through natural language questions.

Introduction

The Human Use Regulatory Affairs Advisor (HURAA) is a web-based facility that provides help, training, and information retrieval on the ethical use of human subjects in research. The content of HURAA is derived from

Federal agency documents and regulations, particularly the National Institutes of Health (NIH, 45 CFR 46), the Department of Defense (32 CFR 219, DoD Directive 3216.2), and particular branches of the US military. The users of the HURA Advisor are high-ranking military officials who must approve research protocols involving human subjects in studies sponsored by the Department of Defense (DoD). These users focus on fundamental ethical issues, but not the detailed procedures and paper work associated with gaining approval from Institutional Review Boards.

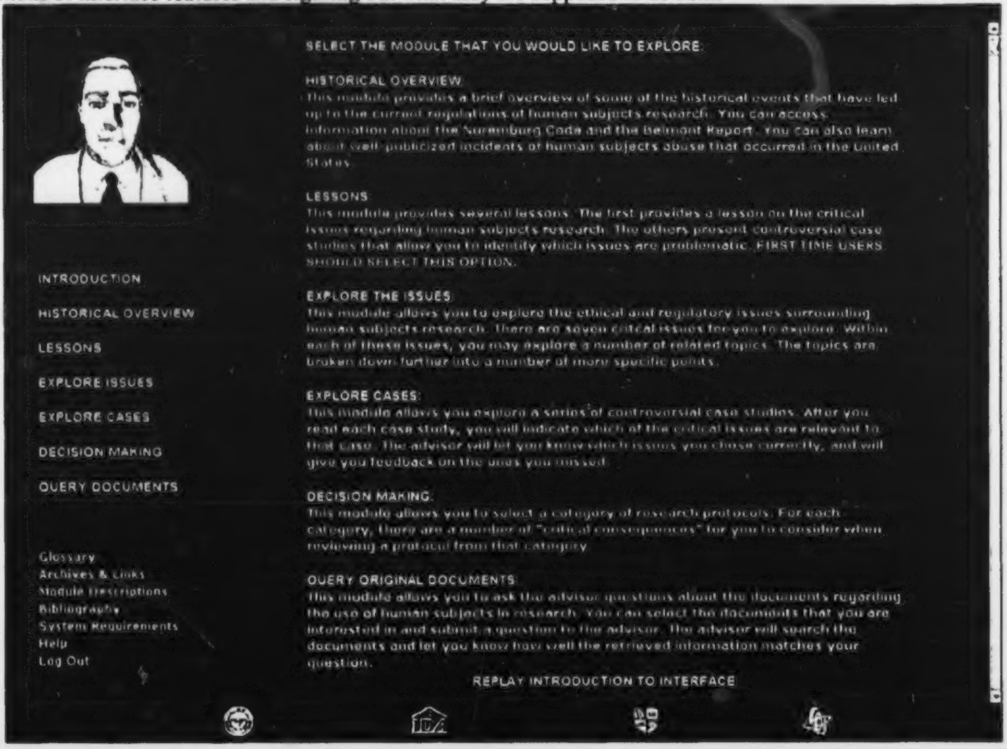
The design of HURAA was guided by a number of broader objectives. First, the layout and design of the web facility incorporate available guidelines in human factors, human-computer interaction, and cognitive science. Such guidelines are advocated by the Advanced Distributed Learning (ADL) Initiative of the DoD. Second, the architecture of the HURAA components needed to be conformant with the ADL standards for reusable instructional objects, as specified in the Sharable Content Objects Reference Model (SCORM 2001). The primary objective of having these standards is to allow course content to be shared among different lesson planners, computer platforms, and institutions. Third, HURAA was designed to optimize both learning and information transmission. High ranking military personnel have very little time, so it is imperative to promote the speed and quality of learning in web-based distance learning environments (Tobias & Fletcher 2000, SCORM 2001). This requires careful consideration of the pacing of the information delivery, the selection of content, and design of the tasks to be performed. Fourth, HURAA incorporated some of the sophisticated pedagogical techniques that have been implemented in intelligent tutoring systems (ITS) during the last two decades (Anderson, Corbett, Koedinger, & Pelletier 1995, Graesser, VanLehn, Rose, Jordan, & Harter 2001, VanLehn, Jones, & Chi 1992). Some of the lessons and modules had case-based, explanation-based, and question-based learning mechanisms in an effort to promote deeper mastery of the material. Fifth, the web site was supposed to be engaging to the user. HURAA incl,uded some persuasive multimedia that was intended to hook the user to continue on the website (Mayer 1997).

A sixth general objective was to optimize information retrieval when users actively attempted to search for information. Some users prefer to learn by actively exploring information, asking questions, and accessing answers to questions (Graesser & Person 1994, Graesser & Wisher 2001, Otero & Graesser, 2001), whereas many learners are more passive and rarely pose questions. A good web facility provides information quickly on demand for those occasions when users are curious, active, self-regulated learners. HURAA implements multiple methods of accessing information in a large space of documents. HURAA has hypertext and glossaries, which are conventional methods of information retrieval. But HURAA does not stop there. HURAA has a *Point & Query* facility (Graesser, Langston, & Baggett 1993), which provides answers to context-sensitive Frequently Asked Questions (FAQs). HURAA also accesses documents that provide answers to questions that the user formulates in English, using techniques in computational linguistics (Jurafsky & Martin 2000, Landauer, Foltz, & Laham 1998). It is the latter facility (i.e., document access via queries in natural language) that will receive primary attention in the present article. We will assess the performance of our natural language document retrieval facility in supplying informative and relevant information.

In summary, there are two goals of the present article. First, we present a snapshot of the modules of HURAA, with particular attention to those that provide information retrieval. Second, we report performance on our natural language document retrieval facility.

Modules and Features of the HURA Advisor

The home page of HURAA is presented below (Fig. 1). There are seven primary modules and seven secondary modules. Labels for these modules are presented in the left banner of the HURAA web page. The main display area in the middle of Figure 1 describes primary modules of HURAA. The interchange between the user and the HURAA is managed by an animated conversational agent (see upper left corner) and by discourse mechanisms that are designed to facilitate the dialogue (Graesser, Person, Harter, & TRG 2001, Graesser et al. 2001, Person, Graesser, Kreuz, Pomeroy, & TRG 2001). Many users will be high-level decision-makers with very little time to visit the site (i.e., 30 minutes or less) so HURAA needs to be engineered to maximize its coverage of critical information in the minimum amount of time. This requires some efficient dialog management techniques that are available in the fields of human-computer interaction and discourse processes. For example, the conversational agent briefly identifies the functions of major interface components the user clicks on, and offers recommendations on next steps when each web page is first accessed. This prevents the first-time user from spending undue time analyzing the functions of interface features and figuring out what they are supposed to do next.



SELECT THE MODULE THAT YOU WOULD LIKE TO EXPLORE:

HISTORICAL OVERVIEW:
This module provides a brief overview of some of the historical events that have led up to the current regulations of human subjects research. You can access information about the Nuremburg Code and the Belmont Report. You can also learn about well-publicized incidents of human subjects abuse that occurred in the United States.

LESSONS:
This module provides several lessons. The first provides a lesson on the critical issues regarding human subjects research. The others present controversial case studies that allow you to identify which issues are problematic. FIRST TIME USERS SHOULD SELECT THIS OPTION.

EXPLORE THE ISSUES:
This module allows you to explore the ethical and regulatory issues surrounding human subjects research. There are seven critical issues for you to explore. Within each of these issues, you may explore a number of related topics. The topics are broken down further into a number of more specific points.

EXPLORE CASES:
This module allows you explore a series of controversial case studies. After you read each case study, you will indicate which of the critical issues are relevant to that case. The advisor will let you know which issues you chose correctly, and will give you feedback on the ones you missed.

DECISION MAKING:
This module allows you to select a category of research protocols. For each category, there are a number of "critical consequences" for you to consider when reviewing a protocol from that category.

QUERY ORIGINAL DOCUMENTS:
This module allows you to ask the advisor questions about the documents regarding the use of human subjects in research. You can select the documents that you are interested in and submit a question to the advisor. The advisor will search the documents and let you know how well the retrieved information matches your question.

Figure 1: Home Page of HURA Advisor

Major Modules

The seven modules of HURAA are enumerated below. Links for these seven modules are always present on the web page, in the banner on the left (Fig. 1).

(1) *Introduction*. The Introduction Module is a multimedia movie that plays immediately after a new user has logged in. It is designed to impress the user with the importance of protecting human subjects in research. It describes for the user "what" the site is, "who" should use the site, "why" the site is important, "how" the site works, and "when" the site should be used. It consists of a "voice-over" accompanied by images.

(2) *Historical Overview*. This module contains an additional multimedia movie highlighting some of the most famous abuses of human subjects in history. There are different options for the user to select, in a standard hypertext/hypermedia organization that allows the user to "drill down" to learn more about those topics. Users can also access information through Point & Query (Graesser et al. 1993) or a natural language query facility, as described later.

(3) *Lessons*. This module comprises four lessons that teach the user about the Seven Critical Issues relevant to ethical violations that were identified by Emmanuel et al. (2000). User learns how to apply them to particular cases that involve ethical abuses. After a case is presented, the user is then presented with the Seven Critical Issues and must decide, on a six-point scale, the extent to which there is a problem with each issue in that case. The user then receives feedback comparing his/her responses with those of a group of experts from the DoD, along with a brief explanation. Discrepancies are highlighted in red. This is a form of case-based reasoning, which is recognized to be

BEST COPY AVAILABLE

appropriate for legal and ethical reasoning (Ashley 1990). Cases are dynamically selected on the basis of the user's previous responses, to ensure full coverage of the Seven Critical Issues.

(4) *Explore Issues*. This module expands the Seven Critical Issues into a number of topics and points, hierarchically organized in a hypertext system. The user drills down to learn more specific information about particular issues. Point & Query and natural language queries are also available.

(5) *Explore Cases*. This module has approximately 40 cases used in both the Lessons and Explore Issues modules. The user can drill down to see cases associated with a three-level hierarchy of issues, sub-issues, and sub-sub-issues.

(6) *Decision Making*. The Decision Making module is designed for those who need information about a specific category of protocol (e.g., drug studies, surveys). The user is presented with a list of protocol categories. Selecting one of the categories presents the user with a list of several "critical consequences," i.e., negative results that may occur from an incorrect decision. Selecting one of the critical consequences presents the user with a more complete description of a consequence associated with an incorrect decision.

(7) *Query Documents*. This module allows the user to ask a natural language question (or description) and then retrieves excerpts from various documents and HURAA content. The user can select any or all off several documents to search. For each document that the user selects, the top result selected by the computational linguistics software is displayed in a window. Beneath this window, the headings for the next four results appear. If the top choice is not the one that the user needs, s/he can click on the headings to read those excerpts. The search is driven by mechanisms described later in this article.

Secondary Modules

In addition to the seven major modules in HURAA, there are seven secondary modules that supplement the primary content and help the individual use the site.

(8) *Glossary*. The Glossary contains over 200 terms relevant to human subjects research. The user may either browse the alphabetized listing or search by entering a term. Additionally, throughout HURAA, glossary terms are highlighted and the user may click on the term to see the definition or a list of related terms.

(9) *Archives & Links*. This module contains links to military regulations and relevant civilian documents. There are links to external web sites of military and nonmilitary organizations, and of online tutorials. Original documents are needed when the user has to access the exact text that stipulates policies and procedures.

(10) *Module Descriptions*. This module contains text descriptions for each of the primary modules. It is a good single-page overview of what HURAA has to offer in training.

(11) *Bibliography*. This lists relevant resources, including references for the content of HURAA and other publications that are relevant to the protection of human subjects in research.

(12) *System Requirements*. This module contains links to download necessary software components for running HURAA. This page appears automatically at the beginning of a new user's session. It remains available in case a user is having problems with particular HURAA components.

(13) *Help*. This has helpful hints for users who are having problems navigating HURAA.

(14) *Log Out*. The user logs off the web site when the user clicks on this.

Navigation and Information Retrieval Features

HURAA has a number of features that support diverse methods of navigation and information retrieval. In addition to the traditional features of web sites (such as Graphical User Interfaces and Hypertext drill down), there are a number of unique intelligent features that are now just starting to be used on web sites: an Animated Conversational Agent, Point & Query, and Natural Language Query.

It is convenient to view the various forms of navigation and information retrieval from the perspective of the five approaches to navigation discussed by Quesenbery (2001). The different forms of navigation and retrieval that exist in each of the modules and features of HURAA are identified below (Tab. 1).

1. *Browsing – "I want to see what's available."*
2. *Finding – "I want to locate something specific."*

3. *Query – "I want to see items that meet my criteria."* Query navigation is supported in the Query Documents module and other modules by allowing the user to ask a natural language question. Query navigation is also supported by the P&Q option, although the queries are limited to those provided by HURAA. The advantage of P&Q is that the user can ask sophisticated questions and receive answers specifically tailored to those sophisticated questions, rather than risking a bad search result.
4. *Structured - "I want to be led through a series of choices to help me narrow my focus."* .
5. *Guided – "I want to be led through the information."*

MODULE/FEATURE	Browsing	Finding	Query	Structured	Guided
Introduction					X
Historical Overview	X	X	X	X	
Lessons			X	X	
Explore Issues	X	X	X	X	
Explore Cases	X	X		X	
Decision Making				X	
Query Documents			X		
Glossary	X	X	X		
Archives & Links	X	X			
Module Description	X				
Bibliography	X				
System Requirements	X				
Help	X				
Point & Query	X	X	X	X	

Table 1: Forms of Navigation and Retrieval for Different HURAA Modules & Features

Animated Conversational Agent

This is a talking head with synthesized speech, facial expressions, and pointing gestures. The Agent tells the user what to do next when the user first encounters a web page. For example, when the user enters the Explore Issues Module, the Agent says, "Select the issue that you would like to explore." The talking head moves to direct the user's attention to some point on the display. For example, the talking head looks down when he says, "You may select one of the options below me." The talking head also tells the user what each primary and secondary module is supposed to do, after the user rests the mouse pointer over the module link for more than 2 seconds. The Agent is designed to project an authoritative persona and to help the user navigate through the interface more quickly. Many novice users are lost and don't know what to do next when they encounter a page. The Agent is designed to reduce this wasted time.

Point & Query

The interface displays a question mark (?) for some hot spots. When the user clicks on the question mark, a menu of questions appears. The user selects a question by clicking on it, and then the answer appears. Thus, the user can quickly ask a question with two clicks of a mouse. Users are also exposed to good, relevant questions because the designer of the P&Q handcrafts these Question-Answer items. P&Q can be viewed as a context-sensitive Frequently Asked Question (FAQ) facility.

Natural Language Query

The user can ask a question by typing it in English. The English description can be an interrogative or declarative expression of any arbitrary length. The user can declare what document or set of documents to search for an answer. HURAA accesses 5 paragraphs from the source documents that should contain relevant information to the query. The highest matching document identified by the computational linguistics software is automatically presented; selections 2-5 have a brief description presented, with an option for the user to view any of these paragraphs in their entirety.

Evaluation of Performance of Natural Language Queries

The natural language query feature is the most direct form of information retrieval because the user does not need to depend on or wait for the web content and interface to set the stage for posing a particular question. The user simply asks the question in English, at any point in the session with HURAA. In contrast, all of the other information retrieval facilities require the user to sift through the web pages, menu options, or hypertext hot spots until the right point when a particular question can be posed, if indeed it can be posed at all. Because of this special status of the natural language query feature, we conducted a performance analysis on how well different search engines fetched relevant and informative information. A natural language query facility is useful to active learners only to the extent that it provides relevant, informative information.

We tested 8 search engines, consisting of all combinations of the presence or absence of the following three match functions: (1) Latent Semantic Analysis (called *LSA*), (2) frequency-weighted keyword matching (called *Keyword*), and (3) glossary word matches (called *Glossary*). Each match function produces a value of 0 to 1 when considering the overlap between the words in query Q and the words in paragraph P. The paragraph that has the highest overlap, i.e., max {overlap(P,Q)}, is returned when one of the three functions is considered. When multiple match functions are considered (such as LSA+Glossary), then the paragraph is selected that has the highest average match values from the multiple functions.

Latent Semantic Analysis (LSA)

Latent Semantic Analysis (LSA) has recently been proposed as a statistical representation of a large body of world knowledge (Landauer, Foltz, & Latham 1998). The LSA uses a statistical method called "singular value decomposition" (SVD) to reduce a large Word by Document co-occurrence matrix to approximately 100-500 functional dimensions. The Word-by-Document co-occurrence matrix is simply a record of the number of times word W_i occurs in document D_j. A document may be defined as a sentence, paragraph, or section of an article. Each word, sentence, or text ends up being a weighted vector on the K dimensions. The "match" (i.e., similarity in meaning, conceptual relatedness) between two unordered bags of words (single words, sentences, or texts) is computed as a geometric cosine (or dot product) between the two vectors, with values ranging from 0 to 1. From the present standpoint, LSA is used to compute the highest matching paragraph from the document space that is relevant to the question Q.

Word frequency weighted keyword matching (Keyword)

HURAA has a lexicon with word frequency norms that are available electronically (Francis & Kucera 1982). The frequency of usage is the number of times the word occurs in a representative sample of printed text in the English language. Rare words should have higher weight than frequent words because they are more distinctive. Therefore, each word W_i is weighted according the reciprocal of is word frequency value $fr(W_i)$: $[1/fr(W_i)]$. An overlap score is computed that reflects the proportion of words that overlap between question Q and paragraph P (weighted by the reciprocal of the word frequency).

Glossary word matches (Glossary)

Glossary words are defined as all words in the HURAA glossary. These are technical words and terms relevant to the ethical use of human subjects. An overlap score is computed that reflects the proportion of glossary words that overlap between question Q and paragraph P.

Three experts on research ethics were instructed to generate 20 questions about four sections of the subject matter of HURAA (80 questions total). For each question, there were 8 paragraphs as answers, corresponding to the 8 search engines. The experts judged whether or not each paragraph was relevant to the question (Relevance Judgment) and an informative answer to the question (Informativity Judgment). The performance of the search engine was scored as the proportion of paragraph answers that were judged as relevant or informative. The mean proportion scores are presented below (Tab. 2).

The different search engines clearly yielded different affects on relevance and informativity proportion scores. A one-way ANOVA was found to show statistically significant differences in relevance proportion scores as a function of search engines, $F(7, 88) = 21.03$, $p < .01$, $MSe = .02$, as well as differences in informativity proportion scores, $F(7, 88) = 17.29$, $p < .01$, $MSe = .02$. The keyword match function was the clear winner, and significantly higher than each of the other seven search engines. Interestingly, about 2/3 of the fetched paragraphs were perceived as relevant and informative when the keyword search engine was used. This performance is quite impressive. It supports the claim that the performance of the natural language query module is sufficiently impressive that it should be a worthwhile information retrieval facility for active learners who like to ask questions.

SEARCH ENGINE	Relevance	Informativity
LSA	.40	.48
Keyword	.64	.66
Glossary	.19	.22
LSA+Keyword	.55	.56
LSA+Glossary	.26	.30
Keyword+Glossary	.36	.38
LSA+Keyword+Glossary	.37	.39
Random	.06	.08

Table 2: Relevance and Informativity Proportions for Eight Search Engines for Natural Language Queries

Acknowledgements

This research was directly supported by contracts from the Office of Naval Research (N61339-01-C1006) and the Institute for Defense Analyses (AK-2-1801), and was partially supported from grants by the National Science Foundation (REC 0106965) and the DoD Multidisciplinary University Research Initiative (MURI) administered by ONR under grant N00014-00-1-0600. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of ONR, IDA or NSF.

References

Anderson, J. R., Corbett, A. T., Koedinger, K. R., & Pelletier, R. (1995). Cognitive tutors: Lessons learned. *The Journal of the Learning Sciences*, 4, 167-207.

Ashley, K.D. (1990). *Modeling legal argument: Reasoning with cases and hypotheticals*. Cambridge, MA: MIT Press.

32 CFR 219 (1991). *Protection of Human Subjects*, Department of Defense.

Emmanuel, E. J., Wendler, D., & Grady, C. (2000). What makes clinical research ethical? *Journal of the American Medical Association*, 283, 2701-2711.

DoD Directive 3216.2 (1993). *Protection of Human Subjects in DoD supported research*, Department of Defense.

Francis, W.N., & Kucera, N. (1982). *Frequency analysis of English usage*. Boston, MA: Houghton-Mifflin.

Graesser, A. C., Langston, M. C., & Baggett, W. B. (1993). Exploring information about concepts by asking questions. In G. V. Nakamura, R. M. Taraban, & D. Medin (Eds.), *The psychology of learning and motivation: Vol. 29. Categorization by humans and machines* (pp. 411-436). Orlando, FL: Academic Press.

Graesser, A. C., & Person, N. K. (1994). Question asking during tutoring. *American Educational Research Journal*, 31, 104-137.

Graesser, A.C., Person, N., Harter, D., & TRG (2001). Teaching tactics and dialog in AutoTutor. *International Journal of Artificial Intelligence in Education*.

Graesser, A.C., VanLehn, K., Rose, C., Jordan, P., & Harter, D. (2001). Intelligent tutoring systems with conversational dialogue. *AI Magazine*, 22, 39-51.

Graesser, A.C., & Wisher, R.A. (2001). Question generation as a learning multiplier in distributed learning environments. *United States Army Research Institute for the Behavioral and Social Sciences, Technical Report 1121*.

Jurafsky, D., & Martin, J.H. (2000). *Speech and language processing: An introduction to natural language processing, computational linguistics, and speech recognition*. Upper Saddle River, NJ: Prentice-Hall.

Landauer, T.K., Foltz, P.W., Laham, D. (1998). An introduction to latent semantic analysis. *Discourse Processes*, 25, 259-284.

Mayer, R.E. (1997). Multimedia learning: Are we asking the right questions? *Educational Psychologist*, 32, 1-19.

NIH 45 CFR 46 (1991). *Protection of Human Subjects*. National Institutes of Health Code of Federal Regulations.

Otero, J., & Graesser, A.C. (2001). PREG: Elements of a model of question asking. *Cognition & Instruction*, 19, 143-175.

Person, N.K., Graesser, A.C., Kreuz, R.J., Pomeroy, V., & TRG (2001). Simulating human tutor dialog moves in AutoTutor. *International Journal of Artificial Intelligence in Education.*

Quesenbery, W. (2001). On beyond help: Meeting user needs for useful online information. *Technical Communication*, 48, 182-188.

Sharable Content Object Reference Model (SCORM), Version 1.1. www.adlnet.org

Tobias, S., & Fletcher, D. (200)(Eds.) *Training and retraining: A handbook for business, industry, government and the military.* New York: Macmillan.

VanLehn, K., Jones, R.M., & Chi, M.T. (1992). A model of the self-explanation effect. *The Journal of the Learning Sciences*, 2, 1-59.

BEST COPY AVAILABLE

Learning from Hypertext and the Analyst-Intuition Dimension of Cognitive Style

Martin Graff
School of Humanities and Social Sciences,
University of Glamorgan,
UK
Mgraff@Glam.ac.uk

Abstract: **From an instructional perspective, it is conceivable that employing an appropriate hypertext architecture should have the advantage of facilitating learning by representing logically the interrelationships between different units of information contained within the hypertext. Furthermore, there would however appear to be a sound theoretical rationale for suggesting that the degree to which hypertext based instructional systems facilitate learning will be contingent on an individual's cognitive style. This study aimed to investigate the effects of hypertext architecture and cognitive style on learning. Fifty three participants were assigned to one of three hypertext architectures corresponding to linear, hierarchical and relational structures. Cognitive style was assessed using the Cognitive Styles Index (Allinson and Hayes, 1991). The findings revealed an interaction between cognitive style and hypertext architecture on the recall performance of participants. However, when learning was assessed at a deeper level, no significant effects were observed. Further analysis revealed that concept maps of the hypertext architecture differed between participants in each hypertext condition. The results are discussed in terms of a consideration of individual differences in cognitive style in the design of hypertext instructional systems.**

Introduction

System structure has been found to affect navigational performance within a hypertext environment (McDonald and Stevenson, 1996, 1998), and this in turn has been found to influence learning (Shapiro, 1998; Tripp and Roby, 1990).

The potential benefits of hypertext to learning may also be influenced by employing different hypertext architectures for instruction. There is evidence to suggest that learning performance is enhanced when mixed hypertext architectures are employed (Mohageg, 1992; McDonald and Stevenson, 1998, Shapiro, 1998). In these studies mixed hypertext architectures were hierarchical with lateral links. However, a further question may be posed here, which is whether individual differences between learners can influence performance within particular hypertext architectures.

One individual difference characteristic which would appear to be relevant to learner performance in hypertext, is cognitive style. Field dependence-independence is one of the most extensively researched formulations of cognitive and evolved from Herman Witkin's pioneering work on perception of the upright. With regard to the relationship between cognitive style, hypertext and learning it is likely that the complex hypertext structures, predisposes that individuals possessing a style which facilitates their ability to apprehend such structures when browsing may derive greater benefit in terms of learning from hypertext. Results generally reveal that field independent individuals outperform field-dependents in the recall of verbal information from a hypertext delivery (Lin and Davidson-Shivers, 1996), and also that performance of field independents is superior when using explicitly structured hypertext (Korthauer and Koubek, 1994). However, one alternative explanation for these results is that the Group Embedded Figures Test (GEFT) used to measure field dependence-independence has also been found to be correlated with standard ability tests (Verbon, 1972; McKenna, 1984).

Other studies to date have used different psychometric tests of style in order to test the relationship between style and the effectiveness of instruction delivered via hypertext. For example, Melara (1996) used Kolb's Learning Style Inventory and Beishuizen, Stoutjesdijk and van Putten (1994) and Verhejj, Stoutjesdijk and

BEST COPY AVAILABLE

Beishuizen (1996) using a formulation of the deep and surface processors construct. Many of these studies used recall performance as a measure of learning, yet most academic concepts are more complex requiring a level of learning deeper than is demonstrated by mere recall.

This study aims to assess whether different hypertext architectures are more facilitative to individuals with different cognitive styles and employs a psychometrically sound instrument for the assessment of cognitive style. Furthermore, learning in this study is assessed at a deeper level than mere recall of information from the hypertext.

Method

Participants

55 participants took part in this study, 46 male and 9 female undergraduate students, with a mean age of 22.93, an SD of 6.21, minimum age of 19 and maximum age of 47.

Hypertext

The subject matter of the hypertext document was taken from various pieces of historical information and edited so that the names dates and events were altered in order to maintain consistency. Each page of hypertext, typically contained between one and four sentences of information. The document consisted of 64 nodes or pages containing 3388 words.

Three hypertext document was presented as one of three architectures corresponding to linear, hierarchical and relational. A description of each architecture is outlined below. Diagrams of the hypertext architectures employed are shown below in Figs 1 to 3.

In the linear architecture, the hypertext pages were linked such that the user could move only to the next or the previous page. Each page however had a link to the first page, and the first page had a link to the top page of each of the four general sections within the structure. In this way the structure resembled a book structure, in that the user could start at a contents page, and move to the beginning of any chapter, and similarly from the middle of any chapter could jump back to the contents page again (see Figure 1). The linear architecture comprised 66 links between pages.

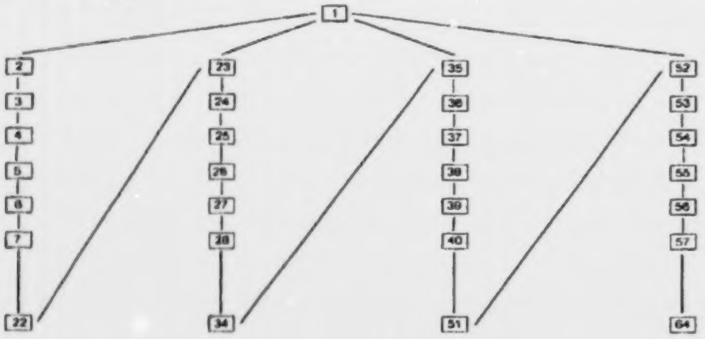


Figure 1: Linear Architecture

The hierarchical architecture was designed so that a user could move from reading a page at one level, down to a page below it in the hierarchy, or back to a page above it in the hierarchy. In this hierarchical architecture, general concepts subsumed more detailed ones. Users could move up and down the hierarchy, exploring subordinate and superordinate relationships. However, no facility was provided for lateral moves (See figure 2). The hierarchical architecture was comprised of 62 links.

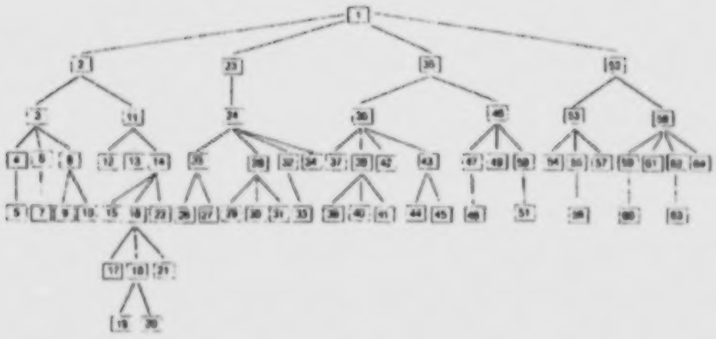


Figure 2: Hierarchical Architecture

The relational architecture was identical to the hierarchical architecture, in that users could move up or down the hierarchy. However, this structure also contained additional links, which meant that the user could move laterally to other locations within the architecture, related by subject matter (see Figure 3). The relational architecture was comprised of 62 links plus a further 32 lateral links.

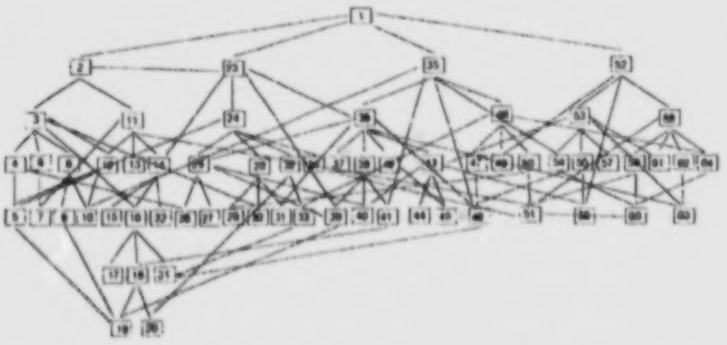


Figure 3: Relational Architecture

Assessment of Cognitive Style (Cognitive Styles Index) (Allinson and Hayes, 1991)

The Cognitive Styles Index is a test of cognitive style developed for large scale use. It determines an individual's position on the analyst-intuitive dimension of cognitive style. Typically analysts are able to apprehend ideas or concepts in parts, but have difficulty integrating such ideas into complete wholes. However, intuitives are able to view ideas as complete wholes, but are unable to separate these ideas into discrete parts. Scores on the CSI can range from 0 up to 76. Analysts can be identified by a low score on this test, while intuitives may be identified by a high score.

Procedure

Participants were assigned to one of the three hypertext architecture conditions, and were asked to read through the hypertext pages in any order they chose, provided that this reading order could be accommodated

BEST COPY AVAILABLE

by the hypertext architecture to which they were assigned. They were then tested in three ways. Firstly with ten recall questions, secondly by writing an essay which could be answered from the information in the hypertext and finally by drawing a map of the hypertext architecture they had used.

The recall test was scored by simply adding up the number of correct answers to questions on information within the hypertext. Each essay was assessed in terms of the amount of detail it contained and also how well each participant had integrated the information content in the essay. Maps produced by participants were scored in terms of complexity and density measures. The formula for the calculation of complexity as given by Johnson, Gregory and Smith (1986) is links drawn / nodes drawn. The formula for calculation of density as given by Klein and Cooper (1982) is links / nodes (nodes – 1).

Results

Table 1 displays the results of an analysis of variance for recall questions for architecture and cognitive style, with the means and standard deviations displayed in Table 2. No significant main effects can be observed for architecture and cognitive style, although a significant interaction effect is evident between architecture and cognitive style. Inspection of the table of means reveals variation between cognitive styles within each architecture condition.

Source of Variation	**F**	**p**
Architecture	0.61	0.54
Cognitive Style	0.23	0.78
Architecture X Cognitive Style	3.04	0.02

Table 1: Analysis of Variance for Recall for Hypertext Architecture and Cognitive Style (N= 53)

	Mean	**SD**	**Cases**
Entire sample	6.18	2.29	55
Relational	6.71	2.31	19
Analyst	5.66	3.01	6
Intermediate	7.78	2.11	7
Intuitive	6.50	1.37	6
Hierarchical	5.91	2.11	18
Analyst	7.58	2.10	6
Intermediate	4.66	2.06	6
Intuitive	5.50	1.04	6
Linear	5.88	2.47	18
Analyst	4.80	1.92	5
Intermediate	5.77	2.53	9
Intuitive	7.50	2.64	4

Table 2: Means and standard deviations for recall scores

Table 3 displays the results of an analysis of variance for essay detail and integration scores for architecture and cognitive style, with the means and standard deviations displayed in Table 4. No significant main effects or interaction effects can be observed for architecture or cognitive style for each of these variables.

Source of Variation	F	p
Detail		
Architecture	0.21	0.80
Cognitive Style	0.00	0.99
Architecture X Cognitive Style	0.83	0.51
Integration		
Architecture	0.13	0.87
Cognitive Style	0.60	0.54
Architecture X Cognitive Style	1.33	0.27

Table 3: Analysis of Variance for Detail and Integration Scores for Hypertext Architecture and Cognitive Style (N= 50)

	Mean Detail	SD	Mean Integration	SD	Cases
Entire sample	64.36	46.02	37.50	23.28	50
Relational	66.79	50.05	35.26	20.10	19
Analyst	87.83	75.62	38.33	25.82	6
Intermediate	63.29	35.94	39.29	18.58	7
Intuitive	49.83	29.23	27.50	16.36	6
Hierarchical	57.81	38.00	37.81	22.87	16
Analyst	56.67	51.58	36.67	22.95	6
Intermediate	55.50	30.92	25.00	14.72	4
Intuitive	60.50	32.90	47.50	25.84	6
Linear	68.27	50.72	40.00	28.35	15
Analyst	46.00	49.34	23.75	23.23	4
Intermediate	71.00	44.91	42.86	27.21	7
Intuitive	85.75	66.70	51.25	34.49	4

Table 4: Means and standard deviations for detail and integration scores

Table 5 displays the results of an analysis of variance for essay detail and integration scores for architecture and cognitive style, with the means and standard deviations displayed in Table 6. A significant main effect can be observed for architecture on the density, F (2,35) =4.43, p = 0.01. Inspection of the means scores in Table 6 reveals that participants performing in the relational architecture condition score highest on density scores. Tukey's test of post-hoc comparisons, reveals significant differences in complexity scores between participants in the relational and hierarchical architecture conditions ($p<.01$), however, no differences were observed between relational and linear conditions or between hierarchical and linear conditions for complexity. For density scores, the main effect for architecture is approaching significance, F (2,35) = 2.80, p = 0.07. Finally, an interaction effect approaching significance between architecture and cognitive style can be observed F (4,35) = 2.24, p = 0.08.

Source of Variation	F	p
Complexity		
Architecture	4.43	0.01
Cognitive Style	0.64	0.53
Architecture X Cognitive Style	0.96	0.43
Density		
Architecture	2.80	0.07
Cognitive Style	0.91	0.40
Architecture X Cognitive Style	2.24	0.08

Table 5: Analysis of Variance for Complexity and Density Scores for Hypertext Architecture and Cognitive Style (N= 44)

	Mean Complex	SD	Mean Density	SD	Cases
Entire sample	1.22	0.35	0.20	0.31	44
Relational	1.40	0.31	0.30	0.52	13
Analyst	1.45	0.35	0.18	0.18	4
Intermediate	1.24	0.22	0.16	0.11	6
Intuitive	1.65	0.31	0.75	1.08	3
Hierarchical	1.03	0.19	0.08	0.04	14
Analyst	1.07	0.18	0.09	0.03	5
Intermediate	0.95	0.09	0.09	0.05	6
Intuitive	1.13	0.33	0.06	0.02	3
Linear	1.22	0.41	0.23	0.20	17
Analyst	1.14	0.24	0.17	0.12	5
Intermediate	1.32	0.54	0.32	0.25	8
Intuitive	1.18	0.32	0.12	0.07	4

Table 6: Means and standard deviations for complexity and density scores

Discussion

This study examined several issues regarding cognitive style and learning from hypertext. Firstly, a significant interaction was observed between cognitive style and hypertext architecture for recall questions. While it is conceded that recall does not represent an effective measure of learning, the results go some way to suggesting that individuals possessing different cognitive styles learn more efficiently from certain hypertext architectures. This finding is in accord with the cognitive styles matching hypothesis.

The cognitive style matching hypothesis essentially suggests that when the cognitive styles of the system and the user are matched, then the amount of learning will be improved. An illustration of the interaction between a teacher's and learner's cognitive styles is given in the diagram below. (see figure 4).

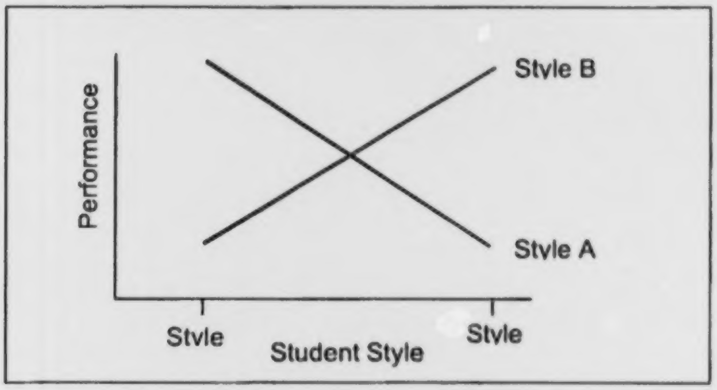


Figure 4: Theoretical interaction between learner's and teacher's cognitive styles

In this respect, hypertext appears to offer promise to such a matching hypothesis, as the architecture may be designed with consideration to the cognitive style of the user.

No differences were found on assessment of detail and integration in the essay question for hypertext architecture or cognitive style. This somewhat calls into question the previous results, although it is equally possible that the scoring system employed for the essay question needs further refinement.

A significant effect was observed for complexity scores for architecture, with participants in the relational architecture producing significantly more complex maps than those performing in the other two conditions. This may be accounted for by the fact that the relational condition had more hypertext links than each of the other two conditions. Finally differences were observed for density scores between architectures and furthermore an interaction effect was also observed here. As density scores approach 1 the map's density increases as it approaches optimal connectivity. In this study map density was used as an indication of the degree to which participants had integrated the individual concepts within the subject domain. However, the effects here are only approaching significance.

At least two important methodological points need to be considered in future studies. Firstly, it is possible that individuals may engage differently with certain types of information depending on their cognitive styles. Therefore a different type of information content may possibly give different results. Therefore the type of information featured in the hypertext also needs to be considered. Secondly, in this investigation, learning was measured by scoring essays for level of detail. It is relevant also to consider other methods of learning in future studies.

Conclusion

It is tentatively suggested that the results revealed in this study may be applied in the context of matching hypertext architecture to the cognitive style of the user in order to facilitate more effective learning. This therefore has important implications for e-learning as it is possible that individuals may benefit by using hypertext architectures designed to take account of their particular cognitive styles. Hypertext would appear to offer great promise to such a matching, as these systems may be designed with consideration to the cognitive style of the user, and their ability to effectively apprehend the structure of the system and also to perceive their correct orientation.

References

Allinson, C. W. and Hayes, J. (1991) The Cognitive Styles Index. University of Leeds. UK.

Beishuizen, J. Stoutjesdijk, E. and Van-Putten, K. (1994) 'Studying textbooks: Effects of learning styles, study task and instruction' *Learning and Instruction*, 4 (2) 151-174.

Johnson, R. J., Gregory, D. and Smith, D. M. (1986) Dictionary of Human Geography (2nd edition), Oxford, Blackwell.

Klein, J. H. and Cooper, D. F. (1982) 'Cognitive maps of decision-makers in a complex game' *Journal of the operational research society*, 33, 63-71.

Korthauer, R. D. and Koubek, R. J. (1994) 'An empirical evaluation of knowledge, cognitive style and structure upon the performance of a hypertext *task*' *International Journal of Human Computer Interaction*, 6, (4), 373-390.

Lin, C. H. and Davidson-Shivers, G. V. (1996) 'Effects of linking structure and cognitive style on students' performance and attitude in a computer-based hypertext environment' *Journal of Educational Computing Research*, 15, (4), 317-329.

McDonald, S. and Stevenson, R. J. (1996) 'Disorientation in hypertext: The effects of three text structures on navigation performance' *Applied Ergonomics*, 27 (1) 61-68.

McDonald, S. and Stevenson, R. J. (1998) 'Effects of text structure and prior knowledge of the learner on navigation in hypertext' *Human Factors*, 40 (1) 19-27.

McKenna, F. P. (1984) 'Measures of field dependence: cognitive style or cognitive ability' *Journal of Personality and Social Psychology*, 47 (3) 593-603.

Melara, G. E. (1996) 'Investigating learning styles on different hypertext environments: Hierarchical-like and network-like structures' *Journal of Educational Computing Research*, 14, (4) 313-328.

Mohageg, M. F. (1992) 'The influence of hypertext linking structures on the efficiency of information retrieval' *Human Factors*, 34, 351-367.

Shapiro A. M. (1998) 'Promoting active learning: The role of system structure in learning from hypertext' *Human Computer Interaction* 13, (1), 1-35.

Tripp, S. D. and Roby, W. (1990) 'Orientation and disorientation in a hypertext lexicon' *Journal of Computer-Based Instruction*, 17, 120-124.

Vernon, P. E. (1972) 'The distinctiveness of field independence' *Journal of Personality*, 40, 366-391.

Verheiji, J., Stoutjesdijk, E. and Beishuizen, J. (1996) 'Search and study strategies in hypertext' *Computers in Human Behaviour*, 12 (1) 1-15.

Developing an Online Professional Development Program Using Instructional Technology For Supervisors and Administrators

Robert J. Graham
Principal, Port Richmond High School
New York City Board of Education
United States
rgraham@nycboe.net

Terry H. Daniels
Department of Education
St. John's University
United States
danielst@stjohns.edu

Abstract: A problem facing many supervisors and administrators in K-12 and higher education is how to effectively integrate technology into the instructional program. Professional development plays a key role in providing training and support required to develop the instructional technology (IT) skills necessary to have a positive effect on instruction. This paper will explore the role of supervisors and administrators as instructional leaders in their schools in the formation and support of programs aimed at the integration of instructional technology. An online professional development course for supervisors was developed by the principal of a large urban high school in the northeast, using Blackboard as the vehicle for the course's implementation. The goal of the course was to provide turnkey training for the ten assistant principals at the school. In addition to providing some essential IT skills for the supervisors and administrators, the online course aimed to begin to cultivate a community of learners within the school.

Teaching and Learning in the 21st Century

There have been many notable changes in our society as we move forward into the 21st century. Basic philosophical changes in teaching and learning have dominated the educational landscape. According to Schlechty (1997) the way people access, work with and communicate information is fundamentally different than it was a decade ago. Education and teaching are no longer seen as a method of delivery of information. Kavanagh (2001) believes that educators have had to make a radical shift in their approach to teaching and learning, and must focus more on the process by which students learn. A true educator is no longer viewed as the center of attention and does not merely impart knowledge to the eager-to-learn student. Barth (2001) contends that the "Transmission of Knowledge" model fails to meet the needs of students to be involved and engaged learners. In the effective classroom, the true educator serves more as a coach and facilitator who draws forth learning from within the student.

Schlechty (1997) stresses that in order to shift attention from teacher to learner, teachers must plan lessons that are more interactive and more student-centered. This shift in attention toward the student also requires a more learner-centered approach to curriculum writing and revision.

The Role of Technology in Teaching and Learning

In the past two and a half decades, technology has become an integral part of classroom instruction. This technology has been computer based. Only ten years ago, there was approximately 1 computer for every 30 students in the United States. In 2000, that figure dropped to 1 computer for every 4.9 students (Education Week, 2001). Educators across this country and around the world have recognized that computers have a genuine place in the education of our children. As Lemke and Coughlin (1998) point out, technology accelerates, enriches and deepens basic skills; it motivates and engages students in learning.

In recent years, as the computer has found its way into more classrooms, a myriad of uses has developed. While early classroom use was relegated to BASIC programming, today's uses include traditional computer applications such as word processing, database management, use of spreadsheets, presentation software, and computer graphics, as well as more advanced programming, web design, and other web-based applications such as online research and e-mail.

As computers and access to the Internet become more widespread in schools and homes of students and teachers, technology has become a tool that is quickly changing the way teachers teach and the way in which students learn. According to Fisher and Dove (1998) we are clearly in a period of transformation. To move forward will require leadership, vision and a willingness to take risks and to make mistakes for the opportunity of improving instruction and increasing learning in our students. As Schmeltzer (2001) notes, administrators can no longer avoid providing the same leadership in technology as they have in the more traditional areas.

Access Issues for Staff and Students

While embarking upon professional development programs to train teachers and administrators in the use of the computer as a technology tool for teaching and learning, we need to understand that there may be access issues for teachers as well as for our students. Do our administrators, teachers and students have computers readily available to them in the schools? What about at home? In addition, how many of these computers have Internet access?

The answer to the access question is that, in general, most teachers have access to a computer. In a recent study by the National Center for Educational Statistics (2000) virtually all (99 percent) public school teachers reported having access to a computer somewhere in their school. In addition, the NCES cited that 82 percent of public school teachers reported that there was a computer available to them at home. However, access to the Internet is much less widespread - only 63 percent of those responding to the NCES study had Internet access.

Having access to a computer, though, does not guarantee its usage in the classroom. According to the NCES study (2000), only half of the teachers who had computers or the Internet available in their schools used them for instructional purposes.

The Role of the Supervisor

To effectively integrate educational technology into the learning environment, Gibson (2000) points out that it is essential for informed and effective leadership to have a visible presence. Serving as the instructional leaders in their buildings, administrators and supervisors must provide the means and professional development necessary to achieve technology infusion and to ensure that computers and the Internet are optimally utilized. In order to do so, it is essential that all administrators and supervisors become technologically competent. As Gillingham and Topper (1999) assert, administrators of teacher prep programs need to learn more about modern forms of communication and IT, and to make them an integral part of their programs.

One of the main frustrations of teachers is that learning computer skills requires an extended amount of time before they reach a comfort level and a level of confidence that will enable them to involve their students (Fisher & Dove, 1998). Imagine the plight of the school administrator or supervisor who needs to become sufficiently computer competent to be an integral part of a professional development program in instructional technology. According to McKenzie (1998) the challenge of integrating technology into the instructional program may be more about attitude and spirit than it is about skill. To move instructional technology to a higher plateau administrators and supervisors must become stakeholders and buy into the use of technology as an administrative and instructional tool. To accomplish this, districts and school principals need to devise innovative ways of delivering ongoing professional development that is both flexible and effective.

Implementation of an Online Course for Supervisors

The Principal of a large, urban high school in the northeast instituted a course of study for administrators using Blackboard as the vehicle. The purpose of the course was to train the ten assistant principals in his school in the use and implementation of IT in the classroom. The ultimate goal was for the assistant principals to provide turnkey training for teachers in their own departments. The Principal chose to offer an online course for this professional development because it had the greatest chance for optimal participation by those involved. According to Sujo de Montes and Gonzales (2000) courses that are Web-based provide a viable option for professional development of teachers and administrators.

Although the Principal of the school had a background in computer science and IT, the level of computer competence among the assistant principals varied greatly. While one of the assistant principals was a supervisor of business subjects and author of textbooks and workbooks in various computer applications, two others had little or no experience with computers. The other seven assistant principals were at the same level of minimal competence. Most were infrequent users of e-mail with personal accounts at home. All used word processing software to write letters, memos and observation reports. A few even developed some test banks for different courses within their department.

Each of the ten "learners" had access to the Internet at home and each had a computer in his/her office in school. However, only six had Internet access in their office. Therefore, the first order of business in the beginning of the school year was to provide Internet access for the four assistant principals who were without this tool in their office. Once Internet access was available to each of the assistant principals, both at home and in school, the course of study began.

Following the normal routine of a typical school year, regular bi-weekly administrative cabinet meetings took place. The difference for this school year would be that every other cabinet meeting would include one and one half hours of professional development in an Internet accessible computer lab with the Principal serving as trainer and facilitator. According to Holbein and Jackson (1999) teachers and administrators need both time and support to acquire and sustain computer literacy. Given the regular training schedule, the accessibility of Blackboard, and the expertise and support of two colleagues, the course of study had an excellent chance for success.

The Online Course of Study

The focus of the initial meeting for the training course was to familiarize the supervisors with Blackboard. Supervisors completed the data entry of personal information and were given a guided tour of the Web-based tool. Once familiar with navigating Blackboard, supervisors were given assignments at regular intervals over the course of the fall semester to be completed by the following meeting.

The **Announcements** section of Blackboard was used as a method of conveying information to the assistant principals about new assignments and general feedback regarding previous assignments. The **Course Information** and **Staff Information** sections were used for demonstration purposes, showing the assistant principals how a teacher could readily relay information about an online course to his/her students. The **Course Documents** section contained several documents: the course content, course objectives, and a web site evaluation form.

The **Assignments** section listed all of the assignments up to and including the most current assignment. The first assignment required participants to log onto Blackboard, enter the requested personal information, then use the **Communication** section of Blackboard to e-mail the instructor (Principal) that they got to this point in the assignment. Initially, all participants used their personal e-mail addresses in setting up their Blackboard accounts. Since this was the participants' initial encounter with Blackboard, the instructor used a face-to-face meeting to walk them through the assignment, making sure that they were comfortable with the online classroom tool.

The next feature explored by the group was the **Discussion Board** of the **Communication** section. Teaching this skill early in the course enabled the instructor to create a community of interactive learners. As Brown (1997) points out, online discussion has a number of advantages over oral real time discussion. Learners can respond at a time that best suits them, allowing for reflection and further research before responding. Dutt-Doner and Powers (2000) maintain that while a new instructional tool such as electronic discussion groups can have some stumbling blocks, it can have tremendous impact upon discussion and thought. In addition to giving his supervisors this new instructional tool, the Principal was also able to get feedback regarding school related issues, programs and possible changes in certain school policies. The **Discussion Board** served a dual purpose – it allowed for dialogue among the supervisors and administrators, and at the same time, reinforced the use of the **Discussion Board** as a tool for ongoing communication among all participants for the duration of the training course and after completion of the course.

Since all of the participants were familiar with MS Word and had some experience surfing the Web, much of the training and assignments given utilized this common knowledge as part of an overall assignment. Web-based training and assignments included Web surfing, Web site evaluation using a comprehensive form placed in an MS

Word document on Blackboard and downloaded by the participants, a scavenger hunt using various search engines, simple Web page design using Blackboard, and a "googlewhacking" contest in which participants had to find two words that produced a single hit in a Google search. Other training and assignments included saving a graphic to disk, inserting a graphic into an MS Word document, and attaching a document to an e-mail message.

A slight detour in the course took place when the Board of Education for the school instituted a new Web-based e-mail system using Microsoft Outlook Web Access for all supervisors and teachers in the entire school district. Since all the learners were using their own private e-mail, the group agreed that it would be wise to learn the new system for consistency. The training for the new e-mail system was then done through the online course using Blackboard. A simple user's guide was created by the Principal and the Business Department Assistant Principal, and distributed to the participants via Blackboard. A new set of assignments was created for the group that reinforced such common e-mail tasks as reading a message, replying to a message, forwarding a message, and attaching a document to a message. Other features of Outlook Web Access such as creating folders, setting up a directory of contacts, and creating distribution lists were reviewed in the **Course Documents** section using "How to" sheets and reinforced through the **Assignments** section.

Having used an online method of delivery, the assistant principals shifted to the new system of e-mail with relative ease. Personal information on Blackboard was updated, and all further e-mail correspondence used the new system for reinforcement.

By the end of the fall semester, each of the assistant principals demonstrated skills acquired through the regular submission of assignments. By the beginning of the spring semester, nine of the ten assistant principals were using e-mail on a daily basis. For his part, the Principal made it a point to e-mail the assistant principals each day. This served not only as a method of daily communication, it also served as a way of reinforcing e-mailing skills learned in the online course.

As the group moved into the spring semester, the focus shifted to more advanced uses of computer technology. In doing so, more ambitious training and assignments were implemented during the spring semester. These included such activities as creating a PowerPoint presentation, using Inspiration to create semantic maps, downloading and adapting lesson plans, and creating inquiry-based learning projects. A single face-to-face training session took place for each activity. This was followed by a reinforcing assignment, done independently or collaboratively, and submitted online.

Plans for the end of the spring semester revolved around preparations for the assistant principals to turnkey this training with their teachers in the fall 2002 semester using a similar ongoing, online professional development program with Blackboard as the vehicle of delivery. Department supervisors planned to tailor the supervisors' course to meet the needs of the teachers in their particular academic discipline.

Reflections

According to Schmeltzer (2001) creating a community of learners among the administrators of a school or district is crucial to the success of any professional development program. Throughout the year, the online course provided a mechanism for the school supervisors and administrators to share ideas and skills. By creating such a learning circle, great improvements in teaching quality can be realized (Collay, Dunlap, Enloe & Gagnon, 1998).

A course evaluation was conducted at the end of the school year through the discussion board. Each assistant principal was asked to offer his/her evaluation of the course and to respond to at least one of his/her colleague's evaluations. In general, the assistant principals found the online course to be a very worthwhile endeavor. As one computer novice assistant principal remarked, "The projects required me to use the computer to a much greater extent than I had, something that was necessary for me to see its advantages."

During the fall semester most of the assistant principals reached a comfort level with the technology and developed a better sense of community with one another. Through the use of the discussion board, the learners were also able to share reflections and experiences, frustrations and successes. The administrators and supervisors felt strongly that the social element provided by the online course was as important as the technical and instructional components. As one participant noted, "The discussion board and regular use of e-mail enabled us to maintain ongoing communication, something that was lacking in the past."

The use of regular "face-to-face" meetings was deemed important and necessary by the participants. However, since the meetings were scheduled during the school day, some of the administrators and supervisors had occasional distractions that were somewhat disruptive. It was agreed that, in the future, these "face-to-face" meetings be conducted outside the normal school day, thus limiting unforeseen disruptions.

Conclusions

Comprehensive integration of technology into curriculum and into the classroom will require tremendous vision and effort from our school leadership. As Kavanagh (2001) states, the potential of information technology and the Internet to create communities of learners will continue to have a significant effect on the design of educational programs. School administrators and supervisors need to be trained in ongoing professional development programs that maximize their participation, increase their IT skills, and develop a community of learners and instructional leaders within their schools. Collaboration tools such as *Blackboard* can facilitate the "anytime, anywhere" professional development necessary to accomplish this goal. Other such collaboration tools include *LiveText* by LiveText (www.livetext.com), WebCT by WebCT (www.webct.com), *FirstClass* by Centrinity (www.centrinity.com), and *Polycom WebOffice* by Polycom (www.polycom.com). Since budget limitations can be an issue for many schools, similar ongoing collaborative professional development can also be accomplished through the use of e-mail and attachments.

Whatever the method of delivery, a professional development program that provides opportunities for learning, and is independent of time and location, has the greatest chance for ensuring technology integration into the classroom.

References

Barth, R.S. (2001). *Learning by Heart.* Jossey-Bass.

Brown, A. (1997). Designing for learning: What are the essential features of an online course? *Australian Journal of Educational Technology,* 13 (2), 115-126.

Collay, M., Dunlap, D., Enloe, W., and Gagnon, G., Jr. (1998). *Learning circles: Creating conditions for professional development.* Corwin Press, Inc.

Dutt-Doner, K.M., and Powers, S.M. (2000). The use of electronic communication to develop alternative avenues for classroom discussion. *Journal of Technology and Teacher Education*, 8 (2), 153-176.

Education Week. (2001, May 10). Technology counts 2001:The new divides. *Education Week,* 22(35), 10-11.

Fisher, S.C., and Dove, M.K. (1998). *Muffled voices: Teachers' concerns regarding technological change.* WebNet1998.

Gibson, I.W. (2001). *The role of school administrators in the process of effectively integrating educational technology into school learning environments: New research from the mid-west.* Paper presented at SITE Conference, Orlando, Florida, 2-5 March.

Gillingham, M.G., and Topper, A. (1999). Technology in teacher preparation: Preparing teachers for the future. *Journal of Technology and Teacher Education*, 7 (4), 303-313.

Holbein, M.F., and Jackson, K. (1999). Study groups and electronic portfolios: A professional development school inservice project. *Journal of Technology and Teacher Education*, 7 (3), 205-218.

Kavanagh, M. (2001). *Managing change to flexible learning using online technologies: Bridges to cross, lessons to learn.* SITE (Society for Information Technology & Teacher Education) 2001 Conference paper.

Lemke, C., and Coughlin, E.C. (1998). *Technology in American schools: Seven dimensions for gauging progress.* Retrieved March 1, 2002: http://www.mff.org/pubs/ME158:pdf.

McKenzie, J. (1998). *Adult technology learning: Creating culture with just-in-time support.* Retrieved February 23, 2002: http://staffdevelop.org/adult.html.

National Center for Educational Statistics. (2000). *Teachers' tools for the 21st century.* Retrieved March 2, 2002: http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid2000102.

Schlechty, P. (1997). *Inventing better schools.* San Francisco: Jossey-Bass.

Schmeltzer, T. (2001). Training administrators to be technology leaders. *Technology and* Learning, Retrieved March 15, 2002: http://www.techlearning.com/db_area/archives/TL/200106/training.html.

Sujo de Montes, L.E., and Gonzales, C.L. (2000). Been there, done that: Reaching teachers through distance education. *Journal of Technology and Teacher Education*, 8 (4), 351-372.

An Analysis of Instructional Strategies Used in Synchronous Learning Environments

Melanie W. Greene
Department of Curriculum and Instruction
greenemw@appstate.edu

Sara Olin Zimmerman
Department of Curriculumand Instruction
zimmermnsj@appstate.edu

John H. Tashner
Department of Leadership and Educational Studies
tashnerjh@appstate.edu

Linda Pacifici
Department of Curriculum and Instruction
pacificilc@appstate.edu

Appalachian State University
United States

Abstract: The purpose of this project was to investigate the perceptions of instructors and students with regard to delivering effective instruction in synchronous learning environments. The specific research goals were to attain an evaluation of the quality of distance education courses, to determine the effectiveness of the delivery medium, and to examine instructors' and learners' perceptions of the instructional strategies implemented in courses delivered through the medium of real-time audio-video teleconferencing via the North Carolina Information Highway.

Introduction

Distance education programs across the country have been expanded to meet increased needs in higher education. Traditionally these courses have used face-to-face, two-way interactive video, and web-based instruction. Guidance often consists of learning about the use of cameras, PowerPoint, video options, and web boards. Numerous training manuals have been written in this field with a questionable basis in research. Educators need to make sure that technology is not driving the learning experience when there is added pressure to enlarge the number of students in various programs. In addition, educators who understand pedagogy must take the lead in teaching techniques via distance. Before we continue serving students with distance learning we need to answer some essential questions regarding effective teaching in synchronous and asynchronous environments. In search of the answer, the fields of education and technology have studied student perceptions comparing online to traditional lecture class quality (Ryan, 2000), the achievement of students in distance education and traditional classrooms (Schulman & Sims, 1999; Dominguez & Ridley, 1999), demographics of students taking online courses (Guernsey, 1998), staff training needs (Connell, 1998), support for faculty teaching (Bremner, 1998), and community and team formation in distance education classrooms (Berg, 1999) and numerous other subjects. We have also examined traditional versus nontraditional roles for the teacher and new paradigms for on-line learning (Bourne, McMaster, Rieger, & Campbell, 1997; Shneiderman, Borkowski, Alavi, & Norman, 1998). The need still exists to examine the role of the teacher and effective strategies for effective teaching. As Shneiderman (1998) wrote, "technology can be wonderfully empowering for teachers and students, (but) the relationship between human beings is still the heart of the educational process."

BEST COPY AVAILABLE

Purpose

This study attempted to examine the perceptions of teachers and students in distance education classes taught by university faculty from a college of education. Graduate students who were practitioners in various fields of education were the participants in these synchronous classes. It was anticipated that this pool of students would give insight into appropriate and inappropriate uses of various teaching strategies and techniques due to their expertise in education. A web site with a discussion board was created to allow for interactions among students about: 1) the quality of learning, 2) effective teaching strategies, and 3) the effectiveness of the media of course delivery. Four instructors with experience teaching in synchronous learning environments also responded to these questions and their responses were also compiled, analyzed, and compared with student summaries.

Theoretical Framework

The conceptual framework that serves as a philosophical basis for our institution posits that faculty and students come together as a community of inquirers to examine the aims of education and the nature of teaching and learning for achieving worthwhile educational goals. Teaching is viewed as a dynamic, goal-oriented, social activity, and learning is perceived as an active process of acquiring, assessing, and producing knowledge. We collectively embrace the exploration of new forms of teaching and learning through experimenting with emerging technologies. To this effort, we work as a community of practitioners who embrace the social constructivist perspective and encourage discourse from various levels of participants in solving educational problems.

The Study

When the researchers in this study determined a need to engage graduate students in a collaborative effort to evaluate the quality of their learning experiences from courses offered via distance learning, two groups of students were selected. These two groups of students consisted of majors from the field of instructional technology and elementary and middle grades education who were currently employed in their field of expertise. The technology majors were enrolled in the course *Planning for Technology in Education*. It is one of the advanced courses students must complete for a graduate degree and K-12 licensure in instructional technology in North Carolina. The course emphasizes the development of technology plans at local, school, and district levels. In addition, the issues and processes of successful grant writing are explored. This course was taught simultaneously to two groups of students at remote sites and one group on the campus. The remote sites had computers for each student, while the main campus site required students to use a computer lab located in another building. Each site had a technician to assist with the overall operational details of the teleconference. A web-based supplement was also developed for the course that included an orientation, daily outline and assignments, resources and a threaded discussion forum. The instructor for this course had previously taught with this delivery medium. The elementary and middle grades education majors were enrolled in the course *Connecting Learners and Subject Matter*. It is one of the required courses for all education majors for the graduate level degree. The course emphasizes effective strategies for ensuring student mastery of content. This course was taught simultaneously to two groups of students with one group on the main campus and the other section at a site approximately 90 miles away. Each site had a technician who assisted with cameras, sound, equipment, and trouble-shooting when the technology difficulties occurred.

The North Carolina Information Highway (NCIH) program used in this distance learning study provided video teleconferencing capability to universities and public schools across the state. The "Highway" originally established for video communication today serves as the centerpiece of the states high-speed data network, supporting the data, voice, and video needs of all government at the state and local levels as well as school systems and other public entities. Using the high-speed backbone of the

North Carolina Integrated Information Network (NCIN), our NCIH services provide broadband connectivity and setup of on-site video conference rooms to support a host of point-to-point and multi-point conferencing applications, including the distance learning medium used in this study.

Altogether 73 students were enrolled in these two classes. The instructional technology majors were aware of the synchronous learning environment in advance. However, the students enrolled in *Connecting Learners and Subject Matter* were not informed in advance of the delivery system to be used. These students met for a sixteen-week semester and when the courses were complete, they were asked to provide feedback on their pedagogical and technological experiences. These students volunteered to participate in an open-item questionnaire that was designed to collect demographic data and feedback regarding the quality of their learning experiences in these distance education courses versus courses that did not involve this delivery system. Students also analyzed the effectiveness of teaching strategies used in these courses and the effectiveness of the NCIH. The survey was posted on a password protected website and required students to give permission for their comments to be used in a research study. Results were summarized and presented below.

Research Questions

Each graduate student enrolled in these two courses was invited to participate in a research project designed to assess the quality of the delivery system used in their class and to examine their perceptions of the instructional strategies used. The following questions were posted on a password protected website.

1. Contrast the quality of the learning experience in distance education courses versus on campus courses (interaction, instruction, assessment, etc.).
2. What teaching strategies have you found to be effective in distance education courses?
3. How effective was the medium for delivery of the class (ie. NC-REN, NCIH, web-based)?

Altogether 46 students logged onto this website and participated in this research project. Four instructors responded to the survey.

Findings from Students' Responses

In the following narrative, the students' responses to the research questions are summarized. Specific quotes are used to highlight student perceptions.

Question 1

When students were asked to evaluate the courses delivered in synchronous environments using NCIH, the quality of instruction was perceived as high and being "as good or better than courses taken on campus." However, students reported a strong preference for the professor to be at their site and felt that "instructors should be required to spend equal time at the various sites. Students miss a lot by not having direct contact with the instructor." One student wrote, "...the quality of instruction is not diminished by the remoteness of the instructor and learner" and further stated, "We tend to work more cooperatively as a group because of the distance, therefore, depending on one another more." Another student commented, "Distance education is a good tool if all people included work together to make it successful. I don't believe it can be successful when the groups are looked upon as separate entities. We must be a whole."

Several respondents commented on the limitations of distance education courses. "The frustrations of the technological problems... made this class difficult and often non-productive," wrote one student. Statements such as the following were posted. "A few glitches occurred with the delivery because of the equipment." "Time was wasted due to technical difficulties." "As technology bugs are worked out, distance learning should improve." These comments appear in the final research question as well.

In summation, while students prefer direct instruction with the professor, many would not have been able to obtain a graduate degree due to living a distance from the university campus. The convenience of this delivery medium has "truly benefited" the majority of students.

Question 2

Graduate students were asked to reflect on the effectiveness of the strategies used in distance education courses. The majority of students commented that small group discussions and cooperative learning activities were the most "effective strategies used by the professor." One student stated, "I believe that small groups discussing the topics and then coming together as a whole is the best strategy I have used." This use of instructional time allows students to "get things accomplished without the hassle if technological problems." Another stated, "Small group discussions kept the program personal and relevant." "The instructors were adept at encouraging students to pursue areas of interest."

One student commented, "Just like in a regular classroom, variety is key: Cooperative Learning, Videos, Power Point, Direct Instruction (providing that the technology is working). For two sites, it is effective to bounce questions back and forth so that you can get everyone involved and sharing." "Power point and the overhead were good to supplement direct instruction" because visual learners need additional support. Literature circles used in the *Connecting Learners and Subject Matter* class was cited as a "very effective strategy" also.

Least preferred by students were lectures and large group discussions. For example, "whole group discussion was limited to the technological difficulties" of having cameras and sound focused on the speakers.

Question 3

Determining the effectiveness of the NCIH delivery system was the purpose of the third question in this survey. Students enrolled in *Connecting Learners and Subject Matter* reported more frustrations with the delivery medium than their counterparts in the *Planning for Technology in Education* course. Technical difficulties such as "...voice delays, freeze frames, and just being down were common to our classes this term." Most students made comments such as the "...the NCIH was not successful in truly making the class a good learning atmosphere." "I know that the technical folks here worked really hard; however, we have experienced technical problems," and "NCIH has a lot of room for improvement."

To the contrary, students enrolled in the technology course said, "NCIH has worked well. We've only had a few instances when connections did not work. The biggest problem was that voices broke down often and at times the volume from campus was very low." One student reported that this delivery system had been used frequently and they had learned the value of flexibility." However, one of thee students questioned the amount of money the state invested in this technology saying, "It would be better to just have web-based courses." Another concluded that though there were technical problems, they far outweighed the safety concerns of having to drive 60 miles at night through winter weather, and the fee was affordable."

In summary, both groups of students see NCIH as a good idea that will continue to be a part of graduate level education.

Findings from Instructors' Responses

Each of the authors in this project has had experience teaching in synchronous learning environments. When queried, each gave responses to the survey questions posed to the students enrolled in these two graduate level courses. Examples of summarized responses are included to provide insight from their perspectives.

Question 1

When instructors were asked to contrast the quality of the learning experience in distance education courses versus on campus courses, the following comments were dicited. "When I create a course for students, I begin with a philosophical stance and an examination of the goals and objectives for the course. Then I consider the delivery medium, as in the case of face-to-face instruction versus satellite delivery of content. My goal is to maintain the quality of instruction in each learning environment and to ensure that each student masters the content of the course with a high level of satisfaction." "I taught an off-campus introductory course with undergraduate students enrolled in an elementary education cohort. These students were adult learners juggling family responsibilities, full-time jobs and two evening courses over a fall semester. As an instructor, I am committed to incorporating social constructivist teaching methods into the teaching and learning of a course. It was my goal to deliver this course via satellite with the same quality as an on-campus course." Another instructor made this comment. "I have taught campus based face-to-face, remote synchronous audio/video conferencing based courses (both site-to-site and site-to-multi-site). Learning on campus or delivered at a distance must retain the same high qualities expected of adult graduate education. Regardless of delivery systems used, one would expect students to become independent learners, to explore ideas beyond their usual comfort levels, and to develop practical meanings and applications from their studies. Face-to-face communication enables an instructor to continually monitor the nuances and progress of individuals and groups toward these goals. Using distance delivery systems, the instructor must develop new ways of assessing progress. This includes giving up much of the local 'control' associated with traditional teaching. It also requires a strong emphasis on the student's responsibility for learning. Using distance modes of delivery has not diminished the quality of student learning as measured by the stated goals; however, these goals may differ from those associated with more traditional instruction." The fourth response follows. "My initial thought on the quality of the learning experience in distance education courses was that these classrooms were inferior to traditional face-to-face teaching situations. As a teacher who enjoys a lot of communication, physical movement, and group interaction in classrooms, it was hard to look past the model of the talking head in distance education. At first, I felt like a news reporter that should stay in one place and restrict movement After several weeks, I became more comfortable with the new environment and realized that the surroundings could be adjusted for effective learning. At this time I retreated to my knowledge base of good teaching and used effective strategies that have worked in other learning settings."

Question 2

Instructors' perceptions of teaching strategies found to be effective in distance education courses via satellite are summarized here. "I believe 'best practice' requires the use of effective research proven strategies and that requires a socio-constructivist bent as is articulated in the conceptual framework which guides the practices of our faculty. As a result, I strive to create a classroom that is characterized by a community of learners who collectively and collaboratively solve problems and engage in activities designed to enhance their understandings of subject matter. Specific strategies include small cooperative group assignments, presentations, and discussions, as well as guest speakers, lectures, PowerPoint presentations and videos. The underlying goal is to engage students in constructing their own understandings of subject matter." "I used small group cooperative learning activities, web board discussions, and literature circles in addition to discussions and presentations with this class. I made the decision to travel to the class site every other week and to conduct the class via NCIH on alternate weeks. I did this because I believe the richness and immediacy of face-to-face communication was needed with this particular group of students." "Teaching strategies that seem to enhance my distance education courses include interactive websites, assignments which guide but not direct, group interaction, executive summaries, projects, and guest speakers." "Direct instruction and lecture were effective if I kept thoughts concise and frequently interjected student comments, video examples, and other visuals. Group discussions and cooperative learning were initially difficult for me because I felt the need to closely monitor the groups. Presentations that allowed the students to experience communication through a synchronous environment were highly successful."

Question 3

The question regarding the effectiveness of the medium for delivery of the class (ie. NC-REN, NCIH) received the following reactions. "As long as the cameras, sound equipment, and the links to remote sites were working correctly, my instructional goals were met. However, on days when the technology support

BEST COPY AVAILABLE

personnel had difficulty with the equipment, delays occurred, and learning goals were not met. It became clear that the greatest barrier to effective teaching via synchronous delivery systems was a medium that did not work!" "I found that the time delay in the two-way interactive video transmission hindered class understanding and learning. Discussion was very important in order to teach and learn concepts. It was impossible to maintain the affective elements of a discussion, particularly maintaining eye contact, reading body language, and conveying non-verbal messages via the two-way interactive video medium. I subsequently ended the NCIH and traveled to the site weekly for class. The web-assisted medium of the web board discussions worked very well. Students learned how to use a piece of technology, could complete the assignment at a time convenient for them (asynchronous), and participated in a small community of learners. The students worked in this same team during class time and the carry over from class to the web board was very effective. In conclusion, I believe the two-way interactive video is dependent upon factors out of the instructor's control, such as bandwidth allotted for the transmission, skill of technicians assigned to the class, and the learning needs of student populations. As such, the quality of instruction is variable. The web board, in my experience, was an excellent teaching and learning tool." "In my experience, each distance delivery medium has capabilities that emphasize different aspects of learning. One of the greatest challenges for each mode of distance education is how to best engage students in conversations with each other. The available technology may enhance or diminish these communications. I have found, for instance, that in using synchronous audio/video, it was difficult to meaningfully engage small groups at each of the multi-sites and provide them with opportunities to share their work at other sites. The non-dependability of the synchronous environments require that each site had access to the web for each session so that students could work independently if the technology failed. Another great challenge is to switch from being a dispenses of knowledge to being a guide – and trusting students to take responsibility for their own learning." "Technological problems hindered my class and affected the effectiveness of learning. On several occasions I did not have the necessary support to change camera angles, switch to PowerPoint, or watch videos. There was not a good working relationship between the technical staff and the instructor. (Staff usually consisted of students who were often replaced during the semester and sometimes during the class period.) The technical problems between two sites also ranged from delayed audio and visuals to complete disconnection. All of these problems were very frustrating and prompted me to begin driving between the two sites on alternative weeks. When I teach in a synchronous environment again, I will also create a web to assist the class with assignments and to create another method for interactions. This medium was highly effective when I asked a colleague to help teach at the second site. He kept students performing at one setting while I was teaching and interacting at the other."

Discussion

Teaching is a complicated task even in the most favorable of conditions. Teaching and learning in a nontraditional environment requires both the teacher and learner to modify how they interact. The instructional strategies employed in distance programs must be examined from the perspective of the learner and the instructor. Instructors must be apprised of specific guidance based on research. By analyzing the perceptions of classroom teachers and instructors in their roles as students, we can delineate good from poor practice. Studies such as this offer much insight into the pedagogical issues that accompany the integration of new forms of technology.

References

Berg, G.A. (1999). Community in distance learning through virtual teams, *Educational Technology Review, 12.*

Bourne, J., McMaster, E., Rieger, J., & Campbell, J. O. (1997). Paradigms for on-line learning: A case study in the design and implementation of an asynchronous learning networks course, *JALN, 1(2).*

Bremner, F. (1998). On-line college classes get high marks among students, *USA Today, November 16.*

Connell, G. (1997). Distance holds the key to growth, *Times Higher Education Supplement, 12.*

Dominguez, P.S. & Ridley, D. (1999). Reassessing the assessment of distance education courses, *T.H.E. Journal, 27(2).*

Guernsey, L. (1998). Distance education for the not-so-distance. *The Chronicle of Higher Education, 44(29).*

Ryan, R.C. (2000). Student assessment comparisons of lecture and online construction equipment and methods classes, *T.H.E. Journal,* January.

Schulman, A.H. and Sims, R.L. (1999). Learning in an online format versus an in-class format: An experimental study, *T.H.E. Journal, 26(11).*

Shneiderman, B. (1998). Relate-create-donate: An educational philosophy for the cyber-generation, *Computers & Education, 31(1).*

Shneiderman, B., Borkowski, E.Y., Alavi, M, & Norman, K. (1998). Emergent patterns of teaching/learning in electronic classrooms, *ETR&D, 46(4).*

BEST COPY AVAIL

Cognitive user profile and its involvement into adaptive interface

Laboratoire ICTT
Leonard de VINCI 21 Avenue Jean Capelle
INSA de Lyon
69211 Villeurbanne Cedex - FRANCE
E-mail: {habieb, tarpin}@ictthp.insa-lyon.fr

ABSTRACT

An adaptation technique of multimodal interfaces based on a cognitive modeling of users is presented this paper. The adaptation process tries to select a combination of modalities that best fit the cognitive profile of each user. This profile contains indicators of cognitive abilities and styles. Today, we focus our attention on output modalities and apply our technique on hypermedia documents. The system we here present is implemented using the XML and ASP technologies.

KEYWORDS: adaptive interface, user modeling, XML document.

INTRODUCTION

Researches on adaptive interfaces and user modeling have attracted attention over a decade ago and seems to have recently aroused a renewal of interest, mainly thanks to hypermedia. As the amount of on-line information grows at an astonishing speed, people feel overwhelmed by the information currently available, and the corresponding media landscape [Elting, 2002]. This clearly leads to a need of automated methods, commonly referred to as adaptive interfaces, that present information with respect to the user's profile. As adaptive interfaces aim at automatically adapting to individual users, the development of appropriate user modeling techniques is of great importance. Techniques dealing with user profile construction are drawn from work from cognitive psychology and human computer interface.

We first describe the supervised cognitive training program called HAPPYneuron™. This program enables the construction of the cognitive profile of users. We then investigate adaptive techniques using this profile. We focus our first work on output modalities in the context of hypermedia. We have chosen XML and ASP technologies to implement the system. Evaluation tests are in progress.

'HAPPYNEURON' SITE DESCRIPTION

In collaboration with the SBT society, we have worked on an interactive web site proposing a supervised cognitive training: www.happyneuron.com [Tarpin-Bernard, 2001]. Mainly dedicated to seniors, this web site provides exercises that train and evaluate cognitive abilities. During each training session (i.e. each connection), the user performs a set of exercises suggested by the system. Presented in a playful and cultural dimension, exercises vary in difficulty level, speed... in order to entertain the user [Habieb-Mammar, 2001].

Normalized data is stored into a database (means and standard deviations) for each variant of exercise and family of population distinguishing gender, educational level and age [Tarpin-Bernard, 2001]. Current statistics show that since the web site was open to the public (summer 2001), the number of performed exercises exceeds 600.000 and the population of players is well distributed between 15 and 80 years of age. Comparing the trainee's results and normalized data, we are able to progressively build the user cognitive profile. It then enables the system to advise the user in his choice of exercises.

In this context, we have built an evaluation module composed of ten precise exercises that enables to quickly build a cognitive profile. Then, this profile, which is quite stable, can be used in very different contexts. Our first purpose is to elaborate an adaptive multimedia course on the brain. Depending on one's profile, the lesson will be presented using the most adapted media.

Before describing the adaptation process module, we may start with the definition of these cognitive styles.

WHAT ARE COGNITIVE STYLES ?

Cognitive styles refer to a person's usual, prevalent, or preferred mode of perceiving, memorizing, learning, judging, decision-making, problem-solving [Dufresne, 1997].

Individual differences about how people carry out tasks involving these functions may constitute a style if they appear to be: pervasive, which means that they consistently emerge in different contexts, independently of the particular features of situation; or stable, that is, they are always the same at different times.

BEST COPY AVAILAB

They are one of the most stable user characteristics overtime. They are consistent across a variety of situations, as opposed to user knowledge or experience that is more specific and evolving. Numerous studies have shown the importance of cognitive styles in the area of HCI research and their implication in the design of the interface [Muylwijk,1983].

Cognitive styles induce people to adopt similar attitudes and behaviors in a variety of domains concerned [Daniels, 1996]. Cognitive styles are important in determining the most effective interface for a particular category of user, especially in the formative stages of an interaction [Fowler, 1985].

They can be conceptualized as a cross-road of thinking, personality, and motivation. In fact they concern the kind of strategies an individual tends to apply when faced to a situation or to the preferred way of processing information.

OUR APPROACH

The two important steps adopted in our approach are structured as follows (figure 1) :

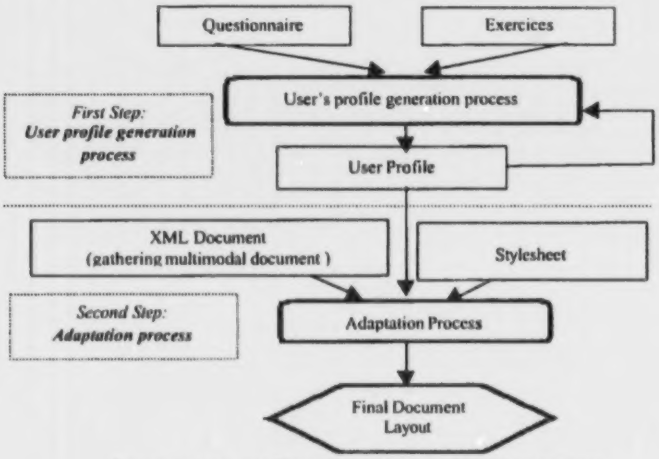

Questionnaire
Exercices
User's profile generation process
First Step: User profile generation process
User Profile
XML Document (gathering multimodal document)
Stylesheet
Second Step: Adaptation process
Adaptation Process
Final Document Layout

Figure 1: User profile generation and adaptation process

The user's profile generation process consists in executing a sequence of interactive exercises then computing the cognitive profile.

The main components of the output profile are:

1- Cognitive indicators dispatched into 5 sectors: *memory, attention, executive functions, language and visual & spatial capacities* [Tarpin-Bernard, 2001]. In detail, 25 indicators have been determined. We can mention several of them as an illustration: cultural memory, recent memory (verbal, visual or musical), working memory, lexical spelling, categorization, comprehension, planning, reasoning, form recognition, etc ;

2- Styles indicators revealing some cognitive styles such as field dependence. These indicators are determined combinating cognitive indicators or through the comparison of the results obtained in several exercises. For example to determine whether the subject is field dependent or not, we use an indicator which measures the difference in performance after running the same exercise with two different images (the first with significant context and the second with non-significant context) then we adjust it with other cognitive indicators such as recent memory (verbal, visual or musical) and comprehension.

Using the cognitive indicators, we have modeled the cognitive sectors that are most solicited while performing an exercise. However, in practice, an exercise cannot imply a unique sector. Every cognitive activity results from a parallel or hierarchical processing of a lot of cognitive abilities. For each exercise, we have determined the different solicited indicators and chosen weight factors ($0 \le p_i \le 10$). After each exercise running, the performance (P) of the user is computed using the average performance (M) and the standard deviation (σ) of this performance that are stored in our database and result from other users which have the same characteristics (age, gender and level of education). A user with an average performance will obtain a score of 50 (the default value)

BEST COPY AVAILABLE

and someone with a very good performance of M+2σ will obtain 90 (2,5 % of the population) [Habieb-Mammar, 2001][Tarpin-Bernard, 2001].

This user profile enables the selection of outcome modalities. The multimodal document is defined into an XML document. We here consider the three main modalities: text, image (picture, diagram, video) and sound (music, jingle or voice). Prior to any process, the stylesheet contains the layout of the complete page to be presented. For a specific subject, the final layout of this page is brought through the adaptation process which is mainly a filtering process. According to us, this layout is the most compatible with the user cognitive profile.

To illustrate the adaptation process, we hereafter give an example of a page dealing with the *Memory* item. This page presents two sub-items : "definition of memory" and "mechanism of memory". In the XML document, the page falls under 2 elements. Each one may be presented according to different modalities. *TR* and *TC* stand for Reduced and Complete Textual elements of a page. *IR* and *IC* refer to Image modalities (Reduced and Complete) and *RV* corresponds to a Recorded Voice that explains a concept (figure 2).

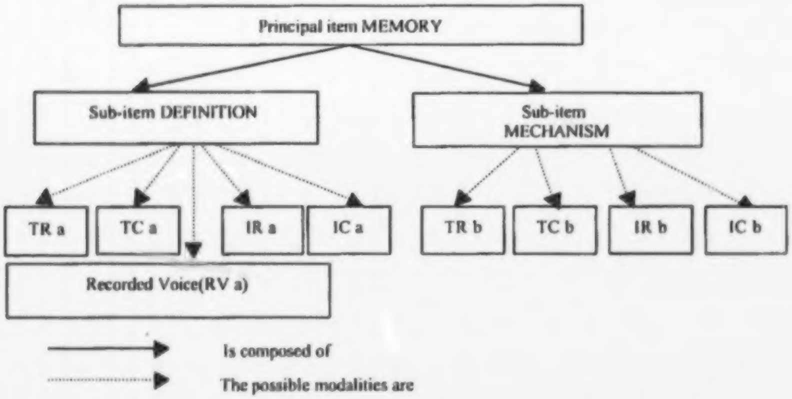


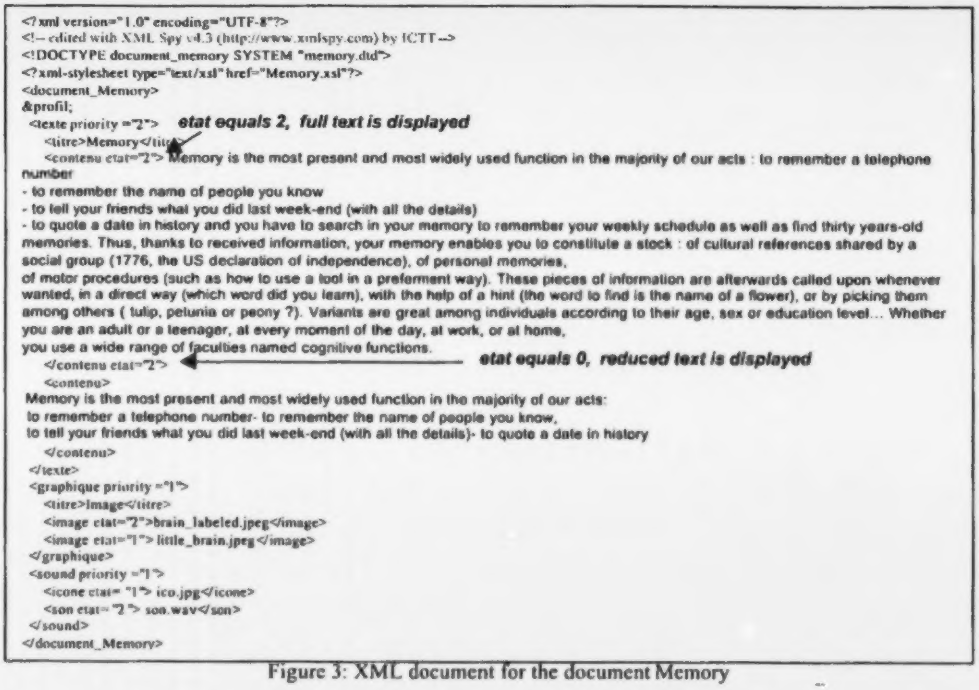
Figure 2: XML document structure

The issue is to find the "best" combination of modalities according to the will of the designer and the abilities of the reader. According to the XML structure, the possible combinations are: (*TRa*, *TCb*), (*TCa*, *IRb*), (*TRa*, R*Va*, *TCb*), etc.

On the other hand, we build a compatibility matrix whose lines correspond to criteria extracted from the user profile components (cognitive styles and interaction styles) and whose rows are the possible combinations of modalities.

For each combination and each criteria (e.g. capacity to manage of multimodality, respect of preferred modality, field-dependency...) a compatibility factor is calculated using an arithmetic formula that combines the user's profile and the characteristics of the combination. The combination of modalities that results in the biggest sum is considered as the most compatible one.

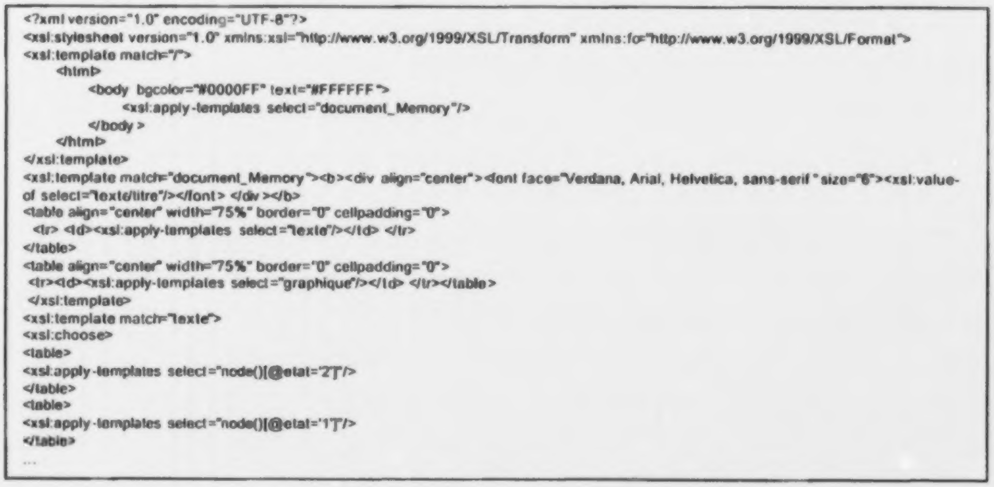
Indeed, An ASP program on the server side builds an enriched XML document that contains the whole page to be presented. Each part, which is presented as a tag, has an attribute called *etat* (*state)*. This attribute may hold the values 1 or 2, where 1 corresponds to the reduced form of the output modality and 2 is the full form. Thanks to the user profile and the items priority (i.e. the important items which have to be shown), the ASP program include the state values into each (figure 3).



```
<?xml version="1.0" encoding="UTF-8"?>
<!-- edited with XML Spy v4.3 (http://www.xmlspy.com) by ICTT -->
<!DOCTYPE document_memory SYSTEM "memory.dtd">
<?xml-stylesheet type="text/xsl" href="Memory.xsl"?>
<document_Memory>
&profil;
  <texte priority ="2">    etat equals 2,  full text is displayed
    <titre>Memory</tit
    <contenu etat="2"> Memory is the most present and most widely used function in the majority of our acts : to remember a telephone
number
- to remember the name of people you know
- to tell your friends what you did last week-end (with all the details)
- to quote a date in history and you have to search in your memory to remember your weekly schedule as well as find thirty years-old
memories. Thus, thanks to received information, your memory enables you to constitute a stock : of cultural references shared by a
social group (1776, the US declaration of independence), of personal memories,
of motor procedures (such as how to use a tool in a preferment way). These pieces of information are afterwards called upon whenever
wanted, in a direct way (which word did you learn), with the help of a hint (the word to find is the name of a flower), or by picking them
among others ( tulip, petunia or peony ?). Variants are great among individuals according to their age, sex or education level... Whether
you are an adult or a teenager, at every moment of the day, at work, or at home,
you use a wide range of faculties named cognitive functions.
    </contenu etat="2">                    etat equals 0,  reduced text is displayed
    <contenu>
 Memory is the most present and most widely used function in the majority of our acts:
 to remember a telephone number- to remember the name of people you know,
 to tell your friends what you did last week-end (with all the details)- to quote a date in history
    </contenu>
  </texte>
  <graphique priority ="1">
    <titre>Image</titre>
    <image etat="2">brain_labeled.jpeg</image>
    <image etat="1"> little_brain.jpeg </image>
  </graphique>
  <sound priority ="1">
    <icone etat= "1"> ico.jpg</icone>
    <son etat= "2 "> son.wav</son>
  </sound>
</document_Memory>
```

Figure 3: XML document for the document Memory

In Figure 3, we present the XML document of the sub-item DEFINITION. According to the user profile, the XML document is first modified in such a way that the relevant tags are attributed with the corresponding states values. The stylesheet is then applied to this document by formatting the relevant tags of the document(figure 4).

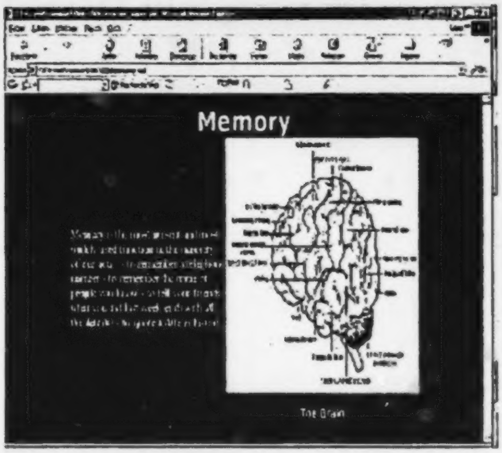


```
<?xml version="1.0" encoding="UTF-8"?>
<xsl:stylesheet version="1.0" xmlns:xsl="http://www.w3.org/1999/XSL/Transform" xmlns:fo="http://www.w3.org/1999/XSL/Format">
<xsl:template match="/">
     <html>
          <body bgcolor="#0000FF" text="#FFFFFF ">
               <xsl:apply-templates select="document_Memory"/>
          </body >
     </html>
</xsl:template>
<xsl:template match="document_Memory "><b><div align="center"><font face="Verdana, Arial, Helvetica, sans-serif " size="6"><xsl:value-
of select="texte/titre"/></font> </div ></b>
<table align="center" width="75%" border="0" cellpadding="0">
  <tr> <td><xsl:apply-templates select="texte"/></td> </tr>
</table>
<table align="center" width="75%" border="0" cellpadding="0">
 <tr><td><xsl:apply-templates select="graphique"/></td> </tr></table>
 </xsl:template>
<xsl:template match="texte">
<xsl:choose>
<table>
<xsl:apply-templates select="node()[@etat='2']"/>
</table>
<table>
<xsl:apply-templates select="node()[@etat='1']"/>
</table>
...
```

Figure 4: XSL document for formatting the document "Memory".

The corresponding tags are selected and formatted as described above. Hereafter, we show an example of the output documents. In the first image (figure 5), the two modalities *TR* and *IC* are chosen while *TC* and *IR* modalities are adopted in the second image (figure 6).

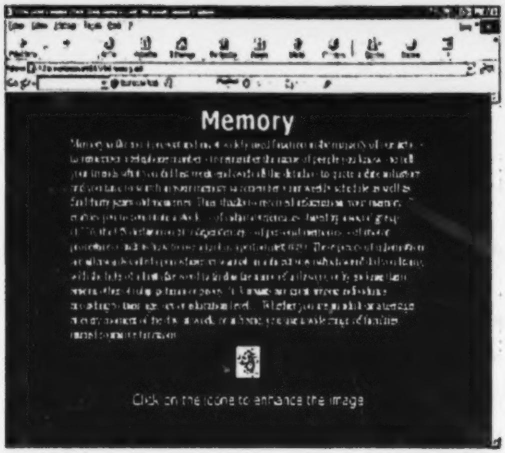
BEST COPY AVAILABLE



Memory

The Brain

Figure 5: Output document with modalities TR and IC



Memory

Click on the icone to enhance the image

Figure 6: Output document with modalities TC and IR

CONCLUSION

In this paper, we have described how to generate and then incorporate the cognitive profile into adaptive multimodal interfaces. The first step consists in building the user cognitive model through a set of interactive exercises. Based on demographic data, this model combines 2 different types of information: cognitive indicators and style indicators. This profile is the input of the last step of the adaptation process, where the couples (indicators, multimodal combinations) are evaluated with weighting factors. These factors enable to select the most compatible output documents.

As we know that it can be very dangerous to completely rely on our adaptation process, the most compatible items are presented and the less compatible ones can be shown as catchwords using auditory and iconic information. The user can have more information by clicking on these elements. Indeed, additionally situations where spoken and written text deliver non-redundant information could be of interest [Elting, 2002]. An extension of our work will be to learn of these kinds of behaviours, which can induce that our profile has to be corrected.

The first working track has been defined, experimentation and validation work are currently in progress especially to determine the compatibility factors. However, we are leading experimentation upon a population of 50 users to validate the cognitive profile generation process. The aim is to construct a reliable user profile in order to exploit it not only in our site but other coming applications. To evaluate the adaptation process, we are going to compare the amount of learned information between several populations confronted to different presentations of our course. This experimentation, planed in 2002 summer, will be done on HAPPYneuron's users grouped according to their profile. Adapted presentations and non adapted presentations will be proposed and results will be compared. Results will be presented to the conference.

According to theories guide-lines and to our preliminary work we can say that this research field will be promising and fertile with new developments. All this work has been possible by adopting multidisciplinary approach i.e. computer science, cognitive psychology and neuro-psychology.

REFERENCES

Daniels, H. L. *Interaction of Cognitive Styles and Learner Control of Presentation Mode in a Hypermedia Environment.*, Dissertation submitted to the faculty of Virginia Polytechnic Institute, Blacksburg, Virginia, July 1996.

Dufresne, A. Turcotte, S. *Cognitive style and its implications for navigation strategies.* In B. d. Boulay, & R. Mizoguchi (Ed.), Artificial Intelligence in Education: Knowledge and Media in Learning Systems (pp. 287-293). Kobe, Japon, 1997.

Elting, C. Zwickel, J. Malaka, R. *Device-Dependant Modality Selection for User-Interface – An Empirical Study.* In IUI'02, San Francisco, USA, 2002.

BEST COPY AVAILABLE

Fowler, C. J. H., Macaulay, L. A., Fowler, J. F. *The Relationship Between Cognitive Style and Dialogue Style: An Explorative Study.* Paper presented at the Proceedings of the HCI'85 Conference on People and Computers: Designing the Interface p. 186-198, 1985.

Habieb-Mammar, H. Tarpin-Bernard, F. Croisile, B. Noir, M. *User cognitive model for adaptive interfaces.* 2nd International Conference NimesTIC 2000 Maîtrise des Systèmes Complexes et la Relation Homme-Système, Nîmes, France, December 2001.

Muylwijk, B. V., Van Der Veer, G., Waern, Y. *On the implications of user variability in open systems. An overview of the little we know and the lot we have to find out.* Behaviour & Information Technology, p.313-326, 1983.

Tarpin-Bernard, F. Habieb Mammar, H. Croisile, B. Noir, M. A supervised Program for Cognitive e-Training. *WebNet'2001, World Conference on Web technologies.* Orlando. Octobre 2001.

XSL Transformations (XSLT) http://www.w3.org/Style/XSL/

Language XML- W3C Recommandation http://www.w3.org/XML/

Adapting Corporate Portal Technology for Management E-Learning

Michael D. Hamlin, Charla Griffy-Brown
Graziadio School of Business and Management
Pepperdine University
Malibu, California, USA
mhamlin@pepperdine.edu

Abstract As the largest provider of MBA talent in the Western United States the Graziadio School of Business and Management had a need to create a technology infrastructure to support students and staff distributed in 7 educational centers throughout California. This paper will describe the process by which the School came to recognize the potential for portal technology to foster communication, improve the quality of service, and enhance the learning experience and will explain how we created a vision for a new collaborative learning and administrative environment. It will also describe how we adapted and deployed real-world corporate portal technology to enhance executive and management education through E-Learning. The School's process for adapting portal technology for E-Learning and knowledge management to create a collaborative learning and working environment has implications and should be of interest to those in higher education and corporate/management training.

Physical Environment: Distributed Students and Faculty

As the largest provider of MBA talent in the Western United States the Graziadio School of Business and Management had a need to create a technology infrastructure to support its 2000+ students and staff distributed in 7 educational centers throughout California. With only a small full-time program at our Malibu campus, the majority of students were working adults attending night-time classes at one of our seven educational centers in Southern and Northern California. Students would often identify with a center or a program but often felt disassociated from the Graziadio School. Faculty were distributed as well often teaching at 3 different educational centers.

Administrative Environment

As is often the case, the School administration saw a general need for an improved information technology infrastructure to tie together students, staff and faculty. There was a general feeling that information technology could be useful to:

- Extend the reach and scope of the Graziadio School business model
- Prepare students to be effective professionals in a knowledge economy
- Use technology to enable the School to "run like a business."

However, the School did not have a large information technology staff nor much experience in technology use or planning. School administration turned to an outside consultant, PriceWaterhouseCoopers (PwC) to guide the development of a technology action plan. PwC helped the School form a Steering Committee and create a process to develop a technology plan to better define the School's technology goals. PwC along with the Steering Committee developed a technology planning Roadmap to guide the design of a new information technology infrastructure for the School.

IT Vision	IT Infrastructure	IT Action Plan
Create a vision for School information technology	Assess existing IT infrastructure including Hardware, systems, software, and networks	Develop recommendations and define initiatives
Agree on guiding principles that will be used to prioritize investments	Integrate best practices	Develop rationale
Identify role for technology and the School's technology goals	Analyze gap between current and desired state	Develop implementation plan
	Design future IT infrastructure model that will allow for future growth	
	Develop cost estimates for hardware, software, maintenance, and implementation	

IT RoadMap

Once the Steering Committee had the RoadMap it could proceed to focus the School's technology goals. The Steering Committee first developed a vision for information technology in management education that was driven by the following premises:

> In the future, management education could be divided into two types of educational providers:
>
> 1. Mass produced, automated, online learning. This learning will be convenient and low-cost. It will be offered to a large number of people.
> 2. Premium quality, personalized learning. This type of learning will be "high-touch." It will also be high-tech, full-service, time-efficient, and relatively high-cost. Small classes and a low student-faculty ratio will enable personalized education.
>
> Straddling these two types will be difficult and dangerous. Pepperdine aspires to be in the second category and must develop a technical infrastructure to maintain -- and enhance -- the quality of its education.

Vision

Built as it was on small classes and individualized attention to student needs, the School was interested in creating a vision that supported its student-centered orientation. The following technology vision was developed based on the School's emphasis on responsiveness to students needs and a desire to improve service and communication.

> The Graziadio School values personal interaction. The School also recognizes the potential for technology to foster communication, improve the quality of service, and enhance the learning experience. Technology should not be embraced for its own sake; technology usage should support the institution's mission and strategic goals.

Desired Benefits

A technology vision is still on a general level so the committee proceeded to focus in on desired goals and objectives to help drive the development of a new information infrastructure. The next step involved the definition of guiding principles and objectives for a successful system implementation. Always mindful that the new system sould be supportive of the school's mission and business goals the committee determined that a system should accomplish the following objectives:

- eliminate redundancy and create synergies between the School and the University

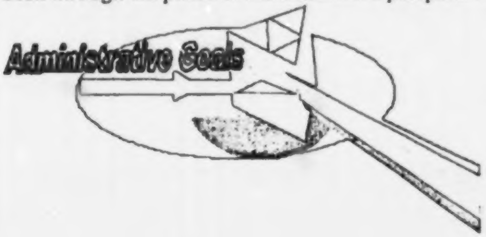
- enable the School to operate more "like a business" through the application of technology that enables increased customer service and the cost-effective administration of the School.
- expand learning and teaching opportunities and effectiveness
- foster a learning environment that is current and relevant to today's business community

Along with these objectives,the committee established some general priniciples to guide the development of the new system:

- User-friendly solutions -- Technology solutions must be user-friendly and rapidly adopted by students and faculty.
- Avoid "bleeding edge" technology -- Although exciting, new technologies are often costly and unreliable. Moreover, supporting new technologies is challenging, particularly given the unique characteristics of GSBM end-users.
- Immediate implementation -- The School is eager to make progress on its technology infrastructure and wants to begin the next phase of this project immediately
- Affordable -- The School has limited resources and must find cost-effective solutions

Administrative Perspective

Seen through the prism of administrative perspective the goals for the system were:

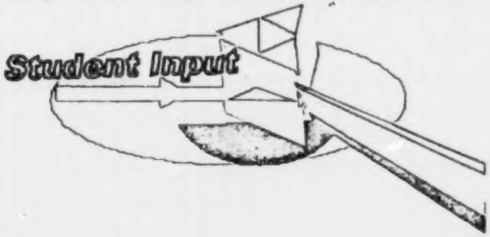


- Extend the reach and scope of the Graziadio School business model,
- Prepare students to be effective professionals in a knowledge economy
- Use technology to enable the School to "run like a business."
- Supportive of the institution's mission and business goals

Needs Analysis

PwC and the School, aware that there any successful system implementation is dependent on user acceptance strove to uncover the needs and perspectives of the potential users of the system. An extensive schedule of interviews, focus groups and surveys was outlined and all major stakeholder groups were consulted to determine how a new technology infrastructure should support the work of the various groups.

Interviews and focus groups conducted with students were quite enlightening and uncovered some interesting insights. See through the student prism, the system would need to address the following:



- Existing technology does not support the learning experience
- Personal service but increased electronic access to information and better access to technology tools.
- Strengthen ability to communicate and collaborate

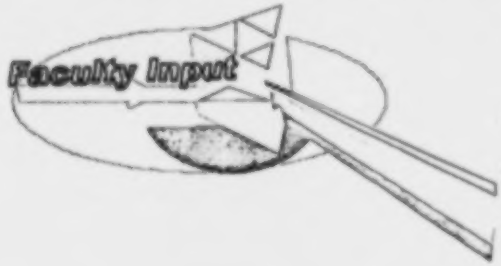
Faculty of course had a different set of perceptions about technology. Because many faculty did not have a lot of experience with technology the committee set out to get a general feeling for what the faculty valued

BEST COPY AVAILABLE

about the teaching and learning environment at Pepperdine. The faculty felt that any new technology should support the traditional strengths of the Graziadio teaching program including these core values:

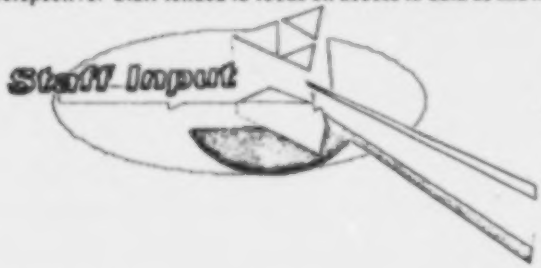
- The freedom and ability to create and re-formulate classes as the situation and opportunity dictates
- Real-world orientation of teaching
- Continued face-to-face contact and small classes.
- Personal contact with students and availability of individualized attention

Seen through the perspective of the faculty the system would support the following



- Support team process and increase collaboration outside class.
- Improve connectivity of students to course-related material, to instructors and other students and provide access to an expanded resource base.
- Provide access to systems that are similar to those used in "real world" businesses.

Polling students and faculty was enlightening and helped focus development of the new system. It became clear that what started out as a desire to improve information technology generally had expanded to become a system that supported teaching, administrative and collaborative activities. Each set of needs can be pictured as being reflected through a different prism Interviews with staff produced yet a different perspective. Staff tended to focus on access to data as shown by the following



- Administrative support is highly dependent on University level services, policies, systems and resources.
- Staff are hindered by manual processes, distributed database development, distributed maintenance, and inadequate storage procedures Data are dispersed among multiple data

Proceeding from the general business process goals defined by the administration further analysis by PwC and the Steering Committee determined that the desired system would have to be very flexible and extensible. A final reduction of the various stakeholders' perspectives produced the following list of objectives the system would have to meet:

- Alignment of technology with business goals
- Access to integrated information
- Ability to communicate, collaborate, and work from any location
- Access to and proficiency in technology tools
- Ability for administration to provide cost-effective, high-quality service

Solution: Corporate Portal Technology

The School looked at a number of different platforms for learning including WebCt, Campus Pipeline and StudyNet as well as communications platforms like FirstClass. Eventually if became clear that none of these platforms could support a majority of needs. One criteria that had climbed to the top of the needs analysis was that the system should allow students to receive hands-on experience with a system that is actually used in corporate America. There was a real desire on the part of faculty and administration that the system be a

BEST COPY AVAILABLE

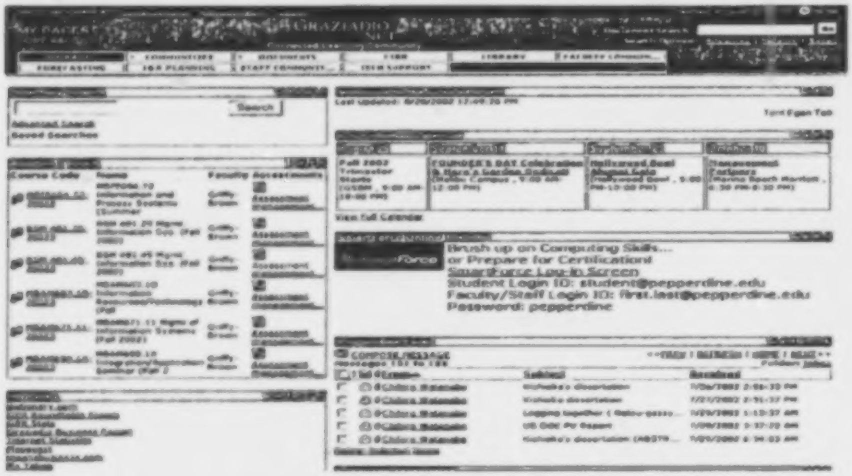
business-world technology in keeping with the GraziadioSchool's focus on real-world business applications. Eventually we received three responses, one from Oracle, one from Microsoft Consulting Services and one from a systems integration company, Spectria who proposed to link a corporate portal product from Plumtree Software with a collaborational piece called eRoom.

A corporate portal brings together under a standard web-based interface content, applications and services from incompatible platforms, for students, faculty and staff. It is a single point of access to:

- Enterprise applications
- Documents and Web pages
- Internet services
- Collaboration Tools

GraziadioNet Portal Implementation

The GraziadioNet is an implementation of corporate portal technology designed to meet the needs of students, staff and faculty in the areas of education, administration and support.



Brush up on Computing Skills...
or Prepare for Certification!
SmartForce Log-in Screen
Student Login ID: student@pepperdine.edu
Faculty/Staff Login ID: first.last@pepperdine.edu
Password: pepperdine

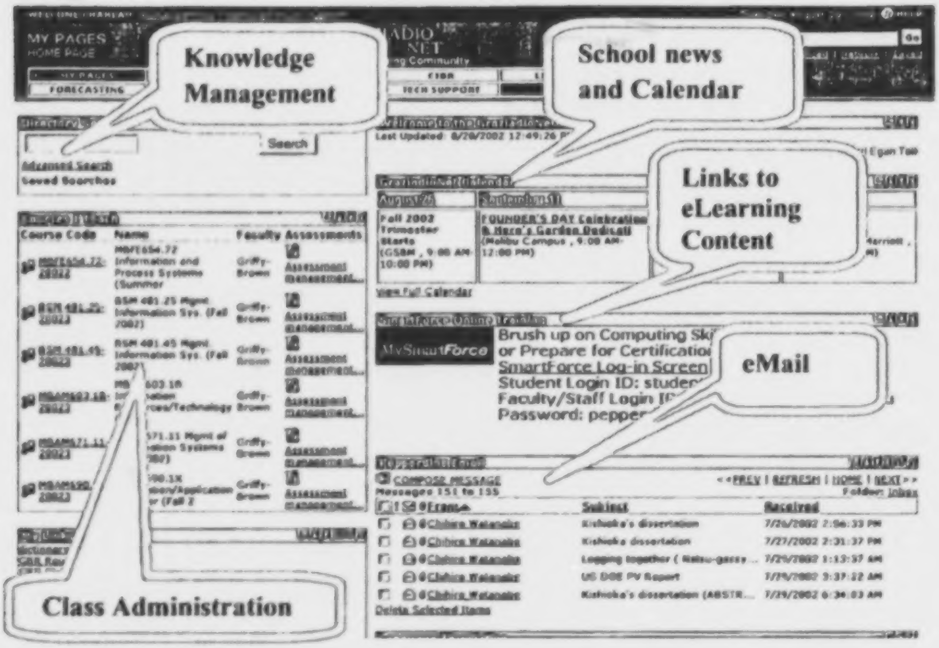
GraziadioNet Portal "Homepage"

Portals Fill Multiple Needs

From the School's extensive needs analysis it was clear that we needed a flexible tool that could handle:

- Knowledge management and access to multiple sources of information
- Links to eLearning and class content
- Class administration
- Consolidation of multiple information tools such as e-mail and calendars

BEST COPY AVAILABLE


MY PAGES
HOME PAGE
FORECASTING
Knowledge Management
Search
Advanced Search
Saved Searches
School news and Calendar
Links to eLearning Content
View Full Calendar
MySmartForce
eMail
COMPOSE MESSAGE
Class Administration

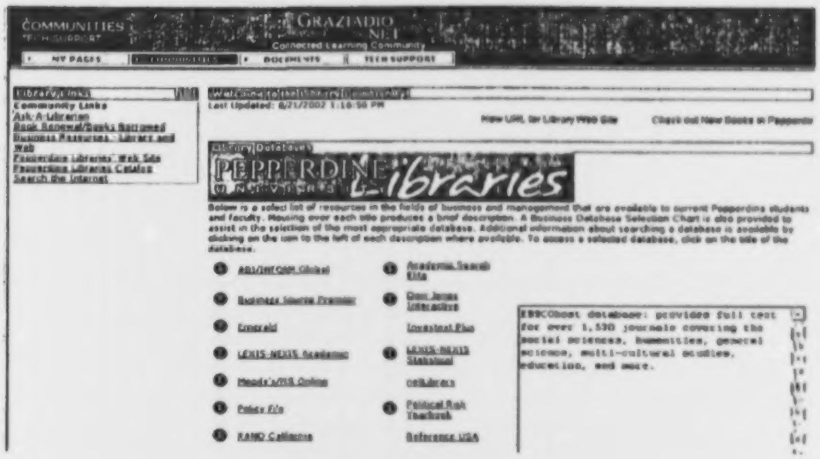
Fulfilling Many Functional Needs

Seen through the prisms of the various user groups the system requirements became quite extensive. It should be remembered that a high premium was placed on any system that was a real-world corporate solution, could help students better identify with the School, could consolidate multiple information sources and help students, faculty and staff collaborate. As well, faculty were strongly desirous of a system that could support student team projects and increase connectivity among students and faculty. The corporate portal platform which allowed linkages to collaboration software proved to be a real-world corporate tool that could meet administrative needs to automate more of the school's business functions and still serve as a learning platform for students.

Multiple Information Sources

The GraziadioNet Business Education Portal as it came to be called recognizes users as students, staff or faculty and takes them to an individualized portal home page upon logging in. The web-based system can be accessed from any computer linked to the Internet. The individualized home page contains information resources called "gadgets" that allow access to multiple forms of information. Two of the more useful gadgets are the Library and Course eRoom gadgets. The Library gadget provides single-login linkage to a number of business databases such as Lexis-Nexus and Dow Jones Interactive.

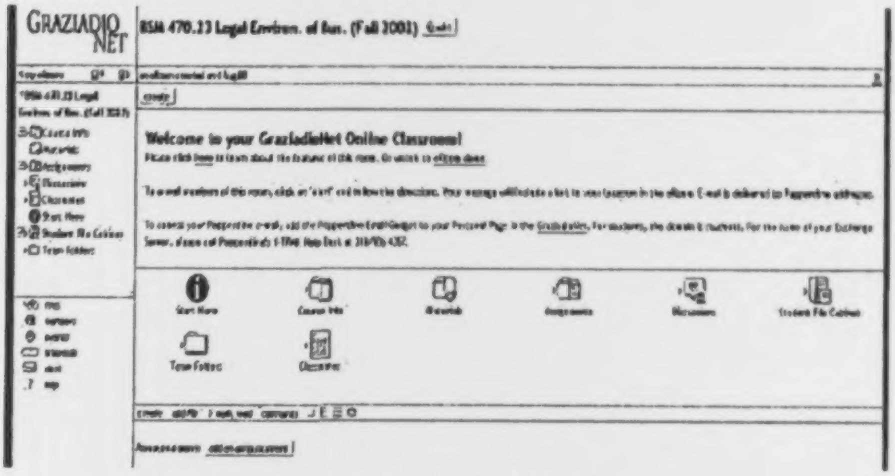
BEST COPY AVAILABLE


COMMUNITIES
GRAZIADIO NET
Connected Learning Community
MY PAGES
COMMUNITIES
DOCUMENTS
TECH SUPPORT
Library Links
Community Links
Ask-A-Librarian
Book Renewal/Books Borrowed
Business Resources - Library and Web
Pepperdine Libraries' Web Site
Pepperdine Libraries Catalog
Search the Internet
Welcome to the Library Community
Library Databases
PEPPERDINE Libraries
ABI/INFORM Global
Academic Search Elite
Business Source Premier
Dow Jones Interactive
Emerald
Investext Plus
LEXIS-NEXIS Academic
LEXIS-NEXIS Statistical
Moody's/FIS Online
netLibrary
Policy File
Political Risk Yearbook
RAND California
Reference USA

EBSCOhost database: provides full text for over 1,530 journals covering the social sciences, humanities, general science, multi-cultural studies, education, and more.

Links to Library Business Databases"

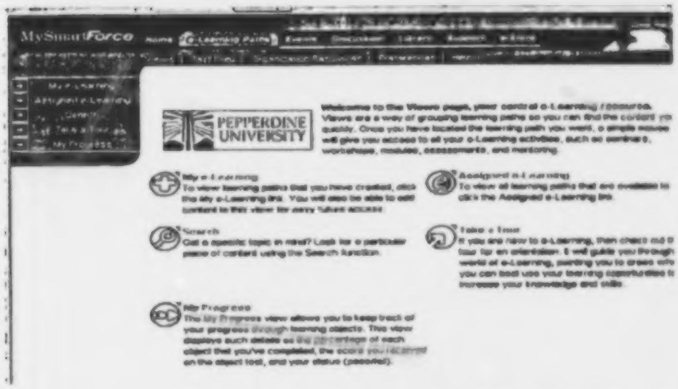
The eRoom Course gadget provides links for faculty and students to any workspaces for any courses they teach or for which they are registered. Course eRooms have extensive collaborational support and help faculty manage course materials. Students can access course materials and information from anywhere they can login.


GRAZIADIO NET
BSM 470.23 Legal Environ. of Bus. (Fall 2001)
Welcome to your GraziadioNet Online Classroom!
Start Here
Course Info
Student File Cabinet
Team Folder

Links to Online Class Workspaces

Other information resources include a searchable document directory and a link to online eTraining materials from SmartForce.

442 BEST COPY AVAILABLE



Welcome to the Views page, your central e-Learning resource. Views are a way of grouping learning paths so you can find the content yo quickly. Once you have located the learning path you want, a simple mouse will give you access to all your e-Learning activities, such as seminars, workshops, modules, assessments, and mentoring.

My e-Learning
To view learning paths that you have created, click the My e-Learning link. You will also be able to add content to this view for easy future access.

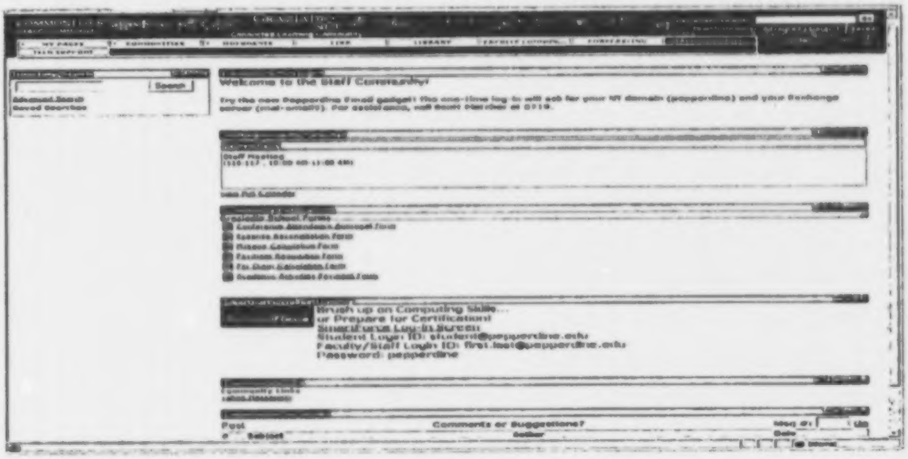
Assigned e-Learning
To view all learning paths that are available to click the Assigned e-Learning link.

Search
Got a specific topic in mind? Look for a particular piece of content using the Search function.

Take a Tour
If you are new to e-Learning, then check out t tour for an orientation. It will guide you through world of e-Learning, pointing you to areas wh you can best use your learning opportunities t increase your knowledge and skills.

My Progress
The My Progress view allows you to keep track of your progress through learning objects. This view displays such details as the percentage of each object that you've completed, the score you received on the object test, and your status (passed/failed).

The GraziadioNet provides extensive support for collaboration through both community features in the portal such as the Staff Community shown below.



Welcome to the Staff Community!

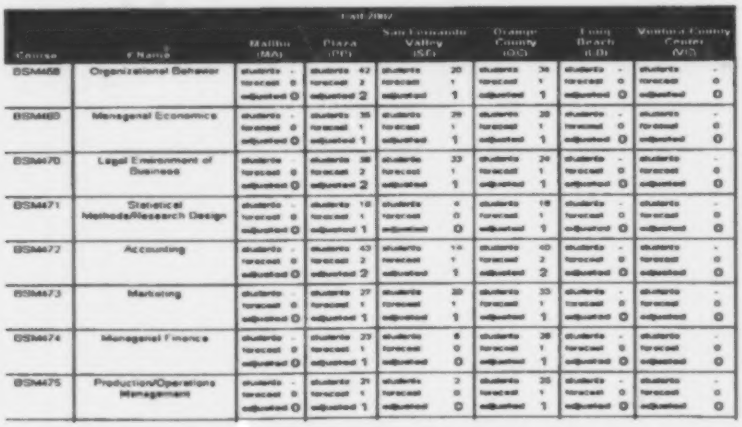
Staff Meeting

Brush up on Computing Skills...
or Prepare for Certification
SmartForce Log-in Screen
Student Login ID: student@pepperdine.edu
Faculty/Staff Login ID: first.last@pepperdine.edu
Password: pepperdine

Comments or Suggestions?

Post | Subject | Author | Date

Finally, the GraziadioNet through programming extensibility of the gadget structure allows for automation of administrative tasks such as class scheduling allowing the School to run more efficiently and cut down on manual operations



Fall 2007

Course	Name	Malibu (MA)	Plaza (PP)	San Fernando Valley (SF)	Orange County (OC)	Long Beach (LB)	Ventura County Center (VC)
BSM468	Organizational Behavior	students - forecast 0 adjusted 0	students 42 forecast 2 adjusted 2	students 20 forecast 1 adjusted 1	students 34 forecast 1 adjusted 1	students - forecast 0 adjusted 0	students - forecast 0 adjusted 0
BSM469	Managerial Economics	students - forecast 0 adjusted 0	students 35 forecast 1 adjusted 1	students 29 forecast 1 adjusted 1	students 28 forecast 1 adjusted 1	students - forecast 0 adjusted 0	students - forecast 0 adjusted 0
BSM470	Legal Environment of Business	students - forecast 0 adjusted 0	students 38 forecast 2 adjusted 2	students 33 forecast 1 adjusted 1	students 24 forecast 1 adjusted 1	students - forecast 0 adjusted 0	students - forecast 0 adjusted 0
BSM471	Statistical Methods/Research Design	students - forecast 0 adjusted 0	students 18 forecast 1 adjusted 1	students 4 forecast 0 adjusted 0	students 18 forecast 1 adjusted 1	students - forecast 0 adjusted 0	students - forecast 0 adjusted 0
BSM472	Accounting	students - forecast 0 adjusted 0	students 43 forecast 2 adjusted 2	students 14 forecast 1 adjusted 1	students 40 forecast 2 adjusted 2	students - forecast 0 adjusted 0	students - forecast 0 adjusted 0
BSM473	Marketing	students - forecast 0 adjusted 0	students 27 forecast 1 adjusted 1	students 20 forecast 1 adjusted 1	students 33 forecast 1 adjusted 1	students - forecast 0 adjusted 0	students - forecast 0 adjusted 0
BSM474	Managerial Finance	students - forecast 0 adjusted 0	students 23 forecast 1 adjusted 1	students 6 forecast 0 adjusted 0	students 28 forecast 1 adjusted 1	students - forecast 0 adjusted 0	students - forecast 0 adjusted 0
BSM475	Production/Operations Management	students - forecast 0 adjusted 0	students 21 forecast 1 adjusted 1	students 2 forecast 0 adjusted 0	students 35 forecast 1 adjusted 1	students - forecast 0 adjusted 0	students - forecast 0 adjusted 0

BEST COPY AVAILABLE

Learning Networks: A Proven Approach for Delivering Massively Scalable Blended Learning Solutions

John Harris
Director of Technology
Sapient Corporation
jharris@sapient.com

Peter Cundall
Director of Business Consulting
Sapient Corporation
pcundall@sapient.com

Abstract: Learning networks are a proven way to deliver massively scalable blended learning solutions that have been successfully implemented in a variety of commercial situations. For learning challenges that involve educating hundreds of thousands of distributed learners across thousands of organizations, learning networks can enable the delivery of up-to-the-minute learning content in a blended learning environment for a fraction of the cost of traditional methods. While the challenges of large-scale learning vary depending on the context and subject matter, a variety of common best practices from various implementations of learning networks can be applied to many situations. Any organization seeking a cost effective, scalable, geographically dispersed blended learning solution should consider the learning network approach.

What is a Learning Network?

Learning networks are a cost effective way of delivering learning solutions to large, distributed target audiences. They are highly scalable with no effective upper size limit. Typical examples have thousands of training centers structured in a network of collaborating organizations. These networks typically support thousands of instructors and hundreds of thousands of students. Learning networks often deliver many related courses and some have produced millions of certified alumni. The cost of education in a learning network is usually shared across the entire network of participating organizations and this encourages collaboration between institutions. This type of network has been tried and tested. Many highly effective examples serving various industries and fields of interest exist. They are made significantly more effective when combined with a blended learning approach that utilizes the Internet to deliver instructional material, assessments, communication, and community support tools. Learning networks are not a universal panacea for scaling learning solutions. Some subject matters do not require a blended approach or are otherwise not suitable for learning networks

Scalability and Technology

Many existing learning networks have undergone remarkably rapid growth and now successfully support large numbers of students often distributed around the world. In most cases they have achieved this growth without the significant use of digital technologies. A few networks have recently been built based on digital technologies and these examples show significant improvements over traditional methods. When combined with digital technologies, learning networks offer a compelling approach to delivering massively scalable blended learning solutions.

Scaling blended learning solutions requires all aspects of the solution to be scaled, not just the technology used to deliver content. Many people performing different roles are fundamental to the success of such solutions. Students, teachers, instructors, mentors, and administrators must all participate in the solution. In addition, the solution must be scalable with respect to content development and delivery, instructional practices, and community. These aspects of scaling learning solutions are best solved by an organizational approach supported by technology. They cannot be solved by technology alone.

Typical Features of a Learning Network

Centers of Instruction and a Clearly Defined Theme

Instruction delivered within learning networks usually falls within a narrowly defined theme. This theme usually includes both cognitive and manual skills. The use of specialist equipment is common and the initial learning curve is often extremely steep, requiring students to apply new cognitive and manual skills while using unfamiliar equipment. All these features combine to necessitate the existence of instruction centers that house equipment and provide a place where students can go for initial instruction under close guidance. Mastering the content and skills taught within learning networks often requires a significant amount of study and practice. As a result, the instruction centers often become a focal point for community by bringing both novice and experienced learners together in a collegial atmosphere.

Highly Structured Progression of Courses Leading to Formal Assessment and Certification

Learning networks typically provide a clearly defined learning path for students. A progression of courses from beginner through intermediate and advanced lays out a path that all students must follow. Students can only progress to the next stage following completion of a course and the successful completion of the associated assessment. Once the student reaches the intermediate level, a series of optional, specialized, supplemental courses is available for enthusiastic or precocious learners. Assessment and certification are an integral part of learning networks. Certifications gained within learning networks often have meaning and value outside the network. They can help with employment and sometimes reduce the cost of products and services. In some cases the assessment leading to certification is carried out by a third-party organization, such as a government agency.

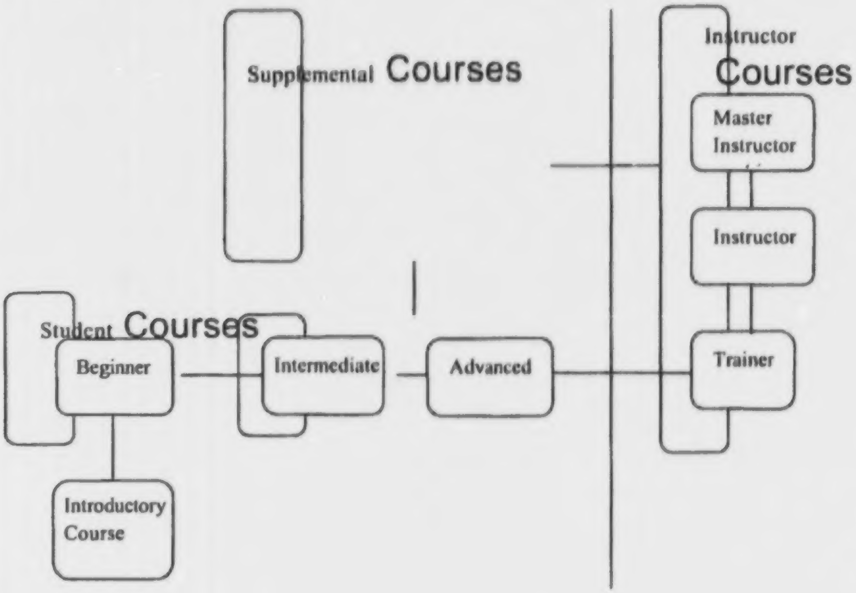


Figure 1: Typical Structure of Courses Offered in a Learning Network

BEST COPY AVAILABLE

Integrated Instructor Training

Most learning networks provide at least two course programs, one for students and a second—available only to those who have completed the advanced courses—for instructors. It is common for learning networks to require instructors to have completed the network's own instructor training course prior to teaching the program's material. Similar to the courses available to students, instructor courses are arranged in a clearly defined learning path. Instructors can, if they wish, progress to be advanced and even master instructors. Instructors commonly earn their living from instructing within the learning network whereas students, even advanced students, do not. Instructor training courses often include administration training for running a participating organization.

A Central Management Agency

A central agency that sets direction and defines curriculum, assessment, and quality standards and ensures overall program consistency is a typical component of learning networks. Agencies of this type are often created initially to serve the needs of the instructor community—only later do they become the central hub of a learning network. In cases where the agency is established by some other organization that seeks to "own" the network, maximum effectiveness can only be realized if the central agency leaves enough "on the table" to keep the instructors involved and motivated. This may be accomplished through financial incentives or the ability to control or customize the program. The central management agency is never run for a significant (if any) profit. Instead, the network is run for the benefit of the member organizations, instructors, and students. The financial value generated by successful learning networks is spread throughout the entire network, not concentrated in the central managing agency.

A Network of Ranked Collaborating Organizations

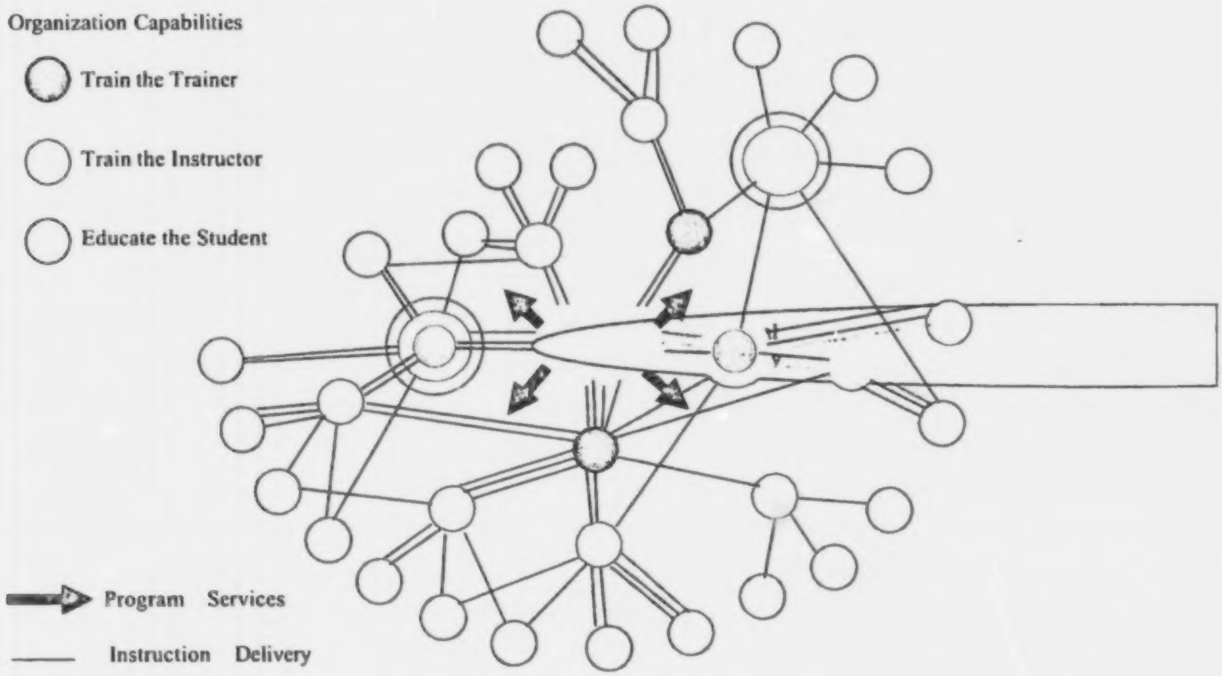


Figure 2: A Schematic Representation of a Learning Network

The organizations that comprise a learning network are typically ranked based on their capabilities within the program (for example, one- to five-star academies). These rankings are determined by the proficiency of the instructors an organization employs as well as the facilities and equipment it possesses. The rank of an organization determines the type of courses it is allowed to offer within the program. Usually, this rank determines the highest level of student the organization is allowed to certify. For example, a one-star academy can certify students in the basic, intermediate, and advanced courses; a two-star academy can certify trainers; and a three-star academy can certify instructors that train trainers. To advance within the program, an organization must increase the proficiency of the instructors it employs. This can be done by sending instructors to other, higher ranked academies for training. This train-the-trainer model leads to the development of a hierarchy within the network. Higher ranked organizations are required to recruit and grow less capable organizations. These features combine to drive the growth of learning networks and self regulate the network—whereas poor-quality organizations tend not to grow

Quality Assurance Program

A formal process for removing low-quality instructors and organizations from the program is typical of many learning networks. This process is usually provided by the central management agency and takes the form of a quality program for collecting and investigating complaints.

The Anatomy of a Learning Network

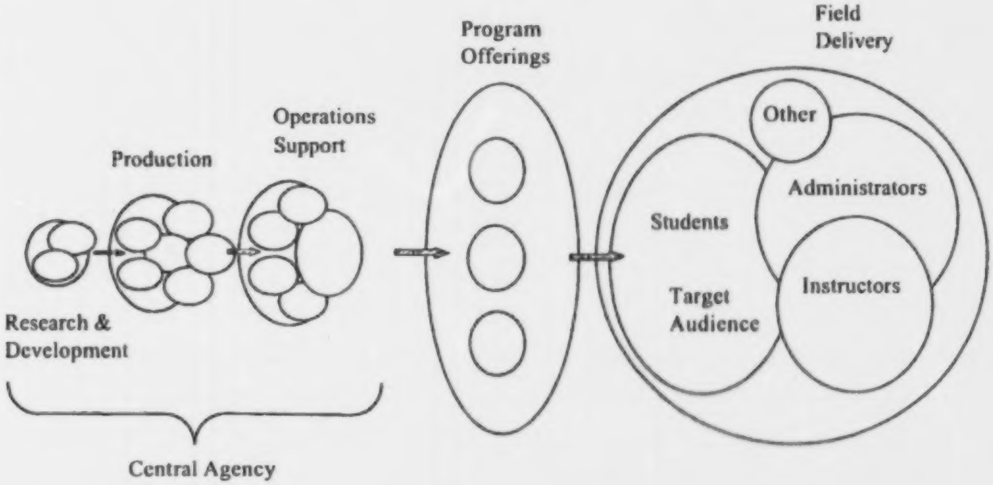


Figure 3: Functional Components of a Learning Network

The Production Line Analogy

Learning networks are analogous to typical product manufacturing production lines. Many of the rigorous business processes developed for product manufacturing can be beneficially applied to learning networks. The central management agency of a learning network is responsible for "manufacturing" and "bringing to market" programs of instruction. These programs usually contain multiple courses and are delivered into the field by the "distribution network" of organizations that provide instruction to students. Many of the disciplines of product manufacturing can be applied. Launching new programs is analogous to launching new products, and program quality can be maintained by adopting many of the total quality management processes common in manufacturing. Ultimately, however, learning networks do not manufacture products. The analogy, while useful, must not be taken too far. The goal of providing effective learning experiences must not be sacrificed in pursuit of greater efficiency. Striking the correct balance between the two is one of the primary responsibilities of the central management agency.

Research and Development

BEST COPY AVAILABLE

Typically a small "core team" focused mostly on learning-model evaluation and design leads the research and development (R&D) efforts. This team works closely with outside groups to identify and evaluate emerging trends and best practices that may be applicable to further enhancing the network. Research subjects include adoption of different teaching and assessment methods and their application to procedural, collaborative, and problem-based learning. This group is responsible for prototyping new technologies, such as simulations and virtual reality, case-based learning, and peer-to-peer collaboration. Using data provided by the operations-support and field-delivery teams, these prototypes can be rapidly evaluated, improved, and rolled out to the entire learning network.

Production

The production group is responsible for developing and implementing learning programs with direction from the R&D, operations support, and field delivery teams. Specific areas of focus include both designing and planning the instructional program. This includes the design and development of the curriculum, instructional material, and associated assessments. Once this is completed, translation and localization can be carried out—if required. Finally, the production group is responsible for quality assurance of the instructional material.

Operations Support

The largest of the central management agency groups, operations support is directly responsible for the delivery and support of all programs and services to the dispersed field delivery network. The operations support group provides hands-on support to the many field delivery organizations around all aspects of running their academy. Operations support is broken down into five main areas:

1. Program management: This function ensures the smooth transition and roll out of new programs and delivery systems to the field delivery network. This includes supporting recruitment of instructors and academies, as well as promoting and demoting academies.

2. Delivery support: This function directly supports instructors in the field. Through a central helpdesk or website and regular site visits, instructors are supported and taught about new features, techniques, and opportunities.

3. Field quality assurance: This function monitors academy performance and student results. It also investigates and resolves complaints.

4. Marketing and communications: This group provides academies with marketing materials to help attract students. It also supports academies of higher rank in recruiting other academies into the program.

5. Technical support: This group manages the network infrastructure and maintains levels of service.

Field Delivery

Field delivery is, by far, the largest part of any learning network. This function contains many varied sub-groups. Included here are the organizations or academies responsible for managing the delivery of instruction as well as the employees that work for these institutions, typically instructors and administrators. The students themselves are included in this group and provision is often made for alumni so that community and support can be provided beyond the immediate learning period. Field delivery is the last stage in the production line analogy. Equivalent to a manufacturer's distribution channel, field delivery involves the largest number of people and is the most difficult part of the learning network to change. As delivery organizations in the field mature, they often assume some of the operational and support roles (instructor training, delivery-system support and recruitment, etc.) for less mature organizations. This feeds the growth of the overall program.

Supporting Technology

Many effective large-scale learning networks have evolved without the extensive use of technology to support program delivery. However, the Internet has made possible lower-cost platforms to further enhance efficiencies in most areas: content authoring and management systems are available to support production of new programs; content distribution systems enable content to be delivered directly into the classroom; and assessment engines that enable the measurement of proficiency and learning management systems support the administration of academies and the tracking of student grades and certification. While all the components of a standard integrated learning management system are required for each academy, there is a need for network-level tools and services to administer the network of organizations and track instructors and students as they move between institutions. These tools are typically custom built, as few vendors of integrated learning management systems provide this functionality.

Applicability of Learning Networks

A learning network is most applicable when three key features are present. The absence of one of these features does not mean a learning network cannot work, but it does mean it may be less appropriate.

1. A blended-learning model is required because pure distance learning will not support the required access to people or equipment. In such cases, teamwork or social interaction may be an integral part of the instruction, or access to location-dependent specialist equipment may be mandatory.

2. A large number of organizations are able and willing to join the network and deliver the instructional program. These organizations can take many forms: a network of dealers, resellers, or agents; schools and adult education centers; or large organizations with many semi-autonomous sub-groups, such as government agencies, armed forces, and healthcare providers.

3. The target audience values certification and is willing to pay a reasonable fee and invest a significant amount of time to qualify. For example, certification may significantly improve employment or promotion prospects, or enable leisure activities.

Benefits of Learning Networks

Learning networks have many benefits. The network structure itself allows the costs of instruction to be spread across the entire network. The network often functions like a market; this prevents any one organization from making inordinate profits and also serves to keep costs at reasonable levels. The network structure also enables rapid reaction to market dynamics. New curriculum and assessment can be prototyped, refined, and rolled out to the entire network in very short time frames. These features support the rapid growth of learning networks.

The academy-based delivery model enables high-quality blended learning and—as a side effect—develops significant customer loyalty. Students and instructors meet at centers where they form communities that are surprisingly enduring.

Learning networks are massively scalable. They do not require a single, expensive, monolithic organization to deliver on a global scale. Indeed, global delivery is possible with just a few hundred people running the central management agency. By leveraging technology to streamline administration and delivery, the central management agency can stay in direct touch with many parts of the field organization.

Example Learning Networks

Many examples of learning networks exist, supporting different industries, professions, and areas of interest:

- Operation of Complex Equipment
  - National Association of Flight Instructors (NAFI)
  - Driving Instructors Association (DIA)
- Vocational Training
  - Cisco Networking Academy

    - Automotive collision repair (I-CAR)
- Education
    - Science Learning Network
- Leisure Activities
    - Scuba diving (SSI)
    - Professional Association of Dive Instructors (PADI)
    - British Sub-Aqua Club (BSAC)
    - Professional Ski Instructors of America (PSIA)

Cisco Networking Academy

The Cisco Networking Academy program is a comprehensive e-learning program that provides students with multiple levels and kinds of certified Internet technology skills. Initially focused on network system skills (Cisco Certified Network Associate and Professional CCNA and CCNP), the program has rapidly expanded both the geographical coverage and the program curriculum. The program now includes courses sponsored by IT industry leaders (including Unix and Web Design) and is offered by a wide range of high schools, technical schools, colleges, universities, community based organizations, and military academies worldwide. The fully web-based program provides educational content, online testing, student performance tracking, and instructor training and support. The instructor-led classroom structure leverages this technology while providing high-touch support for students.

Business Results

- 9,000 Academies
- 130 Countries
- Nine Languages
- 15000 Instructors
- 250,000 students
- 30,000 + examinations per day
- Support for three million page views per day
- 50-percent annual growth
- A global delivery network, including an advanced, scalable LCMS and LMS tailored for learning network support

The Professional Association of Dive Instructors (PADI)

PADI is the world's largest recreational diving membership organization. Membership includes dive businesses, resort facilities, academic institutions, instructor trainers, dive educators, divers, snorkelers, and other water sports enthusiasts. PADI is focused on maintaining industry standards for dive training, safety, and customer service by supplying a range of educational materials, training aids, promotional pieces, certification, and recognition materials to support the delivery and marketing of PADI programs.

PADI certifies multiple levels of instructors. Instructors, master instructors, and course directors all exist within the program, which employs strict educational standards to maintain worldwide consistency and quality. The program has a full-time quality assurance department and all student training is conducted by certified instructors.

Business Results

- 526,904 new diver certifications (worldwide, 2000)
- Since 1967, over 10,151,841 diver certifications issued
- 106,893 total PADI individual professional members (2000)
- 4,726 total international resort and retailer association members (2000)
- Active in over 100 countries worldwide
- Curriculum is delivered to training organizations via traditional methods books, videos, CDROM, etc.

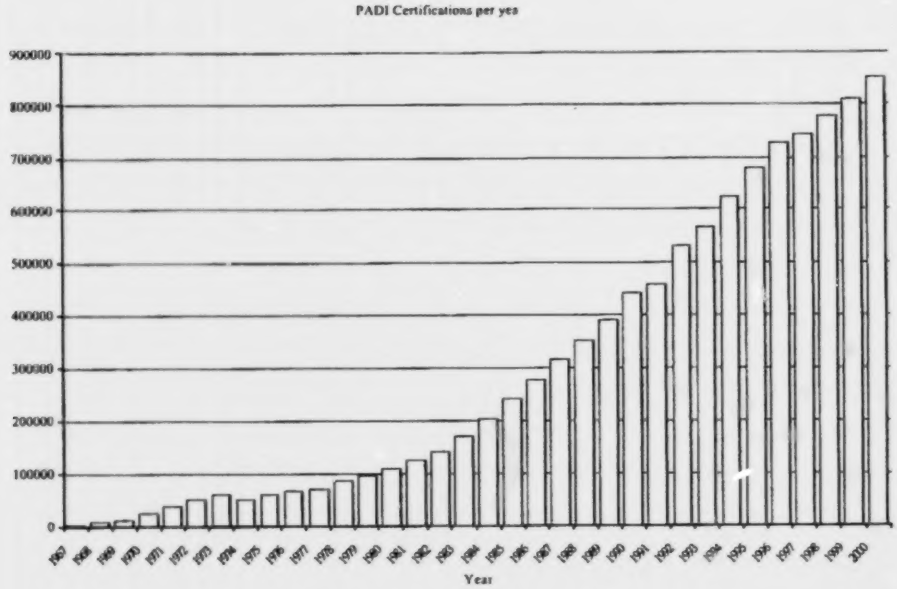


Figure 4: **PADI certifications per year since 1967**

Conclusion

Adoption and acceptance of e-learning is growing rapidly. However, there are classes of learning that are still best accomplished through the use of instructor-led training, leveraging physical classroom settings and resources. Learning networks offer a proven approach to building large-scale blended learning solutions. And emerging technologies can significantly increase the effectiveness of learning networks.

International E-Learning Business: Opportunities & Strategies

Dr. Joachim P. Hasebrook & Dr. Dirk W. Rudolph, efiport Inc.[1]

Abstract

Education is already a big business. E-learning, by making it easy to impart information and skills to anyone, anywhere, anytime, and for any purpose will grow the education market. As always, the big winners will be those vendors that identify and serve emerging and sometimes hidden markets. The biggest growth segments unleashed by e-learning are education for non-traditional students and the use of educational methods in related areas such as public relations, sales, and investor relations. E-learning permits dramatic expansion of the education market. While "distance learning" is the best-known example, we believe providing continuing education for busy professionals is a much bigger opportunity. E-learning is primarily about superior solutions for self-study and online courses. These solutions, however, can be readily adapted to sales and public/investor relations. In both cases, the object is to get information across to the recipient. While the education industry correctly emphasizes the learner, that does not mean there is no longer a need for teachers. Teaching and persuading have many things in common and can share many of the same advanced tools. Corporate training and personal career development are segments ripe for explosive growth. Businesses need to impart both general skills and company-specific information to their employees. They need solutions that are highly reliable, consistent, and available in order to bring new employees quickly up to speed. Increasingly, corporations are realizing that the Internet and extranets can be used to train customers and business partners, as well as persuade investors, consultants, industry analysts, and potential customers.

Key Enabling Technologies

The gradual development of e-learning standards will lead to interoperability between content, learning platforms, and testing. This, in turn, will make it easier and less costly to develop courses on highly specialized topics and for niche markets. To wit, the best tools will be available and affordable for use with all topics, whether popular or esoteric.

Networks will play a particularly important role, making it possible to deliver content and courses in new ways, and changing the way students, teachers, and others interact. The public Internet is central, but it is not the whole story. Private networks and virtual private networks (VPNs) will also play significant roles.

The Web is both a global marketing channel and a delivery vehicle. While the lack of significant local markets has been an obstacle to highly specialized courses, it is not the only obstacle. Just finding such courses can be a major problem. For the first time, there is a fast and convenient way to both identify and access specialized courses. The Internet can be used for real-time classes (distance learning) and non-real-time classes – or a combination of the two.

LANs enable classroom automation, and can be used to enhance the educational value of conferences and seminars. While schools have invested heavily in personal computers, they often put them in computer labs where students are taught how to operate them – but for no specific purposes. Wireless LANs enable distributing PCs throughout the school and moving them around as needed.

Virtual private networks enable education institutions to create virtual campuses with whatever geographic reach is desired. VPNs also enable enterprises to extend education to workers, business partners, and resellers in the field. The continued growth of VPNs, however, depends on the industry's ability to prevent major security breaches.

Mobile learning will make it possible for busy professional to pursue continuing education. Public wireless LANs and 3G wireless networks will enable users to remotely access courses, content, and other learning resources. Though some 3G wireless networks have been delayed, others haven't, and

---

[1] Sonnemannstrasse 9-11, 60314 Frankfurt/Main (Germany), phone +49-69-154 008 600 (fax 670), jh@efiport.de

BEST COPY AVAILABLE

the migration to 3G networks that support high-speed data is inevitable. (See our report: "Third Generation Wireless: Business Models & Strategies."

E-books have not had much success in the consumer market, but they could become a factor in the corporate training and post-secondary education markets. For example, the equivalent of several large textbooks could be stored in a much smaller and lighter weight package. E-books could also be used to train service technicians; after they complete the training the ebook becomes a convenient way of carrying a complete library of service manuals.

The development of multimedia content for education will create demand for better ways to search for and identify video and audio content. Thus, training and education in general may provide the stimulus for new products and services addressing this problem. The use of metadata and pattern recognition software are promising methods for cataloguing audio and video content.

E-learning products and services may also be enhanced through the use of speech recognition, text-to-speech, and natural language technologies. The use of voice technology is particularly useful in teaching and practicing foreign languages. Voice technology will extend the reach of online e-learning courses to any telephone. Thus, learners could study a few minutes here and there, in different places and at different times. For busy professionals, voice technology could prove helpful in squeezing learning into their schedules (for example, while commuting to and from work).

Copyright protection is a key concern for the e-learning industry. A number of solutions, generally referred to as digital rights management (DRM), do more than just protect content from unauthorized access and distribution. DRM can be used to control the number of times that material is viewed, whether it can be printed, how long it is accessible, and so forth. Thus, DRM will enable content producers to block sales of "used" content for which they are rarely compensated.

Key Business Opportunities

The biggest opportunities for e-learning are for content producers and distributors. E-learning enables those who have knowledge to reach a wider audience, both in terms of geographic reach and audience composition through the use of different versions (packages).

There are also opportunities for software developers. Learning/testing platforms, authors' tools, and virtual campuses are among the best. Online courses and mobile learning create opportunities for software that is highly interactive and can intelligently suspend/resume lessons as needed. There is still much to be done in development of custom courseware that adapts to the learner's needs, knowledge, and skill set.

Given the size and importance of the education market, one should not rule out the need for special hardware. For example, e-books should be adapted to the needs of students and trainees. Education, rather than the convenience of reading a backlit display in bed, may prove to be the bigger market for e-books.

There are numerous opportunities for e-learning portals, online universities, and mobile learning (m-learning) services. These service providers can also benefit from specialized tools. As telecom operators strive to move up the value chain, education and persuasion will prove key markets. We would not be surprised to see virtual network operators emerge, focusing exclusively on education and persuasion.

Main Driving Forces of Global E-learning Markets

Education is the second largest service sector in the global economy (health care is the largest), and K-12 is the largest segment within the education sector. It is estimated that worldwide education expenditures have reached US$2 trillion per year. E-learning accounts for perhaps 0.1% today; thus, increasing e-learning's share to a mere 1% would expand the market for e-learning products and services by nearly US$20 billion. According to UNESCO statistics, there were 1.15 billion students enrolled worldwide in primary, secondary, and higher education in 1997.

The key to e-learning firms' future profits is what analysts call "scalability." With traditional classroom teaching and training, class size is limited. For example, it is generally agreed that class sizes for continuing education seminars should not exceed about twenty students. This is also true for many higher education courses. The size limit, however, severely constrains profits. One hour of a teacher's time in class cannot generate more revenues than about twenty hours of seminar attendance. This puts a cap on the scalability and profit potential of traditional classroom education.

In computer-based training (CBT), the distribution of production costs between fixed and variable sources is radically different. The fixed costs of producing one hour of training are very high -- much higher than preparing an hour of traditional classroom teaching. But the variable cost of providing an additional hour of computer-based training is much lower. Thus, the average cost of providing an hour of computer-based training decreases with the number of students. The number of CBT students is not limited by classroom size and class manageability. Thus, the number of students worldwide for a specific CBT product determines the average cost per hour.

E-learning is also more scalable because the Internet makes it fairly easy to reach a worldwide market. The cost of marketing and distributing a course over the Internet is much lower than an advertising campaign using print media or sending CD-ROMs through the mail. It is the combination of worldwide market reach, low marketing/distribution costs, and a product with very low variable production costs that adds up to potentially high profits for e-learning products.

E-learning for K-12

The prospects for elearning in the K-12 market segment are very strong. According to UNESCO, there are currently 1,175 million students enrolled in K-12 institutions worldwide. Internet connectivity for secondary schools in most West European countries and the U.S. was estimated between 80% and 100% in the second half of 2000. The markets for primary and secondary education are the largest education market segments in the U.S. and worldwide. Expenditures in the U.S. for primary and secondary schooling reached US$371.9 billion in 1998, or 4.4% of GDP. Enrollment in the U.S. is expected to grow further. The study "The Knowledge Web" by Moe and Blodgett [2000] estimates the K-12 e-learning market in the U.S. at US$1.3 billion. They expect it to grow to US$6.9 billion by 2003.

E-learning for Higher Education

Higher education is a growth market. In the U.S. alone, 15 million students are enrolled in higher education. Worldwide, there are 84 million students pursuing higher education. Expenditures in the U.S. for post-secondary education, both private and public, are growing steadily, having reached US$146 billion and US$87 billion for the 1997-1998 school year in the public and private sector, respectively. The "Report of the Web-Based Education Commission to the President and the Congress of the United States" shows that growth in jobs requiring a higher education continues. According to the report, in 1950 the majority of jobs (60%) required no special skills. Today, 85% of jobs in the U.S. require an education beyond high school, up from 55% in 1991.

The Post-Secondary E-Learning Market

Moe and Blodgett (2000) estimate that the post-secondary online education market currently generates US$ 1.2 billion per year. They expect the market to grow to US$7 billion by 2003. Within this market segment, enrollment in distance learning demonstrates the growth potential of Internet-based course delivery. The graph below shows a sharp increase in enrollment in distance learning courses between 1995 and 1998. The "Agenda Project" report of the U.S. Department of Education (Office of Post-secondary Education) shows that the number of people enrolled in distance learning courses at post-secondary institutions in the U.S. nearly doubled between 1994-95 and 1997-98. The share of students enrolled in distance education as a percentage of total post-secondary enrollment was 5% in 1998, expected to rise to 15% by 2002. The "Report of the Web-Based Education Commission to the President and the Congress of the United States" shows that 710,000 students were enrolled in distance learning courses in 1998. The report predicts that enrollment will increase to 2.2 million by 2002. While 62% of four-year colleges offered distance learning courses in 1998, the share is expected to increase to 84% by 2002. In particular, online MBA programs are expected to grow rapidly. The global market for online post-secondary education was US$875 million in 1998 and is projected to reach US$3.9 billion by 2002. Crucial to the development of e-learning courses is the availability of technology-based content. In 1998, there was already a large selection of academic learning software

(3,300 titles) available. Most of this content is CD-ROM-based; the potential for using such content to supplement online courses is significant.

E-learning for Continuing Education

Many non-profit universities, such as Pennsylvania State University, the University of California at Los Angeles (UCLA), and the University of Wisconsin, have a long tradition of developing continuing education programs and courses through their extensions and outreach divisions. Many of these programs have begun to use online course delivery. For example, the School of Continuing Education at New York University, one of the largest programs in the U.S. (60,000 students), offered 30 online courses in fall 1997. Penn State World Campus wants to develop 30 certificate programs based on more than 300 courses. The University of California-Berkeley Extension also offers a large number of certificate courses online. Another e-learning pioneer is Athabasca University (Alberta, Canada) (http://www.athabascau.ca/) Its Centre for Innovative Management was the first to offer a complete MBA program online (in 1994). Many traditional c-learning firms are in the process of entering the e-learning market. Examples are Achieve Global, ARIS Coporation, Development Dimensions International, DeVry, ExecuTrain, Franklin Covey, Global Knowledge Network, Learning Tree International, New Horizons Worldwide, and Provant. For continuing finance education, New York Institute of Finance (http://www.nyif.com), Canadian Securities Institute (https://www.csi.ca/pub/en/index.html), and the efiport AG in Germany (http://www.efiport.de) now offer web-based courses.

E-learning for Corporate Training

E-learning for the corporate market is a function of B2B e-commerce. The second largest e-learning segment is also the quickest at adopting new technologies: the corporate training market. For example, a single U.S. company such as General Electric spends US$500 million on training and education per year.

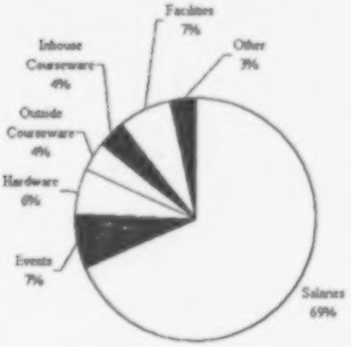


Figure: Annual global training expenses [2]

Corporate universities are a particularly interesting e-learning segment. In the U.S., the number of corporate universities has grown from 400 to 1,800 over the last thirteen years. According to the "Report of the Web-Based Education Commission to the President and the Congress of the United States," 40% of Fortune 500 companies have established a corporate university. A survey conducted by Corporate University Xchange suggests e-learning will rapidly gain market share in corporate training. In 1999, traditional classroom training (c-learning) was the dominant course delivery mode with an 80% share. By 2003, Corporate University Xchange predicts this share will decline to 60%, with e-learning grabbing the remaining 40% share.

Training Magazine estimates roughly US$62.5 billion was spent on formal training by U.S. organizations in 1999. This is an increase of 24% compared to 1993. The major share (44%) was spent on trainer salaries, another 24% went to outside providers of training products and services, and the rest was used for facilities, materials, hardware, seminars, and conferences. This means outsourced training providers captured a 24% share of the corporate training market, which corresponds to US$15-17 billion.

---

[2] From: http://www.internettime.com/itimegroup/market.htm

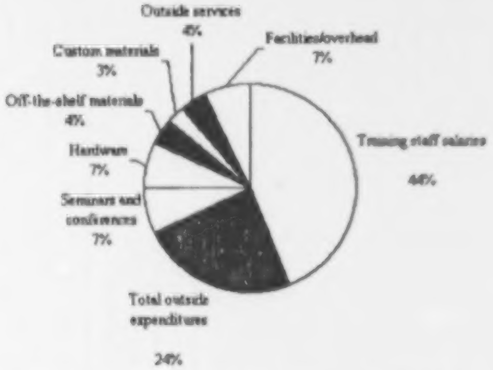


Figure: Corporate training budgets, U.S. (1999)[3]

Outsourced training accounts for nearly 30% of information technology (IT) training but less than 18% of soft skill training (e.g., seminars on time management). Around 10% of the IT training is technology or Web-based, whereas only 3% of the soft skills training is mediated through technology or the Web. The e-learning segment of the corporate training market in the U.S. accounted for about US$550 million and US$ 1 billion in 1998 and 1999, respectively. A particularly interesting segment is corporate IT training. In 1999, more than 2.2 million IT specialists worked in core IT occupations (computer scientists and engineers, systems analysts and computer programmers). Training Magazine notes that one third "of all employer-sponsored training in the U.S. is devoted to teaching people about computers." Today, technology-based IT training is a relatively small market in the U.S. with US$2.3 billion in revenues. However, this will change soon.

E-learning for Non-traditional Market Segments

There is a clear trend towards higher education for non-traditional student groups in the U.S. Between 1970 and 1993 the number of traditional students (age 18-24) enrolled in higher education increased by 35%. During the same period, the number of older students (above age 40) increased by 235%. Surprisingly, traditional undergraduate students (age 18-22 and who live on campus) made up just 16 percent of post-secondary enrollment in 1999, according to an article in Newsweek (April 16, 2000). Thus, traditional undergraduate and graduate students now account for less than one-third of U.S. higher education enrollment. Part-time and older students account for two-thirds of those enrolled in higher education. These non-traditional students are prime targets for e-learning because they are highly motivated but can't spend all day in classrooms. The primary target group for private education is self-directed, self-motivated, and ambitious students with job experience and clear learning objectives. A pioneer in for-profit adult education is the University of Phoenix. They have shown that providing higher education for non-traditional student groups is financially viable.

Customer Training and Client Education

E-commerce has clear competitive advantages for information-intensive products and services. The ability to employ e-learning for customer training is one of them. One example are the online computer courses known as "Educate U" (www.educateu.com), developed by Dell Computer Corporation and the Web-based training firm SmartForce. Anyone can take two basic courses for free.

---

[3] From: Ruttenbur, Spickler, and Lurie, [2000]. Source: Morgan Keegan estimates, National Center for Education Statistics, Training Magazine

Dell customers may receive three more courses for free, after which they become eligible to purchase courses from a selection of about 1,000 courses priced between US$5 and US$200 each.

Major Conclusions

- E-learning does not replace traditional classroom education. Instead, it expands the market for education products and services. Thus, e-learning assists the growing population of non-traditional learners, many of whom must divide their time between work and school, to pursue an education.
- E-learning solutions can be applied to non-education markets such as public relations, sales, and investor relations. The same tools developed to facilitate imparting knowledge to students can be used with great effect in persuading customers, investors, and commentators.
- Corporate training, career development, and expert enhancement are areas ripe for explosive growth. E-learning facilitates cost-effective production and delivery of courses for specific companies, jobs, and skills. It also enables organizations to adopt standard courses that can be kept up-to-date without confronting a logistical nightmare.
- E-learning technology enables course authors and producers to readily re-use content in different courses or different versions of the same courses. Thus, e-learning courses can be more customized than traditional c-learning courses. The ability to address special needs with minimal effort ensures the broadest possible market for any given content.
- While there has been much interest in using the Internet for "distance learning," its use as a global distribution channel presents a much bigger opportunity. Highly specialized courses for which there is insufficient local demand may do well in the global market. The Internet can also multiply the success of courses that do well locally.

Table. Growth prospects for e-learning technology in various market segments and time frames.

		0 - 1.5 years	1.5 - 3 years	3 - 5 years	Comments
Traditional					
K-12	US	medium	medium	low	Disillusionment in the US. Europe never really gets started.
	Europe	low	low	low	
K-12 supplementary	US	high	high	high	Homework assistance and special services for gifted children. Europe lags.
	Europe	low	medium	high	
University undergraduate students	US	medium	medium	high	Mainly e-books, online tutoring and later licensed video lectures supplementing textbooks. In Europe: limited willingness to pay for education; teaching content continues to be less standardized.
	Europe	low	low	medium	
University graduate students	US	low	medium	high*	Low domestic potential due to research orientation and large share of self-studying via free online content. *High enrollment potential for foreign students at U.S. e-learning centers. Europe will gain negligible share in this market.
	Europe	low	low	low	
Corporate training	US	medium	high	high	After initial disillusionment with cost-savings and quality, this segment will comeback strong with more targeted applications, a higher share of instructor-led courses, and quality content. Little difference between major US and European corporations.
	Europe	medium	high	high	

BEST COPY AVAILABLE

Non-traditional					
Undergraduate	US	high	high	high	Growth is mainly supply rather than demand constrained (too few institutions & e-teachers). Europe lags.
	Europe	medium	medium	high	
Graduate	US	high	high	high*	Same as undergraduate plus: *High enrollment potential among non-traditional European students for (online) U.S. e-learning universities.
	Europe	medium	medium	high	
Professional (updating knowledge)	US	medium	medium	high	Big potential in medical research, law, finance, cross cultural marketing. Mainly constrained by dearth of experts with e-learning course design skills.
	Europe	medium	medium	high	
Expert (seeking specialized knowledge)	US	low	medium	high	Online tutoring by experts in niche applications such as data mining, engineering, quantitative finance, business plan design. Constrained by low market transparency and dearth of experts.
	Europe	low	medium	high	
Employee training, post M&A	US	medium	high	high	After M&A, corporate-wide learning often a matter of economic survival. Great potential in fields such as banking, insurance, automobile, aviation, hotel chains, chemicals, telecom services, software, consulting.
	Europe	medium	high	high	
Client/customer training	US	high	high	high	Will become part of customer relationship management (CRM).
	Europe	high	high	high	
Consumer (personal interest)	US	low	low	medium	Primary target group: age 55+. Big long term growth potential, but only modest medium term growth. Exceptions: financial planning and investing, foreign languages, and technology enabled communication among similar-minded, educated people.
	Europe	low	low	medium	
Non-Education					
Public relations	US	low	low	medium	Long term growth potential for select applications includng (private sector) hospital and nursery home evaluation, school and college evaluation, environmental efforts of oil and chemical companies, and working conditions in high growth firms. Potential in public sector: SEC, consumer protection (e.g. mad cow disease), public pension plans, and tax law changes.
	Europe	low	low	medium	
Investor relations	US	high	high	high	This is the most promising application for e-learning outside traditional education.
	Europe	high	high	high	
Political campaigns	US	medium	medium	high	Offers potential for small parties and special interest groups (e.g. agriculture) exercising greater pressure.
	Europe	medium	medium	medium	

BEST COPY AVAILABLE

- Virtual private networks enable creation of virtual campuses that extend out into the local community and beyond. In addition to distributing course content, VPNs can be used to facilitate communications between learners and instructors, for collaboration between learners, and to administer tests.
- Wireless LANs will enable K-12 schools and universities to provide a range of advanced services for students, faculty, and administrators. In K-12 schools, wireless LANs facilitate the use of PCs and the Internet in classrooms and laboratories that lack network wiring. Wireless LANs on university campuses will permit students to access a variety of resources (such as online libraries) from their own laptop PCs and PDAs.
- Third generation wireless technology will enable mobile learning (m-learning). This will open entirely new opportunities for busy professionals who don't have time to attend classes. It will also spawn development of courses designed for "bursty" learning.
- Digital rights management (DRM) can be used both to protect content and facilitate creation of different versions. DRM technology was primarily developed to prevent unauthorized access and redistribution, but it can also limit authorized use to create targeted versions at different prices for specific customer groups. Thus, a quick refresher course that expires in two weeks could be offered at a low price.
- E-books have not experienced much success in the mass market. However, they are a perfect fit for many e-learning markets. E-books simplify distribution of the latest versions of service manuals and catalogues. They also enable non-traditional students and field workers to carry a library of reference materials in a small and lightweight package.

References

- Original study:

Hasebrook, J. P., Rudolph, D. W., & Steffens, J. U. (2002). *E-learning business – strategies and opportunities*. Chichester (MI): Datacomm Research.
→ http://www.datacommresearch.com/competitiveedge/toc/elearn.asp

- Further international e-learnind studies and data sources:

EdInvest, "*Online Education Clicks in India*", The World Bank, October 2000,
→ http://www1.worldbank.org/edinvest/docdetails.asp?doc_id=13&searchonly=1

EdInvest, "*Private education: the poor's best chance?*", The World Bank, November 2000,
→ http://www1.worldbank.org/edinvest/docdetails.asp?doc_id=17&searchonly=1

SunTrust, "E-Learning & Knowledge Technology, Technology and the Internet Are Changing the Way We Learn", SunTrust Equitable Securities.
→ http://www.eduventures.com/pdf/suntrust_elearning.pdf

Raths, David, "Looking to the East," Technology Training, June 2000.
→ http://www.trainingsupersite.com/ittrain/pastissues/June00/coverstory1.htm

Ruttenbur, Brian W., Spickler, Ginger, and Lurie, Sebastian, [2000], "e-learning: The Engine of the Knowledge Economy", Morgan Keegan & Co., Inc. July 2000.
→ http://www.internettime.com/itimegroup/morgankeegan.pdf

Tooley, James, "Overview of Global Private Education Sector," pp.5-14, Investment Opportunities In Private Education In Developing Countries, An International Conference Sponsored by The International Finance Corporation, Member of the World Bank Group Washington, D.C., June 1999.
→ http://www.worldbank.org/edinvest/pubs.html

Urdan, Trace A., and Weggen, Cornelia C., [March 2000], "Corporate E-Learning: Exploring a New Frontier", WR Hambrecht Equity Research, March 2000.
→ http://www.wrhambrecht.com/research/coverage/elearning/

Supporting decentralized education with personal technologies

Ulf Hedestig, Victor Kaptelinin, Carl Johan Orre
Department of Informatics
Umeå University
Sweden
[uhstig, vklinin, cjorre@informatik.umu.se]

Abstract: The paper deals with the use of personal technologies in decentralized university education. Decentralized education, delivered to off campus students located in the same geographical area, is a hybrid genre combining features of both on campus and distance education. The paper reports two studies. The first study focussed on communication patterns among students in a regular decentralized education setting. It was shown that (a) there are obstacles preventing the students from developing communities of practice, and (b) some of the obstacles are likely to be eliminated to alleviated with personal technologies helping the students to get an access to various resources and to communicate to each other. The second study included providing a student group with a set of PDAs and analyzing the impact of the technology on students' learning and communication patterns. The prospects for using personal technologies in decentralized education are discussed.

Introduction

Online courses and educational programs provided by universities for off-campus students have become increasingly popular during the last decade. One of the main factors contributing to the widespread interest in online courses is the freedom that the students are assumed to have when choosing time and place for their learning activities. The transformation of traditional learning into the so-called "e-learning" follows other general societal trends induced by information and communication technologies (ICT), such the trends towards e-commerce, e-democracy, and e-government. For universities the idea of a virtual campus has been put forward as a possible solution to the problem of overcrowded classrooms that impose constraints on on-campus teaching and learning. New demands for virtual campuses have also been articulated by regions and municipalities, which want to set local university programs to meet the needs of their local labor markets.

The changes in university education are associated with new challenges for teachers. Many teachers have to combine traditional on-campus teaching with giving distance courses or hybrid types of courses, such as decentralized ones. The trend toward extending university education beyond campuses also has an impact from students' perspective. On-campus education takes place in a setting that evolved from centuries of experience with supporting traditional classroom teaching. The setting provides a coherent context that is rich in various types of resources crucial for successful teaching and learning. These resources include a possibility for students to participate in a variety of regular classes, communicate with fellow students, have an access to university library, and various types of advanced technological resources (currently they often include a high-speed connection to the Internet). Besides, on-campus settings are characterized by physical presence of teachers, counselors, student unions, and so on. This context supports an enculturation process, so that the students can develop different communities of interests. On the other hand, in case of decentralized education and distance education, there is a limited access to resources, such as library facilities, teachers, computer capabilities, connection to the Internet, etc. Besides, there is often no predominant context for teaching and learning, as it is in the case of on-campus education. Students participating in decentralized university education have to study in a number of contexts, not only in formal educational settings, such as a local study center, but also at home, at workplace, on a bus, etc. Since students' learning activities are distributed over both time and space, it is more problematic to establish communities of interests. As a result, for many distance/decentralized education students learning is a more lonely process than it is for on-campus students.

BEST COPY AVAILABLE

Universities have been provided with information and communication technologies supporting the structural changes towards "more virtual" educational settings. Many discussions related to the educational use of technology have been focussing on finding standard ways of successfully using hardware and software depending on a certain course content. However, when education becomes more diverse other demands also come into the foreground. Given that the learner-centered teaching and learning perspective is crucial for education, and that there are profound individual differences between students in mental processes underlying learning and cognition (Gardner, 2000), it is necessary to take into consideration the specific contexts and circumstances, in which students live and study. According to Reigeluth (1999) in development of educational settings and pedagogical methods it is important to focus on customization instead of standardization. If customization is to be taken seriously, one has to recognize that proliferation of diverse educational forms forces students and teachers to become more mobile, in the sense that the context where those actors act changes all the time. Further, teachers have to be aware that students who attend their courses have different motives and prerequisites. Implementation of educational technologies in education has to deal with the above issues and complicated contexts. Finally, one more consequence of the customization perspective is that the traditional top-down approach to creating learning environments, that is, an approach, according to which webmasters and technicians construct an ICT-based environment, should be replaced with an alternative "bottom-up" approach, when teachers and students are more actively involved in the design process.

> *"The best way to support learning is from the demand side rather than the supply side. That is, rather than deciding ahead of time what a learner needs to know and making this explicitly available to the exclusion of everything else, designers and instructors need to make available as much as possible of the whole rich web of practice- explicit and implicit, allowing the learner to call upon aspects of practice, latent in the periphery, as they are needed"* (Brown and Duguid, 1993, p 13)

The starting point for both this paper in general and the project reported below has therefore been an attempt to investigate from a students' perspective the technologies they actually use and how communication and behavior patterns evolve with the use of different media. One of our previous studies (Hedestig and Orre, 2002) showed that students communicate through other channels than can be traditionally found in ICT-based learning environments. In particular, the use of mobile phones has become very common in the last several years. The majority of the students participating in the study reported in this paper (that is, 31 out of 32 students) had mobile phones. A promising type of tool to support students in learning settings typical of decentralized education could therefore be mobile artifacts, since certain types of such artifacts have been already adopted by students and they are flexible enough to deal with the complex nature of the reality of distance and decentralized education, mentioned above.

A case for personal technologies

In recent years mobile artifacts, such as mobile phones and handheld computers (PDAs), changed our ways of interacting with colleagues and friends. There is an appealing "aura" around these devices attracting people interest and stimulating the willingness to use them. With a tremendous speed and smoothness mobile technologies have been assimilated in our working life, as well as our everyday life. However, what are the attributes and the features of mobile technologies? Before we answer this question it is necessary to define what we mean by mobile artifacts. We would like to address the notion of personal technologies as it was introduced by Sharples (2000) and relate it to our discussion of mobile artifacts. According to Sharples (2000), mobile technology can be considered as a subset of personal technologies. Personal technologies in a broad sense include several other technologies. The main feature of various personal technologies is that we use them for organizing our everyday life. Digital date books or PDAs contact lists on IRC clients and mobile phones provide some examples of personal technologies. In this paper we will discuss characteristics of mobile technologies, which, from our point of view, can have an impact on the design of learning environments.

Characteristics of mobile technologies

Contextual features of mobile technologies are related to processes and factors at the micro-social level, that is, interactions among and between people (Townsend, 2001). Interpersonal interactions are the domain

BEST COPY AVAILABLE

where we find the most challenging and intriguing characteristics of mobile technologies. For instance, Kopomaa (2000) describes the mobile phone user as a newly emerged flaneur reclaiming public places and sites. Due to the ability to get mediated access through mobile technologies people are free to choose where and when to interact with others, and place is no longer a restriction. Rather, choosing or finding a place became a routine issue that parties involved in a conversation via a mobile phone have to deal with, often being influenced by rules and habits inherited from fixed-line communication. Interpersonal interactions are dynamic and undergo developmental changes, so that people face a special problem of maintaining relations with other people through different means. In the past fixed-line telephones, postcards and letters were used, in addition to face-to-face meetings, to maintain relationships. Today, even though we still use fixed-line phones, it is mobile phones, e-mail, and different types of instant messaging systems that are more often chosen as a communication channel. Postcards and letters are still playing some role but their use decreases due to decreasing costs and efforts related to the use of alternative media.

Maintenance of personal relations is one aspect of personal technologies, relevant to their use in education. Another aspect related to contextual features that needs to be taken into consideration is the possibility of micro-coordination. With mobile technologies we can co-ordinate our activities with others more easily. This is a type of the use of technology that can be found among young people as well as among families. If one drives home from school and stops by a grocery store, a brief phone call from one's mobile phone can help to decide what to buy and bring home.

Flexibility is a feature that can be discussed and analyzed from different perspectives. Mobile artifacts, such as handhelds or mobile phones, have both a personal dimension and a public dimension, supporting activities taking place during either leisure or working time. Greenberg, Boyle and Laberge (1999) refer to personal artifacts as those that are owned by one person and public artifacts as those that are created and collectively owned by co-operating group members. The above distinction can be exemplified by a student group working with an assignment, where each student can use his or her handheld to access two types of repositories: (a) personal repositories, e.g., contact lists, personal files and notes, and (b) public repositories, e.g., course schedule, class discussions, and other resources from the common information spaces. It is important to take into account that there is a tension between these domains. What is socially acceptable in one setting is not necessary acceptable in another one. Sharples (1999) describes mobile technology as potentially disruptive when use patterns collide with established norms and values. The example he gives is a mobile phone ringing in a classroom. The signal is irritating both for the owner himself, who feels guilty for forgetting to turn off the device, and for the teacher and fellow students, who experience an interruption of the lesson.

Mobile technologies play different *roles* in different situations. The user and the needs that currently are the most important ones determine a specific role to be taken. For instance, Ling (2001) illustrates different motives behind adopting mobile phones through the following example. Imagine that someone, person X, travels from point A to point B. For X a mobile phone can be a safety device giving a feeling of security while traveling if something happens. For people who are waiting for X at point B a mobile phone can be used, if needed, to notify X that they are going to be late. Besides, people at point B can be confident that if something happens to X, he or she will notify them, as well. Ling & Haddon (2001) discuss motives such as accessibility, display, coordination and security/safety indicating that these motives have generational bounds and social needs that is determined by contextual perquisites. These and other examples clarifies the role and the mediated effect of mobile technology to extend beyond the tool view.

Thus, personal technologies, such as mobile phones, may play numerous important roles in our society. Studies show that these technologies answer to the needs and hopes of the modern individual and incorporation of these technologies into our way of life is a two-way process. Not only is the device being adapted to our everyday practices; our practices also change as a consequence of the use of technologies (Hedestig, Orre, 2002).

Mobile technologies in learning settings

Teachers become mobile due the fact that higher education undergoes similar structural changes as industry does, when considering the effects of the development towards the information society. Virtual universities often create new demands for teachers' mobility by introducing new forms of education. Decentralized education and distant education, for instance, force teachers to travel to give lectures and provide assistance to students. Maintenance of resources connected to a course, as well as maintenance of relations with fellow teachers can only be done by means of different technologies that overcome constraints associated with time and place. At the same time, it is necessary for the teacher to perform micro-coordination with the family as well. Existing technologies in learning environments lack the flexibility necessary to deal with all these circumstances, and therefore teachers have to adopt other technologies in order to attain these goals. One candidate technology for supporting teachers in mobile work settings, which we mentioned and discussed above, is a mobile technology integrating public and private environments.

Students are as well affected by these changes, since education becomes more virtual and accessible "anytime, anywhere". Students engaged in decentralized and distance education are more differentiated in age, background, etc, comparing to students participating in on-campus courses and programs. This means that teaching and learning, as mentioned above can occur in different places (e.g., at home, on campus, or at work places). In these environments different means of communication and collaboration are necessary. Existing technologies can lack appropriate features to support informal and formal communication. The learning process contains highly situated and collaborative elements, and the place of learning can be defined as the place where connections to social networks exist and are accessible (Hedestig, Orre, 2002).

Since late 90s there has been an increased use of mobile phones among all age groups (Ling, Vaage, 2000). New communication patterns have emerged with the advent of these devices and new cultures of use have been built around these technologies. The phenomenal success of adopting these devices in everyday life of millions of people can be used as a promising and potentially instructive example in designing architectures of new learning environments. Recently there has been a growing interest in the use of personal technologies in education, especially within K-12 settings, where these technologies open up new possibilities for children to get a better access to different resources (Danesh et al 2001). The traditional way to use computers in education has been to make computers centrally located, e.g., in computer labs. Such an arrangement has resulted in a limited access to technology for students. Since placing computers in one specialized location isolates them from other educational settings, the technology has been almost exclusively used for computer-oriented activities and not for domain-oriented or subject-oriented activities (Inkpen, 1999). Recently a number of pilot projects tried to find out how personal technologies can be integrated into a wide variety of learning settings. These projects have focused on specific issues, for instance, tests and assignments (Chen, Myers and Yaron, 2002), collaborative learning (Landay 1999, Roschelle and Pea 2002, Luchini et al 2002), and distributed training of medical students (Lundby, 2002).

Mobile technology and competence development in work settings has also been a popular topic of research since the late 90's. The work conditions in the "information society" have been recognized as demanding more distribution and mobility of the work force (Kristoffersen and Ljungberg 2000) In IT-based work settings mobile workers need new types of competence development opportunities, which are not restricted by time and space. Several recent research initiatives have been initiated to face this challenge by focusing on new models of using mobile technology in competence development (Hardless et. al. 2000) and supporting knowledge management (Fagrell, Forsberg and Sanneblad 2000).

A mobile learning project

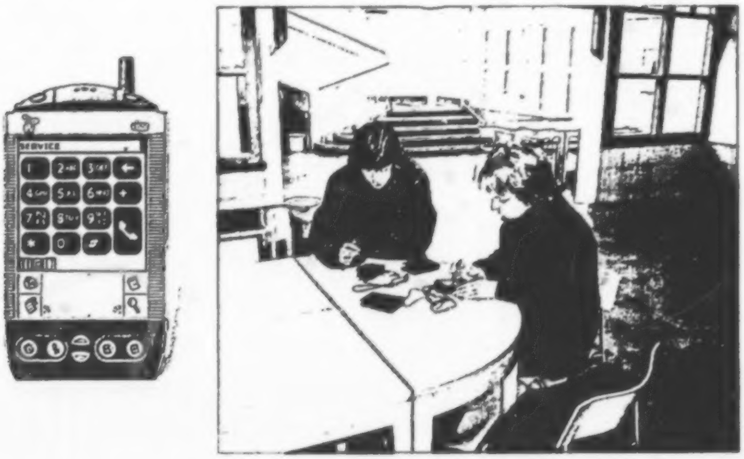
A project reported in this paper was initiated at the Department of Informatics, Umeå University, during Fall 2001 (Orre, Hedestig, Kaptelinin, 2001; Hedestig, Kaptelinin, 2001). The aim of the project was to understand existing communication patterns and use of mobile artifacts among undergraduate students and how this knowledge can be used to inform design of learning environments for distance and decentralized education. The project had adopted a bottom-up approach to designing learning environments, that is, attempted to view teaching and learning from students' perspective. In other words, the goal was to understand how students learn and interact with each other. A class of 32 students in a town located 150 km from the University campus attending a decentralized undergraduate program in Informatics took part in the project.

Framing Communication Among the Students

The first phase of the project was to deal with how the students socialized and communicated within a group of classmates. The aim was to reveal student's communications patterns and then capitalize upon this knowledge when introducing PDAs and further investigating the impact of technology on students' learning activities. Every student participating in the project was asked to keep a diary of his or her communications. The students recorded to whom and when and by what media they communicated. The diary data allowed us to reveal several patters of communication showing how different groups within the class emerged and evolved.

Another source of empirical data were interviews used to cross check the data from the dairies and to capture aspects that were hard to find in the dairies. Interviews were both conducted with students either in small groups or individually. We found group interviews a useful technique both as a source of new data and as a cross-reference to the dairies and the individual interviews. The interviews were recorded and then transcribed.

The second phase of the project was to focus on the adoption process. Twenty PDAs were distributed among the students approximately three months after the initiation of the first phase. We video-recorded the distribution of the PDAs the students in order to get hold of their initial response in the first encounter with the devices. We followed up the introduction with individual interviews conducted, respectively, one week and two weeks after the distribution. All PDAs were equipped with a mobile phone Springboard module, which enabled the students to use PDAs as a mobile phone and connect their PDA to the Internet. One reason for combining PDAs and the mobile phone module was our belief that the hybrid bridging two worlds - the world of the PDA and the one of mobile phone - is one of the most promising directions of the development of mobile technology. The objective of the study was an investigation of the feasibility of the artifacts for problem solving and the attitudes of the students, including their feelings and concerns experienced during the use of the devices in their studies. An important goal of the project was an attempt to integrate the above devices in the student's everyday life and make these devices a natural part of the ecology of learning environments, and thereby follow the developmental process of the mobile technology in use.



a) b)

Figure. 1. (a) The personal technology employed in the study and (b) a typical use situation.

Supporting Horizontal Communication

Due to a lack of resources available at a local study center, the students have formed study groups that regularly met and provided an important support for individual learning. In these groups a work practice had developed, where some students would take the role of a teacher and help the others to deal with the problems and difficulties they encounter. The traditional models of communication between the teacher and students, which are typically based on the idea of vertical communication, did not apply to the above interactions in study groups. Participating in the study groups was shown to influence students' attitudes towards technologies used in education. For instance, sending e-mails to the teacher was perceived by the students as a rather formal means of communication. It was also considered too slow in terms of receiving prompt replies to students' questions. It took a few days for the teacher to deliver an answer, and by then, the question was usually already discussed and dealt with in a study group. Therefore, the answer given from the teacher was more of a confirmation of the solution already developed within a study group. The emergence of study groups indicates the need for supporting horizontal communication in order to maintain and coordinate educational activities, both formal and informal. It can be concluded that the flexibility of means supporting horizontal interaction is an important

BEST COPY AVAILABLE

resource helping students to deal with the variety of contexts in which they learn. It was found that the observed increase of frequency of communication over the course of the study could be attributed to an increase in communication through horizontal communication channels (Hedestig, Orre, 2002). The students used these channels when studying at home or being located at some other place than the study center. In either case the mobile technology described above supported the students in being connected to networks of peers and being a part of a community of learners.

Our findings indicatess that in decentralized learning settings there are patterns of the use of *information* and communication technology, which are not adequately supported by existing technologies. Despite having an access to a variety of information and communication technologies, such as email and course websites, which are common artifacts in distance education, students preferred other, more mobile technologies in their interaction with each other. It can be concluded that decentralized education setting, heavily relying on more synchronous interactions, requires the participants to be more mobile

The Students Adoption of Mobile Technology

After distributing the set of PDAs we have carefully followed the process of adoption of this technology by the students. Our data indicates that the strategy of adopting the technology, employed by the students, was successful and the students have incorporated the PDA in their everyday life in a number of ways. We found that high motivation of the students, based on their interest in technical artifacts, positively affected the process. The students began to practically use the artifacts in an early state of the adoption process. The use of the calendar provided by the PDA replaced the use of ordinary calendars. Even those students, who never used a calendar for scheduling and planning their activities before, started to use the PDA as a digital calendar. It was also found that earlier experience of the students with mobile phones was one of the factors affecting their initial rejection of the mobile phone module. Due to low speed of transmission and low quality of the speakers of the module, which were inferior to the ones typical of conventional mobile phones, the majority of the students rejected the module in the beginning. Later on (in spring 2002) many of the students who rejected the phone module started to use it since they found new possibilities of using it in their everyday life. The PDA itself has been a success with the students. Our interviews indicate that the students especially appreciated the color screen, processing speed, and other advanced technical features. An interesting finding was that the hybrid device provided to the students was not considered as a single unit. The students always referred to a PDA and a mobile phone module as two different devices.

We identified two types of patterns in the students' process of technology adoption. All students had an intensive exploration phase in the beginning of the process. After that about 2/3 of the students started to use the PDA practically in their everyday life, while the rest (approximately 1/3 of the students) continued their exploration (Jacobsson och Jonsson, 2002). Even though initially the applications run on the PDA were only single-user applications, the process of technology adoption cannot be considered a purely individual process. It can be seen as a socially distributed activity. The students actively shared their experiences with each other, for instance, by exchanging software, encouraging each other to try new features of the technology, and providing help.

Conclusions

The studies reported in this paper call for three main conclusions. First, they show that there is an apparent need for personal technologies in education. Analysis of existing communication patterns among undergraduate students taking part in decentralized education had revealed a number of needs that cannot be addressed by current technologies. Decentralized education to a large degree consists of what can be called "mobile learning". Accordingly, the students need to get an access to course materials, to the teacher, and to fellow students when being located in a wide range of physical and social contexts. Currently the students have to rely mostly on conventional mobile phones, which have substantial limitations as a mobile learning technology. Therefore, first conclusion from our studies is that there is certainly a niche for new types of personal technologies, such as PDAs, in decentralized education settings.

The second conclusion based on preliminary results of our pedagogical intervention, in which a set of PDAs was provided to a group of students, deals with the adoption of technology. Our data shows that assimilation of personal technologies into everyday practices of students does not happen immediately. The group is appropriating the technology over the course of developmental changes underwent by their learning activity as a whole.

Third and finally, our data indicate that the most important problems with personal technologies are related not to the technologies themselves but to the type of coordination between personal and public artifacts and between individual and collective learning activities that can be supported with personal technologies (cf. Kaptelinin, Cole, 2002). The criteria of what is a useful and usable personal technology depend on the social context of decentralized learning. For instance, the possibility to send email messages or use an instant messaging system, provided by PDAs, is important not only because it allows a student to get in touch with a teacher or other students. Mobile phones can also be used for communication between participants in a decentralized course. However, as opposed to mobile phones, PDAs allow for establishing communication without violating rules and norms existing in the social context. A student can potentially get a prompt reply from a teacher without the distraction associated with the use of a phone. Therefore, designing successful personal technologies for decentralized education requires that, on the one hand, an understanding of the social context of this type of educational setting and, on the other hand, a coordinated development of technological support for both individual and collective learning activities.

Acknowledgements

The paper has been conducted within a research project funded by the Swedish Agency for Distance Education (DISTUM) and The Bank of Sweden Tercentenary Foundation.

References

Brown, J S., Duguid, P. (1993) Stolen knowledge. *Educational Technology*, March, p 10-15.

Chen, F., Myers, B., Yaron, D (2000). *Using Handheld Devices for Tests in Classes*. Human-Computer Interaction Institute, School of Computer Science, Carnegie Mellon, University, PA. CMU-HCI-00-101.

Danesh, A et al (2001). Geney: Designing a Collaborative Activity for the Palm Handheld Computer. *CHI Letters:* Human Factors in Computing System, CHI 2001, 3 (1).

Fagrell, H., Forsberg, K., Sanneblad, J. (2000). FieldWise: A Mobile Knowledge Management Architecture. *Proceedings of ACM 2000 Conference on Computer Supported Cooperative Work*, 2-6 December, Philadelphia

Gardner, H. (1999). *Intelligence reframed. Multiple intelligences for the 21st century*. Basic Books, New York.

Greenberg, S., Boyle, M., Laberge, J. (1999) PDAs and shared public displays. Making personal information public, and public information personal. *Personal Technologies Journal*, March 1999.

Inkpen, K (1999). Designing Handheld Technologies for Kids. *Personal Technologies*, Vol 3 (1&2), 1999.

Hardless, C et al (2000). MobiLearn: Education for mobile people. In L. Svensson et al (eds*) Proceedings of IRIS 23*. Laboratorium for Interaction Technology, University of Trollhättan, Uddevalla,

Hedestig, U., Kaptelinin, V. (2001). A conceptual model of the social context of distance learning. In *Proceedings of 20th World Conference on Open and Distance Education*, ICDE, Dusseldorf, Germany.

Hedestig, U., Orre, C. J. (2002). Personal technologies and development of learning environments. In Flückiger et al *Proceedings of 4th International Conference on New Educational Environments*, 8-11 May, Lugano, Switzerland.

Jacobsson, F., Jonsson, M. (2002). Vad händer när vi möter ny mobil teknik? En studie om studenternas adaption av PDAhybrider. In Homström, J., Persson, T (eds*) Proceedings of Umea Student Conference on Design and Use of IT*, SPD-01.05. Department of Informatics, Umea University, Sweden.

Kaptelinin, V., Cole, M. (2002) Individual and collective activities in educational computer game playing. In: T. Koschmann, R. Hall, N. Miyake (eds.) *CSCL 2: Carrying Forward the Conversation*. Lawrence Erlbaum. Mahwah, NJ.

Kopomaa, T. (2000). *The city in your pocket - the birth of the mobile information society*. Tampere:Gaudemus Krja. Oy Yliopistokustannus University Press, Finland Ltd.

Kristoffersen, S., Ljungberg, F (2000). Mobility: From stationary to mobile work. In K Braa, C. Sörensen, B. Dahlbom (eds) *Planet Internet*. Studentlitteratur, Lund, Sweden

Landay, J A (1999) Using Note-Taking Appliances for Student to Student Collaboration. *29th ASEE/IEEE Frontiers in Education*, session 12c4, November 10-13, 1999, San Juan, Puerto Rico

Ling, R. (2001) *The diffusion of mobile telephony among Norwegian teens: A report from after the revolution*. Telenor R&D rapport Nr 11/2001, Norway.

Ling, R, Vaage, O. F. (2000). Internett og mobiltelefon- ikke lenger bare for de få. *Samfunnspeilet*, nr 6. Statistisk sentralbyrå.

Ling, R., Haddon, L., (2001). *Mobile telephony and the coordination of mobility in everyday life*. Telenor R&D Rapport Nr 16/2001, Norway.

Luchini, K et al (2002). Using Handhelds to Support Collaborative Learning. In G Stahl (ed) *Proceedings of Computer Support for Collaborative Learning 2002*. Lawrence Erlbaum Ass, Hillsdale, N:J.

Lundby, K (ed) (2002) *Knowmobile: Knowledge access in distributed training*. Mobile opportunities for medical students. InterMedia Report 5, University of Oslo.

Orre, C. J. Hedestig, U. & Kaptelinin, V. (2001). Mobile technology and the social context of distance learning, Presented *at ED-MEDIA 2001 - World Conference on Educational Multimedia, Hypermedia & Telecommunication* , 25-30 June 2001, Tampere, Finland.

Reigeluth, C M. (1999). What is instructional-design theory and how is it changing? In Reigeluth C M (ed), *Instructional-design theories and models. A new paradigm of instructional theory*, Volume II. Lawrence Erlbaum Ass, Mahwah.

Roschelle, J., Pea, R (2002). A Walk on the WILD Side: How Wireless Handhelds May Change CSCL. In G Stahl (ed) *Proceedings of Computer Support for Collaborative Learning 2002*. Lawrence Erlbaum Ass, Hillsdale, N:J.

Sharples, M.(2000) The design of personal mobile technologies for lifelong learning. *Computers & Education*, 34 p 177-193.

Sharples, M. (forthcoming) Disruptive Devices: Mobile Technology for Conversational Learning. Paper accepted for publication in *International Journal of Continuing Engineering Education and Life-long Learning* special issue on Collaborative Learning in Networked Environments.

Townsend, A, M. (2001) Mobile communications in the twenty-first century city. In Brown, B., Green, N., Harper, R. (Eds) *Wireless World - Social and interactional aspects of the mobile age*. London: Springer Verlag Ltd.

BEST COPY AVAILABLE

A Media Rich Interface vs. a Simple Interface for Interactive Television

Anders Hedman , Sören Lenman
Royal Institute of Technology (KTH)
CID, Dept of Computer Science, Lindstedtsvägen 5
S-100 44 Stockholm, Sweden
ahedman@nada.kth.se, lenman@nada.kth.se

Abstract We compare and discuss the results from two user studies of interactive television (ITV) with a total of 50 subjects. The interfaces of two different ITV information services were studied: one with a place-like interface rich in graphics, animation and audio, and the other a simple interface with text and still images. In the first study, which evaluated the place-like interface, problems occurred with the mappings of the DTV-remote buttons and with the basic multimedia-interaction techniques used in interface. In the second study it was found that factors of concrete and conceptual nearness, with respect to the TV show, should be taken into account when evaluating the ITV service.

Introduction

ITV (Furth et al 1995, Ju et al 1994, Koller et al 1997, Srivastava 2002) allows for the development of graphically rich services with novel interfaces. ITV services surpass the limits of traditional text-TV based services in that they can resemble PC based multimedia applications. The resemblance is not perfect however, for ITV services multimedia is generally of lesser quality than traditional PC-based multimedia. The television screen, with low resolution and slow refresh rates, is not ideally suited for complex interfaces and the hardware performance of an ITV set-top box is drastically inferior to that of a standard PC. The current state of the art of ITV put developers in a dilemma. While they may recognize the possible gain of designing new and novel interfaces for ITV services, they also see the practical problems involved in such endeavors. On the one hand, if they develop simple interfaces modeled largely on traditional web sites (with e.g., navigation frame on left, content frame on right) they can be fairly confident that the design will at least work in practice. On the other hand, web-style interfaces may not be the best or even especially suitable for ITV services.

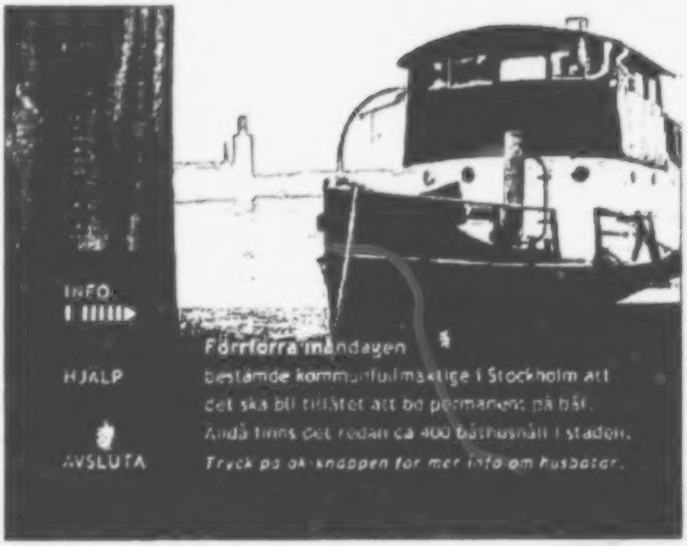
In what follows, we examine the results from two case studies of interfaces for interactive television. We discuss results on navigation, organization and level of engagement. The first case study was undertaken to help Teracom, a Swedish broadcasting network operator, evaluate a prototype ITV service with a place-like interface for educational TV. The second case study was conducted to guide The Swedish Educational Broadcasting Company (UR), a public service broadcasting institution, in designing simple user interfaces with text and still images for ITV information services in distance-learning.

Definitions

ITV can be implemented and deployed in various ways. In this paper interactive television (ITV) is seen as consisting of three parts:

(1) the ITV equipment which includes a remote control and a set-top box
(2) a digital TV show
(3) an interactive information service, complementing the digital TV show

The TV show is digital, but not interactive per se. Any interactivity is added by an ITV service, i.e., an interactive information service for digital television (se figure 1 for a screen shot of a service that was examined in one of the studies in this paper).



Förrförra måndagen
bestämde kommunfullmäktige i Stockholm att
det ska bli tillåtet att bo permanent på båt.
Ändå finns det redan ca 400 båthushåll i staden.
Tryck på ok-knappen för mer info om husbåtar.

Figure 1: A sample screen from an ITV information service for a TV show about houseboating

First Case Study Set-up

Equipment

A prototype ITV application developed with Macromedia Director™, running on a standard PC, and displayed on a TV through a Nokia™ set-top box was used in the study. The trials took place in a furnished living room (with e.g., a couch, framed paintings, and green plants). User explorations and conversations were video taped. The camera captured users and what they saw on the TV (trough a split signal cable to a second TV). The place-like environment was a simulation with a series of photographs. The ITV package permitted users to "drive" down a road using a remote control and reach interactive stations (movie clips, texts, and still images). The TV show was an educational TV show about the history of Sweden.

Subjects

20 subjects, age range 25-60, 12 female, and 8 male took part in the study.

Procedure

Each person participated with a friend, i.e., they formed a pair with someone they knew and felt comfortable with. Each pair was asked to imagine themselves as being part of a study group on digital media. The scenario was that a group met weekly to discuss digital media applications. Next week they were to discuss the application presented to them in the trial. The subjects were given minimal operating instructions and asked to explore the service so that they could report on it at the study group meeting. The experimenters then left the room to allow the subjects to explore the simulated ITV service on their own and discuss their experiences more freely. All trials were video taped and at the end of each trial, the subjects completed a questionnaire. Lastly, the subjects were interviewed. Trials lasted for about 45 minutes (including a 15 minute interview). The scenario was purposefully open-ended because one important aim was to approximate the natural viewing situation of someone getting started with the ITV service at home. Moreover, this open-ended scenario also allowed for testing the whole of the ITV service. Since no previous studies had been performed on the service it was important to conduct an explorative study. The scenario did, however, provide the subjects with a sufficiently concrete task so that they did not feel lost.

BEST COPY AVAILABLE

Second Case Study Set-up

Equipment

A Sagem™ development set-top box with a remote control was used. It is similar to an ordinary Sagem™ set-top box, but has added functionality. The development set-top box and an ITV SDK (Software Development Kit) allow developers, to develop ITV services, and test them together with simulated TV shows. A video mixer was used to capture the TV screen (the simulated TV show and use of the ITV service). Thus both user reactions and what they saw on the TV in front of them was captured side-by-side on a single tape. The TV show was an educational TV show about house boats, and the ITV service complemented the TV show by providing images and texts about house boats.

Subjects

30 subjects participated in the final study: 20 were male, and 10 were female. The age range was 20-50 years.

Procedure

The procedure was the same as in the first study.

Results from the Case Studies

It is challenging to try to give an accurate comparison of two interfaces used in different applications, and tested in different studies. Not least, because the user groups might be incomparable. We have focused on three dimensions that we find concrete and possible to compare, although the last dimension (level of engagement) might, admittedly be highly influenced by the first two (ease of navigation and perceived organization). The questionnaires from the two studies revealed that the two ITV services from study one and study two received markedly different ratings on ease of navigation, organization, and on how engaging they were.

	Disagree completely	Disagree partly	Agree partly	Agree completely
Study 1: Place-like, media-rich interface				
Easy to navigate	30%	10%	30%	30%
Clear organization	50%	20%	25%	5%
Engaging	45%	35%	10%	10%
Study 2: Simple interface, text and still images				
Easy to navigate	7%	17%	3%	73%
Clear organization	17%	13%	13%	57%
Engaging	70%	10%	20%	0%

Table 1: Questionnaire responses for the two ITV-services from study one and study two with respect to navigation, organization and level of engagement.

On the one hand, the ITV service with the place-like interface was perceived as engaging but somewhat cumbersome to navigate and understand. On the other hand, the ITV service with the simple interface was easy to navigate and understand, while not being particularly engaging. This is just what might be expected, the novel, graphically rich interface is engaging but non-standard and consequently cumbersome to use. The simple interface, in contrast, is standard, but rudimentary and not very exciting. However, our analysis in the discussion section also gives another story.

BEST COPY AVAILABLE

Discussion

Navigation and organization issues of the service with the place-like interface

The video tapes from the study with the service with the place-like interface were transcribed and coded. It turned out that majority of the sentences involved problems in using the interface. That the service was still perceived as engaging could be seen as indicating a potentially high value in using non-standard media-rich interfaces for ITV services. However, the content, among other factors, could have influenced the ratings on perceived level of engagement.

Closer examination of video sequences of breakdowns indicated a major problem with the ITV service with the place-like interface. Many subjects were frequently "stuck" and found themselves staring at the remote control. While users could go forward and back with the top and bottom buttons, it was impossible to go left and right with the left and right buttons. These latter buttons were used for content selection. Thus the buttons were mapped according to a cognitively dissonant schema. Cognitive dissonance (Festinger 1957) occurs when one must choose between incompatible beliefs or actions. Great dissonance is created when alternatives are equally viable as in the case of the ITV-navigation, i.e., seeing the ITV-navigation as spatially mapped to movement or seeing it as functionally mapped to content selection. Also, some subjects were oblivious to basic multimedia interaction techniques used in the interface, e.g., "highlighting" to show selection.

The lesson to be learned is not only that the mappings of remote controls should be logical, but that it is complex to develop non-standard interfaces. The risk of making mistakes is much higher than when developing more time-proven, standardized interfaces such as standard desktop applications with menu bars, tool bars and dialog boxes or even web site navigation. Not only is the risk of making mistakes higher because the interface is non-standard, but also because as indicated above, the user group for ITV is not necessarily on par with the average PC user with respect to understanding novel interfaces. It is easy to forget that ITV is an area of design with its own user demography.

Engagement issues and the content of the service with the simple interface

At first hand one might guess that the problems of engagement with the simple interface had to do only with the rudimentary nature of its interface. It was discovered however, that the content of the ITV service did not work so well. The content of the ITV service had been chosen so as to provide more information than was available in the TV show, e.g., it expanded on the presented subject matter. Most of the subjects were dissatisfied with the choice of content in the ITV service. The subjects did not report that the content was of low quality per se, but that it was unfitting. The content did not work well although it was conceptually close to the TV show. This might seem paradoxical. There is, however, a simple explanation for why the subjects reacted the way they did to the ITV service content. During interviews it became clear that the subjects wanted a particular kind of "content nearness". This nearness can be summarized (for want of a better expression) as TV show concrete nearness. Such nearness can be distinguished from TV show conceptual nearness. Something is concretely near to a TV show if it brings up and elaborates on the concrete things, settings or people within the TV show. So if a person is depicted in a TV show as "John the houseboater" on his houseboat, then content that is concretely near would involve John and his houseboat. In contrast, content that is conceptually near would not have to treat of John the houseboater or his houseboat. Conceptually near content could simply treat of houseboating in the abstract or other houseboaters and/or houseboats. The subjects in the show were generally in favor of content that manifested concrete nearness and they only advocated bringing in content manifesting conceptual nearness if it was particularly valuable (i.e., contact information, and pointers to further information). One way to summarize this is to say that in absorbing the content of the ITV service, the subjects were more willing to make concrete associations to the particulars of TV shows rather than engage in abstract or conceptual associations.

Concrete and conceptual nearness will let the viewer accommodate more easily to the ITV service since little is demanded mentally to do so. The viewer accommodates mentally to the TV-show, the ITV-interface and the ITV-content in unison. In figure 2, optimal accommodation is predicted to occur in the first quadrant, we may call it the accommodational quadrant. It is only in this quadrant that the ITV service elements are both concretely and conceptually near. We realize that no final conclusions can be drawn from this study regarding the importance of concrete and conceptual nearness. We hope, however, to in some small way suggest how usability can be thought of as being dependent on factors that have to do with the content presented with an information tool rather than the tool itself. Why the subjects reacted the way they did regarding the content of the ITV service need to be investigated in future studies.

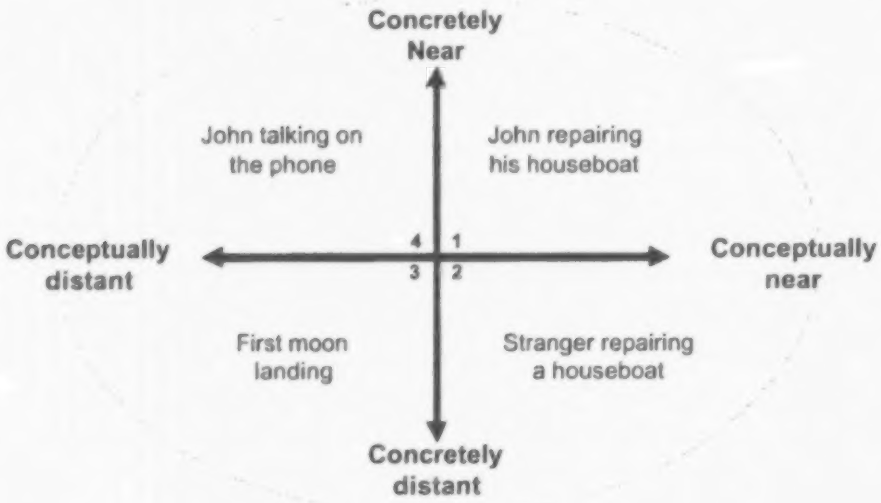


Figure 2: Concrete and conceptual nearness for a TV show about John the houseboater.

Conclusions

We suggest a way to make ITV services more attractive. The traditional approach has often been to include various appealing graphics (Westerlink 1998). Our suggestion, however, is that careful attention not only be given to the appearance and metaphorical meaning of included graphics, but that included graphics be evaluated in terms of concrete and conceptual nearness. When using place-like interfaces for DTV, the buttons on DTE remotes should be mapped carefully to avoid cognitive dissonance between, e.g., user beliefs about navigation and item selection. However, DTE remotes have limited sets of universally usable buttons (across hardware) and designers may be tempted or even forced to design cognitively dissonant use schemas. Furthermore, it is unsafe to rely on basic multimedia interface techniques in DTV interfaces as many users seem to have considerably difficulty with them. In the final analysis, we acknowledge the difficulty of designing novel media rich interfaces, and the need to establish good usability as fundamental.

If our conclusions are correct with respect to concrete nearness, which further investigations would have to decide, then the implications for ITV educational television are important to consider. We have not treated of learning in the traditional sense, e.g., in terms of retention and recollection, much because of our limited knowledge of the subject. The results presented here point to a way of making a more positive impact on the learners' attitude to ITV information services for distance education. By treating the content of an ITV information service as being subject to blending, through concrete nearness, with the TV show, the ITV information service can be received as more interesting, enjoyable and meaningful. In sum, we have arrived at a suggestion for a tripartite agenda in developing and ITV information service: (1) to put usability first and make early usability studies, (2) choose content which is concretely near to the TV show at hand and, if time and the budget at hand permits it, (3) experiment with novel interfaces for even more engaging learning experiences.

BEST COPY AVAILABLE

References

Furht, B., Kalra, D., Kitson, F., Rodriguez, A.A. and Wall, W.E. (1995) "Design Issues for Interactive Television Systems", IEEE Computer, Vol. 28, No. 5, 25-39.

Ju G., Angiolillo J. S., Hicks J. A. (1994) The Challenges of Designing a User Interface for Consumer Interactive Television. In *Proc. of the International Conf. on Consumer Electronics `94.* Digest of Technical Papers, 114-115.

Koller F., Burmester M., & Wöhr A. (1997) User Interface for Interactive TV – A Case Study with end users. In Proc. of the European Conference on Multimedia Applications, ECMAST'97. Springer Verlag.

Srivastava, H.O. (2002) Interactive TV Technology & Markets Artech House.

Festinger, L. (1957) A Theory of Cognitive Dissonance. Stanford University Press, Stanford CA, 1957.

Westerlink J H D M, van der Korst M, Roberts G (1998) "Evaluating the use of pictographical representations for TV menus" In Proc. of CHI '98.

Implementing Complex Web-Based Training Strategies with Virtual Classrooms

Denis Helic
Institute for Information Processing and Computer
Supported New Media
University of Technology Graz

Hermann Maurer
Institute for Information Processing and Computer
Supported New Media
University of Technology Graz

Nick Scerbakov
Institute for Information Processing and Computer
Supported New Media
University of Technology Graz

Abstract: Current training strategies implemented in online WBT training sessions are rather simple strategies. They lack a number of aspects of typical classroom training strategies, such as composite training strategies, possibility to customize and adapt training strategy, collaborative training strategies, and so on. In this paper we present a novel WBT tool called Virtual Classrooms, which we implemented to support such aspects. By doing so we wanted to mirror at least a small part of the typical classroom experience onto online training sessions in a WBT environment. Virtual Classrooms are implemented as a part of the modern WBT system called WBT-Master.

1. Introduction

From the users' point of view WBT systems deal with online training sessions. Learners (students) are participating in different training sessions, whereas teachers (tutors, authors) are preparing and conducting those training sessions.

Conceptually, a WBT training session consists of a number of training objects and a particular training strategy (Helic et al., 2000; Helic et al., 2001a; Helic et al. 2002). Training objects might be learning courses, learning goals, discussion forums, etc. On the other hand, a particular training strategy reflects a particular way of working through the subset of training objects to achieve a particular training goal. Such a training strategy might be considered as a certain training methodology.

Technically, a training methodology is implemented as a collection of WBT tools combined to support the desired way of working with the WBT system (Helic et al., 2001a). For example, consider the basic WBT training strategy known as Web-based learning. This training strategy is a collection of WBT tools, such as simple navigation links (prior/next/up), course maps, course syllabus, etc. Those tools provide functionality needed to work with simple WBT learning courses, i.e., to access, browse, navigate, and read through such courses (Dietinger and Maurer, 1998).

All WBT systems support at least the basic WBT training strategy, but usually they also support a number of more advanced strategies.

For example, e-Learning Suite (Dietinger and Mauerer, 1998) supports a training strategy called organizational learning (Malone et al., 1999). Organizational learning is supported by sophisticated WBT tools, which provide the access to the so-called Corporate Memory (Abecker et al., 1999; Ackermann, 1994), made up of information that is found within a company in the form of not only learning courses, but also other documents, discussion forums, etc.

Another advanced WBT system, WBT-Master (Helic et al., 2000; Helic et al., 2001; Helic et al., 2001a; Helic et al. 2001b; Helic et al., 2001c; Helic et al., 2002), supports a wide range of different WBT training strategies, such as Web-based tutoring (Helic et al., 2001a) (tools leading students through a sequence of learning actions to a particular learning goal), Web-based mentoring (Helic et al., 2001a, Helic et al., 2001c) (tools supporting synchronous online mentoring sessions), and so on.

Obviously, WBT systems that support not only the basic Web-based learning, but also a number of advanced online training strategies can be much more effective in an online learning process. Let us just consider the following simple example. Suppose a WBT tutor has two groups of students and WBT-Master system installed in his organization. The students from the first group prefer to work with the learning material in some kind of a "guided tour", i.e., they prefer if the tutor leads them through the learning process by pointing out what to do at each step of the learning process. Thus, for the first group of students the tutor might conduct a training session supporting Web-based tutoring strategy. On the other hand, the students from the second group prefer to work with the learning material in a more free and associative way. Thus, this group can be the subject for Web-based learning strategy.

If we compare advanced WBT systems with more typical ones (that just support Web-based learning) we may see that the advanced ones provide at least more flexibility in choosing a particular training strategy for online training sessions.

Usually, advanced WBT systems provide even more (Helic et al., 2001a): synchronous/asynchronous communicational facilities, collaboration tools, sophisticated customization mechanisms, progress tracking, etc. These facilities tremendously improve not only the overall quality of the conducted online training sessions, but also the experience of all participants (learners and teachers) of these sessions.

Nevertheless online training sessions still lack a number of important aspects of any typical classroom session (Plagemann and Goebel, 1997; Simoff and Macher, 2000; Schneidermann et al., 1995). Let us mention here just a few of these aspects.

A training strategy in a classroom session can be composed of a number of more simple training strategies. Such simple training strategies can be combined in a number of ways: they can be applied at the same time, in a time sequence, etc. For example, a classroom training session on object-oriented programming might start with the lecture on object-oriented programming concepts (the first training strategy) and then move over to students having to write an object-oriented program and apply the concepts from the lecture (the second training strategy).

Moreover, since the teacher in the classroom training session immediately gets the feedback about the applied training strategy he may adapt it accordingly. Thus, the classroom training strategy is not only a composite (heterogeneous) strategy, but it can be also adapted, or even extended on the fly. On the other hand, particular training strategies in online training sessions are rarely composite, but rather they are simple and atomic.

Usually, we can just select one of such simple atomic (Web-based learning is an example of an atomic online training strategy) training strategies from the strategies that are supported by the system in order to conduct our training sessions. Even if we have the possibility to pick an advanced training strategy (such as Web-based tutoring, which in fact can be composed as a sequence of different more atomic training strategies) we still lack the possibility to adapt such training strategy in a synchronous manner as the result of an immediate students' feedback.

Another important aspect is the collaborative aspect of any classroom training strategy. Writing the object-oriented program from the example above by a group of students can be achieved only if all students from the group work in collaboration. Many of current WBT systems lack such collaborative aspects completely, needless to say that they lack support for a collaborative training strategy and that maybe in the scope of a more heterogeneous, adaptable online training strategy.

Obviously, supporting at least such basic aspects of classroom training sessions in an online WBT environment would improve the experience of all WBT users (Brusilowsky, 1998). Learners would be confronted with more sophisticated training strategies; they would have a possibility to work in collaboration with other learners, and they would have a feeling that they are being "heard", since the training strategy adapts to their needs. Tutors would not be restricted to a certain simple training strategies, but they would have the possibility to create sophisticated, customized training strategies, which can be adapted in the real time to students' preferences. Thus, they would obtain more freedom in implementing their training sessions.

We implemented a simple WBT tool called Virtual Classrooms that support the above aspects and try to mimic as closely as possible a typical classroom training session in a WBT online environment. This tool is a part of the advanced WBT system: WBT-Master.

2. Virtual Classrooms Concept

Conceptually, WBT-Master Virtual Classroom is a special synchronous/asynchronous collaborative training and working environment. A Virtual Classroom provides all necessary tools for both tutors and learners that they need to conduct training sessions with highly sophisticated, adaptable, extensible and collaborative training strategies.

Usually, a tutor creates a single Virtual Classroom to support an online training session. The created classroom comprises:

- All training objects that are needed to conduct the training session.
- All WBT tools that reflect the particular (usually composite or heterogeneous) training strategy for that training session.
- All communication/collaboration tools needed for collaborative synchronous/asynchronous work.

Virtual Classroom allows the tutor to use any kinds of WBT-Master training objects (i.e. courses, goals, documents, even other classrooms, etc.) available in the system. Further, both the tutor, as well as the learners may upload local files and use these files as training objects in that particular training session. Also, the tutor may remove training objects from the Virtual Classroom.

A particular training strategy is reflected through the kind of training objects that the tutor provides for the learners. Thus, whenever the tutor selects a training object for the training session the system automatically recognizes the type of that training object (e.g. learning course, learning goal, etc.) and provides all the tools that are necessary to work with that training object. For example, if the tutor selects a simple learning course, all navigational tools such as course map, course syllabus, etc. are immediately available for the learners, thus reflecting Web-base learning strategy. Similarly, if the tutor selects a learning goal all tools needed to guide the learners through the sequence of the learning actions contained in that goal are automatically available, thus reflecting Web-based tutoring strategy. Since, any number of training objects may be inserted into the Virtual Classroom the tutor may in that way create rather composite and heterogeneous training strategies. The adaptability and extensibility is guaranteed in the way that the tutor may add, even remove training objects from the created Virtual Classroom at any given time.

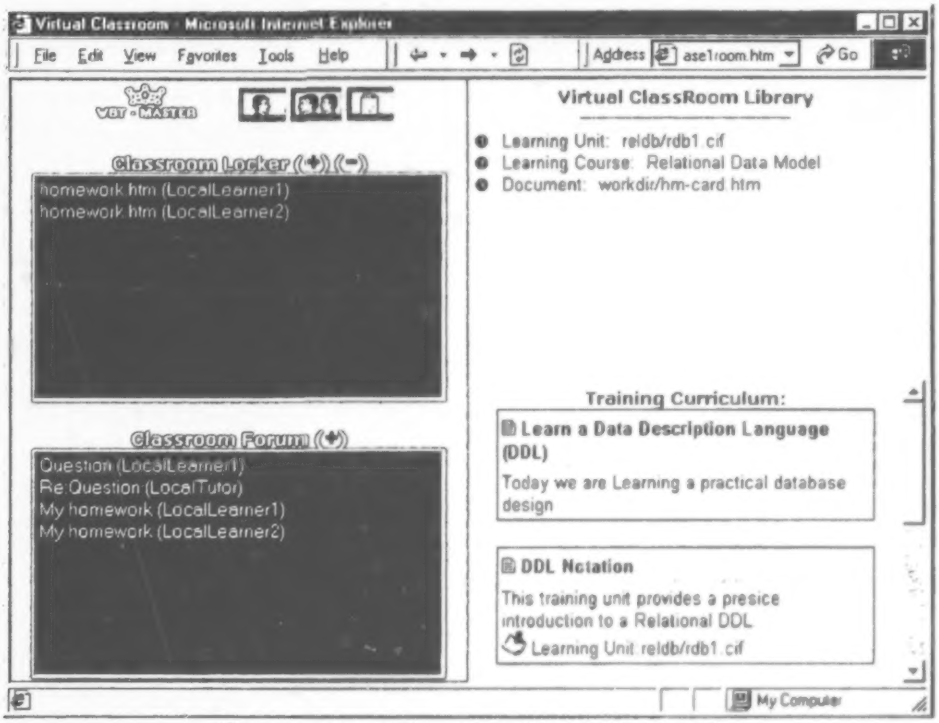
At all times the learners may see the tutor and other classmates presence, communicate via the special messaging mechanism or work together on a certain document.

3. Virtual Classrooms in WBT-Master

Technically, Virtual Classroom consists of the following components (see Figure 1):

- *Virtual Classroom Library* is a collection of WBT-Master training objects selected for the particular training session. As we already mentioned training objects of any type may be selected for such classroom library.
- *Training Curriculum* is a description of the training session. The curriculum explains what actions should be performed by learners and in which sequence. Thus, the curriculum can be also seen as the starting training strategy of using the resources and classroom tools for achieving a particular training goal. Of course, as we already mentioned at any given time the tutor may adapt or extend this training strategy.
- *Classroom Locker* is a repository of materials (i.e. files) uploaded to the WBT-Master server by users working with this particular Virtual Classroom. Obviously, the Classroom Locker is a shared repository in the sense that users may upload their local files and/or references to existing Internet resources (URL) to make them available for other users. The locker might be seen as the primary tool for collaborative learners' work.

- *Classroom Forum* is a sequence of messages (on-the-fly contributions) made by the learners of the virtual classroom. The classroom messages may refer to files/references previously uploaded to the classroom locker.
- *Classroom Blackboard* is a special window where a currently selected training resource is visualized. The Classroom blackboard may be individual or shared. In case of an individual blackboard, the learners are free to select any of previously defined training resources and/or elements from the classroom locker to work through on such individual blackboard. In case of the shared blackboard, the classroom tutor may select training resources and files for all participants of the classroom. The blackboard (especially the shared blackboard) may be seen as the primary tool applied in order to adapt the training strategy, since the tutor may receive an immediate feedback from the learners in a synchronous manner. Of course, the forum might be used all the time for providing the feedback in a more asynchronous manner.



homework.htm (LocalLearner1)
homework.htm (LocalLearner2)

Question (LocalLearner1)
Re:Question (LocalTutor)
My homework (LocalLearner1)
My homework (LocalLearner2)

Virtual ClassRoom Library

- Learning Unit: reldb/rdb1.cif
- Learning Course: Relational Data Model
- Document: workdir/hm-card.htm

Training Curriculum:

Learn a Data Description Language (DDL)

Today we are Learning a practical database design

DDL Notation

This training unit provides a presice introduction to a Relational DDL

Learning Unit: reldb/rdb1.cif

Figure 1 : Virtual Classroom without a blackboard

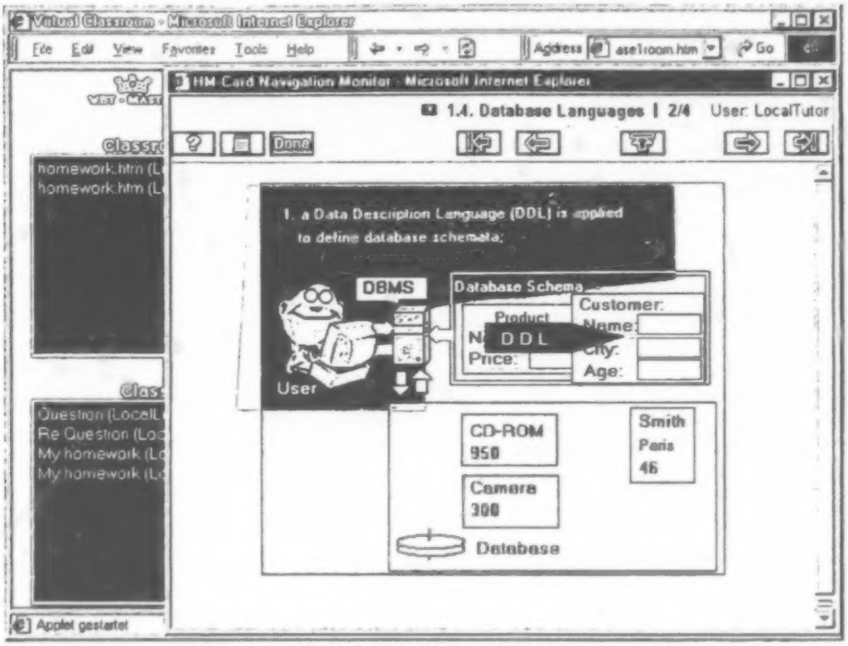
User interface solutions in Virtual Classroom tool are rather simple and intuitive. For example, the classroom library is displayed as a list of items. Clicking on a particular item in that list results in activating a new blackboard window, which allows working with this particular training object.

Once when the blackboard is activated the set of tools needed to work with that type of training object is automatically provided for the learners. Thus, if a learning course is selected all tools associated with learning courses are displayed (see Figure 2). In that way it is guaranteed by the system that a particular training strategy that the tutor had in mind is actually implemented.

In the case of the shared blackboard the tutor gets additionally few tools for synchronous communication with the learners. For example, the tutor may use a special pointer to point to certain areas on the screen and write additional comments on that pointer.

Note that similar synchronous communication mechanisms are available for the learners all the time. Thus, they may at any given time obtain information about the online presence of other learners, send them messages, or comments to documents that they are working together, and so on.

BEST COPY AVAILABLE

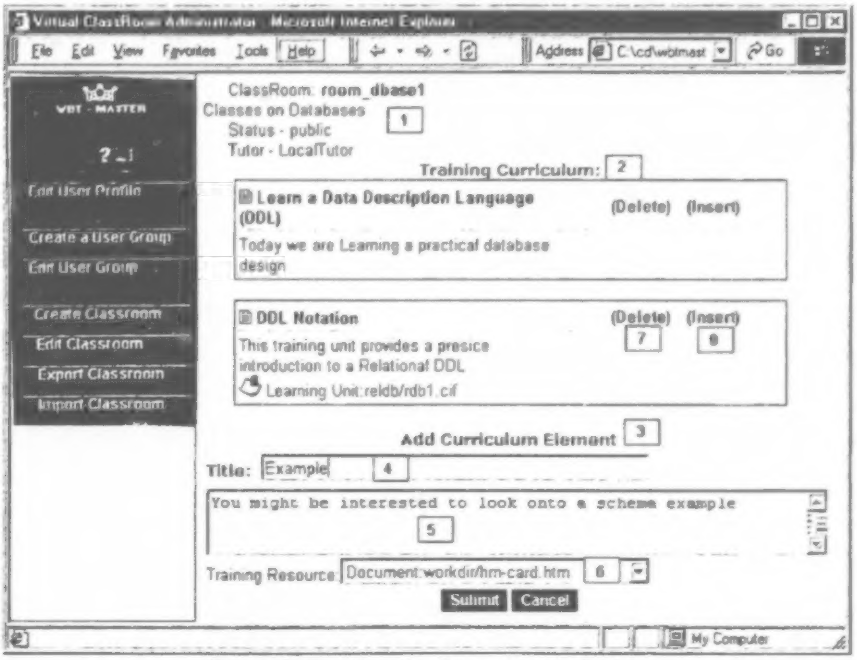


Virtual Classroom - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Address aselroom.htm Go
HM Card Navigation Monitor - Microsoft Internet Explorer
1.4. Database Languages | 2/4 User: LocalTutor
Done
homework.htm (L
homework.htm (L
Question (LocalL
Re Question (Loc
My homework (Lo
My homework (Lo
DBMS
Database Schema
Product
Price:
Customer:
Name:
City:
Age:
DDL
User
CD-ROM
950
Camera
300
Smith
Paris
46
Database
Applet gestartet

1. a Data Description Language (DDL) is applied to define database schemata;

Figure 2: Virtual Classroom with a blackboard

The Classroom locker and classroom forum are also represented as lists of items. In the case of the classroom locker the list represents all documents uploaded by the learners, and in the case of the classroom forum the list holds all contributions. In both cases, special Add and Remove buttons are available for adding or deleting an item from the list (see Figure 1).



Virtual ClassRoom Administrator - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Address C:\cd\wbtmast Go
WBT - MASTER
Edit User Profile
Create a User Group
Edit User Group
Create Classroom
Edit Classroom
Export Classroom
Import Classroom
1
2
(Delete) (Insert)
(Delete) (Insert)
7
8
3
4
5
6
Submit
Cancel
My Computer

ClassRoom: room_dbase1
Classes on Databases
Status - public
Tutor - LocalTutor

Training Curriculum:

Learn a Data Description Language (DDL)
Today we are Learning a practical database design

DDL Notation
This training unit provides a presice introduction to a Relational DDL
Learning Unit:reldb/rdb1.cif

Add Curriculum Element

Title: Example

You might be interested to look onto a scheme example

Training Resource: Document:workdir/hm-card.htm

Figure 3: Creating the classroom curriculum

BEST COPY AVAILABLE

An additional administration screen is provided for the tutor. Basically, the tutor works all the time just with the curriculum and classroom library. Thus, at the beginning of each training session the tutor creates the starting curriculum and selects a number of training objects for that curriculum. As the training session progresses he might need to modify the curriculum and/or the classroom library. The administration screen allows the tutor to do so (see Figure 3).

Another interesting aspect of the administration subsystem is the possibility to export and import virtual classrooms. For example, the tutor wants to move a very successful Virtual Classroom from one WBT-Master server to another one. Thus, the tutor exports the Virtual Classroom from the first server (all training objects, the curriculum, etc. are exported) and imports this Virtual Classroom into the second server. All needed information is restored on the second WBT-Master server.

Lastly, since WBT-Master supports a highly sophisticated user access control mechanism the tutor may define the access rights for all the learners by using the administration subsystem.

4. Conclusion

We saw that a Virtual Classroom provides an integrated working environment for all of its participants.

The tutor may create a Virtual Classroom with particular training objects and a particular training strategy for any training session, which he/she is going to conduct. Typical example would be a special organization offering training sessions on a contract basis. Each employee of such training organization may be provided with a special virtual classroom where he/she would define a particular classroom library of training objects by selecting from a big repository of training objects accumulated by the training organization of its main assert. Taking into account, a particular customer's training request the tutor may also define a very special classroom curriculum for this customer.

On the other hand, the learners participating in the Virtual Classroom are provided with all tools needed not only to work through the selected training objects, but also with tools that allow them to communicate with other learners and to work together with them on certain documents. Thus, by working in such Virtual Classroom environment the learners are provided with a strong classroom feeling.

References

A. Abecker, A. Bernardi, and M. Sintek, *Proactive knowledge delivery for enterprise knowledge management*, in Proceedings of the 11th International Conference on Software Engineering and Knowledge Engineering(SEKE'99), Kaiserslauten, Germany, pp. 120–127, (June 1999).

Ackerman, M.S. (1994) *Augmenting the organizational memory: a field study of Answer Garden*. In the Proceedings of the Conference on Computer-Supported Cooperative Work. ACM Press, pp 243-252.
R. Dieng, O. Corby, A. Giboin, and M. Ribiere. *Methods and tools for corporate knowledge management*. Int. Journal of Human-Computer Studies, 51(3):567– 598, 1999.

Peter Brusilovsky. *Adaptive educational systems on the world-wide-web: A review of available technologies*. In 4th International Conference in Intelligent Tutoring Systems, San Antonio, TX, 1998.

Dietinger T., Maurer H.: *GENTLE - (GEneral Networked Training and Learning Environment)*; Proceedings of ED-MEDIA'98, AACE, Charlottesville, VA

Helic D., Maurer H., Scerbakov N.: *Web Based Training: What Do We Expect from the System*. Proceedings of ICCE 2000, Taiwan 2000, 1689-1694.

Helic, D., Maurer, H., Scerbakov, N.: *Accessing Best-Match Learning Resources in WBT Environment*, Proceedings of ED-MEDIA 2001, Tampere, AACE, Charlottesville, VA (2001), 726-727 2001.

Helic D., Maurer, H., Lennon, J., Scerbakov, N.: *Aspects of a Modern WBT System*, In Proc. Intl. Conf. on Advances in Infrastructure for Electronic Business, education, Science, and Medicine on the Internet, SSGRR 2001, CD-ROM publication (ISBN:88-85280-61-7), paper 38, August 2001.

Helic. D., Maurer, H., Scerbakov, N.: *Mentoring Sessions: Increasing the Influence of Tutors on the Learning Process in WBT Systems*, Proceedings WebNet 2001, AACE, Charlottesville, USA (2001), 515-519.

Helic, D., Maurer, H., Scerbakov, N.: *Knowledge Domains: A Global Structuring Mechanism for Learning Resources in WBT Systems*, Proceedings WebNet 2001, AACE, Charlottesville, USA (2001), 509-514.

Helic D., Maurer H., Scerbakov N.: *Aspects of Collaborative Authoring in WBT Systems*, In Proc. Intl. Conf. on Advances in Infrastructure for Electronic Business, education, Science, and Medicine on the Internet, SSGRR 2002w, CD-ROM publication (ISBN 88-85280-62-5), paper 37, January 2002.

Malone, Thomas W.; Crowstone, Kevin; Lee, Jintae; Pentland, Brian; Dellarocas, Chrysanthos; Wyner, George M.; Quimby, John; Osborn, Charles; Bernstein, Abraham (1999): *Tools For Inventing Organizations: Toward a Handbook of Organizational Processes.* In Management Science, Vol. 43 (March 1999), No. 3, pp. 425-443.

T. Plagemann and V. Goebel. *Experiences with the Electronic Classroom - QoS Issues in an Advanced Teaching and Research Facility.* In Proceedings of the 5th IEEE Workshop on Future Trends of Distributed Computing Systems FTDCS'97. IEEE, IEEE, October 1997.

Ben Shneiderman, Maryann Alavi, Kent Norman, and Ellen Yu Borkow ski, "*Window of opportunity in electronic classrooms*," Communication of the ACM, vol. 38, no. 11, pp. pp. 19–24, November 1995

Simoff, S. J. and Maher, M. L. "*Analysing Participation in Collaborative Design Environments*," Design Studies, 21, 119-144 (2000).

How University Faculty Assess Scholarly Use of the Internet

Paul David Henry, Ph.D.
Program House
pdhenry@programhouse.com

Abstract: This quantitative survey of university faculty tested a theory of status-related risk by examining the affect of three organizational statuses on the use of this educational innovation. It also explored how use is mediated by assessment of risks to their professional perquisites. Academic field and computer-based specialty statuses were moderately correlated with Internet use. Computer-based specialty as an indicator of prior knowledge and experience was also correlated to use while controlling for assessment of risk. Thus, there was some overall support for a status-risk theory in the relationships between use and both status and risk assessment. Overall, this study shows that faculty attribute Internet use with generally positive impact on scholarly work, especially as it contributes to greater scholarly exchange of ideas.

Introduction

The faculty experience for those who seek to study and teach online is a path paved with change. Measured against the history of educational innovations, scholarly use of the Internet by faculty is in its infancy, despite its rapid growth from a government-sponsored boost for academic research in the late 1970s to the rise of online courses, online learning communities, e-journals, and virtual universities within two decades. The novelty and complexity of these educational innovations are associated with some uncertainty and a need to assess individual investment against risk - for with individual commitment to change comes both risk and (hoped for) benefit. As reflected in the Confucian adage "only the wisest and stupidest of men never change," there is no change without risk, but many will risk not changing - at least when and where the risk seems greatest.

As educational research and practice continue to reveal, learning has a social and organizational dimension - whether or not the meeting of minds is achieved through media such as the Internet. The fulcrum for this change can be found where individual aspiration and this social and organizational framework meet. Measuring attitudes and behavior of individual faculty within this context can reveal what otherwise lies hidden beneath change and may inform those seeking greater adoption and use of this new medium for scholarship. This paper summarizes findings from a quantitative survey of faculty in a research university setting that tested a theory of status-related risk in an attempt to understand why some faculty may be using this new medium more than others. In the context of viewing faculty as models for online scholarship, it seemed practical and timely to study how they have been using this new medium for that purpose.

A typical university with its schools, departments, and programs and the administrators and faculty is an example of a stratified, hierarchical social structure (Bess 1982). Despite the principle of academic freedom afforded by previous innovations, such as tenure and peer-based review, there are clear norms interpreted by administration and peer committees. These norms largely equate tenure, promotion, and considerations of faculty duties and schedule to evidence of research and publication productivity (Schweitzer 1989). With faculty reporting decreasing amounts of time for performing their varied duties, there may be diminishing time for research or the social and collegial contact that stimulates and refines the development of ideas (Creswell 1986).

Although some social and collegial contact can be achieved through traditional communications, there is still the challenge of disseminating knowledge or publishing results of research. This important component of scholarship is daunting to junior faculty as they are subject to the traditional academic reward system of "publish or perish" (Carnegie Foundation 1989). Despite its potential to overcome many of the limitations

BEST COPY AVAILABLE

of traditional communications, the use of network communications still poses risks to faculty who try to use an innovative and formally unrecognized medium for scholarly publication, especially if it is submitted for faculty evaluation (Martin 1992; McNulty 1995).

Theoretical Framework

This study employed a theoretical framework that previously has shown promise in understanding aspects of receptivity to organizational innovations. This theory is known as the status-risk theory of receptivity. As articulated by Giacquinta (1975a, p.42), it predicts that organizational and non-organizational statuses are basic in determining member receptivity to innovations within an organization. His status-risk model posits that: "1) all innovations contain varying degrees of possible benefits, risks, and uncertainties for organizations and organizational members depending on their statuses, and 2) that organizational member receptivity is a function of the extent to which he perceives risks, and more specifically of the degree to which he perceives direct or indirect risks to the perquisites accruing to his organizational status, were the innovation to become a reality."

Giacquinta's initial test of this theory was based on educator reactions to the proposed introduction of sex education into elementary schools (Giacquinta 1975a). His findings on differences in degree of receptivity confirmed the prediction for the four statuses that he studied: (from least receptive to most receptive) board member, administrator, teacher, and specialist of sex education.

This study took status risk theorizing in a different, though related, direction: the *use* of innovations by organizational members. Three academic organizational statuses were examined based on their importance in previous studies of faculty research performance (Creswell 1986): faculty tenure, academic field, and computer-based versus non-computer-based academic specialty. The basic model (Fig. 1) examines the following relationship among variables: an independent variable of status differences which influences both the intervening variable of perceived advantage or disadvantage to perks and the dependent variable as use of network communications in scholarly work.

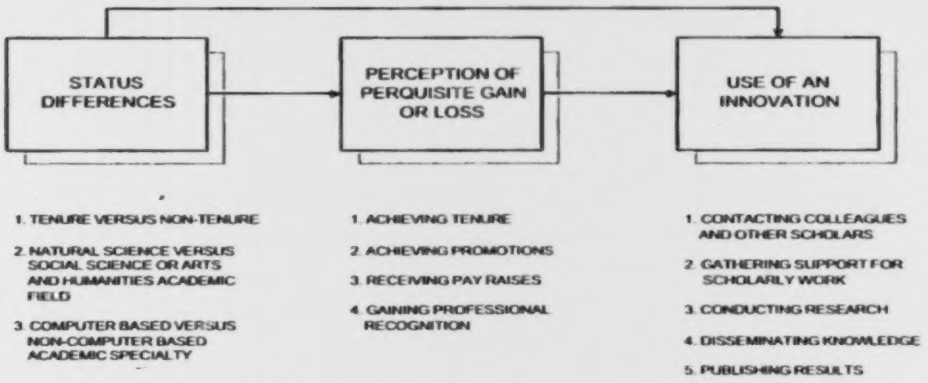

STATUS DIFFERENCES
PERCEPTION OF PERQUISITE GAIN OR LOSS
USE OF AN INNOVATION
1. TENURE VERSUS NON-TENURE
2. NATURAL SCIENCE VERSUS SOCIAL SCIENCE OR ARTS AND HUMANITIES ACADEMIC FIELD
3. COMPUTER BASED VERSUS NON-COMPUTER BASED ACADEMIC SPECIALTY
1. ACHIEVING TENURE
2. ACHIEVING PROMOTIONS
3. RECEIVING PAY RAISES
4. GAINING PROFESSIONAL RECOGNITION
1. CONTACTING COLLEAGUES AND OTHER SCHOLARS
2. GATHERING SUPPORT FOR SCHOLARLY WORK
3. CONDUCTING RESEARCH
4. DISSEMINATING KNOWLEDGE
5. PUBLISHING RESULTS

Figure 1: Causal model of theoretical framework.

BEST COPY AVAILABLE

Method

A survey research design was chosen as the approach to study the use of network communications among faculty. A short, self-administering questionnaire was used to measure such uses and statuses. The need for basic, self-descriptive information from many faculty to test a theory involving their use of network communications, perceptions of risk, and statuses could not have been met by other basic empirical methods such as a controlled experiment or face-to-face field work.

The setting selected for the study was a large, eastern university with a national reputation as a research institution. Its large size, number of schools, students, and its faculty with diverse academic statuses satisfied the need for data in this study. Subjects were selected from a sampling frame composed of all full-time, tenured and non-tenured (but tenure-track) faculty. In this setting, all full-time faculty were automatically issued accounts that allow computer and network access.

Faculty from four schools within the university were included in the sample. As school affiliation was initially defined as an important variable and a source of status in this study, comparison of equal numbers of faculty was important. To do this, a stratified, disproportionate random sampling design was adopted. The sample size was based on the school with the smallest number of faculty (n=67). Drawing a random sample of 67 faculty from within each of the other three schools provided a total sample of 268 faculty.

Findings

The theoretical focus of this study was primarily concerned with a group of three paired hypotheses that tested the efficacy of the status-risk theory in predicting the use of this innovation by selected statuses. To test this model, four relationships were tested: status and use, status and perquisites, perceived advantages and use, and the relationship between status and use by controlling for perceived advantages. The following descriptions and corresponding tables present the findings from each of these four analyses. Each of these hypotheses predicted that subjects possessing one status within a grouping would use network communications for a given scholarly activity more than those with the contrasting status in that grouping.

Hypothesis 1a predicted that tenured faculty would make more use of network communications for publishing results of scholarly work than non-tenured faculty. Hypothesis 2a predicted that natural science faculty in this study would make more use of network communications for contacting colleagues and other scholars, gathering support for scholarly work, conducting research, disseminating knowledge, or publishing results of scholarly work than social science faculty or arts and humanities faculty. Hypothesis 3a predicted that faculty in computer-based academic specialties in this study would make more use of network communications for contacting colleagues and other scholars, gathering support for scholarly work, conducting research, disseminating knowledge, or publishing results of scholarly work than faculty in academic specialties that are not computer-based.

Pearson product-moment correlations (Tab. 1) were made between the use of network communications for the five scholarly activities and globally with the three sets of faculty statuses: tenure vs. non-tenure, academic field (natural science vs. social science and arts and humanities), and computer-based vs. non-computer based academic specialty.

Tenure was not correlated globally or with any of the five scholarly activities. Thus, Hypothesis 1a was not confirmed. However, moderate correlations between academic field and the five scholarly activities as well as global use of network communications confirmed Hypothesis 2a. Similar correlations were found for computer-based specialty, which confirmed Hypothesis 3a.

Pearson Correlations of Network Communications Uses With Selected Status Characteristics of Faculty (n=141)

	Tenure	Academic Field	Computer Specialty
Contact Colleagues	-.15	.30***	.25**
Gather Support	-.10	.28**	.30***
Conduct Research	-.13	.33***	.33***
Disseminate Knowledge	.04	.41***	.40***
Publish Results	.02	.28**	.27**
GBLUSE	-.11	.36***	.35***

Note: GBLUSE represents overall use of network communications across scholarly activities.

*** p <=.001
** p <= .01
* p <= .05

Table 1: Correlations of Network Communications Uses with Faculty Status Characteristics.

Another aspect of status risk theorizing led to three other hypotheses. Hypothesis 1b predicted that compared to tenured faculty, non-tenured faculty would consider network communications for publication of the results of scholarly work to be less advantageous for achieving tenure, achieving promotions, receiving pay raises, or gaining professional recognition.

Hypothesis 2b predicted that natural science faculty would perceive the use of network communications for contacting colleagues and other scholars, gathering support for scholarly work, conducting research, disseminating knowledge, or publishing results of scholarly work as more perquisite-enhancing (i.e., achieving tenure, achieving promotions, receiving pay raises, and gaining professional recognition) than would social science faculty or arts and humanities faculty. Hypothesis 3b predicted that faculty in computer-based academic specialties would perceive the use of network communications for contacting colleagues and other scholars, gathering support for scholarly work, conducting research, disseminating knowledge, or publishing results of scholarly work more as more perquisite-enhancing (i.e., achieving tenure, achieving promotions, receiving pay raises, and gaining professional recognition) than would faculty in academic specialties that are not computer-based.

To reduce the complexity of this analysis, two summary scales (CONSUPRES and DISSPUB) were successfully derived through factor analysis (with high factor loadings) and were then used to represent the data. Pearson product-moment correlations (Tab. 2) were made to determine whether the perceived advantages in the use of network communications were related to the three sets of faculty statuses: tenure versus non-tenure, academic field (natural science versus social science and arts and humanities), and computer-based versus non-computer based academic specialty. Tenure was not correlated with either of the two factors representing perceived advantages. Thus, Hypothesis 1b was not confirmed. However, moderate correlations between academic field and both scales confirmed Hypothesis 2b. Similar correlations for computer-based specialty confirmed Hypothesis 3b.

Pearson Correlations of Two Scales of Perceived Advantages to Network Communications Uses with Selected Status Characteristics of Faculty (n=141)

	Tenure	Academic Field	Computer Specialty
CONSUPRES	.03	.22*	.32***
DISSPUB	.13	.31***	.29***

Note: The CONSUPRES scale represents faculty contact, support, and research activities, whereas DISSPUB represents knowledge dissemination and publication of results.

*** p <=.001
** p <= .01
* p <= .05

Table 2: Correlations of Perceived Advantages to Network Communications Uses with Faculty Status Characteristics.

A further test of this theory requires that perceived advantages and network communications use should be positively related. Perceived advantages showed moderate correlations with use (Tab. 3). CONSUPRES was with one exception, somewhat more strongly related to contacting colleagues, gathering support, and conducting research as expected, whereas DISSPUB was more strongly related to disseminating knowledge and publishing results.

Pearson Correlations of Faculty Uses of Network Communications with Two Scales of Perceived Advantage (n=141)

	Global Use	Contact Colleague	Gather Support	Conduct Research	Disseminate Knowledge	Publish Results
CONSUPRES	.36**	.23	.40***	.40**	.34***	.23***
DISSPUB	.27**	.12***	.27*	.27*	.33***	.32***

*** p <=.001
** p <= .01
* p <= .05

Table 3: Correlations of Faculty Uses of Network Communications with Perceived Advantages Scales.

As a final test of the theory, the relationship between status and use controlling for perceived advantages was determined using a series of partial Pearson product-moment correlations (Tab. 4). According to the theory, perceived advantage acts as an intervening variable between status and use. If perceived advantage is controlled, the zero order correlations should drop between status and use.

Controlling for perceived advantages did lead to reductions in the size of the original bivariate correlations for the status of computer specialty. Thus, the analysis does lend support to status risk theorizing in the case of the computer specialty status. However, controlling for perceived advantages had little or no affect on the correlations for the status of academic field with any of the five scholarly activities.

Partial Correlations of Computer Specialty With
Scholarly Uses Controlling For Perceived
Advantages of Network Communications (n=141)

Status	Zero Order	Control for CONSUPRES	Control for DISSPUB	Control for both
Computer Specialty with:				
Global Use	.35***	.23**	.26**	.23**
Contact Colleagues	.25**	.17	.20*	.17*
Gather Support	.30***	.10	.19*	.14
Conduct Research	.33***	.21**	.26**	.22*
Disseminate Knowledge	.40***	.27**	.29***	.26**
Publish Results	.27**	.18*	.16	.16

*** p <=.001
** p <= .01
* p <= .05

Table 4: Correlations of Scholarly Uses Controlling for Perceived Advantages of Network Communications.

Conclusions

The results of this study add moderate support to the premise that status-risk theorizing, previously found useful in characterizing receptivity at the initial stage of planned change, can also contribute to determining use during the implementation stage. In particular, this study points to its usefulness in characterizing individual response (in the context of work) to the type of complex organizational and social innovation represented by network communications.

Moderate support was found in the relationship of status to use. Two of three organizational statuses (academic field and computer-based specialty) were moderately correlated with use of this innovation. Only one of three statuses (computer-based specialty) was correlated to use while controlling for assessment of risk. However, there was also moderate correlation between assessment of risk and use that was independent of statuses selected in this study. Thus, there was some overall support for the status-risk theory in the relationships between use and both status and risk assessment.

There are several possible reasons for the lack of variance between non-tenured and tenured faculty in their use of network communications for publishing results of scholarly work, but foremost is this shared sense of uncertainty. This may reflect the relationship between uncertainty and outcome found in other innovation studies (Cancian, 1972; Giacquinta, 1975b), where inaction and resistance would broadly characterize a predominant outcome and some degree of risk-taking reflecting another outcome. However individuals assess this or even observe and reflect changing group norms, it seems clear that both non-tenured and tenured faculty largely agree rather than differ in their cognitive assessments of the value of publishing online for tenure.

Though typical of social science studies, there was a relatively small variance explained (roughly 20%) by the testing of hypotheses. Thus, a confirmation of the findings should be sought in a replication study that would account for possible limitations in the design and execution of this study. For example, the sample was under-represented by Math and Computer faculty (67.9% of non-returners). And although males represented 66% of the original sample, when comparing return versus non-return, more females in the sample returned (68.6% of females) than males (48.4% of males). Thus, a replication of this study should consider a larger sample size and other measures to ensure a better representation of statuses.

Another area of implication in this study has to do with the variance in network communications use attributed to an individual's prior knowledge and skills in using computers. At a basic level, the significance of this factor in this study implies that an individual's prior knowledge and skills should be operationalized as an important status in studies and practices during the implementation stage of complex innovations like network communications.

Allowing that prior knowledge and skills associated with computer use in the natural science academic fields and/or computer-based specialties are not necessarily equivalent to the knowledge and skills in the related, though distinct area of network communications, some degree of transfer must be occurring to explain the relative success that subjects with these statuses had in their network communications for scholarly work.

In sum, the implications of this study are that efforts to support the use of network communications for scholarly work should explicitly recognize an individual's statuses and assessment of risk. Also, an individual's prior knowledge and experience should be addressed in the support of implementation efforts. Rather than solely providing computer equipment and training in the use of software applications, change agents should employ this social and cognitive understanding as strategies to support online scholarship.

References

Bess, J. (1982). University Organization: A Matrix Analysis of the Academic Professions. New York: Human Sciences Press, Inc.

Cancian, F. (1972). Change and uncertainty in a peasant economy. Stanford, CA: Stanford University Press.

Carnegie Foundation for the Advancement of Teaching. (1989). The Condition of the Professoriate: Attitudes and Trends, 1989.

Creswell, J. (1986). "Concluding Thoughts: Observing, Promoting, Evaluating, and Reviewing Research Performance." In Measuring Faculty Research Performance. Creswell, J. (Ed) San Francisco: Jossey-Bass Inc., Publishers. . pp. 87-98.

Giacquinta, J. (1975a). "Status, Risk, and Receptivity to Innovations in Complex Organizations: A Study of the Responses of Four Groups of Educators To the Proposed Introduction of Sex Education in Elementary School." Sociology of Education. 48: 38-58.

Giacquinta, J. (1975b). "Status Risk Taking: A Central Issue in the Initiation and Implementation of Public School Innovations." Journal of Research and Development in Education. 9(1):102-114.

Martin, J. (1992). "Bringing Sense into Chaos: Humanities Research in the Computer Age." In Haden, C.R. and Brink, J.R, (Eds.) Innovative Models for University Research. Amsterdam: North-Holland.

McNulty, T. (1995). "The Electronic Journal: Is It Here To Stay?" Connect: Academic Computing and Networking at NYU. Summer 1995.

Schweitzer, J. (1989). "Faculty Research Varies Among Universities." Journalism Educator, 44(2): 45-49.

Asynchronous conferencing with a twist of synchronicity: in search for tools for collaborative moderation in online discussions

Pentti Hietala and Kimmo Koivunen

University of Tampere
Department of Computer and Information Sciences/ HCI Group
P.O. Box 617, FIN-33101 Tampere, Finland
Tel: + 358 3 2156780, Fax: + 358 3 2158557
ph@cs.uta.fi, kimmo.koivunen@uta.fi

Abstract: Carrying out argumentative discussion online has become rather common in higher education. This task is traditionally supported by asynchronous collaboration tools, but we believe that also synchronous supports could be useful. In this paper we focus on scaffolding the knowledge construction: the work of two student moderators jointly moderating a theme as part of a seminar type university level course. As a new scaffold, we describe a collaborative note-taking tool as an extension to a standard conferencing system. This new tool can be utilized either asynchronously or "semi-synchronously". An empirical evaluation of our first implementation of this tool is reported. There were almost 60 students on three courses who had an opportunity to use the tool. The evaluation shows that our students were not used to working together this way, although they recognised the benefits for joint moderating. We offer some explanations for these results and discuss our further plans in this area.

Introduction

In higher education today, there is a tremendous worldwide pressure to produce online "E-courses" that would be available for both students on-campus and those off-campus, e.g. working simultaneously with their studies. Indeed, there are currently numerous efforts underway transferring existing courses online and creating new online ones. At the same time, there is a well-recognised need to learn how to work collaboratively. Because people seem to find less and less time for face-to-face meetings, collaboration should be an essential part in E-courses, too. A vast body of research shows, however, that online cooperation and collaboration is not easy.

One emerging issue is the fact that in a well-designed WWW-based learning environment there should not be just one dominant way of communication and collaboration, but several of them – for different learners and for different teachers (Collis & Moonen 2001). In this approach, however, there is a danger that there might be too many separate tools for the learner – the richness becomes an overload. In our opinion, for the best benefit, the learner should receive scaffolding and support in choosing these facilities, and they should be "close to the task" and available "just-in-time". We agree with Erkens *et al.* (2002): "The relationship between collaboration processes, task strategies and the use of the tools and resources that the computer environment offers, may be crucial for the effects of computer supported collaborative learning."

One of the most common tools in any online learning environment today is an asynchronous conferencing facility that allows the learners to participate and contribute free from specific lecture times and free from specific physical places of education institutions. However, learning in real-time together with your teacher and peer learners should not be forgotten.

We have been working with asynchronous conferencing systems (Hietala 1999, Hietala 2001) with the emphasis on collaboration of small groups and student pairs. We have noticed that, in some learning situations, a considerable amount of student work consists of collaborative writing and planning, which would benefit from working synchronously. One tool to support this might be a collaborative note-taking tool, inside the conferencing system, that could be used in "synchronous fashion".

In this paper we report on an empirical evaluation of our first implementation of a tool of the above kind on three courses with 59 students. The students worked in pairs and the task to be scaffolded was a joint moderation where two moderators were required to moderate together an online discussion during four weeks' time. Besides normal conferencing facilities they were provided with a personal notebook within the conferencing system, which they could share with their moderator pair.

The evaluation shows that our students were not used to working together online this way, although they recognised the opportunities offered for joint collaborative writing and moderating ongoing discussion. We offer some explanations for these results and discuss also our further plans in this area.

Asynchronous vs. synchronous collaborative moderation

According to Mason (1998) there are several advantages to the asynchronous online learning, e.g.:

- flexibility - access to the computer conference discussions can take place at any time and from many locations,
- time to reflect - rather than having to react immediately, the learner is allowed to mull over ideas and prepare a comment, and
- situated learning - because the technology allows access from home and work, the learner can integrate the ideas being discussed on the course with the working environment.

On the other hand, Mason (1998) lists advantages to synchronous systems, too:

- motivation and pacing - synchronous systems focus the energy of the group, providing motivation to distance learners to keep up with their peers and continue with their studies,
- telepresence - real time interaction with its opportunity to convey tone and nuance helps to develop group cohesion and the sense of being part of a learning community, and
- good feedback - synchronous systems provide quick immediate feedback on ideas and support consensus and decision-making in-group activities.

In this paper we are interested in the task of moderating online conferences. Modern "integrated" environments, like e.g. WebCT, offer the course designer (teacher) an opportunity to include both asynchronous (bulletin boards, e-mail...) and synchronous (chats, IRCs...) discussion areas for their students. However, these are often used separately and seen as complementary. Intertwining of them is seldom suggested.

These two interaction modes seem to support different, albeit necessary working methods. Considering argumentative university-level discussions, for example, one study (Veerman *et al.* 1999) found out that in one synchronous system, students engaged into short and strong discussions. They checked, challenged and countered each other's information and produced additions and evaluations. On the other hand, in the same study, the asynchronous discussions with an asynchronous tool could be characterised as highly constructive, and students tended to argue 'mildly' by information checks and they mainly added or explained information.

However, are there situations or tasks, which would benefit from both of these two interaction types being available? We introduce collaborative moderation of online discussions as one such a task. The task we consider here is a pair of students jointly moderating a theme on a computer conferencing area. There are numerous guidelines for the moderating task (see e.g. Paulsen 1995, Muilenburg & Berge 2000), but interestingly, joint student moderation has been studied very little. A recent exception is the work by Rourke and Anderson (2002), where groups of four students were used to lead online discussion on course readings. In our work the student moderators worked in pairs, and also, they were able to utilize the content of their moderated discussion group later on when they prepared and presented their seminar paper on the very same topic they were earlier moderating.

We can distinguish several subtasks in the moderator's work: how to start the discussion (Phase I), how to keep the ongoing discussions alive (Phase II), and how to summarize and end the discussion (Phase III). We can envision several scenarios where collaboration is essential:

- In *Phase I*, the pair is required to prepare a joint statement on the topic at the beginning of the four-week discussion period. Bonk and his colleagues (Hara *et al.* 2000) have recommended and studied this kind of an instructional method, which emphasises the starting of the discussion process (starter-wrapper activity). Their analysis shows that student electronic comments in the discussions were highly dependent on the directions of the discussion starter – the initial posting. In collaborative moderating the pair must build joint initial understanding of the topic and compose a thought-provoking initial statement for the discussion group. Although our pairs received material and guidelines concerning their task and they had time to familiarize with the topic, we assume that still much two-way communication would be required here.

- In *Phase II*, there is an obvious need for some kind of scheduling and deciding who will answer each question or comment on a specific issue raised by the discussants in the group. Good questions are essential as part of the starting contribution, but good follow-up questions are also needed to maintain the online discussion. Moreover, there is the crucial question when to bring in new material and links to boost a weaker-growing discussion? Furthermore, building a joint understanding requires a fair amount of communication between the moderators. We believe all this calls for either synchronous or "semi-synchronous" online meetings between the moderators.
- Finally in *Phase III*, wrapping up the findings and conclusions of the discussions is required. Clearly, writing a reflective summary of the contributions resulting from online discussions of several weeks in a discussion group calls rather naturally for joint planning (asynchronously and synchronously). In our seminar course, to motivate the pair, they were given the possibility to use this summary as part of their seminar paper for their standard face-to-face seminar presentation.

To sum up, we believe that, in a task like this, there is a need for a just-in-time facility for "synchronous" collaboration within an asynchronous system. Other tools could of course be used, e.g., e-mail, chat, telephone, face-to-face meetings, but we wanted to provide one tool in line with the actual authentic discussion task and conference area. We hypothesized that here e-mail might be too slow, and chat might be too cumbersome. Placing a new facility "very close" the actual work area – the commenting area – we believe this could yield many benefits for the learning process, e.g. in the opportunity for sustained preparation of joint statements (needed as part of the moderators' work).

The Study

In this section we first outline the conferencing system within which we implemented the new tool and after that describe the use of this tool on our courses.

Collaborative note-taking tool

The CoWoGLe (Conferencing on the Web for Group Learning) project at the University of Tampere investigates the use of Web-based lightweight conferencing systems especially as part of university level course work. Earlier courses using our systems have been reported in Hietala (1999, 2001). Recently, some of our students raised the issue of the need for a note-taking tool inside our conferencing system. In considering this, we decided that the tool could also be a shared one, thus allowing the pairs to collaborate almost "in real-time".

The new note-taking tool was available for each of the students all the time he/she was using the conferencing forum. It was possible to copy onto it parts of the discussion entries of the others, write one's own ideas, edit them and save them for further use (giving extra time to reflect). We call this *Mode A* of utilizing the note tool. Besides helping to remember, to think, to clarify, we believe that the tool can help to share: either asynchronously, or semi-synchronously. We call these two ways, Mode B and C. In *Mode B*, the pairs would leave messages to their partner onto the note area, and see and answer to that at a time that would suit them best. In *Mode C*, the pairs would decide a time when they should both be present at a networked computer, and then exchange ideas and maybe reach decisions by adding them onto their personal note areas and letting their partner see that and respond to that ("semi-synchronously"). In our system this was supported by indicators of the notes made by the pair of the student: whether they had been changed after the last peek, and also a possibility to have a look at them (see Figure 1).

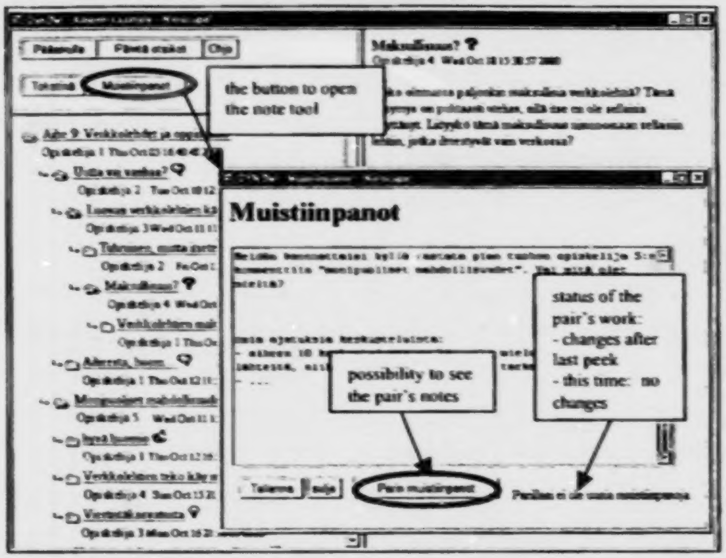

Muistiinpanot
the button to open the note tool
status of the pair's work:
- changes after last peek
- this time: no changes
possibility to see the pair's notes

Figure 1: The note-taking tool, with the possibility to collaborate and to see the notes of your pair.

The Courses

Next we describe our data from three undergraduate level courses where the students were given the opportunity to utilize the note-taking tool as part of producing their Web discussion and moderation postings. The course is titled "Internet based learning environments" (all students had earlier completed our basic course on Instructional Technology). There were a few lectures to start the course, followed by the work on the Net and finally traditional face-to-face seminar sessions. At the beginning of the course the students chose a seminar topic either provided by the teacher or suggested their own one. The seminar work was conducted in pairs, which were formed by the topic selection process. The "matching" of pairs was entirely carried out on the Web - we hoped that similar interests brought them together. Next, students conducted a four-weeks online moderating of the discussion in their topic after which they presented their seminar paper in a one-hour session before the entire class.

We ran three courses of the above format in Autumn 2001 and Winter 2002. On these three courses there were altogether 59 students: 34, 9 and 16 respectively. In the following, we call these three courses as follows: The Distributed Course, The Local Course, and The Open University Course. The Local and the Open University Course students (basically) came from Tampere area and could easily work in the same computer classrooms. The Local Group consisted mainly of regular Computer Science undergraduates, although there was also one student mastering in the English Language and one vocational level in-service teacher. The Open University Group was more heterogeneous, these students were older, worked daily and attended the course at evenings or weekends.

On the other hand, The Distributed Course was a little bit different. The lectures were the same but were given at these two different locations (Hämeenlinna and Tampere, 100 kilometers apart). The group of 34 students in this group consisted of 17 in-service teachers (from Hämeenlinna) and 17 university students (from Tampere). Each moderator pair consisted of one in-service teacher and one university student. The in-service teachers mainly taught at elementary level, although there were a few mathematics teachers at secondary level. The university students were mostly computer science majors, with 20 % of them majoring to become mathematics teachers.

Table 1 depicts the corresponding discussion activity in the three groups during the four-week online discussion period. Each participant was required to produce one posting in three conference topics during each week: one moderating comment in his/her "own" topic (the one he/she would make the seminar presentation) and two in two topics that he/she had committed him/herself as a commentator. These kinds of requirements are common in order to ensure equal participation and even distribution of comments on discussions lasting for many weeks. So the minimum number of comments in our courses for each participant was 12. As we can see in Table 1, most students contributed more.

We can see from the Table 1 that the Open University students were most active and produced most postings onto the discussion areas, while the Local and Distributed Groups were almost the equal with this respect. As moderators, the Distributed Group was clearly behind the others.

	Distributed	Local	Open Univ
Number of students	34	9	16
Total number of comments	710	187	370
Average number of comments/student	20,88	20,78	23,13
Average number of comments as a moderator	6,21	8,56	8,5

Table 1. The amount of Web discussion on the three courses

Results

Our main interest in this paper is the use of the note-taking tool. We wanted to find out how the students acted in the three phases and three modes we outlined earlier. During the lecture part of the courses, the conferencing system was briefly introduced (as well as the new facility for note-taking). Students were also given a paper leaflet describing the conferencing tool.

We collected data mainly in two ways: logging the actual use of the tool, and posing a questionnaire at the end of the course. Let us first have a look at the log data. In Table 2 we have counted the use of the different functionalities present in the Note-taking Tool window (cf. Figure 1): opening and closing the tool, saving the contents of the tool, and looking at the notes of one's pair. The first three actions above give indications if the students actually made use of the tool and the fourth tells us whether the tool was used for collaboration. The student has to save his/her notes on the tool area, before his/her pair has a chance to see that there has been a change in the contents of the notes (cf. Figure 1, indicator at the lower right-hand corner). Thus the amount of the saves can be seen also as part of the collaboration.

	Distributed	Local	Open Univ
Number of pairs	17	4	7
Average number of openings/student	3,09	8,38	8,21
Average number of closings/student	1,41	6,25	4,79
Average number of savings/student	0,35	0,86	2,36
Average number of looking the pairs' notes/student	0,9	4,75	3,36
Percentage of students who did not use the tool at all	23,5%	37,5%	25%

Table 2. The use of the note-taking tool on the three courses

In Table 2 we concentrate on the pair work, so we have excluded those students from it who had to work alone. There are a few small figures in Table 2, because of the fact that in all groups there were quite many students who did not use the tool at all. However, they have been included into Table 2 figures to give a more comprehensive picture. Overall, the Distributed Group did not utilize the tool as much as the two other groups. One reason for this might be that for them both the Web-conferencing and the partner was a new acquaintance. The two other groups were more "local" and more experienced in Web-conferencing. In an unfamiliar and new situation, a learner might rely more on communication methods that one is familiar with, say, on e-mail and telephones. It takes a lot of energy to start using a rather new facility in a situation where also other tasks are resource demanding, e.g. the moderating and preparing for the seminar talk. Finally, the Distributed Group consisted of pairs where one member was typically older than the other, so the age-difference might have had an influence.

A closer look at the data shows that in the Local Group there was one student who used the tool very much and in a group as small as this (only 8 students) it will give a rather distorted outcome. This leaves the Open University Group having the most use for the tool. This might be a consequence of a closely-knit group or from the fact that they also had suggested most topics of their own. These might have motivated them to take care of the discussions more (see Table 1).

Considering the log data from the point of view of the task itself, we can say that students used the note tool almost only for moderating the ongoing discussion (Phase II). They made some notes, discussed with their partner about distribution of work and new ideas and so on. It seems that these students liked to use the tools, which are available at the same place with their ongoing work. This might also explain why students did not use the tool in Phases I and III. In Phase I the discussion hasn't yet started, so they are preparing their initial contribution with other tools. In Phase III, the discussion has come to an end, so they might have preferred here also other text processing facilities to make conclusions of the moderated discussion. The contributions of Phases I and III are also different from those of Phase II in that that they are typically longer and might need more time to prepare.

As for the "modes" of using the tool, our students found the tool most useful in supporting individual work (Mode A). In every group there was at least one pair who employed the tool for asynchronous collaboration (Mode B), the Open University Group leading also in this. However, the log data shows that no pair used it "semi-synchronously" (Mode C). One reason for this might be that our current conferencing system did not support awareness about co-learners, which in fact made it impossible for a student to know whether his/her pair is inside the system at the same time. A facility of this kind would be essential in semi-synchronous collaboration.

Opinions of the students

In all three groups about a quarter of the students did not use the tool at all (see Table 2). In the questionnaire most common of their explanations was that "I did not remember that there was such a tool". A few said "I prefer the e-mail" or "I rather do my notes using the text editor on my computer". It seems these students employed the conferencing system from their own computer at home. So they did not have actually any use for notes within the system because they used the same computer all the time. One student brought up an interesting issue - the issue of privacy: "I did not use the tool, because I wanted privacy into my communication with my pair. The teachers are able to read our notes if made using the tool". This is something the teachers should consider when teaching online. The supervising and monitoring of each student should also be visible for the student. In this way, students can themselves see, how the teacher monitors their actions and it hopefully helps them to trust the system.

Those who had employed the tool brought up similar issues that we had envisioned earlier in this paper. E.g. "I used it as a scrap board where I had several bits and parts which I used later on in my contributions" (Mode A of utilizing the tool). A few of those who had preferred the tool said that their partner's unwillingness bothered them: "I myself did not use it to anything else than having a peek at my partner's texts. He did not write anything", or "... I could have used it to give messages of my plans, so that we did not have to use the e-mail all the time". This supports our view that the students should have many tools at their disposal for successful collaboration. Indeed, they don't have to use all of these tools, but they are given an opportunity to choose those tools, which are most appropriate for their needs.

Concluding remarks

Our data seems to suggest that on-campus students used the collaboration tool more than those off-campus. We think this has to do with the nature of collaboration: it is beneficial if you "know your partner", i.e. you have seen your collaborator at least at the beginning of the course. Indeed, our tool was used most in the Open University group, who had been together on other courses, and had better familiarity of their fellow students.

Several students reported that they find the note-taking tool sensible and used it in their private work, and would have used it collaboratively if their partner had used it. Also some students, who worked alone, mentioned this issue. So, as in all group work, certain decisions and compromises are made. In our case, it seemed that most of our students a tool (telephone, e-mail) more familiar to them.

This study raises improvement ideas that we will be implementing into the next version of the note tool. We believe that it would help the collaboration if one were able to know whether his/her partner is online at the very same time. We think that there should be "pair awareness" indicators in the system along the lines of Koivunen (2002) to support the collaborative moderating process. This could benefit especially the users of the note tool when they work in the semi-synchronous fashion (mode C).

In some situations learners' virtual communication is a must, and at least in those situations in our opinion it is good for the learners to have options in their virtual collaboration. However, as our study shows, older and "safer" options are often utilized whenever possible, and there are also other, equally important ingredients in good collaboration than technology. By this we mean group-forming, preferences of the members of the pair and so on. According to our study, these issues seem to influence equally or more to the success of group work than the computer tools.

References

Collis, B. & Moonen, J. (2001). *Flexible learning in a digital world: Experiences and expectations*. London: Kogan Page.

Erkens, G., Kanselaar, G., Prangsma, M. & Jaspers, J. (2002). Using Tools and Resources in Computer Supported Collaborative Writing. In Stahl, G. (ed.): *CSCL 2002*: Proceedings of the fourth conference on Computer Supported Collaborative Learning, Boulder, CO, 389-398.

Hara, N., Bonk, C.J. & Angeli, C. (2000). Content Analysis of Online Discussion in an Applied Educational Psychology. *Instructional Science*, 28:2, 115-152.

Hietala, P. (1999). Web Pedagogy: Extended Seminars on the World Wide Web. In deBra, P. & Leggett, J. (eds.), *WebNet 99*: Proceedings of the World Conference on the World Wide Web and Internet. AACE, 1292-1293.

Hietala, P. (2001). Enthusiasm meets experience: collaboration of two communities through computer conferencing. In Montgomerie, G. & Viteli, J. (eds.), *ED-MEDIA 2001*: Proceedings of the 13th World Conference on Educational Multimedia, Hypermedia & Telecommunications, 25th - 30th June, Tampere, Finland, AACE, 745-750.

Koivunen, K. (2002). Knowing who we are - supporting companion awareness in discussion forums. In Barker, P. & Rebelsky, S. (eds.), *ED-MEDIA 2002*: Proceedings of the 14th World Conference on Educational Multimedia, Hypermedia & Telecommunications, 24th - 29th June, Denver, CO, AACE, 1013-1018.

Mason, R. (1998). *Globalising education: trends and applications*. London and New York: Routledge.

Muilenburg, L. & Berge, Z.L. (2000). A framework for designing questions for online learning. *DEOSNEWS* 10 (2).

Paulsen, F.M. (1995). Moderating Educational Computer Conferences. In Berge, Z. L. & Collins, M. P. (Eds.). (1995). *Computer-mediated communication and the on-line classroom in Distance Education*. Cresskill, NJ: Hampton Press.

Rourke, L. & Anderson, T. (2002). Using peer teams to lead online discussion. *Journal of Interactive Media in Education* 2002 (1).

Veerman, A.L., Andriessen, J.E.B. & Kanselaar, G. (1999). Collaborative learning through computer-mediated argumentation. In C. Hoadly & Roschelle, J. (eds.), *CSCL 1999*: Proceedings of the third conference on Computer Supported Collaborative Learning, Palo Alto, CA, 640-650.

Acknowledgements

The authors would like to thank Antti Kaakinen for the implementation of the note-taking tool and the students who participated into the three courses.

A Fundamental Study for Grouping Formation Module based on Personality Information

Masateru HISHINA*, Roberto OKADA**, Tomoya OGASAWARA**,
Eisuke SAKAMOTO*** and Katsuaki SUZUKI****

* *Tokyo International University*
1-13-1, Matoba-kita, Kawagoe, Saitama, 350-1197, JAPAN
URL : http://www.tiu.ac.jp/
E-mail : hishina@tiu.ac.jp

** *Miyagi University*
1,Gakuen, Taiwa-cho, Kurokawa-gun, Miyagi, 981-3298, JAPAN
URL : http://www.myu.ac.jp/
E-mail : okir@myu.ac.jp

*** *Tohoku Gakuin Graduate School*
2-1-1, Tenjinzawa, Izumi-ku, Sendai, 981-3193, JAPAN
URL : http://www.tohoku-gakuin.ac.jp/
E-mail : sakamoto@edutech.tohoku-gakuin.ac.jp

**** *Iwate Prefectural University*
Iwate Prefectural University, 020-0193, JAPAN
URL : http://www.et.soft.iwate-pu.ac.jp/
E-mail : ksuzuki@soft.iwate-pu.ac.jp

Abstract: Many concepts, methods and technologies regarding computer supports in collaborative learning environments have been proposed. We believe that it is important to take into account human relations in collaborative learning environments, where personality plays a central role. However, it is not easy to build human relations in WBE, because there are some problems in computer mediated communication. To overcome such problems, we propose the concept of personality information for awareness (PIA, for short), which represent information for self-awareness/analysis, self-disclosure, person awareness/analysis and person perception. We are designing a PIA-based system, called "PIAGETS (Personality Information for Awareness applied to Group learning in web-based Education/ Training Support system)", which supports human relations building for collaborative learning in WBE. In this paper, we report with focus on sub-systems for self-awareness/analysis, consisting of functions such as YG test module and Grouping Formation module.

1. Introduction

In the brave new world of Web Based Education (WBE), many educational systems have been proposed. Collaborative learning in WBE can be as effective as in face-to-face classroom activity, but it is not easy to design. In web-based collaborative learning environment, awareness is important to create efficient collaboration.

We believe that it is important to take into account human relations in collaborative learning environments - either face-to-face or web-based - where personality plays a central role. However, our view concerning the current situation of most Universities in Japan is that it has become difficult that to build human relations in face-to-face classroom, because students are not motivated to collaborate with their classmates. On the other hand, for the case of web-based classes, it is not easy to build human relations due to problems related to computer-mediated communication (CMC) .Matsushita et al 1995..

To overcome such problems, we propose the concept of personality information for awareness (PIA, for short), which represent information for self-awareness/analysis, self-disclosure, person awareness/analysis and person perception. We are designing a PIA-based system, called "PIAGETS (Personality Information for Awareness

BEST COPY AVAILABLE

applied to Group learning in web-based Education/ Training Support system)", which supported human relations building for collaborative learning in WBE.

In this paper, some fundamental studies for the design of PIAGETS are described. We first discuss the concepts of PIA and PIAGETS. Next, we report on the development of a sub-system called "YG test module" followed by sociometric investigation. Finally, we present an overview of the "Grouping Formation module" design.

2. PIAGETS for Human Relations Building

In this section, we first explain our motivation to focus on the human relations. Next, we propose the concept of PIA. Finally, the overview of our PIA-based system called "PIAGETS" is presented.

2.1. Attention to the human relations

The authors are in charge of an information system design class. By looking at the students, we note that their participation in the class is relatively poor. Their participation is more passive than active, like if they where watching TV, with no expression or reaction sometimes. The amount of discussion regarding lesson content with the classmate is poor. It seems like the human relations between learners is not deep enough.

We believe that such human relationships can be improved through discussions with classmates, thus the learning will be promoted. In our view, the functions necessary to support collaborative learning in WBE includes tools for cooperative work, support for knowledge awareness and understanding and functions for building human relationships.

In this paper, we focus on the function that supports the improvement of human relations.

2.2. Personality Information for Awareness (PIA)

According to [Ogata et al 1996], the collaboration process is lead from the following four processes: Co-presence, Awareness, Communication, Collaboration and Coordination. In collaborative learning environments, awareness is important to create efficient collaboration. We believe that it is important to take into account human relations in collaborative learning environments, where personality plays a central role. Thereupon, we propose the concept of PIA. Our hypothesis is that in order to build the human relationships, each learner pursues the communication activities shown in Figure 1.

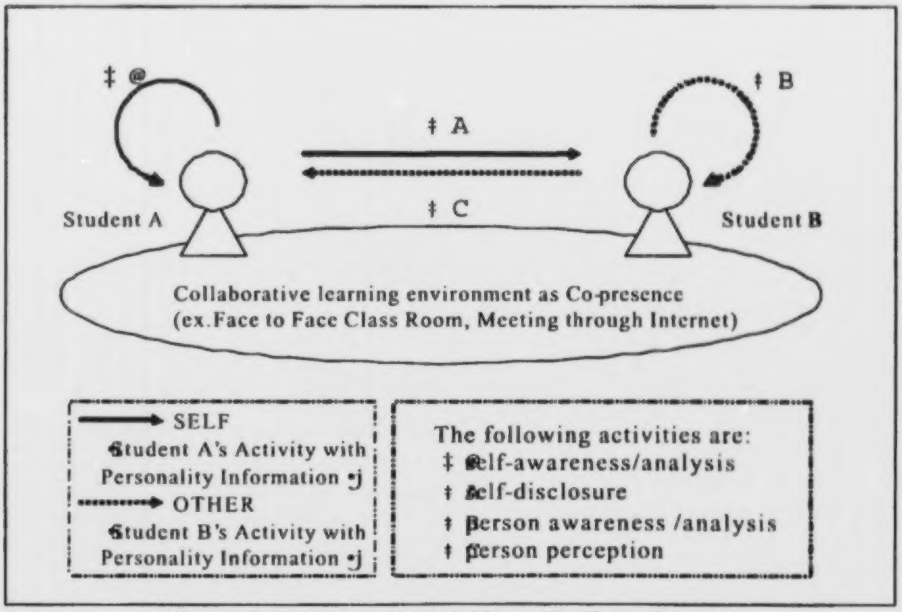

‡ @
† A
† B
† C
Student A
Student B
Collaborative learning environment as Co-presence
(ex.Face to Face Class Room, Meeting through Internet)
SELF
Student A's Activity with Personality Information
OTHER
Student B's Activity with Personality Information
The following activities are:
‡ Self-awareness/analysis
† Self-disclosure
† Person awareness /analysis
† Person perception

Figure 1: Communication activities realized by each learner

BEST COPY AVAILABLE

Although the Figure 1 shows the student A as the focus of attention, the same activities are valid for student B.
The PIA represents information for:

- self-awareness/analysis: The process in which, the student A perform self-analysis in order to form the self-concept. By this, the student A discovers himself.
- self-disclosure: The process in which - from the results of self-awareness/analysis - the student A selects, some time decorates and shows to the public (student B in case of figure 1) only the selected/decorated information.
- person awareness/analysis: The process in which, the student B notice and analyze the personality information presented by others (student A in case of figure 1).
- person perception: The process in which – from the results of person awareness/analysis - the student B acknowledge whether or not to build interpersonal relationship with student A.

2.3. Overview of "PIAGETS"

We are designing a PIA based system, called "PIAGETS", which supported human relations building for collaborative learning in WBE.

PIAGETS is composed of the following functions, shown in Figure 2:

(1) Sub-systems for self-awareness/analysis,
(2) Sub-systems for self-disclosure
(3) Sub-systems for person awareness/analysis
(4) Sub-systems for person perception

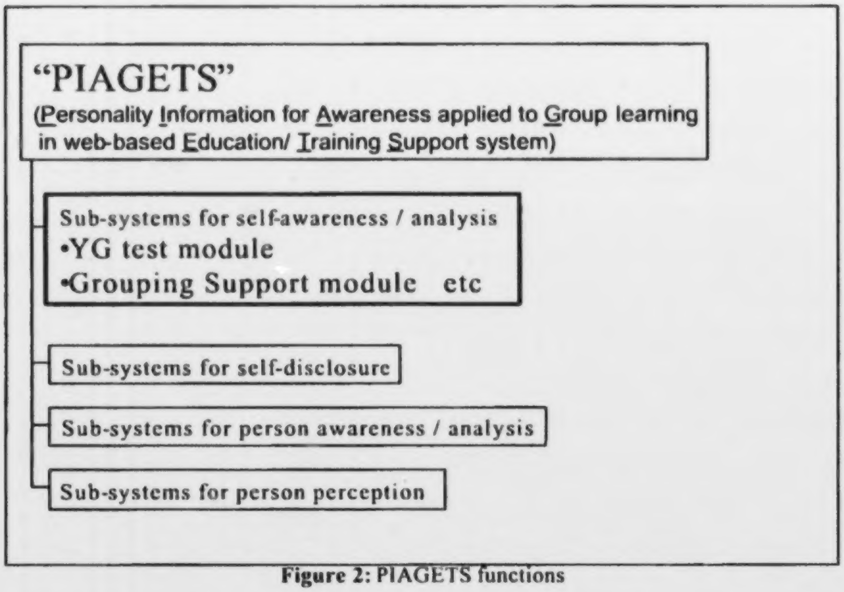

"PIAGETS"
(Personality Information for Awareness applied to Group learning in web-based Education/ Training Support system)
Sub-systems for self-awareness / analysis
•YG test module
•Grouping Support module etc
Sub-systems for self-disclosure
Sub-systems for person awareness / analysis
Sub-systems for person perception

Figure 2: PIAGETS functions

In this paper, we report with focus on (1) Sub-systems for self-awareness/analysis, consisting of functions such as YG test module and Grouping Formation module. We provide the details of YG test module and Grouping Formation module, in section 3 and section 4, respectively.

3. Basic investigation for face-to-face classes

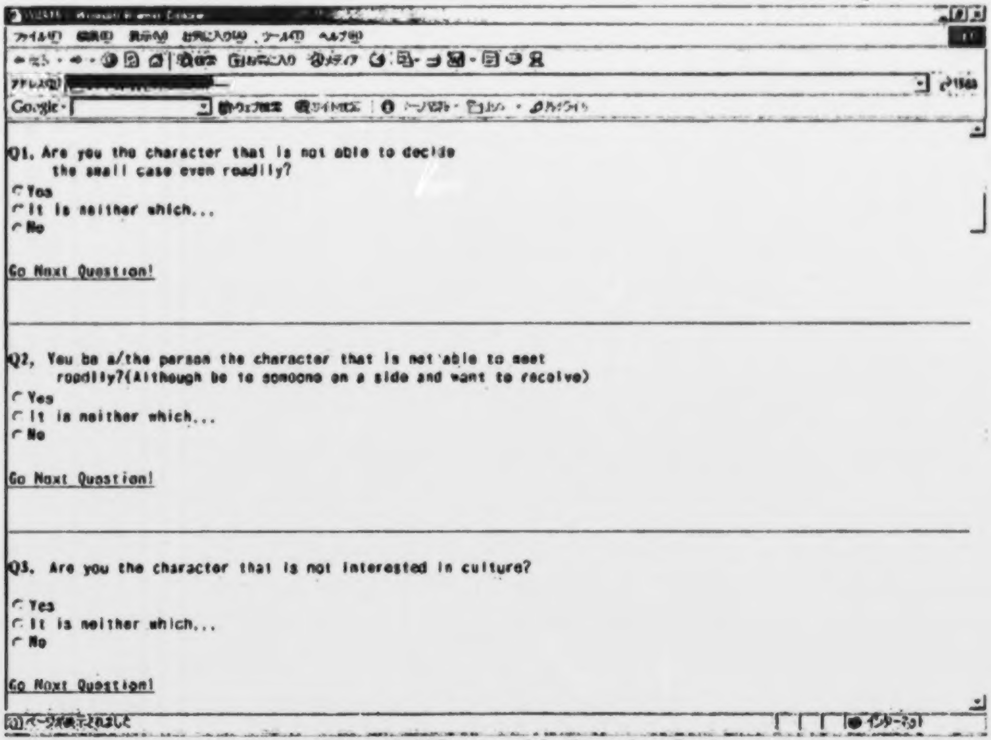
We focus on face-to-face learning environments such as classrooms, where the learner is participating in the class by developing human relationships with the teacher and with the classmates. In order to make clear the structure of such human relationship from the personality viewpoint, we have conducted two investigations, described in the following subsections.

3.1. Development of YG personality test module, and personality test

In this research, we have focused on the YG personality test (Y for Yatabe, G for Guiford), which is a traditional method to examine the personality in Japan. First, in order to clarify the individual's character and their characteristics, the strength of 12 pre-defined personality trait are measured. Based on this measurement, the individuals are classified into 5 personality group types A, B, C, D or E. These 12 personality traits belong to one of 2 classes, where 6 belong to the "General emotionalism" class (D: Depression, C: Cyclic tendency, I: Inferiority, N: Nervousness, O: Objectivity, Co: Cooperativeness) and the remaining 6 to the "Extroversion/Introversion" class (Ag: Agreeableness/Aggressiveness, G: General activity, R: Rhythmic, T: Thinking extroversion, A: Ascendance, S: Social extroversion). Moreover, there are cases in which the individuals are judged to be of two or more of the A, B, C, D or E types, e.g. belonging to both type A and type C.

The original YG personality test has 120 questions. However, in order to reduce the time required to answer the questionnaire, we have used the trial YG personality test developed by Uehara, which consists of 36 questions.Uehara 1997.. In Uehara's trial test, the 5 personality types are named as follows: A as "average type", B as "black list type", C as "sedative type", D as "adaptive type" and E as "eccentric type".

We have developed a Web-based YG personality test, which we will refer as YG test module, for short. The module is based on CGI with Perl and a set of HTML Web pages. This YG test module can be used as a psychological testing to analyze self- personality objectively. (The output data is used in the Grouping Formation module.) An example of answer input screen and the result display screen for the YG test module are shown in figures 3 and 4, respectively. The user answers the questions given in the input screen by selecting one of the radio-buttons. When user finishes with the answers, the module calculates which of the personality group he belongs to and displays the results on the screen. A sample data of the personality that was obtained with the YG module is shown in Table 1.



Q1. Are you the character that is not able to decide
the small case even roadily?
○ Yes
○ It is neither which...
○ No

Go Next Question!

Q2, You be a/the person the character that is not able to meet
roodily?(Although be to somoone on a side and want to receive)
○ Yes
○ It is neither which...
○ No

Go Next Question!

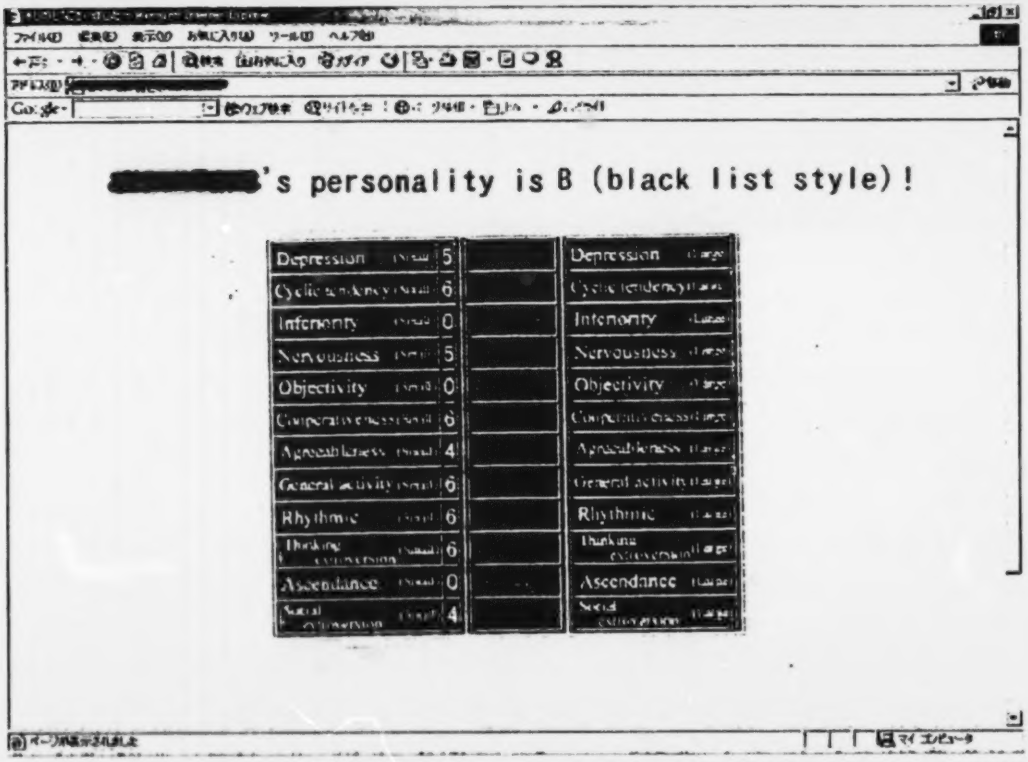
Q3. Are you the character that is not interested in culture?

○ Yes
○ It is neither which...
○ No

Go Next Question!

Figure 3: YG test module (Input interface)

BEST COPY AVAILABLE



[redacted]'s personality is B (black list style)!

Depression (Small)	5		Depression (Large)
Cyclic tendency (Small)	6		Cyclic tendency (Large)
Inferiority (Small)	0		Inferiority (Large)
Nervousness (Small)	5		Nervousness (Large)
Objectivity (Small)	0		Objectivity (Large)
Cooperativeness (Small)	6		Cooperativeness (Large)
Agreeableness (Small)	4		Agreeableness (Large)
General activity (Small)	6		General activity (Large)
Rhythmic (Small)	6		Rhythmic (Large)
Thinking extraversion (Small)	6		Thinking extraversion (Large)
Ascendance (Small)	0		Ascendance (Large)
Social extraversion (Small)	4		Social extraversion (Large)

Figure 4: YG test module (Output interface)

Table 1: The personality type data by YG test module

Respondent• iStudent No.• j	D	C	I	N	O	Co	Ag	G	R	T	A	S	personality type (by YG)
Student .P	2	4	2	1	4	6	3	0	0	4	2	4	C
Student .Q	1	3	4	4	3	2	3	5	2	5	4	5	A
Student .R	4	4	5	4	4	2	2	4	0	5	1	6	A
Student .S	1	1	3	2	2	1	1	1	0	1	2	3	C
Student .T	1	6	5	4	2	1	2	3	2	2	3	3	C
Student .U	4	4	6	2	2	1	2	0	0	0	2	3	C
Student .V	2	4	2	2	3	2	4	1	1	3	6	4	C
Student .W	0	6	3	5	1	0	4	2	0	3	4	5	C
Student .X	0	6	3	2	2	2	4	1	2	0	4	5	C
Student .PO	2	2	4	1	4	2	5	2	1	5	6	5	D
Student .PP	2	4	2	2	2	2	3	2	5	6	5	6	D
Student .PQ	2	6	4	4	2	2	2	1	5	4	3	6	C and D
Student .PR	4	4	3	4	4	4	4	2	3	4	0	3	A
Student .PS	2	2	2	1	1	1	6	1	4	6	5	6	D
Student .PT	2	6	3	3	3	1	5	2	2	5	5	2	C and D
Student .PU	1	3	5	2	3	1	4	2	6	3	6	4	A and D
Student .PV	2	3	2	3	1	3	1	4	3	4	2	2	A and C
Student .PW	3	3	5	4	2	0	1	2	0	3	3	2	C
Student .PX	3	2	3	4	5	0	1	1	2	0	6	2	C
Student .QP	4	4	1	3	2	0	3	2	2	3	6	4	A
Student .QQ	1	3	3	3	4	2	3	0	0	2	4	4	A

- !There is not the reply data of student 20 that was absent to the lesson that did the YG test.

BEST COPY AVAILABLE

3.2. Measuring the influence of student's " buddy" or " pal" on the personality structure

In order to measure the influence of the student's "buddy" on his personality structure, we have investigated using the YG test module the student's buddy concurrently with the execution of the YG personality test. Concretely - to clarify the student's buddy based on observations - we have observed several times the student's seat selection in the classroom.

First, based on the observations of the students in the classrooms, we have guessed the student's buddy as shown in Figure 5. For instance, the learners surrounded by lines in Fig. 5 were assumed to have some student's buddy. Then we have investigated the seating places in the classroom of the students, during 4 classes.

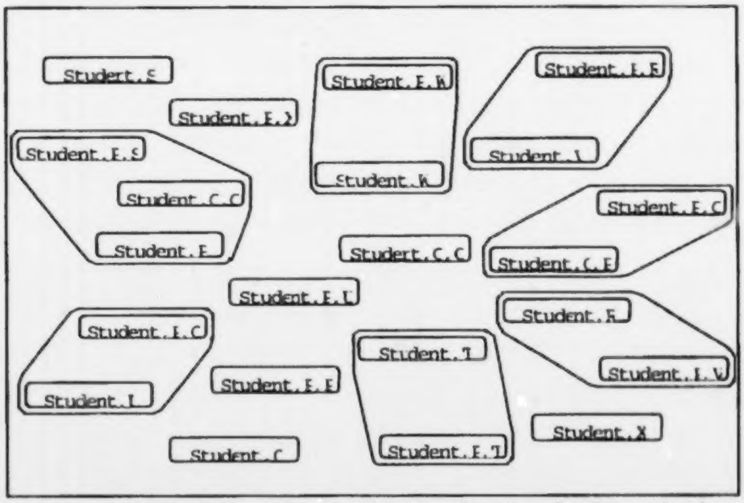

Studert. S
Student. E. W
Student. E. F
Student. E. X
Student. E. S
Student. W
Student. 1
Student. C. C
Student. E. C
Student. E
Studert. C. C
Student. C. E
Student. E. L
Student. R
Student. I. C
Student. T
Student. E. E
Student. I. V
Student. L
Student. X
Student. C
Student. E. T

Figure 5: The student's associates (based on the observations)

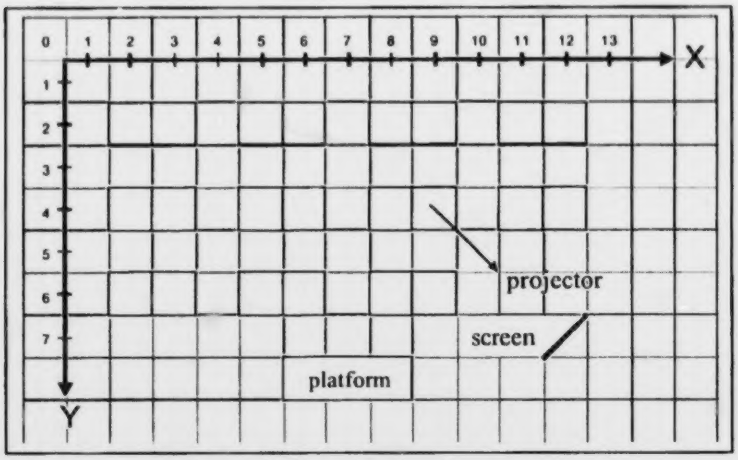

0
1
2
3
4
5
6
7
8
9
10
11
12
13
X
1
2
3
4
5
6
7
Y
projector
screen
platform

Figure 6: The students' seating position

The students' seating positions were plotted according to the axis shown in Figure 6, and the physical distance between students calculated using the formula 1. .Note : we have excluded from the study the students with more than 1 absence. From the position of the seats in the classroom, our assumption is that students with average physical distance of two or less (i.e. pair) show a student's buddy.

BEST COPY AVAILABLE

Student ƒ ¿s seating position •ìX1• ©1•j
Student ƒ Às seating position •ìX2• ©2•j

The physical distance between
Student ƒ ¿and Student ƒ À

•@@ $\sqrt{\text{«X2- X1 }j^{Q}\text{ «Y2- Y1 }j^{Q}}$ @«formu la , P

Formula 1: the physical distance between students

Table 2 summarizes the result of the mean distance and the YG test module for each pair. From the results of the Table 2 and Figure 5, we found correspondence in all pair of students, which prove the correctness of our assumptions. Thus, we have confirmed that buddies tend to seat close to each other.

Table 2: Summarizes the result

Pair No. / physical distance	Respondent• iStudent No•j	D	C	I	N	O	Co	Ag	G	R	T	A	S	personality type (by YG)
Pair_P	Student_R	4	4	5	4	4	2	2	4	0	5	1	6	A
1.25	Student_PV	2	3	2	3	1	3	1	4	3	4	2	2	A and C
Pair_O	Student_U	4	4	6	2	2	1	2	0	0	0	2	3	C
1.00	Student_PQ	2	6	4	4	2	2	2	1	5	4	3	6	C and D
Pair_R	Student_V	2	4	2	2	3	2	4	1	1	3	6	4	C
1.00	Student_PR	4	4	3	4	4	4	4	2	3	4	0	3	A
Pair_S	Student_PS	2	2	2	1	1	1	6	1	4	6	5	6	D
1.25	Student_OO	1	3	3	3	4	2	3	0	0	2	4	4	A

3.3. Student's buddy are build between learners with different personality types

Basically, the data of the YG test module is judged to belong to one of the five personality types A to E. However, taking into account the cases in which a data can belong several types simultaneously, there are 31 possible combinations types (calculated based on the combinatorial formula 2). We can see from the results shown in Table 2 that the pairs are composed of learners belonging to different personality types. For instance, regarding the pair 2, the result of the YG test module shows that learner 12 is both C type and D type, while learner 6 is only type C. Thus, we can say from the results of the 4 pairs that in face-to-face classrooms, student's associates are build between learners with different personality types.

•@•@•@•@•@•@•@ $\overset{5}{\underset{k=1}{\int}}$ $^{Q}_{5}$, **b** •«formu la , Q
•@•@•@•@•@•@•@

This case is
•@ b {5, b• {5, b• {5, b• {5, b
• @: RPossible Combinations types.

Formula 2: calculated based on the combinatorial formula

4. Grouping Formation Module based on Personality Information

We have developed a Web-based Grouping Formation module, based on CGI with Perl and a set of HTML Web pages. The Grouping Formation module uses the judgment result data from the YG test module. Based on the results of the judgment result data, the system propose the learner's grouping (pair) so that each group is composed from members with different personality types.

The group-formation process (pair) is done with 7-steps algorithm explained bellow:
Step 1: the learner's name is stored in the arrays, one array for each of the 31 type combinations.
Step 2: For each of the 31 arrays, the learners are re-ordered randomly.

Step 3: The number of learners is counted at each array, and the 31 arrays are ordered in descendent order, based on the total number of learners for each type, i.e. the array type with most learners first.

Step 4: In order to form the pairs, one learner is picked up sequentially, from the array with most learners and the second with most learners. Output the resulting pair.

Step 5: For step 4, if there are no more learners left on the array to form the pairs, then the next array with most number of learners is selected.

Step 6: Repeat the step 4 (and step 5 when necessary), to continue the pair formation process.

Step 7: When there is no two arrays of different types, then form the pairs randomly with learners from the same array.

5. Conclusion and Future Works

In this paper, we first discuss the concept of personality information for awareness, and a PIA-based system, called "PIAGETS", which supports human relations building for collaborative learning in WBE. Next, we report on the development of a sub-system called "YG test module" followed by sociometric investigation. Finally, we present an overview of the "Grouping Formation module" design.

Based on the data gathered from the YG test module, we worked to find out the influence of the student's buddy on the personality structure. We can see from the results that the pairs are composed of learners belonging to different personality types.

Future works include the evaluation of the effectiveness for our proposed PIAGETS, the investigation of the human relationship building process and the implementation of additional support functions for human relationship building.

References

.Hishina et al 2002.Hishina, M., Ogasawara, T., Okada, R., Sakamoto, E., Suzuki, K. (2002). Design of Grouping Support System for Collaborative Learning in Web Based Education / Training. In *Research Report of JSiSE (Japan Society for Information and Systems in Education)*. Vol. 2001, No. 6, pp.31-36. (In Japanese)

. Matsushita et al 1995 . Matsushita, Y., Okada, K. (1995). Collaboration and Communication, KYORITSU SHUPPAN, Inc. (In Japanese)

.Ogata et al 1996.Ogata, H., Matsuura, K., Yano, Y. (1996). Knowledge Awareness: Bridging between shared knowledge and collaboration in sharlok. In *proc. of ED-TELECOM 96*, pp.232-237, June 1996.

.Sugino et al 1999.Sugino, K., Kameshima, S., Andou, A., Komaki, K., Kawabata, H. (1999). The psychology for learning the human relations , Fukumura Publication's Inc. (In Japanese)

.Uehara 1997.Uehara, M. (1997). Yatabe Guiford personality test. In *Your Personality able to understand and be changed!* , pp.81-89 , TAKARAJIMASHA, Inc. (In Japanese)

Wearing Four Pairs of Shoes:
The Roles of E-Learning Facilitators

Ed Hootstein, Ph.D.
Intelligent Decision Systems, Inc.
edhoot@adelphia.net

The teacher-centered model that has dominated instruction for centuries is slowly giving way to a learner-centered conception with instructors in roles of facilitators, or "guides on the side." Active learning and collaboration increasingly characterize learning environments. E-learning is unable to promote learning on its own; its use does not preclude facilitators' responsibilities for structuring learning experiences. The effectiveness and success of e-learning programs depend on facilitators' roles in delivering and managing instruction. E-learning facilitators take on four roles to meet the necessary conditions of effectiveness, because they "wear four pairs of shoes," - instructors, social directors, managers, and technical assistants. The framework herein provides a means of describing tasks and responsibilities of e-learning facilitators.

Introduction

The emergence of e-learning comes during a time when education and training are undergoing important transformations. The teacher-centered model that has dominated instruction for centuries is slowly giving way to a learner-centered conception with instructors in roles of facilitators, or "guides on the side." (Bens, 2000; Hanna, 2000). Learning environments are increasingly characterized by active learning and collaboration (Mantayla, 2000; Rosenberg, 2001).

E-learning is unable to promote learning on its own; its use does not preclude facilitators' responsibilities for structuring learning experiences (Imel, 1998). The effectiveness and success of e-Learning programs are dependent on facilitators' roles in delivering and managing instruction.

The primary focus of this paper is the roles e-Learning facilitators must assume to be effective. The paper is organized in four major sections; facilitators "wear four pairs of shoes," - instructor, social director, program manager, and technical assistant (Collins & Berge, 1996).

A Framework for Defining Roles of E-Learning Facilitators

Instructor - Consultant, Guide, and Resource Provider

The role of facilitator as instructor is consistent with seminal adult learning research in which instructors guide self-directed learning in problem-centered environments (Cross, 1998; Knowles, Holton, & Swanson, 1998; Wlodkowski, 1993). Facilitators are resources for learning rather than instructors who have all the answers (Brookfield, 1986). They employ some of the same best practices as traditional classroom instructors (Merriam & Calfarella, 1998), however the roles assumed and skills used differentiate the two approaches.

Facilitators provide their own unique insights as they guide learners to acquire knowledge and develop skills. Their primary instructional tasks are a) providing information to help learners complete assignments, b) suggesting ideas or strategies, and c) helping learners to connect content with prior knowledge (Collins & Berge, 1996).

A discussion of some best practices and their implications for E-Learning is presented below.

Fostering Learner-Centeredness

Educators in the field of adult learning (e.g., Brookfield, 1986; Merriam & Caffarella, 1998) support the premise that facilitators humanize self-directed learning by focusing on learners rather than technology (Willis, 1993). The essential quality of learner-centeredness is most relevant when learners are personally challenged with a problem to solve, a project to complete, or a dilemma to resolve (Abbey, 2000; Schreiber & Berge, 2000).

Facilitators and learners often participate together as partners in learning activities (Driscoll, 1998; Merriam & Calfarella, 1998). Specifically, facilitators guide learners to play a part in determining course direction by discovering content on their own, carrying out assignments and projects (Kearsley, 2000), and creating learning opportunities to meet their own needs (Khan, 1997).

Implications for E-Learning

The variety of interactive tools and resources on the World Wide Web highlight the importance of selecting instructional methods (e.g., forums, case study analyses). Facilitators manage the distribution of learner-selected activities and scaffold them with comments and support to guide and support learner achievement (Khan, 1997).

In virtual asynchronous environments, learners are often expected to participate in establishing an agenda, defining objectives, and assessing outcomes. In virtual synchronous environments, learners may share responsibility for programs when facilitators take roles as mutual learners.

Structuring Problem-Based Learning and Authentic Work

Facilitators structure realistic problem-based experiences to make content more personally meaningful for learners (Woolfolk, 1998). Knowledge is adapted to the settings, purposes, and tasks to which it is applied (Greeno, Collins, & Resnick, cited in Berliner & Calfee, 1996; Lave & Wenger, 1991).

Facilitators tend to change their style of teaching from didactic to project-based approaches in which learners ask questions, perform investigations, and act on their findings. They also use strategies such as small-group discussions, simulations, case studies, and collaborative activities to engage learners in problem solving (Khan, 1997). They ask questions and closely monitor learners' efforts and are available for assistance (Hanna, 2000).

Implications for E-Learning

Problem-based learning is compatible with e-learning because both environments can be highly authentic in nature and provide access to resources and expertise. Facilitators help learners use the conferencing capabilities of the World Wide Web to provide them with access to expert thinking and modeling. In real-life settings, experts and those who are more experienced help learners solve problems. The resources of the web also can be utilized in an authentic context for solving problems using the strategy of cognitive apprenticeship. Experts and learning guides may be available through mentoring, tutoring, learner work groups, etc. (Khan, 1997).

When learners practice what experts in their discipline do each day, the real nature of technology to change the curriculum occurs. Facilitators are free to use strategies that allow learners to edit, revise, and try again, thus taking an authentic approach to problem solving (Shreiber & Berge, 2000). In this way, technology may change the curriculum without changing the content.

The uses of email, e-conferencing, web databases, groupware, and audio/videoconferencing significantly increase the extent and ease of interaction amongst all participants. The vast array of software tools available for analysis, design, planning, problem solving, and making presentations enable learners to perform sophisticated and complex tasks. Technology provides a milieu that fosters the kind of creativity and communication needed to solve problems in creative ways.

Providing Informative Feedback

Some educators (e.g., Hiltz, 1995) believe that the most important facilitator behavior is timely and personal response to questions and contributions of learners. Facilitators provide informative timely feedback with concise brief statements. They a) offer learners guidance about how they might improve their performance, b) communicate what learners have and have not demonstrated, and c) provide learners with specific detailed information about strengths and weaknesses of their performance.

Both what facilitators say and how they say it has an impact on learners. In fact, the ways facilitators respond may have greater influence on learner behavior than questions asked. In addition, learners' perceptions of their progress may be more important than positive facilitator evaluation of their work (Brookfield, 1986).

Although praise appears to be an encouraging response, making judgments is associated with bringing conformity. If praise is given, facilitators must communicate why performance is positive. For example, "your speech is clear and concise" provides more constructive feedback than "Good job, I like the way you speak" (Brophy, 1998). Facilitators may offer praise or encouragement, however a preferred alternative is to encourage learners to evaluate their own responses.

Implications for E-Learning

Feedback is even more critical in e-Learning than traditional classrooms because learners may feel isolated and detached due to lack of environmental and nonverbal signals. (Kearsley, 2000; Khan, 1997; Willis, 1993).

Constructive and extensive feedback to individuals usually takes the form of email messages about assignments or comments on assignments. Facilitators may also summarize and/or synthesize individual responses given on a topic or activity by posting messages in a discussion forum or conference.

The element of timely feedback is especially important (Kearsley, 2000; Khan, 1997; Paloff & Pratt, 1999). Facilitators should establish a standard such as a forty-eight hour turnaround time.

Learners should provide feedback to each other too; facilitators must establish peer feedback as an expectation in delineated guidelines posted at the beginning of a course. Guidelines can be discussed and negotiated by all learners (Paloff & Pratt, 1999).

Social Director - Creator of Collaborative Environments

Fostering Collaborative Learning

The process of facilitation itself is collaborative. Facilitators and learners are involved in a cooperative undertaking in that leadership and facilitative roles are assumed by different group members to initiate and guide learning efforts.

Underlying collaborative learning is the belief that learners achieve best in social interactions based on consensus building and cooperation. (Brookfield, 1986).

As they promote interpersonal relationships and help learners work together, facilitators guide a developing sense of community within and between small groups. Perhaps the most meaningful facilitation in this collaborative structure is modeling interaction techniques and assuming the role of a group member who contributes to learning (Paloff & Pratt, 1999).

Facilitators stimulate learner participation and interaction by using small group discussions, collaborative projects, case studies, dyadic learning partnership exchanges, and one-on-one exchanges (Berge, 1995). In addition, they monitor and participate in discussion forums or conferences to identify misconceptions or guide more fruitful directions.

Effective facilitators keep discussions focused on the topic, bring out multiple perspectives, and summarize and synthesize main points (Berge, 1996; Kearsley, 2000; Salomon, 2000). They use questions and probes to help learners connect around shared problems, interests, and experiences (Collins & Berge, 1996; Paulsen, 1995).

Implications for E-Learning

Experts in the field of e-learning (e.g., Collins & Berge, 1996; Kearsley, 2000) contend the most important facilitation skills involve encouraging and ensuring a high degree of interactivity and participation. Facilitators support the learning process through the use of collaborative assignments and active discussions.

Interactions among learners may be almost as important as content-oriented goals. Therefore, facilitators begin a course by posting introductions and encouraging learners to seek areas of common interest as they meet in distinctive gathering places, such as chat rooms (Paloff & Pratt, 1999).

Facilitators encourage interaction among learners, facilitators, and subject-matter experts via the Internet using email, list serves, news groups, multi-user discussions (MUDs), forums, Internet Relay Chat, (IRC) and conferencing (Berge, 1996; Driscoll, 1998; Kearsley, 2000; Paulsen, 1995). Kearsley (2000) suggests the use of tangibles such as discussion areas, learner directories modified by learners, and newsletters relevant to particular fields of study.

Facilitators can not be in control of everything learned, given the limitations of time and access to the learner population. Therefore, they guide learners in working together to become more skilled in areas such as scheduling, project management, time management, consensus building, and leadership.

Program Manager - Director of the Agenda

Facilitators as managers are responsible for organizational, procedural, and administrative duties. A consistent theme in the literature is the facilitators' use of organizers to provide an overview of a course. In addition, they show strong leadership, managing interactions proactively by defining expected behaviors of learners through guidelines, protocols, and netiquette (Berge, 1995).

Facilitators develop study guides for courses to help ease learners' anxiety and address both the content and any common technical concerns. Study guides provide introductory information, describe learning activities and resources materials, and provide additional information about course components or procedures (Berge, 1995).

Facilitators are available to help learners manage their time and avoid information overload (Salmon, 2000). Many learners may not be accustomed to increased independence and the vast array of available information.

Technical Assistant - Model of Proficiency

Facilitators as technical assistants help learners become comfortable with systems and software. Assistance also includes preparing learners to resolve any technical difficulties that may occur. The ultimate technical goal for facilitators is to make the technology transparent. When this occurs, learners may concentrate on the academic task at hand (Berge, 1995). The more familiar facilitators are with the technology, the more they can focus on learners rather than technology (Madden, 1998).

Effective facilitators feel comfortable using media and communication tools. Ideally, they can use a variety of media (text, graphics, audio, video) to present material. Such variety may accommodate individual learning styles and provide approaches for both visual and auditory learners (Jones et al.). As an example, "Gen-Xers" typically prefer fast-paced presentations with visual images and frequent feedback.

Summary

This paper has described tasks and responsibilities of e-Learning facilitators as they take on four distinct roles - instructor, social director, program manager, and technical assistant. The following responsibilities represent a considerable aspect of an E-learning facilitator's efforts:

- Address needs of adult learners by guiding self-directed, realistic, problem-based learning experiences.
- Structure learning opportunities in which learners make their own meanings by discovering content on their own.
- Encourage high degrees of participation and interactivity.
- Offer prompt, informative feedback.
- Provide strong leadership.
- Help learners feel comfortable with technology.

Steps should be taken to develop standards for development and implementation of quality e-Learning programs. It is prudent to establish standards for facilitators' responsibilities. Framing their roles generically herein is a step toward helping them be more cognizant of their efforts.

References

Abbey, B. (2000). Instructional and cognitive impacts of web-based publishing. Hershey, PA: Idea Group Publishing.

Bens, I. (2000*). Facilitating with ease.* San Francisco: Jossey-Bass.

Berge, Z. (1995). Facilitating computer conferencing: Recommendations from the field. *Educational Technology*, 35(1) 22-30.

Berge, (1996). The role of the online instructor/facilitator. [*http://star.ucc.nau.edu/~mauri/moderate/teach-online.html]*

Berliner, D.C., & Calfee, R.C. (1996). *Handbook of educational psychology*. New York: Macmillan.

Brookfield, S.D. (1986). *Understanding and facilitating adult learning*. San Francisco: Jossey-Bass.

Brophy, J. (1998). *Motivating Students to Learn*. McGraw-Hill: Boston.

Collins, M. & Berge, Z. (1996*).* Facilitating interaction in computer mediated online courses. *[http://www.emoderators.com/moderators.html*]

Cross, K.P. (1998). What do we know about students' learning and how do we know it? *AAHE National Conference on Higher Education.*

Driscoll, M. (1998). *Web-based training: Using technology to design adult learning experiences.* San Francisco: Jossey-Bass.

Good, T.L. & Brophy, J. (1995). *Contemporary educational psychology.* White Plains, NY: Longman Publishers USA

Hanna, D.E. & Associates (2000). *Higher education in an era of digital competition: Choices and challenges*. Madison, WI: Atwood Publishing.

Hiltz, S.R. (1995). Teaching in a virtual classroom. Paper presented at the International Conference on Computer Assisted Instruction, Hsinchu, Taiwan.

Imel, S. (1998). Technology and adult learning: Current perspectives. Clearinghouse on Adult, Career, and Vocational Education, *ERIC Digest* No. 197.

Jonassen, D.H., Peck, K.L. & Wilson, B.G. (1997). *Learning with technology: A constructivist perspective.*

Jones, M.G., Farquhar, J.D., & Surry, D.W. (1995). Using metacognitive theories to design user interfaces for computer-based learning. *Educational Technology*, 35(4), 12-22.

Kearsley, G. (2000). *Online education: learning and teaching in cyberspace*. Belmont, CA: Wadsworth.

Khan, B.H. (1997). *Web-based instruction*. Englewood Cliffs, NJ: Educational Technology Publications, Inc.

Knowles, M.S., Holton, E.F., & Swanson, R.A. (1998). *The Adult Learner*. Houston: Gulf Publishing.

Lave J and Wenger E, *Situated Learning - Legitimate Peripheral Participation*. London: Cambridge University Press, 1991

Madden, J. (1998). White Paper: A Report to the Office of Training Technology Implementation issues involved with successful distributed learning programs. *Education, Instruction, and Training Methodology.*

Mantayla, K. (2000). *Distance learning: A step- by-step guide for trainers*. Washington D.C.: American of Society Training and Development.

Merriam, S. & Cafferella, R.S. (1999). *Learning in adulthood: A comprehensive guide*. San Francisco: Jossey-Bass.

Palloff, R.M. & Pratt, K. (1999). *Building learning communities in cyberspace: Effective strategies for the online classroom*. San Francisco: Jossey-Bass Publishers.

Paulson, M.F. (1995). Moderating Educational Computer Conferences. In Z.L. Berge & M.P. Collins (Eds.). *Computer-mediated communication and the on-line classroom in distance education*. Cresskill, NJ: Hampton Press.

Rosenberg, M. J. (2001). *E-Learning: Strategies for delivering knowledge in the digital age*. New York: McGraw-Hill.

Salmon, G. (2000). *E-Moderating*. Sterling, VA: Stylus Publishing

Schreiber, D.A. & Berge, Z.L. (1998). *Distance training*. San Francisco: Jossey-Bass Inc., Publishers.

Willis, B. (1995). Distance Education at a Glance, Guide#2. [*www.uidaho.edu/evo/dist2.html*]

Woolfoolk, A. (1998). *Educational psychology*. Needham Heights, MA: Allyn & Bacon.

Development of An Internet Collaborative Learning Behavior Scale – Preliminary Results

Ti Hsu
Department of Business Administration
Tamkang University
Taipei, Taiwan, R.O.C.
th4657@yahoo.com

Hsiu Fei Wang
Da Yeh University and New York University

Abstract: It is well known that math phobia is a common problem among young school kids. It becomes a challenge to educational practitioners and academic researchers to figure out ways to overcome the problems. Collaborative team learning has been proposed as one of the alternatives. The present study was part of a large and an on-going research project designed to help students learn math in a collaborative fashion using a Web-based intelligent system in a virtual reality environment and then to study their learning behaviors. The purpose of this part was to develop an instrument to measure the learning behavior of Taiwan's 8^{th} graders in their learning of the "Pythagorean Theorem." A principal component analysis with the Oblimin procedure was utilized to analyze the 44-item internet collaborative learning behavior scale (ICLBS). The preliminary results revealed that a model with five-factor deriving from 39 item was the best model.

Introduction

Math has always been a very difficult subject to many elementary and/or junior high school students. For years, educational practitioners and academic researchers have continuously worked hard to generate new ideas or alternatives hoping to help alleviate the pressure for students to learn math.

Collaborative learning has been offered as one such alternative to the traditional way of teaching and/or learning. Unlike individualized learning, collaborative learning tends to place heavy emphasis on cooperative learning and the development of certain important skills, such as thinking, interpersonal, and problem solving, etc.

Plowman's (1988) cooperative team learning theory claimed that students could be encouraged to learn on their own through discovering and experiencing themselves, which in turn would also motivate them to learn more willingly. This would be an ideal way of learning and might be deemed as the most effective way of learning. This is why researchers believed that cooperative team learning not only tended to offer better learning than individual learning, but also helped students enhance their self-esteem (Salvin, 1990; Sharan & Shacher, 1988). A better and effective learning provided through the "cooperative team learning" was further supported by the findings of two separate research (Johnson & Johnson,1989; Cooper, et al 1990). Another study undertaken by Webb (1991) revealed that students could obtain better grades if they would participate actively in the team discussion, or if they could answer questions that other members might have, or if they could explain the key points or the highlights of the subject under study. Still, another research (King, 1990) claimed that there was a significantly positive correlation between cooperative team learning and the learning performance.

In a cooperative team learning environment, there are a number of different roles that students need play. They may include the sharing of the leadership, information receiving and providing, coordinating, conflict handling, etc. Team members with different roles will definitely affect the interactive behavior among themselves and the final outcome of the learning as well. Generally speaking, they are five major categories of interactive behavior (Adams, Carlson, & Hamm, 1990, p.12), including 1) information or idea seeking; 2) information or idea providing; 3) information or idea clarifying or explaining; 4) information or idea inductiveness; and 5) process managing.

BEST COPY AVAILABLE

Moreover, as part of the idea generation process, team members may display certain behavior that is related to the process managing (Adams, Carlton, & Hamm, 1990, pp. 13-14). Those processing managing behaviors are: 1) compromising; 2) encouraging; 3) gatekeeping; 4) tension releasing; and 5) sharing of feelings and emotions.

The present research was part of a large research project, which was designed to help students learn math in a collaborative fashion via a Web-based intelligent system in a virtual reality environment called Waltz and then to examine their learning behavior. The purpose of this task was to develop an instrument in order to measure the learning behavior of Taiwan's 8th graders in their learning of the "Pythagorean Theorem." Like this task, the Waltz and an intelligent agent system to learn the concept of "Pythagorean Theorem" were both developed as part of the large on-going research project funded by the National Science Council in Taiwan.

Importance of the Study

In education, it is well known that the most effective learning method is to cultivate students' thinking ability, which is what cooperative or collaborative team learning is all about. In addition to its emphasis on thinking, it also encourages students to learn new materials or skills and to solve problems collectively through interactions. Due to the fact that a lot of junior high school students have math phobia, it was the intent of the study to examine how effective cooperative learning might be able to help overcome or reduce the fear. This was one of the main reasons why this study was designed in the first place. Past studies on collaborative team learning tended to concentrate on the effects of "heterogeneity," such as race, gender, culture, individual ability, etc. among members of a team. Not much attention has been paid to the "homogeneity," which is what the present study was designed to do.

Moreover, studies of cooperative team learning in the past placed heavy emphasis on the comparison of individual learning and group learning in terms of their effectiveness, their motivation, cultivation of self-esteem, etc. Few studies have been conducted to evaluate the group learning process, the interaction among group members, and the group dynamics and their potential impacts. This is especially rare in Taiwan.

Methods

Sampling

The sample used in the project consisted of 134 subjects. They were all eighth graders drawn from two junior high schools in Taiwan. Both schools are located in the central part of the island. One was from an urban area with 65 students and the other from a rural area with 69 students. The sex distribution of the participants was about even in both schools.

Instrument

Since the principal purpose of the present study was to develop a reliable instrument to measure the collaborative team learning behavior of Taiwan's 8th graders in their learning of the "Pythagorean Theorem" in the internet. The scale to be developed and tested was called the internet collaborative learning behavior scale, or ICLBS in short. The scale was initially composed of 44 items. They were compiled after an extensive examination of past studies on the topic and a careful review of a number of related questionnaires. Each item was scored on a seven-point Likert scale with one being the least agreeable and seven being the most agreeable.

Procedure

Experiments were carried out in the computer labs of the two respective junior high schools mentioned above in August 2001. Prior to the experiments, the Waltz system, which was a Web-based intelligent system in a virtual reality environment, was set up in the respective labs. At the outset of each experiment, participants were explained of the nature of the project and were administered a pre-test on materials, that were related to the "Pythagorean Theorem", but had not been taught by their teachers. They were then assigned randomly to small collaborative learning teams with three or four members per team. They were mixed regardless of their ability levels, as judged by their GPAs, gender, computer efficacy, and individual learning style.

At the beginning of each experimental session, members of each collaborative learning team were assigned seats far apart from each other so that no two members would be able to see each other and/or to communicate with each other verbally. Each student was also assigned a computer for his/her sole use. The total duration of the experiment lasted 45 minutes (it should be noted that the students had been classmates for almost two years, thus reducing the need to go through the four group development stages). The first 15 minutes were devoted for the participants to get familiar with the Waltz system and to communicate to each other on any topics they cared to via the internet. In essence, this was the warm-up period for the subjects to get to know the system. The second phase of the experiment was a 30-minute session, which required subjects to learn and solve collaboratively as a team a new algebra problem related to the "Pythagorean Theorem," which was presented in a multimedia form in a virtual reality environment.

At the end of the 30 minutes, they were administered a post-test on the subject again to check how much they had just learned collaboratively as a team. In addition, the 44-item scale was also administered to each of the team members along with some other scales that were not part of the present study. A debriefing was followed immediately thereafter.

Results

Descriptive Statistics

The descriptive statistics for the 44-item internet collaborative learning behavior scale (ICLBS) are presented in Table 1 below.

	Mean	S. D.	Alpha if item Deleted
1. In my team, there existed a positive interdependent relationship (cooperation) among team members during the interactions.	5.52	1.39	0.9016
2. In my team, there existed a negative interdependent relationship (competition) among team members during the interactions*	3.79	1.81	0.9051
3. In my team, there didn't exist any interdependent relationships among team members, resulting in very limited interactions*	4.17	1.74	0.9040
4. In my team, everyone committed oneself to the process of the collaborative team learning	5.04	1.46	0.9034
5. In my team, everyone knew one's own role clearly at any given time	5.06	1.36	0.9020
6. In my team, everyone knew one's responsibility	5.10	1.44	0.9008
7. In my team, everyone did one's duty satisfactorily	5.20	1.42	0.9006
8. In my team, I learned a lot from my teammates that I wouldn't otherwise learn them by myself	4.87	1.57	0.9030
9. In my team, I learned a lot of new knowledge	5.25	1.69	0.9014
10. In my team, I learned a lot of new ways of thinking	5.00	1.72	0.9010
11. In my team, I learned a lot of new study skills	5.12	1.43	0.9001
12. In my team, I learned how to interact actively with others	5.03	1.41	0.8989
13. In my team, I learned how to analyze the problems we faced	5.00	1.72	0.9005
14. In my team, I realized the force of the group synergy	5.06	1.34	0.9000
15. I think the computer contents were very attractive	5.15	1.51	0.9002
16. I think the computer contents were abundant	5.34	1.41	0.9020
17. I think the computer contents were pretty vivid	5.19	1.59	0.9015
18. I was very satisfied with the computerized study environment	5.18	1.34	0.9022
19. The computerized study environment gave me an impulse and made me want to learn more	5.00	1.41	0.9011
20. The computerized study environment actually made me learn more than I had expected to	5.23	1.51	0.9005
21. I think the interactions of our team helped very little on the topics that we were supposed to learn*	3.58	1.70	0.9056
22. I think my teammates rarely challenged each other during the collaborative learning process*	4.16	1.51	0.9034

BEST COPY AVAILABLE

23. I think most of my teammates lacked any innovative ideas during the collaborative learning process*	3.87	1.55	0.9017
24. I think most of my teammates lacked any active thinking that might help generate new ideas*	4.16	1.52	0.9018
25. I think most of my teammates rarely expressed their opinions during the collaborative learning process*	4.46	1.72	0.9016
26. I think the team interactions in my team were dominated by only a few most of the time	3.98	1.68	0.9018
27. I think my teammates often had no ideas of how to actively participate in the interactions*	3.91	1.66	0.9015
28. I think my teammates often had no ideas of how to analyze the problems we faced*	3.83	1.55	0.9041
29. I think my teammates often had no ideas of what they were doing during the collaborative learning process*	3.83	1.56	0.9052
30. I think my teammates often had no ideas of how to express their opinions during the collaborative learning process*	4.26	1.61	0.9049
31. I think my team did not have any member with a high GPA*	3.63	1.82	0.9054
32. I think my team did not have any member with a high IQ*	3.56	1.69	0.9048
33. In my team, I realized the practical value of team learning	4.80	1.55	0.9012
34. I think collaborative team studying was a good way of learning.	4.97	1.62	0.9009
35. I realized that I needed to improve on my interpersonal skills during the collaborative learning process*	4.68	1.50	0.9017
36. I had no problems expressing my opinions openly in my team.	4.56	1.53	0.9015
37. I had no problems expressing my difficulties openly in my team	4.41	1.61	0.9005
38. I think we all needed to improve our interpersonal skills in my team*	4.44	1.51	0.8999
39. I think my teammates made me realize the importance of appreciating the thoughts and the problems of others more.	4.73	1.46	0.8985
40. I think my teammates made me realize the importance of caring others more.	4.89	1.60	0.8989
41. I think we needed to clarify more of the problems we faced during the collaborative learning process*	4.73	1.54	0.9008
42. I think my teammates lacked a basic trust of each other*	3.95	1.69	0.9008
43. I think my team had a good control of the time during the collaborative learning process.	4.71	1.52	0.8989
44. I think my team processed excellent decision-making abilities	4.78	1.51	0.9004

*denotes reverse coding
Alpha = 0.9038

Table 1 Descriptive Statistics and Reliability Analysis

Reliability Analysis

Cronbach alpha correlation coefficients were computed for each of the 44-item scale. Table 1 above presents the results of the reliability analysis as well as the means and the standard deviations. As can be seen, the Cronbach alpha coefficients were 0.9038 for the total scale and at least 0.8985 to as high as 0.9052 for the individual items. The results indicated that the 44-item internet collaborative learning behavior scale (ICLBS) and the individual item had high internal consistency. As such, all 44 items were retained for further analyses.

Factor Analysis

Once the internal consistency analysis was completed, a factor analysis was carried out. A principal component analysis of the 44-item was conducted using Oblimin with Kaiser Normalization procedure of the Statistical Package for the Social Sciences. The procedure extracted 11 factors with eigenvalues greater than 1.0. The largest of the 11 factors accounted for 22.06% of the pre-rotation variance whereas the smallest factor accounted for 2.36% of the variance, for a total variance of 70.03%.

BEST COPY AVAILABLE

Using Gorsuch's (1983) recommendation of considering both the Kaiser-Guttman criterion (Kaiser, 1970) of retaining factors with eigenvalues greater than 1.0, it seemed that the 11-factor model was inappropriate since three of the 11 factors only accounted for between 2% and 3% each. It was decided to

Variables	Computer-Usage	Role behavior	Openness	Passiveness	Incapacity
V1		-.641			
V2					
V3					
V4		.718			
V5		.776			
V6		.832			
V7		.826			
V8		.707			
V9			.720		
V10			.745		
V11			.689		
V12			.611		
V13			.589		
V14			.544		
V15	.691				
V16	.667				
V17	.715				
V18	.721				
V19	.731				
V20	.740				
V21				.476	
V22				.692	
V23				.757	
V24				.669	
V25				.542	
V26					.565
V27					.680
V28					.796
V29					.787
V30					.647
V31					.580
V32					.568
V33					
V34	.518				
V35					
V36			.587		
V37			.643		
V38			.553		
V39			.693		
V40	.549		.634		
V41			.523		
V42					.553
V43			.691		
V44			.580		
Total variance explained	22.06%	11.78%	6.65%	5.65%	4.38%

Table 2: Rotated Component Matrix

review the 11-factor model further using the scree test as suggested by Cattell (1966). A quick visual check of the scree plot revealed two break points in the plotted line of eigenvalues after 5 factors, which accounted accumulatively for 50.53%, and 7 factors, accounted collectively for 58.27%.

The rotated component matrix was utilized for the interpretation of the final factors to be extracted. Since the sample size was 134, an item in order to be retained had to have a component coefficient of 0.50 or greater to be statistically significant, according to Hair, Andersen, Tatham, and Black (1998, p.112). Another word, items with component coefficients of less than 0.50 should be deleted from the instrument. The results of the rotated component matrix tended to indicate that the five-factor model was more appropriate than the seven-factor model. Table 2 shows the results of the factor analysis with the five-factor model.

Discussion and Summary

The results showed in Table 2 above indicated that the scale was basically a five-factor model. Those five factors were respectively named computer usage, role behavior, openness, passiveness, and incapacity..

Computer Usage Factor

The inclusion of the computer usage factor with seven items in the five-factor model, is understandable. This is because computers are rapidly becoming part of the educational process from K to G12 in Taiwan. A major difference between collaborative learning with and without computers is that end users have technological tools that can allow for dynamic exploration via time, space, and ideas in an interactive method.

The successful use of computers means involving both teachers and students in the learning process in a completely different way. Web-based collaborative team learning can help sharpen students' ability to think critically and to develop independent judgments. It is also intended to teach cooperative social skills, individual accountability and group information processing within a group environment.

With the advancement of complicated computer software nowadays, it is no wonder that the Web can be and has been employed easily to collaborate learning on how to undertake a task or project so long as it also offers abundantly attractive multimedia contents. The emergence of this factor certainly attests to that.

"When the excitement of discovery is assisted by peers and the imaginative spirit of inquiry, learning is at its best (Hamm & Adams, 1992, p.87)." It is not surprising to note that "the computer is a natural learning vehicle for cooperative group work (Mandell & Mandell, 1989)."

Role Behavior Factor

As any group behavior researchers can readily attest that there are a variety of roles that team members need to play. They may include, but are not limited to, sharing of the leadership, information receiving and providing, coordinating, conflict handling, etc. What role one member may play within a group depends, to a large extent, on one's perceived concept of identify. The importance of the role of identity was not recognized until the social identity theory was introduced (Tajfel and Turner,1979) . In essence, there are four properties of identity, including identity as rational, situational, interactive, and affective (Hertz-Lazarowitz & Miller, 1992, p.204). The identification of the second factor, role behavior factor, which contained six items, certainly verifies the point.

Openness Factor

How successful a team functions depends, to a large extent, on how open the team and its members are. This is because openness has a lot to do with imagination, artistically sensitiveness, and intellectualism. It also encourages and opens up new ways of communication, stimulates more creativity and innovations within a group. This is not to mention that openness may also help build up the cohesiveness in a group, which is the degree to which group members are attracted to each other and are more likely to be motivated to stay in the group so that they get a stronger feeling of "I belong." Needless to say, there is a potentially positive correlation between the group cohesiveness and the group productivity.

The 13 items that were identified as part of this factor included such items as "expressing my opinion openly (v.36)," "expressing my difficulties openly (v.37)," "made me realize the importance of appreciating the thoughts and the problems of others more (v.39)." This is perhaps why the "force of the group synergy (v.14)" was also recognized here as well.

Most of the 13 items are essential to the building of "trust," which is a crucial issue and perhaps the most difficult one to deal with when it comes to the effectiveness of a group or an organization (Gammetta, 1988; Lewis & Weigert, 1985; Mayer, Davis &Schoorman, 1995). Numerous research (Chidambaram, 1996; Deutch, 1958; Handy, 1995; Leidner & Jarvenpaa, 1995; Meyerson, Weick & Kramer, 1996) has uncovered this. It is not surprising to hear that "Although trust usually is thought of in the context of a long-term relationship, when people join teams for a short period of time, building and maintaining trust is more difficult and, therefore, more important (Durate and Snyder,1999, (p.83)."

Passiveness Factor

It is not surprising to see that "passiveness" showed up in the factor analysis as one of the key factors, which covered 5 items. This may be attributed to two reasons. First, collaborative team learning is a very new way of learning in Taiwan's culture. There has been a tendency to over-emphasize the individual accomplishment at the expense of the group learning. As a result, students often find themselves in a state of competing each other than in a state of working together cooperatively. Second, whenever students are assigned a group project, they are always given the opportunity to form their own teams. As such, groups are often composed of close friends, who are often time socialized together outside the classroom as well. In groups like those, projects are often time carried out not by the entire team, but by a so-called the "core group.". In other words, "free rider" is a common problem. The emergence of the "passiveness" factor is therefore understandable and not surprising.

Incapacity Factor

This factor had eight items and is a very interesting one. It is interesting because it showed all the negative aspects of the teamwork. The indifference of its members might be attributed to a fact that most, if not all, of its members were followers waiting for someone to stand up to take the leadership role. Yet, no one did emerge as either the team leader or the opinion leader because of low IQ (v. 32) and/or low GPA (v. 31). As a result, every one seemed to have lost in the collaborative team learning process. This was why the group as a whole did not know how to participate (v. 27), how to analyze (v. 28), what to do (v. 29), and how to express their opinions (v. 30). Basically, the whole learning process was a terrible mess for the group. This situation is not unusual for a self-directed or self-managing team, which is common with today's virtual teams. Therefore, it is crucial to have a balanced team with members equipped with different background, experiences and functions.

Conclusion

The present study showed that it is possible to construct a questionnaire in order to assess the interactive learning behavior of 8th grade students in a collaborative team learning environment relying on multimedia and virtual reality technologies. The level of homogeneity of the scale as assessed by Cronbach's alpha (0.9038) was very high. The final form of the scale was composed of five factors with 39 items in total. While this is true, two things need be emphasized here nonetheless. First, the findings of the study are only preliminary and should be treated as such. Second, since the subjects of the study were 8th grade students in Taiwan, the conclusion should not be generalized and the scale may not be applicable universally.

References

Adams, D., Carlson, H. C. & Hamm, M. (1990). Cooperative learning and educational media: collaborating with technologies and each other. Englewood Cliffs, NJ: Educational Technology Publications.

Cattell, R. B. (1966). The scree test for the number factors, Multivariate Behavioral Research, 1 (April), 245-76.

Chidambaram, L. (1996). Relational development in computer-supported groups, MIS Quarterly, 20(2), 143-165.

Cooper, J, et al (1990). Cooperative learning and college instruction: effective use of student learning teams. Long Beach, CA: University Academic Publications Program.

Deutch, M. (1958). Trust and suspicion, Journal of Conflict Resolution, 2(4), 265-279

Dunn, R. & Dunn, K. (1993). Teaching secondary students through their individual learning styles: practical approaches for grades 7 – 12. Boston: Allyn & Bacon.

Durate, D. L. & Snyder, N. T. (1999). Mastering virtual teams: strategies, tools, and technologies that succeed. San Francisco: Jossey-Bass Publishers.

Gammetta, D. (1988). Can we trust trust? In D. Gambetta (Ed.), Trust: making and breaking cooperative relations (213-237). New York, NY: Blackwell.

Gorsuch, R. L. (1983). Factor analysis. Hillsdale, NJ: Lawrence Erlbaum Associates.

Handy, C. (1995). Trust and the virtual organization, Harvard Business Review, 73(3), 40-50.

Hair, J. A., el al (1998). Multivariate data analysis, Fifth Ed., Upper Saddle River, NJ: Prentice Hall.

Hamm, M. & Adams, D. (1992). The Collaborative dimensions of learning. Norwood, NJ: Ablex Publishing Corp.

Hertz-Lazarowitz, R. & Miller, N. (Ed.) (1995). Interaction in cooperative groups, Cambridge: Cambridge University Press.

Johnson, D. N. & Johnson, R. T. (1989). Cooperative and competition: theory and research. Edina, MN:Interaction Books.

Kaiser, H. F. (1970). A second generation little jiffy, Psychometrika, 35, 401-415.

King, A. (1990). Enhancing peer interaction and learning in the classrooms through reciprocal questioning, Amercian Educational Research Journal, 27, 664-687.

Lewis, J. D. & Weigert, A. (1985). Trust as a social reality, Social Forces, 63(4), 967-985.

Leidner, D. E., & Jarvenpaa S. L. (1995) The use of information technology to enhance management school education: a theoretical view. MIS Quarterly, 19, 265-291.

Mayer, R. C., Davis, J. H. & Schoorman, F. D. (1995). An integrative model of organizational trust, Academy of Management Review, 20(3), 709-734.

Meyerson, D., Weick, K. E., & Kramer, R. M. (1996). Swift trust and temporary groups. In R. M. Kramer & T. R. Tyler (Eds.) Trust in organizations: frontiers of theory and research (166-195). Thousand Oaks, CA: Sage Publications.

Pintrich, P.R., Smith, D.A. F., Garcia, T., & McKeachie, W. J. (1991) A manual for the use of the motivated strategies for research to improve postsecondary Teaching and Learning.

Mandell, C.J. & Mandel, S. L. (1989). Computers in education today. St. Paul, MN: West Publishing, Co.

Sharan, S. and Shachar, H. (1988). Language and learning in the cooperative classroom, NY: Springer-Verlag.

Tajfel, H. & Turner, J. C. (1979). An interactive theory of intergroup conflict. In W. G. Austin, & S. Worchel (Eds.), The social psychology of intergroup relations.(pp. 33-47). Monterey, CA: Brooks/Cole.

Thousand, J. S., Villa, R. A. & Nevin, A. L. (1994). (Ed.) Creativity and collaborative learning: a practical guide to empowering students and teachers, Baltimore: Paul H. Brooks Publishing Co.

Webb, N. W. (1989). Peer interaction and learning in small groups, International I of Educational Research, 13, 21-39.

Acknowledgements

This research was supported by a grant from the National Science Council of the Republic of China in Taiwan to the first author. The data presented, the statements made, and the views expressed are solely the responsibility of the author.

EBOOK.EXE: A Desktop Authoring Tool for HURAA

Xiangen Hu

Department of Psychology, University of Memphis, xhu@memphis.edu

Eric Mathews

Department of Psychology, University of Memphis, emathews@memphis.edu

Arthur C. Graesser

Department of Psychology, University of Memphis, a-graesser@memphis.edu

Suresh Susarla

Department of Psychology, University of Memphis, ssusarla@memphis.edu

Abstract: The development of authoring tools for intelligent systems is an important step for creating, maintaining, and structuring content in a quick and easy manner. It has the benefit of allowing for a rapid change to new domains or topics for tutoring. The development of such tools requires functional control, access protection, easy of learning, and ease of use. In this paper, we introduce the authoring tool we created for the Human Use Regulatory Affairs Advisor (HURAA). HURAA, is a web-based help facility that provides training on the ethical use of human subjects in research, in addition to serving as an information retrieval system on ethical research policies. EBOOK.EXE is a general purpose database organization tool with special features that can be used for organizing curriculum scripts for intelligent tutoring systems.

Introduction

HURAA is one of several projects currently conducted in the Institute for Intelligent Systems (IIS) in the University of Memphis. HURAA is designed for higher level military personnel to evaluate the ethical conduct of research using humans (Graesser, Hu, & Person, 2001). The content of HURAA is derived from Federal agency documents and regulations, particularly the National Institutes of Health (NIH, 45 CFR 46), the Department of Defense (32 CFR 219; DoD Directive 3216.2), and other particular policies from branches of the US military. The users of the HURA Advisor are high-ranking military officials who must approve research protocols involving human subjects in studies sponsored by the Department of Defense (DoD). These users focus on fundamental ethical issues, but not the detailed procedures and paper work associated with gaining approval from Institutional Review Boards. The purpose of HURAA is to allow users from the DoD to obtain important information, regulations, and guidelines in a short amount of time (less than 30 minutes) using the HURA Advisor.

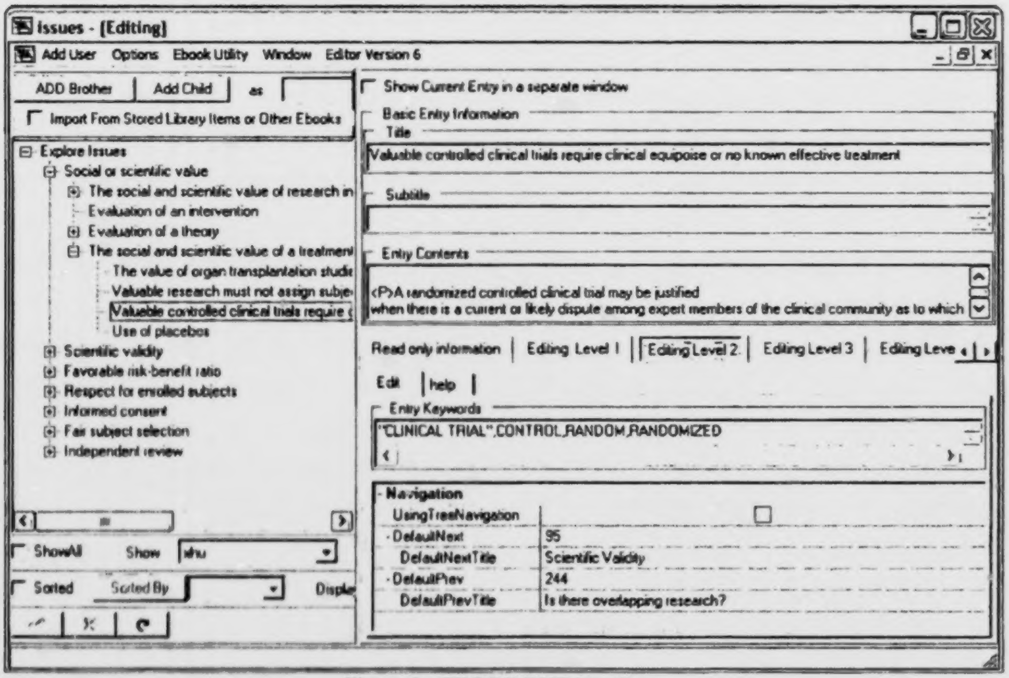
Similar to most of web-based training systems, HURAA contains two major modules: Content and a Learning Management System (LMS). Content is the organized knowledge structure of the information to be delivered to the user. LMS, on the other hand, are a collection of server applications that manage the contents, monitor user-sever interactions and deliver appropriate information to the user. We will first briefly describe the contents of HURAA, and then we will introduce some key features of EBOOK.EXE. The LMS of HURAA has been described in previous papers and thus will not be discussed here (see Graesser, Hu, & Person, 2001).

HURAA

HURAA provides several learning trajectories to users. Within these learning trajectories, two types of learning activities are encouraged: (1) linear order browsing, namely, following scripts in a fixed order (e.g., Historical Overview and Lessons, as illustrated later) and (2) free style browsing of content with the aid of a semantic searching algorithm (e.g., Latent Semantic Analysis or LSA, see Landauer, Foltz, & Laham, 1998). The searching algorithm is a glorified search engine that uses semantic information to help the user obtain desired information from the database. Using these types of learning, HURAA is used to aid users in obtain important information, regulations, and guidelines they need in a short amount of time (less than 30 minutes) to make decisions on ethical human subject research. To make this possible, HURAA tries to help users make connections between major ethical issues and specific cases. That is, the users attempt to identify what ethical issues are problematic for any particular experiment (case). A theoretical case-issue matrix specifies what experts view as the problematic issues for particular cases. Additionally, HURAA houses a context sensitive FAQ function (Point & Query, Graesser, Langston, & Baggett, 1993) so users can ask questions at any point while they are using the system. HURAA makes available other information facilities that are convenient. For example, all glossary items are automatically highlighted throughout the system, so user can obtain definitions of any of the key items without switching to another interface or page.

EBOOK.EXE

EBOOK.EXE is a general-purpose database organization utility. It is written in Pascal and compiled using Delphi 6.0. System equipment and software needed to operate EBOOK is any modern version of Microsoft Windows™ (95/98/2000/XP). Another software requirement is an ADO connection to Microsoft SQL server database (however, it can be any ODBC compliant database locally, if there is no network connection). EBOOK.EXE organizes several database tables (data table for contents, data table Point and Query, Data table for LSA, data table for glossary, etc) with predefined field definitions. The user-interface of EBOOK.EXE is typical of any Windows™ desktop application (see Figure 1).


Issues - [Editing]
Add User
Options
Ebook Utility
Window
Editor Version 6
ADD Brother
Add Child
as
Import From Stored Library Items or Other Ebooks
Explore Issues
Social or scientific value
The social and scientific value of research in
Evaluation of an intervention
Evaluation of a theory
The social and scientific value of a treatment
The value of organ transplantation studie
Valuable research must not assign subje
Valuable controlled clinical trials require c
Use of placebos
Scientific validity
Favorable risk-benefit ratio
Respect for enrolled subjects
Informed consent
Fair subject selection
Independent review
ShowAll
Show
Sorted
Sorted By
Disple
Show Current Entry in a separate window
Basic Entry Information
Read only information
Editing Level 1
Editing Level 2
Editing Level 3
Editing Leve
Edit
help
Navigation

Title: Valuable controlled clinical trials require clinical equipoise or no known effective treatment

Subtitle:

Entry Contents:
<P>A randomized controlled clinical trial may be justified
when there is a current or likely dispute among expert members of the clinical community as to which

Entry Keywords: "CLINICAL TRIAL",CONTROL,RANDOM,RANDOMIZED

UsingTreeNavigation	☐
DefaultNext	95
DefaultNextTitle	Scientific Validity
DefaultPrev	244
DefaultPrevTitle	Is there overlapping research?

Figure 1: EBOOK.EXE interface:
Left of the window displays a tree view of the contents. Right panel of the window displays the property of each entry.

Organizing HURAA in EBOOK.EXE

BEST COPY AVAILABLE

HURAA's contents are organized to emulate either the linear structure of an ordinary book (such as going through the Lessons on the system) or to allow the perusal of a hierarchical outline of knowledge on the topic (as is seen above in the Exploring Issues module). To accomplish this HURAA, uses a relational database with each entry containing several types information. (1) Visible elements, which include: a. text & multimedia, b. associated Point-and-Query items. c. talking head events (what animation will the talking head play, and what tip the talking head will give) and (2) logical elements, which include: a. type of entry (normal/display entry, question entry, multiple choice entry, feedback entry, etc); b. order information (such as which entry will be the default next to display).

According to Murray (1999), HURAA falls in to the new category of intelligent systems called Intelligent and Adaptive Hypermedia. This category is on the cutting edge of web-based media and as such takes strategies from both intelligent tutoring and hypermedia. Authoring tools developed for this category of systems are more difficult to create since they must adapt directly to the methodology used in building the system. Additionally, these types of systems make use of databases, control links, execute tutoring strategies, and adapt to the student, adding to the difficulty (see Murray 1999).

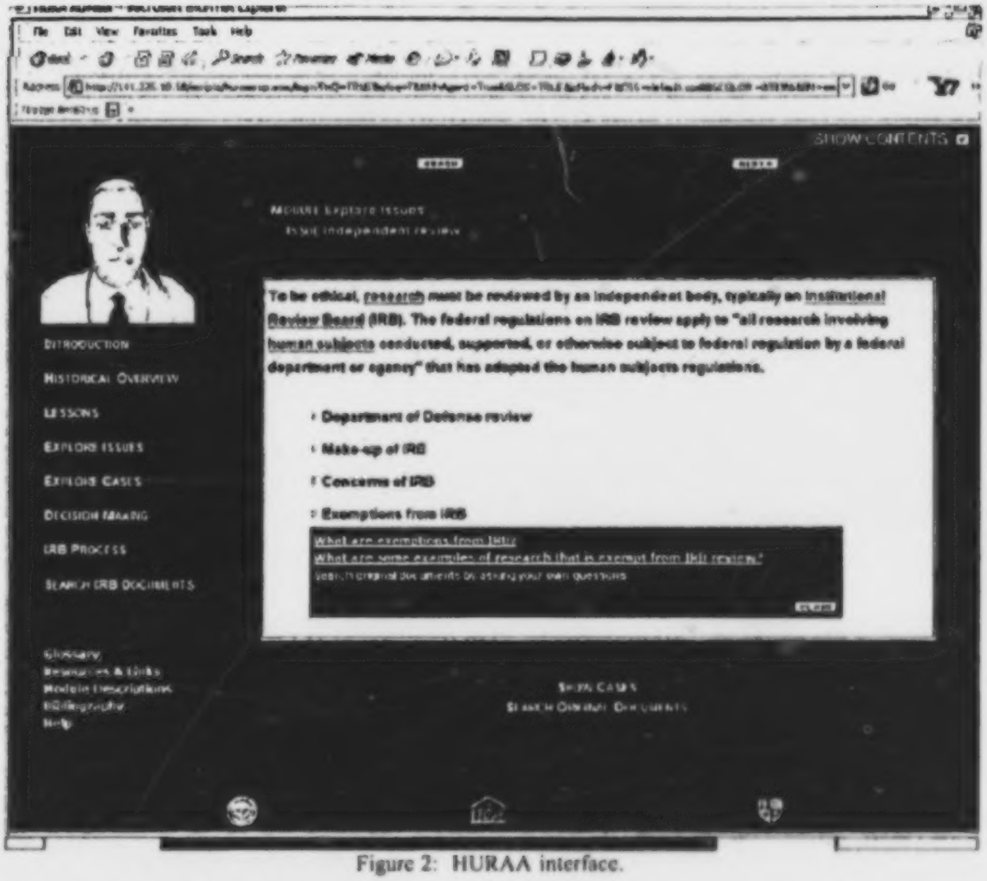
In the past desktop authoring tools have been developed that focus on insulating the user from the underlying architecture and programming of an intelligent system (Jordan, Rose, & VanLehn 2001). This left the user with little control of the structure of the learning, and limited the variety of delivery within these systems to predefined constraints. With EBOOK.EXE we wanted to abandon this type of approach and dramatically increase the control of the knowledge engineer. An advantage of such a desktop authoring tool is that it can offer more total control of the system because it takes advantages of windows user interface (such as drag and drop and variety of functional components). EBOOK.EXE is designed to use ADO and data-aware component in Delphi, so it transmits its data to the centralized server to make updates and changes simultaneously.

A description of useful features and limitations in EBOOK.EXE follows where we note our observations in authoring HURAA contents using the EBOOF.EXE authoring environment.

Graphic Interface

The most important advantage of a desktop application is the capability of using the Microsoft Windows™ graphic interface with which most users are familiar. Building upon this interface, EBOOK.EXE exploits several visual components that make it possible to display the structure of the content organization in a simple and easy to comprehend manner. A graphic tree overview of the contents and its structure allows the user to navigate through the entire course within the interface, as shown in Figure 1.

We used the tree view to display the organized knowledge, allowing authors to concentrate on the contents, and not the html code. In fact, this authoring tool does not require any knowledge of HTML coding. The database organizes the information, and the server application produces the final web pages from the database (using HTML and XML) that reflects hierarchical structure of the content. For example, the hierarchical tree structure corresponds identically to the organization of the material into Modules, Issues, Topics, and Points as is seen in Figure 2.


File Edit View Favorites Tools Help
SHOW CONTENTS
Module: Explore Issues
Issue: Independent review
INTRODUCTION
HISTORICAL OVERVIEW
LESSONS
EXPLORE ISSUES
EXPLORE CASES
DECISION MAKING
IRB PROCESS
SEARCH IRB DOCUMENTS
Glossary
Resources & Links
Module Descriptions
Bibliography
Help
SHOW CASES
SEARCH ORIGINAL DOCUMENTS

To be ethical, research must be reviewed by an independent body, typically an Institutional Review Board (IRB). The federal regulations on IRB review apply to "all research involving human subjects conducted, supported, or otherwise subject to federal regulation by a federal department or agency" that has adopted the human subjects regulations.

- Department of Defense review
- Make-up of IRB
- Concerns of IRB
- Exemptions from IRB

What are exemptions from IRB?
What are some examples of research that is exempt from IRB review?
Search original documents by asking your own questions

Figure 2: HURAA interface.

The authoring tool allows the user to view/edit every aspect of each entry. If a special link needs to be displayed on a specific page, then it can be incorporated into the content with ease. If a deviation from the default display HTML is needed on a certain page of content, it can be explicitly marked up for that page only.

There are several other authoring tools for different intelligent systems. EBOOK.EXE tries to maximize the advantages of a windowing system, so it helps the user to concentrate on the content, not the format of the final deliverable web pages.

Different Levels of Editing

It has been pointed out that developing authoring tools for Intelligent and Adaptive Hypermedia (Murray, 1999) is difficult due to the complexity of the relations among the entries. For example, there are default learning trajectories that user needs to follow. There is also conditional branching that needs to be stored in the database. For every entry, there is other information associated, such as Point-and-Query (most frequently asked question for that entry only), search index (LSA vector, or keywords, etc), cross-links to entries in other data tables (such as case-issue matrix). It can certainly be overwhelming for inexperienced users, since they are only understandable to sophisticated trained users. EBOOK.EXE tries to allow for editing at different levels, so different users only concentrate on material that is relevant to certain editing level proficiencies. For example, content experts can concentrate on the logical relations of the content organization. Cognitive psychologists can make modifications on the interface (such as the talking-head scripts for the guiding of navigation), and computational linguistics experts can work on the

BEST COPY AVAILABLE

LSA or other search indexes. It is in this manner that the complexity of the HURAA system can be distributed and comprehendible to users at various levels.

Import and Export

There are built-in utilities in EBOOK.EXE for importing and exporting the contents of the database into another format (such as another database, html, or XML). The content of HURAA is organized entirely in a database. As a result, it is relatively straightforward to convert the authored contents to other formats. EBOOK.EXE allows authors to export the entire data script to HTML. Most importantly, EBOOK.EXE has a built in conversion utility that exports the contents to XML metadata that is conformant with the Shareable Content Object Reference Model (SCORM). We use XSL to process the XML form of the content database. Currently, XSL for SCORM 1.2 is built-in. For future versions of SCORM, only minor modifications of the XSL files are need for the future versions of SCORM. Modification of the XSL files can be done using EBOOK.EXE or commercial packages such as XMLSpy (see http://www.xmlspy.com/).

Limitations

Most of the features on EBOOK.EXE are still at a functional level, and are not yet user-friendly. For example, EBOOK.EXE uses ADO to remotely connect to the data server on the network (or internet). This is a nontrivial step for users without knowledge of Windows™ database. In addition, the editing of talking-head event requires a special type of mark-up for Microsoft Agent™. And the converting utility to XML metadata for SCORM requires advanced knowledge in SCORM standards (http://www.adlnet.org). Due to these limitations, the current version of EBOOK.EXE is best used as in-house development tool. A future version of EBOOK.EXE is under development that focuses on usability by a variety of trained and untrained users.

Summary

Though we have shown the use of this particular desktop based authoring tool for the HURAA project, it should be noted that any content from any domain can be utilized within the system. The ability for the Learning Management System to deliver specific content rests solely within the authoring tool and its widespread functionality. Although the system we have set-up specializes in the delivery of government policies, procedures, and guidelines, we are confident that other domains can fit within the framework of both the LMS and the content script/database set-up by EBOOK.EXE

In this paper, we introduced an approach on how to develop and use EBOOK.EXE as an authoring environment for the web-based training system, HURAA. Presently, we have explored EBOOK.EXE, a desktop based authoring tool for use with HURAA, and explained some of the design considerations we took into account during our development evolution. While we do not claim our authoring environment is the definitive model for developing authoring tools, we assert that others can build upon these ideas in the development of their intelligent and authoring systems.

We introduced EBOOK.EXE as an authoring environment for adaptable hypermedia content as our solution these challenges associated in authoring the content. Since the LMS of HURAA allows for many learning paths as well as the option of allowing the user to explore the entire system, EBOOK.EXE needed a wide array of functionality and control over the content and its delivery. This led our design to be extremely functional to a finite set of users. Using this version of EBOOK.EXE, a variety of skilled users were able to organize and structure the content of HURAA. However, our future work on EBOOK.EXE will focus on increasing the usability of the system to make it accessible to unskilled users, as well as making attempts to make the authoring more web based.

Acknowledgements

This research was directly supported by contracts from the Office of Naval Research (N61339-01-C1006) and the Institute for Defense Analyses (AK-2-1801), and was partially supported from grants by the National Science Foundation (REC 0106965) and the DoD Multidisciplinary University Research Initiative (MURI) administered by ONR under grant N00014-00-1-0600. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of ONR, IDA or NSF.

References

Fletcher, J. D. (in press) Technology, the Columbus effect, and the third revolution in learning. In M. Rabinowitz, F.C. Blumberg, & H. Everson (Eds.), The Impact of Media and Technology on Instruction. Mahwah, NJ: Lawrence Erlbaum Associates.

Graesser, A. C., Langston, M. C., & Lang, K. L., (1992). Designing educational software around questioning. Journal of Artificial Intelligence in Education, 3, 235-241.

Graesser, A.C., Wiemer-Hastings, K., Wiemer-Hastings, P., Kreuz, R., & the TRG (1999). AutoTutor: A simulation of a human tutor. Journal of Cognitive Systems Research, 1, 35-51.

Graesser, A.C., VanLehn, K., Rose, C., Jordan, P., & Harter, D. (2001). Intelligent tutoring systems with conversational dialogue. AI Magazine, 22, 39-51.

Graesser, A.C., Person, N., Harter, D., & TRG (in press). Teaching tactics and dialog in AutoTutor. International Journal of Artificial Intelligence in Education.

Graesser, A. C., Langston, M. C., & Baggett, W. B. (1993). Exploring information about concepts by asking questions. In G. V. Nakamura, R. M. Taraban, & D. Medin (Eds.), The psychology of learning and motivation: Vol. 29, Categorization by humans and machines (pp. 411-436). Orlando, FL: Academic Press.

Graesser, A.C., Hu, X., & Person, N.K. (2001). Teaching with the help of talking heads. In the Proceedings of the IEEE International Conference on Advanced Learning Technologies (pp. 460-461). Los Alamitos, CA: IEEE Computer Society.

Jordan, P. W., Rose, C., & VanLehn, K. (2001). Tools for Authoring Tutorial Dialogue Knowledge. In J. D. Moore, C. L. Redfield, & W. L. Johnson (Eds.) Artificial intelligence in education: AI-ED in the wired and wireless future Amsterdam, IOS Press.

Langston, M.C., & Graesser, A.C. (1993). The Point and Query Interface: Exploring knowledge by asking questions. Journal of Educational Multimedia and Hypermedia, 2, 355-368.

Murray, T. (1999). Authoring Intelligent Tutoring Systems: An analysis of the state of the art. International J. of Artificial Intelligence in Education, 10, pp. 98-129.

Person, N. K., Graesser, A. C., Harter, D., Mathews, E. C., & the Tutoring Research Group. (2000). Dialog move generation and conversation management in AutoTutor. Proceedings of the AAAI Fall Symposium: Building Dialogue Systems for Tutorial Applications (pp.45-51). Falmouth, MA: AAAI Press.

Sharable Content Object Reference Model (SCORM), Version 1.1. http://www.adlnet.org/.

Stankov, S. Boz ieeviae, J. (1997) Tex-Sys: An Authoring Tool for an Intelligent Tutoring System with Hypermedia. IEEE International Conference on Systems, Man and Cybernetics, (Vol. 3, pp. 2363-2368). Orlando, FL

MBA Students' Satisfaction with Technology Changes from Traditional to Online Courses

Shirley A. Hudson, Ph.D., CPCM
School of Business Decision Sciences Department
Clark Atlanta University
United States
dr_hudson@mindspring.com

Young H. Kim, Ph.D.
School of Business Decision Sciences Department
Clark Atlanta University
United States
ykim@sbus.cau.edu

Abstract: The purpose of this study was to investigate the level of perception and satisfaction of students in online distance learning graduate courses for daytime Regular MBA (Regular) and evening Weekend Professional MBA (Weekend) programs. Distance learning delivery methods have changed over the years but not perceptions. This study attempted to identify if there are any significant differences in Regular and Weekend students' assessments of demographics, personal preferences and habits, technological proficiency and evaluations (course, online course structure, instructors) in their online course experience. This research has shown that online audio chat and text chat have a positive effect on students' learning. The data also showed that moving from traditional to online had no undesirable outcome on students. Working with students to understand the benefits, dangers and limitations helps them adjust to online course environments.

Introduction

The business world is changing and so is the delivery method to MBA students. With the recent growth and development of distance learning, online teaching has become a method of helping students to take their required load of courses even those who might otherwise provide a time conflict. As one of the predominantly African American business schools first accredited by the AACSB International (American Assembly of Collegiate Schools of Business), the Clark Atlanta University School of Business in Atlanta, Georgia (hereafter referred to as CAU Business School) changed computer based information systems courses from traditional to online. This process of development took a three-year effort.

CAU Business School has maintained the standards of a high-quality institution that produced the best-projected return on investment as a two-year MBA program, according to rankings published in Business Week (October 1998). This study discusses transitions: face-to-face meeting in the classroom (1999); one meeting in the classroom and one online with text chat (2000); no face-to-face classroom meetings, online course with text and audio chats (2001). A survey was conducted at the end of each semester. The cross tabs' statistics and measures of association (Pearson chi-square) were computed to determine if there are any significant differences between students' perceptions and satis faction with their online course experiences in Regular and Weekend programs.

Literature Review

California Distance Learning Project (CDLP) (2001, ¶ 1) in its definition of Distance Learning states, "The implementation of DL is a process which uses available resources and will evolve to incorporate emerging technologies." Martinez (September 2000) stated, "You can achieve the same instructional objectives for everyone – it's just that you do it in a different way for people with different learning orientations" (p. 40). Many universities have committed to offering distance-learning courses. According to Langford, Farinella, Weeks & Hobbs (2001, Spring), "It seems clear that the implementation of distance learning offerings has become part of the strategic commitment at many university and college campuses" (p. 75).

Distance learning has increased in the academic environment. Ron Burnett (2000), President of the Vancouver, British Columbia stated:

> In academic circles, there has been a 72 percent increase in the number of distance-learning programs, many of them Web-based courses, with 1.6 million students making use of them during the 1997-'98 academic year alone. The market is expected to grow to $1.6 billion by 2002 (p. 122).

Burnett also believes that "the combined market for corporate and academic distance learning is expected to surpass $11.5 billion by 2003" (Burnett, 2000, p. 122).

Further research is needed to gain insight into students' perceptions of online courses. With that thought in mind this research began in the Spring of 1999. The research involved offering online graduate Management Information Systems courses. Since no courses were online in CAU Business School, the researcher was given permission to pilot this research. These courses were taught in the Decision Sciences Department of CAU Business School. This paper is an account of the transition and students' perception of online courses.

Formal learning is no longer confined to a classroom or a school day. Distance Education has become the wave of present and future learning modes. According to Rex Adams, Dean of Fuqua School of Business at Duke University (2000 ¶1), "Even for top business schools, using the Internet to supplement classroom learning is a relatively new endeavor." (http://www.fastcompany.com/learning/braintrust/radams.html) Adams states "....... most of the world's best business schools are moving at full speed to take advantage of this medium's ability to extend teaching capabilities." (http://www.fastcompany.com/learning/braintrust/radams.html)

According to Culross (Spring 2000), "While few colleges and universities are likely to replace face-to-face instruction totally with computer-based instruction, more and more faculty will opt to teach online courses or to offer portions of their courses through the Web" (p. 38). Terry Neil (February 2001) stated, " With the advent of new educational and training technologies augmented by the Internet, distance learning is a viable option in meeting the needs of today's learning-hungry, but time-pressed students" (p.64). Ed Kazlauskas, Rossier School of Education states:

> ... approaches include examining distance learning from a management perspective at the macro-level, e.g. revenue streams or academic/administrative policies, from a technology perspective, e.g. web-based course management packages such as Blackboard, Mallard, and Web-CT, or from an instructional design perspective, e.g. learning strategies employed in the distance learning approach. But rather than focusing on these as a lens to examine the field, it may be more meaningful for faculty to examine distance learning in terms of the participants involved (2000-2001, ¶2).

This study involved Regular and Weekend students. Weekend program provides time pressed students with an opportunity to upgrade their skills. Weekend Professional students are more experienced and diverse. Stevens (1999) stated, "Web-based, distance-learning MBA programs give busy tech managers an opportunity to hone their business skills and knowledge while remaining at their job" (p. 31). This method of learning is not only being used by tech managers, but by working professionals as a whole.

Technology and instructions designed for students and instructor interaction in online courses can be as effective as traditional courses. Parviz & Ludwig (November 1999) stated, "Research comparing distance education to traditional classroom instruction shows that teaching at a distance can be as effective as traditional instruction" (p. 114). Student-instructor interaction by sharing information and knowledge is the key to delivering online courses. Students must be able to navigate and access information. Email communications allowed instructor to respond quickly.

Methodology

An Internet web based data instrument was developed to collect data. The survey instrument created covered six areas of interest: demographics (questions 1-5), personal preferences and habits (questions 615), technological proficiency (questions 16-21), course evaluation (questions 22-27), online course structure (questions 28-41), and instructors' evaluation (questions 42-47). The instrument was piloted on 20 randomly selected MBA students. Modifications were done and the instrument was administered over five semesters from Spring 1999 to Spring 2001.

At the end of the Spring semester 1999 the first survey was conducted. Emails were sent to the students asking for their participation in an online survey for the study. They were given a Web URL address, user name and password. The instrument required the respondents to identify the courses they took to eliminate the need to code the instrument. Submitted surveys were emailed to the researcher. One follow-up email was sent to remind students that the surveys should be completed by the last week of the semester.

Fifty-seven students in the Spring of 1999 were taught in a regular classroom setting. Twenty-seven students in Special Problems, and Systems Design and Analysis in the Fall of 1999 and 56 students in two sections of Management Information Systems in the Spring 2000 took Web enhanced courses. The Management Information

Systems course was scheduled to meet twice a week on Tuesday and Thursday. The students agreed to meet in the classroom one day and online in Cyber-Class Level Two (text chat only) published by HyperGraphics one day. Email and text chats were used as a means of communication during online sessions.

Cyber-Class was straightforward and students had no problems navigating around the site. Students used asynchronous sharing of e-mail, bulletin board exchanges as conferencing tools, which is searchable and supports the use of attachments for file exchange. It provided learning tools that helped students with concepts and updated news articles.

The students also had a chance to compete with other students from other universities in the Cyber Challenge games. Several students received scores high enough to have the university listed. It was a continuous challenge each week to see if they could get scores high enough to keep the university listed. The games contained questions dealing with the concepts in the textbook. Table 1 lists the features available in Cyber-Class.

Assignments	Audio Classroom
Hot Links (interesting links to web sites)	Text Chat (Private chat room)
Cyber Challenge (Jeopardy-like game tests your mastery of the course materials)	Company Briefs (students learn how companies use/sell technology, scoops on job opportunities plus special student discounts)
Calendar	CyberNews (vital links to CyberClass news)
FlashCards (students practice how well they understand key terms and concepts)	Syllabus
Testing (Chapter/Instructor Test)	Student Administration (user name, grades)
Student Bulletin Board	Student Guide
Sending Messages (e-mail)	Technical Support (telephone, email and live text chat from 10 AM CST – 6 PM CST Monday – Friday)
View Messages	No activity in 4 hours automatically logs students out

Table 1. Cyber-Class

In text chat students were given a question and they typed their answer. The remaining students could agree, add to or disagree with the answer given. Everyone was given an opportunity to answer a question. Bonus questions were also offered. This method was ok, but still provided a problem for students who typed slowly. Assigning questions ahead of time or letting students pick their own questions helped those who typed slowly. The students were able to type their answer ahead of time in Word or Notepad and cut and paste their answer into text chat.

A few students using AOL browser had some technical difficulties during the semester. But the difficulties did not interfere substantially with the course. Students using AOL connection had difficulties during timed exams and quizzes; sometimes the Internet provider disconnected the students. Students using AOL browsers were advised to minimize the AOL browser and open another browser for the exa ms and quizzes.

In the instructor's effort to enhance the course moving the courses from Level Two (text chat) to Level Three (audio and text chats) in CyberClass provided synchronous sharing audio chat. The instructor, student and student's classmates could hear each other speak in the audio classroom. The voice chat enabled two or more to communicate via microphone in a speaker conference call style over the Internet connection in real time.

In the Fall of 2000 and Spring 2001 sixty-one students were strictly taking distance-learning courses using Cyber-Class with both text chat and audio chat. The audio chat room was a great enhancement to the class. This allowed the instructor and students to chat once a week. It was like having a face-to-face meeting without being physically present. Students only needed a sound card and microphone on their computer. Students did not seem to have major problems in moving from a classroom setting to an online teaching method.

In the online meetings weekly chapter reading and review questions were discussed. Each student was given a question to answer. Other students were encouraged to participate once the students' answer was given. Students were encouraged to share ideas, information, articles, books and TV news. This format enhanced students' participation because they did not have to type their answers. They could answer the question using a microphone, which gave the feeling of an in-class meeting. In this format students could concentrate on concepts of the materials rather than typing. Students could also send a private message to the instructor during the audio chat meeting if they had a problem.

Audio chats allowed students to have an interactive online learning environment via the Internet. Students also used the audio chat room for team meetings. This worked out well for the students, because they could be at home and still attend their team meetings. To prepare them for distance meetings and problem solving via the Internet, the students were instructed to hold all team meetings in the text or audio chat rooms.

In the Fall of 2001 the university adopted Web-CT format. All web enhanced or distance learning online courses were switched to Web-CT. When the courses were moved from Cyber-Class to Web-CT the audio chat room enhancements were lost. Web-CT offered text chat and a whiteboard facility, which included a shared text window that supported sharing drawing. The whiteboard allowed the use of standard image formats including JPEG, GIF and BMP. This was a step backward. Audio chat room enhancements allowed the instructor to communicate with students on one-to-one basis about concepts and issues, which was not available in Web-CT.

The sample for this study included 233 MBA students in CAU Business School. Regular program offered Management Information Systems, Special Problems in Decision Sciences, and Systems Analysis and Design. Weekend program offered Information Systems II, Information Systems III and Accounting Information Systems Analysis and Design. Survey questionnaires were collected Spring and Fall 1999, Spring and Fall 2000 and Spring 2001.

Out of 233 students there were 201 (86%) valid respondents. Regular students 158 (78.6%) and Weekend students 43 (21.4%) participated in the survey. There were 81 males and 119 females ranging from 21 to over 35 in age. The chi-square test of independence was used to analyze the data.

Findings

The demographics dimensions included age groups (21 to over 35), gender (female, male), majors (Decision Sciences, Finance, Marketing) and the semesters that online courses were taken. The study indicated that age group and MBA programs are related. Question 2 (Q2) "What group best represents your age?" Regular students 3.5% are in the youngest age group of 21-24, compared to 2.3% of the Weekend. On the other hand, only 9.5% of the Regular students are in the 35 and over, compared to 32.6% of the Weekend students (p=0.000). Q3 "What is your gender?" The study showed no significant difference between Regular and Weekend students.

In Q4 "What is your major?" showed a significant relationship between Regular/ Weekend programs and majors. Weekend students 68.3% are majoring in Finance compared to Regular students 38.1%, in contrast to Weekend students Marketing 31.7% compared to Regular students 47.8% (p = 0.001). Question Q5 "What semester/year did you complete your online course?" showed a significant relationship between Regular/ Weekend programs (p = .044).

In the subgroup analysis of Personal Preferences and Habits Q6 " How many miles do you drive to the CAU campus each day?" Students drove at least 11 miles to campus Regular 67.1% and Weekend 76.8%. In Q7 "Why did you decide to take this course?" Responses to fulfill a requirement and subject seemed interesting were Regular 61.4%, 28.5% compared to Weekend 88.4% and 2.2% respectively. It was interesting to note that two courses in the Regular program were electives for most students (p = .002).

Question Q8 "What is the highest degree you plan to earn from any college or university?" There were no significant differences between the two programs. However Ph.D. was selected by 26.6% of the Regular students compared to 14.0% of the Weekend students. Q9 asked, "Which of the following best describes your reason for taking college course at this time? To advance in current position and to discover new job opportunities were Regular 2.5%, 42.7% compared to Weekend 15.8% and 28.9% respectively (p = 0.018). More Weekend students were interested in advancing in current position while Regular students were interested in discovering new job opportunities.

Respondents were asked in Q10 "How many credit hours are you currently taking?" Students in the Regular program 63.2% were taking 13-15 credit hours compared to Weekend only 10.0%. On the other hand Weekend students 82.5% were taking 7-9 credit hours compared to Regular 4.9% (p = 0.000). Regular students were on semester credit hours and Weekend students were on trimester credit hours. Question Q11 asked, "How many hours per week do you work for pay?" Weekend 62.2% spend 21 or more hours working compared to Regular 37.8%. However Regular 29.1% spend 2-10 hours a week compared to Weekend 18.9% (p = .031). Q12 asked, "On average how many hours per week do you spend on campus for classes? More than half of the Weekend students 56.3% spend 6-10 hours on campus compared to Regular 46.7%. However Regular students 42.0% spend 11-20 hours compared to Weekend students 22.8% (p =0.045).

Q13 "On the average how many hours do you spend on campus working on course assignments in the lab?" All courses required case assignments. Regular and Weekend students spend 60% and 77.5% respectively on campus working on assignments (p= 0.097). Questions Q14 "On the average how many hours per week do you spend working on team projects?" and Q15 "Requiring that students own laptop computers is a reasonable expectation of the business school" showed no significant differences between the programs.

In Q16 the statement "I can search for information on Internet/World Wide Web," Regular students 0.6% were novice users compared to Weekend 14.0%. More Weekend students 25.6% were expert user than Regular students 15.8% (p = 0.001). In Q17 the statement "I can electronically send and receive files by way of the computer (over a modem, the Internet/WWW etc.)," responses showed no significant differences between the two programs.

In Q18 "I have experience using online text chat and audio chat rooms," responses for audio chat rooms were Weekend students 28.6% compared to Regular 15.4%. On the other hand, text chat rooms were Regular students 19.2% compared to Weekend 7.1% (p = 0.048). With both programs using audio and text chat rooms, this study shows that these methods could enhance students' learning experiences.

Q19 "I feel comfortable using the World Wide Web for research purpose." and Q20 "How comfortable are you working on teams using email, text chat and audio chat rooms as primary communication tools?" were not significantly different between the two programs. Question 21 asked, "Did you have connection problems with your Internet provider? More Weekend students 44.2% responded Yes than Regular students 23.8%. Regular 76.2% responded No compared to Weekend 55.8% (p = 0.009). When the students were asked to name the providers, one Internet provider's name stood out more than others.

The following three question statements showed no significant differences between the two programs. Q22 "This course increased my knowledge and understanding of the subject matter," Q23 "This course required me to think and to analyze information." and Q24 "I understand and can apply the concepts I learned in this course."

In Q25 "This course increased my interest in the subject," Regular students 19.1% Strongly Disagreed (SD) or Disagreed (D) compared to Weekend students 7.1%. However Weekend students 85.7% Agreed (A) or Strongly Agreed (SA) compared to Regular 64.7% (p = .031). In Q26 "I found the course material challenging," Regular students 19.8% responded SD or D compared to Weekend students 4.6%. However Weekend students 69.9% responded (A) or (SA) compared to Regular 72.1% (p = .049). Q27 "I felt motivated to do my best work." showed no significant difference between the programs.

Students were asked to respond to the statement in Q28 "My course of study resulted in learning outcomes appropriate to the rigor and breadth of any traditional courses." was not significant. In Q29 "The presentation and organization of the course assignments and materials were coherent and complete." Weekend students 75.7% responded (A) or (SA) compared to Regular 65.6%. On the other hand Regular students 20.1% expressed (SD) or (D) compared to Weekend students 2.3% (p = 0.087). In Q30 "The instructor provided encouragement, support and feedback appropriate to meet my learning needs." Regular students 10.7% showed (SD) or (D) compared to Weekend students 7.0%. Regular students 71.9% responded (A) or (SA) compared to Weekend 55.8% (p = .013). It is important to give students quick responses to their questions or problems. Therefore online courses require prompt responses such as email or voice message communications.

The questions 31-38 showed no significant difference between the two programs. In Q39 "My course of study provided clear learning objectives and expected outcomes for the course." Regular 12.3% responded (D) or (SD) compared to Weekend 4.8%, while 85.7% of the Weekend students responded (A) or (SA) compared to Regular 63.0% (p = .044). The responses to Q40 "The delivery system or technology was reliable and stable" and Q41 "If all graduate students are required to have a laptop, do you think it would be fully integrated in most of your courses?" were not different between the programs.

The following three statements, Q42 "The instructor demonstrated concern and respect for students," Q43 "The instructor was patient and encouraged students' questions" and Q44 "The instructor was enthusiastic about the subject matter" did not show different responses between the programs.

The responses to Q45 "The instructor presented materials in a clear and understandable fashion" were Regular 14.2% (D) or (SD) compared to Weekend 0.0%. On the other hand Regular 72.9% responded (A) or (SA) compared to Weekend 76.8% (p = .062). Q 46 "The instructor demonstrated a thorough knowledge of the subject matter" was responded with Regular 6.6% (SD) or (D) compared to Weekend 0.0%. On the other hand Regular 83.5% students responded (A) or (SA) compared to Weekend 76.7% (p = .021). In Q47 "The instructor made effective use of relevant examples and illustrations", Regular 6.6% responded (SD) or (D) compared to Weekend 4.7%. Regular students responded 81.6% (A) or (SA) compared to Weekend 76.7% (p = 0.022).

Conclusions

Oliver (2000) stated "Evaluation is becoming increasingly important, both as a part of the design of online course and as a mechanism for quality assurance" (p. 83). This research has shown that online audio chat and text chat had a positive effect on students' learning. A quick response helps students move from traditional to online. Working with students to understand the benefits, dangers and limitations helps them adjust to online course environments. Students taking online courses had more flexibility in their schedules, immediate feedback on test scores and seemed to enjoy expanding their technology skills while learning. Participation points and bulletin board discussion keep students actively involved each week. Online instructors are more in touch with their students because they need the continuous feedback. Using the audio and text chats allows the instructors to have interactions with their students while they learn concepts and technology.

The authors have found that it is pedagogically sound to use both audio and text chats to enhance online course delivery. In an effort to better understand the effectiveness of the audio and text chats further research is needed to make sure students learning experience is positive. Research should be used to modify or make changes to online courses as we move toward more flexible and creative methods of delivering online courses.

References

Adams, R. (2001). Do online education and training click? Retrieved October 31, 2001 from http://www.fastcompany.com/learning/braintrust/radams.html

Burnett, R (2000, December 4). Learning in the web. Interactive Week, 7(49), 122. California Distance Learning Project (CDLP) (2001). What is distance learning? Retrieved January 15, 2002 from http://www.cdlponline.org/dlinfo/cdlp1/distance/whatis.html

Culross, R. R. (Spring 2001). Applying a model of instructional design to web-bases courses for adult learners. The Journal of Continuing Higher Education, 49(2), 32-38.

Dunkin, A. (1998, October 19). Getting the most for your b-school money. Business Week, 176-178.

Kazlauskas, E. (2000-2001). Distance learning at USC – A research perspective. Faculty Forum The Newsletter of the USC Academic Senate 2(34). Retrieved October 29, 2001 from http://www.usc.edu/academe/acsen/info_for_faculty/newsletter/0001v2n34/0001vol2num34article04.shtml.

Langford B. E., Farinella, J. A. Weeks, Shelton & Hobbs, B. K. (2001, Spring). Distance delivery: A marketing faculty perspective. Journal of the Academy of Business Education, 2, 75-88.

Neil, T (February 2001). Assessing enrollment and attrition rates for the online mba. THE Journal, 28(7), 64-68.

Oas, B. (2000, September). Have it your way: Adaptive learning puts students in charge. Online Learning, 4(8), 39-40, 42.

Parviz, P. & Ludwig, S. (1999, November). Learning java internationally using webct. THE Journal, 27(4), p. 114, 4p.

Stevens, L. (1999, April). Online mba makes the grade. Internetweek, 761, 31.

****Due to page limitations appendices A, B and F have been dropped. Please email us if you would like to receive a copy of these appendices.**

APPENDIX C **Technological Proficiency Questions**	**N = 201**	**Regular N = 158**	**Weekend N = 43**	X^2
Q16. I can search for information on the Internet /World Wide Web.	No Knowledge	.6%	0.0%	21.755^a 0.001^b
	Knowledge, But No Ability	1.9%	0.0%	
	Novice User	.6%	14.0%	
	Casual User	3.8%	4.6%	
	Moderate User	17.1%	16.3%	
	Proficient User	60.1%	39.5%	
	Expert User	15.8%	25.6%	
Q17. I can electronically send and receive files by way of the computer (over a modem, the Internet/ WWW .etc).	Knowledge, But No Ability	1.0 %	0.0%	8.411^a 0.135^b
	Novice User	6.6%	0.0%	
	Casual User	5.3%	15.0%	
	Moderate User	13.9%	20.0%	
	Proficient User	50.3%	42.5%	
	Expert User	22.5%	22.5%	
Q18. I have experience using online text chat and audio chat	Audio Chat Rooms	15.4%	28.6%	6.072^a

rooms.	Text Chat Rooms	19.2%	7.1%	0.048[b]
	Audio Chat Rooms & Text Chat Rooms	65.4%	64.3%	
Q19. I feel comfortable using the World Wide Web for research purposes.	SD	4.0%	2.3%	5.978[a] 0.201[b]
	D	5.8%	2.4%	
	N/O	9.0%	4.8%	
	A	21.2%	38.1%	
	SA	59.6%	52.4%	
Q20. How comfortable are you working on teams using email, chat and audio talk rooms as primary communication tools?	Very Comfortable	30.4%	34.1%	3.418[a] 0.636[b]
	Comfortable	17.7%	22.2%	
	Somewhat Comfortable	17.1%	14.6%	
	Neutral	12.0%	14.6%	
	Uncomfortable	16.5%	14.5 %	
	Very Uncomfortable	6.3%	0.0%	
Q21. Did you have connecting problems with your Internet Provider?	YES	23.8%	44.2%	6.820[a]0.009[b]
	NO	76.2%	55.8%	

APPENDIX D Course Evaluation Questions

Q22. This course increased my knowledge and understanding of the subject matter.	SD	4.4%	4.7%	2.604[a] 0.626[b]
	D	5.8%	4.2%	
	N/O	12.2%	9.3%	
	A	52.6%	44.2%	
	SA	25.0%	37.2%	
Q23. This course required me to think and to analyze information.	SD	2.5%	0.0%	4.238[a] 0.375[b]
	D	10.9%	2.4%	
	N/O	9.6%	9.5%	
	A	41.7%	47.6%	
	SA	35.3%	40.5%	
Q24. I understand and can apply the concepts I learned in this course.	SD	3.2%	0.0%	5.930[a] 0.204[b]
	D	8.3%	0.0%	
	N/O	14.1%	14.3%	
	A	46.2%	47.6%	
	SA	28.2%	38.1%	
Q25. This course increased my interest in the subject.	SD	2.5%	0.0%	10.645[a] 0.031[b]
	D	16.6%	7.1%	
	N/O	10.8%	7.1%	
	A	44.6%	35.7%	
	SA	20.1 %	50.0%	
Q26. I found the course materials challenging.	SD	1.3%	0.0%	9.513[a] 0.049[b]
	D	18.5%	4.6%	
	N/O	10.3%	23.3%	
	A	45.5%	51.2%	
	SA	24.4%	20.9%	
Q27. I felt motivated to do my best work.	SD	.6%	0.0%	3.024[a] 0.554[b]
	D	9.6%	7.1%	
	N/O	16.0%	19.0%	
	A	42.3%	31.0%	
	SA	31.4%	42.9%	

APPENDIX E Online Course Structure Questions

Q28. My course of study resulted in learning outcomes appropriate to the rigor and breadth of any traditional course.	SD	3.8%	0.0	•4.243[a] 0.374[b]
	D	11. 5%	4.5%	
	N/O	19.9%	18.8%	
	A	44.2%	55.8%	
	SA	20.5 %	20.9%	
Q29. The presentation and organization of the course assignments and materials was coherent and complete.	SD	1.9%	0.0%	8.118[a] 0.087[b]
	D	18.2%	2.3%	
	N/O	14.3%	22.0%	
	A	49.4%	53.7%	
	SA	16.2%	22.0%	
Q30. The instructor provided encouragement, support, and feedback appropriate to meet my learning needs.	SD	5.3%	0.0%	12.703[a] 0.013
	D	5.4%	7.0%	
	N/O	17.4%	37.2%	

BEST COPY AVAILABLE

	A	47.7%	25.6%	
	SA	24.2%	30.2%	
Q31. My course of study provided interaction between faculty and students to meet my needs.	SD	2.6%	2.4%	1.869[a] 0.760[b]
	D	10.4%	11.9%	
	N/O	20.1%	21.4%	
	A	50.6%	40.5%	
	SA	16.2%	23.8%	
Q32. I had reasonable and adequate access to the range of student services all appropriate to support my learning needs and style.	SD	1.3%	0.0%	3.621[a] 0.460[b]
	D	11.2%	7.0%	
	N/O	25.7%	16.3%	
	A	43.4%	55.8%	
	SA	18.4%	20.9%	
Q33. I was provided enough in formation (through advising or orientation) to determine if I had the background, knowledge, and technical skills needed to be successful in this course.	SD	7.1%	4.6%	1.113[a] 0.892[b]
	D	5.2%	7.0 %	
	N/O	24.5%	27.9%	
	A	47.7%	41.9%	
	SA	15.5%	18.6%	
Q34. The advising, recruiting, and admissions materials clearly and accurately represent the course and the services available	SD	5.8%	0.0	7.097[a] 0.131[b]
	D	13.6%	18.5%	
	N/O	27.3%	41.9%	
	A	39.0%	25.6%	
	SA	14.3%	14.0%	
Q35. I would recommend or consider taking another course using the same vehicle.	SD	5.9%	6.9%	5.537[a] 0.237[b]
	D	15.8%	14.0%	
	N/O	17.8%	14.0%	
	A	28.9%	46.5%	
	SA	31.6%	18.6%	
Q36. I felt uncomfortable using the audio equipment necessary for my distance-learning course.	SD	12.9%	9.3%	6.134[a] 0.189[b]
	D	18.7%	30.2%	
	N/O	15.5%	4.7%	
	A	28.4%	34.9%	
	SA	24.5%	20.9%	
Q37. The course ensured that appropriate learning resources are available to students. (links to related supporting web sites and traditional library resources)	SD	3.9%	7.0%	6.674[a] 0.154[b]
	D	7.1%	4.7%	
	N/O	19.5%	9.3%	
	A	48.1%	41.7%	
	SA	21.4%	37.2%	
Q38. The mode of delivery did NOT cause frustration or difficulty in completing the course successfully.	SD	5.2%	4.6%	2.847[a] 0.584[b]
	D	23.5%	34.9%	
	N/O	13.1%	11.6%	
	A	43.8%	32.6%	
	SA	14.4%	16.3%	
Q39. My course of study provided clear learning objectives and expected outcomes for the course.	SD	3.2%	2.4%	9.821[a] 0.044[b]
	D	9.1%	2.4%	
	N/O	24.7%	9.5%	
	A	42.2%	47.6%	
	SA	20.8%	38.1%	
Q40. The delivery system or technology was reliable and stable.	SD	6.4%	7.0%	6.874[a] 0.143[b]
	D	22.3%	9.3%	
	N/O	17.2%	30.2%	
	A	36.3%	41.9	
	SA	17.8%	11.6%	
Q41. If all graduate students are required to have a laptop, do you think it would be fully integrated in most of your courses?	YES	87.1%	87.5%	0.001[a] 0.969[b]

SD = Strongly Disagree, D = Disagree, N/O = No Opinion, A = Agree, SA = Strongly Agree

[a] = Chi-Square Value **[b] = Approximately Significant**

A Preliminary Mapping of Web Queries Using Existing Image Query Schemes

Bernard J. Jansen
School of Information Sciences and Technology
The Pennsylvania State University
001 Thomas Bldg
University Park, PA, 16801, USA
Phone: 814-865-6459 Fax: 814-865-6426
Email: jjansen@acm.org

ABSTRACT: End user searching on the Web has become the primary method of locating images for many people. This study investigates the nature of web image queries by attempting to map them to known image classification schemes. In this study, approximately 100,000 image queries from a major web search engine were collected in 1997, 1999, and 2001. A stratified sample of the queries was classified using three previously published image classification schemes. The results indicated that the features and attributes of web image queries differ relative to image queries utilized in other IR systems and user populations. Given the growing ubiquitous nature of the web, the implications for the design of information retrieval systems and repositories are discussed.

Introduction

The tremendous growth in the quantity of digital images is driving the need for more effective methods of storing, searching, and retrieving image data. With the development of such technologies, image indexing and retrieval have received increasing attention. However, there has been little research into image searching on the Web, especially how users search for images in the web environment. Given the pervasiveness of the web, the manner in which user's conduct image searches on web may also be good indications of how they will conduct future searches in other environments.

One can classify current image retrieval approaches, whether on traditional systems or on the web, as either concept or content based (Rasmussen, 1997). In the concept-based approach, image retrieval research has focused on the retrieval of images utilizing indexed image collections (Enser & McGregor, 1992; Goodrum and Spink, 1999). Researchers and practitioners have created thesauri for visual information, such as the Library of Congress Thesaurus for Graphics Materials, Metadata (Greenberg, 1993). These thesauri are then used to index images within a collection.

Conversely, in the content-based approach, the focus has been on indexing images at the pixel level and the implementation of search features using pixel comparison (Wang, 2000). Content-based image IR systems allow users to search image collections using color, texture, shape, and spatial similarity. These systems many times also provide text-based search functions for notations and text descriptions embedded within images. New technologies have placed the emphasis on content-based retrieval, with commercial systems such as the MediaSite.com (http://www.mediasite.com) system.

However, it is not clear how the retrieval functionality of either of these approaches systems correlates with the image needs of real users. Concerning the context approach, Brown, Hidderly, Griffin, and Rollason (1996) point out that experts are not a good source of terms that are preferred by real users. Concerning the content approach, Chen (2001) notes that users seldom search using content characteristics. Although user studies within specific domains have been conducted, Jansen and Pooch (2001) have shown that Web users differ in their interaction with

IR systems relative to users in other environments. In this respect, studies of the image needs of web users are especially needed for effective and efficient design of web-based, image IR systems.

The research presented in this article focuses on the information needs of web user's as represented by their image queries. Specifically, web user queries from a major web search engine are investigated. We analyze the end-user's image query structure across three periods (1997, 1999, and 2001), classify user queries using accepted classification schemes, compare the characteristics to those identified in previous studies and provides suggestions for improving image indexing and retrieval systems to meet the information need of web users.

Review of Literature

User Information Needs and Image Queries

Ellis (1984, p. 25) advocates that design of IR systems must be with "an orientation to the use and the user's interaction with information sources. Fidel [8] points out that studies in image retrieval have ignored several fundamental issues, including the differences between text and image retrieval, the image attributes important for retrieval, and the characteristics of user's image queries. These points are especially germane with respect to image searching on the web given the almost complete lack of studies in this area.

There have been some studies of image searching on the web, including Goodrumand Spink (1999) and Jansen, Goodrum and Spink (2000) that have analyzed images queries from web users as part of a review of multimedia queries. However, these studies presented primarily factual characteristics of image queries; none of these studies attempted theoretical classification of web image queries using known classification schemes. Without such research, one cannot determine whether or not the web user population's image information needs conforms to currently accepted image retrieval approaches.

Image Retrieval on the Web

In general, Web users must search for multimedia information as they would search for textual information (Schauble, 1997) with many Web IR systems providing no special mechanism for multimedia searching. The advantage of this approach is that image searching is performed in an identical manner to text searching. No additional burden is placed on the searcher. If the searcher desires an image document, the searcher enters the query and specifies some image attribute. The disadvantage of this approach is that it places more contextual knowledge burden on the searchers, who may not be familiar with image formats. Necessitating that users translate a non-textual information need into a textual query may challenges a user's cognitive load, creating a semantic gap (Gudivada & Raghavan, 1995). Excite (http://www.excite.com) and Yahoo search engine (http://www.yahoo.com) are two such Web IR systems that take this approach.

Some Web IR systems specialize in image collections or provide mechanisms for users searching for images (e.g., radio boxes or media specific search syntax). Alta Vista (http://www.altavista.com) and Lycos (http://www.lycos.com) searchers can narrow a query to specifically search for an image. ClipArt Searcher (http://www.webplaces.com/search/), the Yahoo Picture Gallery (http://gallery.yahoo.com), and Webseek (http://www.ctr.columbia.edu/webseek/) are examples of image specific retrieval applications allowing users to search by terms or select from general categories of images and video. Both Webseek and Alta Vista return thumbnail images and file names in the document result list. Webseek also provides tools for content-based searching for images and videos using color histograms generated from the visual scenes.

In terms of image indexing, most web IR systems follow a relative straight forward approach. The simplest image search algorithm locates images files by searching for file extensions, matching the filename to terms in the query (Witten, Moffat, & Bell, 1994). This may not be a good approach, especially given the move to automatic generation of image file names by applications (e.g., converting Power Point © presentations to Web pages or transferring files from a digital camera). In these cases, the file name has little to nothing to do with the image. Web IR systems may also retrieve documents that are primarily textual but that contain embedded images. In these cases, the image filename may not match the query terms, but the Web documents may contain text that does match the query terms. The assumption being that the image relates to the text.

Given the inadequate research of user image needs on the web and a lack of theoretical background for the design and evaluation of web image databases (Chen, 2001), it is logical to examine the both web image queries and present classification schemes to discover the utility of the models for the design of web-based image retrieval systems. A review of three, previously published, image query classification methodologies follow.

Enser and McGregor Classification Categories

Enser and McGregor (1992) analyzed 2,722 image queries requests on an image system with approximately half a million engravings, woodcuts, drawings, cartoons, and maps. The combined size of the collection was about 10 million images. The researchers classified these 2,722 requests in four categories: (1) Unique, (2) Unique with refiners, (3) Non-unique, (4) Non-unique with refiners. The property of uniqueness is readily applied to a request for the visual representation of an entity where the desired occurrence can be differentiated from very other occurrence of the same entity type (Enser and McGregor, 1992, p. 17). Using refiners, one can narrow these queries some degree of specifity. The researchers point out that almost 70% (1905) of the queries were for a unique person, object or event, and 34% (925) of the queries were refined, mostly by time.

Jorgensen 12 Image Attribute Classes

Jorgensen (1998) conducted a study with 107 first semester library science students with a variety of undergraduate majors. The study participants viewed 6 projected color images that were randomly selected from *The Society of Illustrators 25th Annual of American Illustration*. The participants described the 6 projected images, and Jorgensen then classified the descriptions into the 12 classes of image attributes.

Chen's Categories and Attributes Modifications

Chen (2001) collected 534 queries fom 29 college students majoring in art history, using pre-search and post-search questionnaires. The art course students utilized an image collection containing over 75,000 volumes and subscriptions to over 200 journals in relevant fields. The collection also contained significant holding in several art related fields and facsimile collections of medieval manuscripts and original scrolls. Chen did not, however, focus on whether or not the queries were utilized on an image retrieval system. Chen mapped the queries to previous query classification methods, including Enser and McGregor (1992) categories, combining some of Jorgensen (1998) attribute classes. Based on Chen's analysis, the researcher proposed modifications to Enser and McGregor (1992) categories.

The next section of the paper describes the research design used in this study.

Research Design

This research reports the analysis of image queries from a major web search engine. The objective was to examine these image queries from real web users with real information needs, mapping these queries to known image query classification features.

Research Questions

The following research question is addressed: Can web image queries be effectively mapped using previously identified image classification schemes?

Background

The Web is an immense repository of image information (Lesk, 1997). The hypertext transfer protocol (HTTP) lends itself to the easy transfer of audio, video, and image formats integrated with textual information. Lawrence and Giles (1999) estimated there are 180 million images on the publicly indexed Web and 3Tb of image data, not including other types of multimedia files, such as audio and video. As such, the web is an immense, heterogeneous image collection.

Research Procedure

A total of approximately 100,000 image queries from the Excite search engine (http://www.excite.com) were collected in 1997, 1999, and 2001. Each transaction record contained three fields. With these three fields, one can locate a user's initial query and recreate the chronological series of actions by each user in a session:

1. **Time of Day**: measured in hours, minutes, and seconds from 00:00:01.
2. **User Identification**: an anonymous user code assigned by the server.
3. **Query Terms**: exactly as entered by the given user.

Overall, the metrics used in this research are as defined in (Jansen & Pooch, 2001). We defined the session, query, and term variables as:

1. **Session**: A session is the entire series of queries by a user over time, from one query to many.
2. **Query**: A query consists of one or more search terms, and may include logical operators and modifiers.
3. **Term**: A term is any unbroken string of characters (i.e. a series of characters with no space between any of the characters). The characters in terms included everything – letters, numbers, and symbols.

Founded in 1994, Excite, Inc. was a major Internet media public company that offers free Web searching and a variety of other services. It has since been purchased and is no longer an independent company. Excite searches were based on the exact terms that a user enters in the query; however, capitalization is disregarded, with the exception of logical commands AND, OR, and AND NOT. Stemming is not available. An online thesaurus and concept linking method called Intelligent Concept Extraction (ICE) was used, to find related terms in addition to terms entered. Search results were provided in a ranked relevance order. A number of advanced search features were available. A page of search results contained ten answers at a time ranked as to relevance. For each site, the results list provided the title, URL (Web site address), and a summary of its contents. A user could click on the title to go to the Web site. A user could also click for the next page of ten answers.

Content Analysis

A set of 587 image queries was randomly selected from one of the transaction logs. The image queries were then categorized using each of the three classifications schemes discussed previously. A query could be mapped to more than one feature or attribute. Therefore, the number of mapping incidents may be greater than the number of queries. We now present the findings of our research.

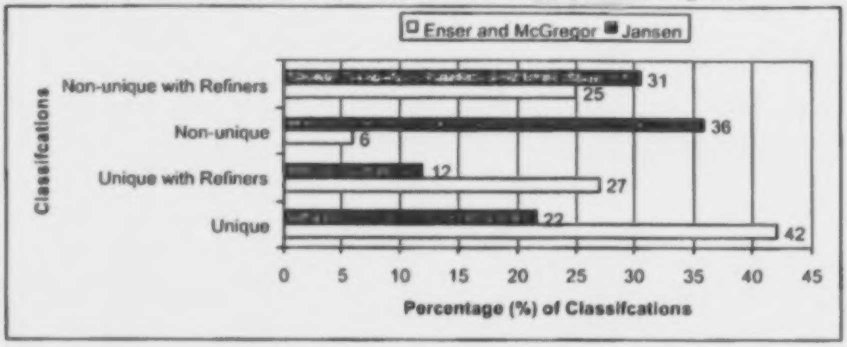
Research Findings

We analyzed to what degree does the image queries map to previous identified image query features, categories, and image attributes. A set of 583 image queries was randomly selected from one of the transaction logs and then mapped to each of following classification schemes.

Mapping Results using Enser and McGregor's Categories

The image queries were mapped to Enser and McGregor's image categories. The overall results are displayed in Figure #1.

Figure 1: Mapping using Enser and McGregor's Four Categories

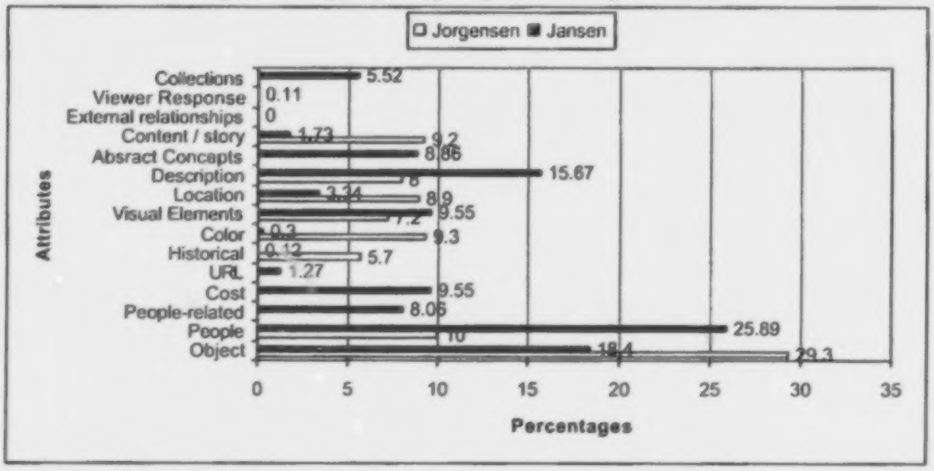


The total number of judgments for the study of Enser and McGregor's was 583. From Figure #1, one can see that the percentage of requests for unique image information was substantial lower on the web than reported by Enser and McGregor's, and naturally, the percentage of non-unique request was higher. Perhaps surprising, given the antidotal comments concerning web users, the use of refiners was quite high, comparable and even exceeding that reported by Enser and McGregor.

Mapping Results using Jorgensen's Image Attributes

We classified the image queries to Jorgensen's image attributes. The overall results are displayed in Figure #2.

Figure 2: Mapping using Jorgensen's image attributes.



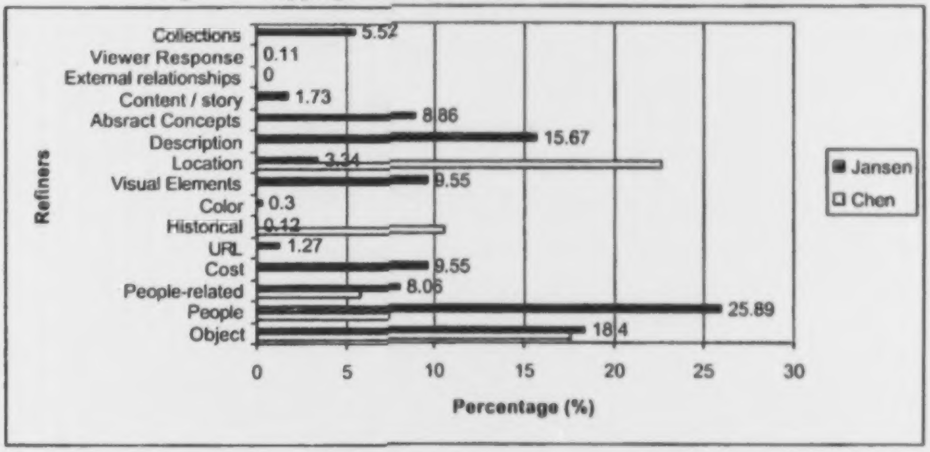
The total number of judgments for the study of Jorgensen's image attributes was 869. Jorgensen's original 12 attributes did not effectively describe the attributes of the web image queries, so an additional three attributes were added, namely cost, URL, and collections. Concerning the three attributes added, it is apparent that cost is factor with web users, a fact that would not be apparent in lab studies using students, as Jorgensen and others have done. Given the unique hypertext environment, the location of the images is apparently a concern of Web users given the high number of URL requests and searches for images collections. People and people – related queries seem to dominate the information needs of web users. Content-based attributes, such as color, do not appear to be utilized by web users even though web IR systems provide relevant results to these content-based attributes (e.g., using Alta Vista, search for blue images).

BEST COPY AVAILABLE

Mapping based on Chen's Modifications

We classified the image queries to Chen image categories modifications. The overall results are displayed in Figure #3.

Figure 3: Mapping using Chen image categories modifications



The total number of judgments for the study of Chen's image attributes modifications was 869. Similar to Jorgensen's scheme, we had to add attributes to account for differences in the web query. The results from the web mapping was much more diverse than that reported by Chen.

Discussion

In Enser and McGregor's study (1992), approximately 70% of the queries were for a unique person object or event. Also, 34% of these requests were refined, primarily by time. In applying the Enser and McGregor's categories to web image queries, we find that the majority of queries were non-unique, but almost all of these were refined in some manner, with cost (24%), presentation aspects (20%), or pornographic (16%) refiners being the most common.

In the Jorgensen study (1998), the literal Object class held the highest position in the searching task (29.3%), followed by the people class (10.0%), and then the color class (9.3%). In the analysis of web queries, the most frequency occurring attribute is People (26%), followed by Description (16%) and then Object (18%).
In the Chen study [4], the 29 searchers mainly utilized unique terms and seldom used refiners. Chen identified five refiners, which were Object, People, Historical, and Location. The web queries correspond to these five categories but there are also substantial numbers of cost (10%), Visual Elements (10%), Description (16%), Abstract Concepts (9%), and Collections (6%).

Conclusion

How users search for images on web is certain to have an impact on how users interaction with other knowledge bases. Thanks in part to the Web, end user searching is now the primary method of locating images for many people. This study investigated web image queries. By mapping a sub-set of image queries to known image classification schemes, the results indicated that the features and attributes of web image queries differ relative to image queries utilized in other IR systems and user populations. The majority of image queries were requests for non-unique entities and almost all contained some refiner. Cost is the most prevalent refiners. Most image queries are for people. Despite these differences, it is apparent that known image classification schemes can be modified to account for the characteristics of web users.

BEST COPY AVAILABLE

In future research, larger sub- sets of web images queries will be provided to multiple reviewers in order to obtain inter rater reliabilities. In this respect, we model off of the technique used by (Chen, 2001). We expect this technique to refine our classification attributes. From this, one can derive a meaningful scheme for classifying web image queries.

References

Brown, P., Hiderley, R., Griffin, H., & Rollason, S. (1996). The democratic indexing of image. The New Review of Hypermedia and Multimedia. 2, 107 – 121.

Chen, H. (2001). An Analysis of Image Queries of Art History. Journal of the American Society for Information Science and Technology, 52(3), 260 – 273.

Ellis, D. (1984). Theory and Explanation in Information Retrieval Research. Journal of Information Science, 8, 25 – 38.

Enser, P.G.B. & McGregor, C.G. (1992). Analysis of Visual Information Retrieval Queries. Report on Project G16412 to the British Library Research and Development Department. London: British Library.

Goodrum, A. & Spink, A. (1999). Visual Information Seeking: A study of image queries on the World Wide Web. *Proceedings the 1999 Annual Meeting of the American Society for Information Science*, Washington, DC. November, 1999.

Greenberg, J. (1993). Intellectual Control of visual Archives: A Comparison between the Art and Architecture Thesaurus and the Library of Congress Thesaurus for Graphic and Materials. Cataloging and Classifications Quarterly, 16(1), 85 – 101.

Gudivada, V.V., & Raghavan, V.V. (1995). "Content-based image retrieval systems," *IEEE Computer*, 28(9), 18-22.

Jansen, B. J. and Pooch, U. (2001). Web user studies: A review and framework for future work. *Journal of the American Society of Information Science and Technology*. 52(3), 235 - 246.

Jansen, B. J., Goodrum, A., and Spink. A. (2000). Searching for multimedia: video, audio, and image Web queries. *World Wide Web Journal*, 3(4), 249 - 254.

Jorgensen, C. (1998). Attributes of images in describing tasks. Information Processing and Management, 34(2/3), 161 – 174.

Lawrence, S., & Giles, C. L. (1999). Accessibility of information on the web. *Nature*. 400, 107 –109.

Lesk, M. (1997). Going digital. *Scientific American, 276*(3), 58-60.

Rasmussen, E.M. (1997). Indexing Images. Annual Review of Information Science and Technology, 32, 169 – 196.

Saracevic, T. (1997). Users lost: Reflections on the past, future, and limits of information science. *SIGIR Forum, 31*(2) 16-27.

Schauble, P. (1997). *Multimedia information retrieval*. Kluwer: Boston.

Wang, J. Z. (2000). ``SIMPLIcity: A region-based image retrieval system for picture libraries and biomedical image databases," *Proceedings of. ACM Multimedia*, pp. 483-484, Los Angeles, ACM, October 2000.

Witten, I.H., Moffat, A., & Bell, T. C. (1994). *Managing gigabytes: Compressing and indexing documents and images*. Van Nosstrand Reinhold: New York.

Towards Implementing a Cognitive Model of Searching

Bernard J. Jansen
School of Information Sciences and Technology
The Pennsylvania State University
001 Thomas Bldg
University Park, PA, 16801, USA
Phone: 814-865-6459 Fax: 814-865-6426
Email: jjansen@acm.org

Abstract This research begins to refine a cognitive model of interactive information seeking for use in the design of information retrieval (IR) systems. The research reported in this article critically examines several interactive information seeking and retrieval models that have emerged over the last two decades. Building primarily on the stratified model, interactions are identified at the surface stratum that can be utilized to design information retrieval systems that infer intentions at other strata, thereby better assisting users during the search process. This paper presents the development technique utilized to modify an existing IR system that monitors these interactions and recommends search tactics to the user. The result is an increase in the performance of an IR system, as measured by precision.

Introduction

This research begins the refining a cognitive model of IR searching to a level of granularity useful in the design of an IR system. End user searching on traditional information retrieval (IR) systems, on-line public access catalogues, Web search engines, and digital libraries has become the primary method of locating information for many people. With the advent of end-user searching, numerous cognitive models of information seeking and retrieval have been proposed. Unfortunately, many of these cognitive models seem to be in a perpetual state of early development and have not taken the next, critical step in refining the models. Presently, many IR cognitive models are not sufficiently developed for the design of IR systems, with the result that current systems may not effectively or efficiently support users' information seeking needs.

This article begins with a review and critique of cognitive models for information seeking and retrieval. One model that is discussed at some length is the stratified model. Building on this model, modifications to the surface stratum that take advantage of the entire range of user – system utterances, not just the query, are presented, along with how these interactions relate to the user's cognitive and situational strata. A development technique is presented to utilize these interactions in the design of an IR system. An existing IR system is modified using this approach. The article contains a discussion on the improved system, the results of a user evaluation, and then concludes with recommendations for future research.

Related Research

Cognitive models have been successfully utilized in human – computer interaction, and research is now underway to incorporate cognitive models within sets of design tools (Ritter, et. al., 2001). However, research into cognitive models of interactive searching on IR systems is still at an incipient stage, despite a large body of research on user – system interaction. Researchers have investigated many aspects of interactive searching, including queries, search terms, sessions, and feedback, among other factors (Saracevic, et. al., 1988; Saracevic, et. al. 1991; Spink & Saracevic, 1997).

However, Ellis (1984) has pointed out the flaws of attempting to develop a theoretical searching model utilizing this approach. These empirical studies have focused on the observed elements of searching as it currently is exhibited, usually taking a grounded theory approach (Strauss & Corbin, 1990). The data gathered in these studies may not translate to other user populations or IR systems. In this respect, the "knowledge derived from the testing is uncertain" (Ellis, 1984, p. 25). As Ellis predicted, indications are that the results from these studies are only specific to a particular IR environment (Jansen & Pooch, 2001). Because of these potential shortcomings, a theoretical approach to IR research on user – system interaction is needed (Saracevic, 1996).

From a theoretical approach, there are numerous cognitive models of interactive IR systems (Bates, 1979; Belkin, et. al., 1989; Ellis, 1997; Ingwersen 1996; Saracevic 1997). All have similar goals, usually to (1) document the interaction between the user and IR system, (2) identify patterns, (3) relate the patterns to retrieval effectiveness, and (4) incorporate those patterns that will increase the performance of IR systems into the designs of IR system mechanisms (Saracevic, 1996). However, no one has yet sufficiently developed any of these models to a level where one can conduct empirical tests or utilize them for IR system design (Saracevic, 1997; Spink, et. al., 1998). In fact, Ellis (1992) points out that it is difficult to identify "any particular achievement which stands out as exemplar" (p. 52) using the cognitive modeling approach to IR. Almost a decade later, Ellis's statement is still valid. Some of the many cognitive models are discussed and critiqued below.

Traditional IR Model

As presented by Robertson (1977), the traditional IR model contains a system and a user. The system has several information objects that are organized in some manner. The user has an information need that is represented by a query acceptable to the system. The system performs the matching between the query and the information objects, presenting the results to the user. There is a feedback function that allows for the user to modify the query based on the previous results list. Although the traditional model addresses a component of the search process, there are several weaknesses. For example, the model assumes that the query accurately represents the user's information need. The traditional model also fails to consider users' cognitive needs, user behaviors, interactive searching, and user gaps in knowledge (Spink, et. al. 1998).

Cognitive Models of Interactive IR

As end user searching continues to proliferate, several cognitive models specific to interactive IR have been proposed, including those derived from observed user behaviors during the information seeking process. Bates (1979) presents several search tactics grouped as monitoring, file structure, search formulation, and term. Bates suggests that the collection of these tactics represents a model of IR seeking with users adopting different tactics for different information needs or environments. However, similar to the traditional model, these different tactics fail to consider actual user needs, situations, knowledge gaps, and disconnections between the system and user.

Bates (1989) suggests a berry-picking model of information retrieval where the information is scattered around like berries around bushes. The information need is not satisfied by a single set of results but rather by selecting a series of information bits along the way. The information need as represented by the query is continually shifting as the user moves through a variety of information sources. As the user discovers new information, new ideas and directions of search may emerge.

Although anecdotally, one can relate the IR process to this berry-picking model, from a system design perspective, there is not enough detail to develop IR. For example: What is a berry? How is it different from non-berries? How does the user distinguish the berries from the non-berries? What are the causes for the changes in directions? How can these causes be coded? How is the model to be evaluated within the accepted IR metrics of recall and precision?

Cognitive Models of IR in Hypertext Environments

With the Web affecting almost every facet of information seeking, several cognitive models specifically addressing a hypertext environment have emerged. Marchionini (1995) proposes a model, based on the behavioral model of Ellis (1989) but accounting for the browsing aspects of hypermedia environments. In the Marchionini model, the information seeking process is composed of eight sub-processes that develop in parallel

(Marchionini, 1995, p. 49-60). The eight sub-processes are: (1) *Recognize and accept an information problem*, (2) *Define and understand the problem*, (3) *Choose a search system*, (4) *Formulate a query*, (5) *Execute search*, (6) *Examine results*, (7) *Extract information*, and (8) *Reflect, iterate, and stop*. Unlike Ellis's version (1989), this model describes a process rather than independent behaviors; however, the issues of implementation in the design of an IR system still remain.

A web user 'taskonomy' (Byrne, et. al., 1999) has taken a grounded theory approach to classify logical groupings of information seeking tasks on the Web. This model identifies six main categories of user actions within a hypertext environment, which are:

- *Use information*: Read, view, listen, save to disk, duplicate, print, etc.
- *Locate on page*: Something "interesting," related concept, tagged information, etc.
- *Go to page*: Hyperlink, back, forward, bookmark, check history list, provide URL, etc.
- *Provide information*: Search string, shipping address, survey response, etc.
- *Configure browser*: Add bookmark, set helpers, change cache size, scroll, etc.
- *React to environment*: respond to dialog, respond to display change, reload, etc.

Choo and Turnbull (2000) examined information seeking behavior of information managers on the web to develop a model of browsing and searching, and Kalbach (2001) has developed specific design criteria using this web model; nevertheless, how these criteria and suggestions relate to the overarching model is not clear. However, in the end these models of hypertext IR seem more a collection of empirical, grounded theory observations. The suggested design criteria appear to be mainly the application of accepted engineering psychology, human engineering criteria, and software engineering practices.

Stratified Model of IR Interaction

One of the more developed models is the stratified model (Saracevic, 1996). Theoretically, it draws on communication concepts in human – computer interaction and stratification theory in linguistics and communication. The stratified model views the interactive-searching process as a dialogue between participants, which are the user and the computer system. The dialogue is defined as a sequence of events in time toward some result. Each of the participants, user and system, has different levels or strata. Interaction is defined as the interplay between various strata over time. The dialogue occurs within these connected strata, converging at the surface stratum. The exchange of information between participants in the dialogue occurs through an interface at a surface stratum.

Saracevic (1996) discusses three strata for the user, which are: situational, affective, and cognitive. At the situational stratum, the user interacts with the given situation or problem that produced the information need. The results of the search may be applied to a resolution of the information need. The situation was the reason for the interaction to start, and the situation may be ill defined. A user brings given states of knowledge, belief, intent, and motivation to the situation. These states may change during the dialogue.

On the affective stratum, users interact with their intentions and associated elements, such as beliefs, motivations, feelings, desires, and urgency.

At the cognitive stratum, users interact with the documents and information as cognitive structure. Cognitive processes at this stratum include interpretation, judgment, assimilation, relevance, and effects of changes in the state of knowledge. From an IR perspective, relevance is a key element at this stratum.

The strata on the computer side are engineering, processing, and content. The engineering level is the hardware along with the system's operational and design attributes. The processing level focuses on the software, especially the algorithms and approaches that underlie the system's IR processes. The content stratum concentrates on the information resources and their representation as made by the system.

The cognitive, affective, and situational aspects from the user strata and the engineering, processing, and content aspects from the system strata converge at the surface stratum, where the user makes utterances and receives responses through the system interface. At the surface stratum, the user engages in searching, matching, browsing, navigating within and among information resources, and reviewing results. On the system side, the system interacts with the user and provides responses in this dialogue. As the dialogue progresses, the situation at the surface stratum changes as new search terms are added, old tactics abandoned, and new tactics utilized.

The strength of the stratified model, relative to other cognitive models in IR, is that it decomposes the interactions into different strata, and it simultaneously separates the different participants within each stratum. This method of decomposition permits the design characteristics to be more easily developed once each of the various components are isolated. One can view each component as a separate object with its own set of characteristics, which lends itself to coding and component design. Saracevic (1997) points out that a weakness of the stratified model, however, is the decomposition of the various strata.

Certainly decomposition is difficult at the cognitive, affective, and situational strata. However, what occurs at these strata may have little impact on the search process if it is not expressed at the surface stratum. From a system design view, concentrating on the actions that occur at the surface stratum and then relating these back to cognitive and situational levels may in part circumvent this shortcoming of the model. In the research reported here, the concentration for refinement of the stratified model is on these utterances at the surface stratum.

Conceptual and Theoretical Framework

Further development of the stratified model in order to aid IR system design must address at least three questions, which are modifications of questions raised by (Saracevic, 1996):

(1) What are the interactions occurring at the surface stratum?
(2) What do these interactions indicate about the cognitive, affective, and situational aspects of the user?
(3) How can the system utilize these interactions to improve performance?

With respect to question one, at the surface level, the stratified model currently focuses almost exclusively on the query, although mention is made of other interactions. This focus is similar to other cognitive models. For example, in the cognitive model (Ingwersen, 1992), the query is the exclusive exchange at the interface level. The stratified model also implies the dominance of the query by referring to 'utterances' at the surface level. In (Saracevic, 1997), the query is the only element depicted that summarizes elements from other strata of the user, and Saracevic states that the "query is the most important aspect of user modeling" (Saracevic, 1997, p. 323). However, investigations at the surface stratum can concentrate on other interactions between the user and the system.

Reviewing empirical studies of interactive searching, one finds the query only one of many actions that the user takes when interacting with information objects. Marchionini (1995) notes that the user examines results and extracts information. Byrne et al. (1999) notes that the user takes several actions, including reading, viewing, listening, saving, duplicating, and printing. In a hypertext environment, the user also goes back, goes forward, bookmarks, and views the history list. These actions are expressions of the user's reaction to the information the system presents. Some expressions may be positive; others negative; others neutral, and other actions may express states of uncertainty. There are some actions that obviously stand out as positive expressions of the relevance of the information presented. These include bookmark, copy, duplicate, print, and save.

If the IR system could utilize these positive expressions of relevance at the surface stratum, both the document that caused the expression and the query that presented the information object, the system would have additional information to assist the user in locating other relevant information. This assistance could include offering searching advice or suggesting other documents that match the query, among many other types of asssitance. If desired, the user could review and process this system-provided information, which could perhaps change elements at the user's cognitive, affective, and situational strata.

This is the approach taken in this research. The aim is to design an IR system that monitors for positive expressions or utterances of relevance by the user concerning the information presented during the search process. Based on these positive utterances, the system then presents to the user courses of action, also utterances, to satisfy the user's information need.

Research Design

We utilize the agent paradigm to imbue a fully functional IR system, MG (Witten, Moffat, &Bell, 1994) with (1) the ability to monitor user utterances at the surface stratum and (2) the ability to make utterances to the user on courses of action to improve the search process.

Interactive sessions between searchers and IR systems are typically extremely short both in terms of the number of queries and time (Silverstein, et. al., 1999) and user interests are extremely varied (Jansen, Spink, and Saracevic, 2000). A method of rapidly recording the user's utterances, drawing inferences from these actions, and presenting utterances back to the user was needed.

To accomplish these aims, a technique used in adaptive hypermedia systems in which the user's information need is represented by of a set of pairs (*c*, *v*) where *c* is a concept and *v* is a value (Eklund & Brusilovsky, 1998) is modified. A concept is an idea, a subject, a preference, a submission or a topic. A value is a measure that associates the user to that concept, such as a Boolean or a numeric indicator.

This approach is altered for use in extending the stratified model. A series of action - object pairs (*a*, *o*) represents a user's pattern of utterances during a session. The agent currently monitors the surface level for five actions (*a*), stated as *a* is an element from the set {bookmark, copy, print, save, submit}. There are currently three objects (*o*) that the agent recognizes, stated as *o* is an element from the set {documents, passages from documents, queries}.

The valid object in the *(a, o)* pair varies with the type of action. Document objects are applicable to the actions of bookmark, print, and save. Passage objects are applicable to the action copy, and query objects are applicable to the action submit. For example, if a user bookmarks a file (e.g., Readings in IR), the *(a, o)* pair would be (*bookmark Readings in IR*). The agent records the series of *(a, o)* pairs during a session, and then offers assistance based on the series of *(a, o)* pairs recorded. Using this approach, one can model the user's information desires relatively rapidly.

Assistance Offered by the Agent

It was necessary at this stage of the research to narrow the agent's assistance, given the scores of user – system interaction issues (Borgman, 1996; Yee, 1991). The agent focuses on five areas of assistance, which are modifications to query structure, spelling corrections, synonyms and term context, changing the query to either increase or decrease the results list, and term relevance feedback. The agent communicates with the user via an interface button. The user can view the agent information or ignore the feedback notification with no impact on the normal operation of the IR system.

Empirical Test

To evaluate whether or not the utilization of utterances at the surface level could improve system performance, the performance of the MG system and the MG – agent system was contrasted. No MG code was modified to integrate the agent other than establishing the application program interface. The MG and the MG-agent system ran on the same computer, displayed the identical interface, and utilized the same document collection. Both systems were installed on a SPARC book 3 running Solaris 2.5. The subjects for the evaluation were 30 freshman college students, 26 males and 4 females. The document collection utilized for the testing was the Text Research Collection (TREC), volumes number 4 and 5, which are approximately 2GB in size and contain approximately 550,000 documents.

Viewing this evaluation as a preliminary evaluation, two TREC topics were chosen, *Number 301: International Organized Crime* and *Number 340: Land Mine Ban*. There were 555 relevant documents (1%) in the collection. For this research, the interest was the agent's effect on precision within the top 20 ranked documents. Thus, if more than 20 documents were returned for a particular query, documents numbered 21 and higher in the results list were ignored. If the query returned fewer than twenty documents, that number was utilized to calculate precision for that particular query.

The 30 subjects utilizing the two search topics and both IR systems generated 175 unique queries. There were 81 unique queries executed on the MG system and 94 unique queries executed on the MG – agent system. Each session was five minutes in duration. All searchers utilized the agent feedback at least once during the session. Precision for each set of unique queries executed on each system was calculated and analyzed, utilizing the documents that the user identified as relevant and the TREC relevant documents. Our analysis revealed a difference between the two sets of queries (paired $t = -3.417$; $p < 0.01$), with the precision of the MG – agent system performing significantly better than the precision performance of the base system. However, the performance of both systems was less than desirable (precision = 10% for the MG and 30% for the MG –agent system). Further evaluation will be needed for statistically meaningful results (e.g., more topics, longer sessions, etc.).

Conclusion and Significance of Research

In refining the stratified model, utterances at the surface stratum that shed light on the cognitive, affective, and situational strata during the information retrieval process were identified. An IR system was successfully modified to use these surface utterances to assist the user in the search process. The (*a*, *o*) development technique permitted the extrapolation of user notions of relevance based on utterances at the surface stratum. Utilizing the (*a*, *o*) pair model, the agent provides this searching assistance solely from using the normal actions of a searcher during the session. The user performs no additional actions during the search process to obtain this assistance. Evaluation of the modified system demonstrates that implementation of the stratified model may be a feasible avenue of research and may lead to improved support of IR systems during the searching process.

The next step is to refine the types of assistance provided and relate specific utterances to specific information needs. The danger is in increasing the type of searching assistance too much. Although one might assume that as searching features increased so would system performance, Saracevic and Kantor (1988) have shown that the increased use of advanced features may have an adverse effect on search performance.

The (*a*, *o*) pair model of user system interaction is being refined. Jansen, Spink, and Saracevic (2000) classified search–user interactions on a web system and isolated sequencing of action. Spink, Jansen, and Ozmultu (2000) also examine the sequence of users actions on web systems, focusing on relevance feedback. By relating these utterances to the cognitive, affective, or situational strata, the hope is to further develop the (*a*, *o*) pair model to identify session patterns in addition to individual utterances during a session.

The research presented in this article is the first step in implementing a cognitive model of interactive IR. Overall, the results of the research conducted so far are promising. They indicate that the stratified model of IR can be refined to a granularity that can positively affect system design. Using this model in conjunction with advanced computer technology, IR systems can become active participants in the information-seeking dialogue.

REFERENCES

Bates, M. (1979). Information Search Tactics. *Journal of the American Society for Information Science*, 205 – 214.

Bates, M. (1989). The design of browsing and berrypicking techniques for the online search interface. *Online Review, 13*, 407-424.

Belkin, N., Cool, C., Stein, A. and Theil, S. (1995). Cases, Scripts, and Information-Seeking Strategies: On the Design of Interactive Information Retrieval Systems. *Expert Systems With Applications*, *9*(3), 379-395.

Borgman, C. (1996). Why are online catalogs still hard to use? *Journal of the American Society for Information Science*, *47*(7), 493-503.

Byrne, M., John, B., Wehrle, N., and Crow, D. (1999). The tangled web we wove: A taskonomy of www use. *Human Factors in Computing Systems: Proceedings of CHI 99*, 544-551.

Choo, C. and Turnbell, D. (2000). Information seeking on the web: An integrated model of browsing and searching. *First Monday, 5*(2). Retrieved from the World Wide Wed on 6 November 2001. Available at http://firstmonday.org/issues/issue5_2/choo/index.html.

Eklund, J. and Brusilovsky, P. (1998). The Value of Adaptivity in Hypermedia Learning Environments: A Short Review of Empirical Evidence. *Proceedings of the Ninth ACM Conference on Hypertext and Hypermedia Hypertext'98*, 13-19.

Ellis, D. (1984). Theory and Explanation in Information Retrieval. *Journal of Information Science*, *8*, 25 – 38.

Ellis, D. (1989). A behavioural model for information retrieval system design. *Journal of information science, 15* (4/5), 237-247.

Ellis, D. (1992). The Physical and Cognitive Paradigms in Information Retrieval Research. *Journal of Documentation*, *48*(1), 45 – 64.

Ingwersen, P. (1996). Cognitive Perspectives of Information Retrieval Interaction: Elements of a Cognitive IR Theory. *Journal of Documentation*, *52*(1), 3-50.

Jansen, B. and Pooch, U. (2001). A Review of Web Searching Studies and a Framework for Future Research. *Journal of the American Society for Information Science, 52*(3), 235-246.

Jansen, B., Spink, A., and Saracevic, T. (2000). Real life, real users, and real needs: A study and analysis of user queries on the web. *Information Processing and Management*, *36*(2), 207-227

Kalbach, J. (2001). Designing for Information Foragers: A Behavioral Model for Information Seeking on the World Wide Web. *Internetworking, 3*(3). Retrieved from the World Wide Wed on 6 Nov. 2001. Available at http://www.internettg.org/newsletter/dec00/article_information_foragers.html

Marchionini, G. (1995). *Information seeking in electronic environments*. Cambridge, Eng.: Cambridge University Press.

Ritter, F., Baxter, G. Jones, G. and Young, R. (2001). Supporting Cognitive Models as Users. *ACM Transaction on Computer – Human Interaction*, *7* (2), 141 – 173.

Robertson, S. (1977) Theories and models in information retrieval. *Journal of documentation*, 33, 126-148.

Saracevic, T. (1996). Modeling Interaction in Information Retrieval (IR): A Review and Proposal. *Proceedings of the Annual Meeting of the American Society for Information Science*, *33*, 3-9.

Saracevic T. (1997). Extension and Application of the Stratified Model of Information Retrieval Interaction. *Proceedings of the Annual Meeting of the American Society for Information Science*, *34*, 313-327.

Saracevic, T., and Kantor. P. (1988). A study of information seeking and retrieving. II. Users, questions and effectiveness. *Journal of the American Society for Information Science, 39*(3), 177-196.

Saracevic, T., Kantor, P., Chamis, A. Y., and Trivison, D. (1988). A Study of Information Seeking and Retrieving: I. Background and Methodology. *Journal of the American Society for Information Science, 39*(3), 161-176.

Saracevic, T., Mokros, H., Su, L. and Spink, A. (1991). Interaction Between Users and Intermediaries During Online Searching. *Proceedings of the 12th Annual National Online Meeting*, *12*, 329-341.

Silverstein, C., Henzinger, M., Marais, H. and Moricz, M. (1999). Analysis of a Very Large Web Search Engine Query Log. *SIGIR Forum, 33*(1), 6 -12.

Spink, A. and Saracevic, T. (1997). Interaction in Information Retrieval: Selection and Effectiveness of Search Terms. *Journal of the American Society for Information Science*, 48(5), 382-394.

Spink, A., Jansen, B. J., and Ozmultu, C. (2000). Use of query reformulation and relevance feedback by Web users. *Internet Research - - Electronic Networking Applications and Policy, 10*(4), 317 - 328.

Spink, A., Wilson, T., Ellis, D. and Ford, F. (1998). Modeling Users' Successive Searches in Digital Environments. *D-Lib Magazine*. April 1998.

Strauss, A. and Corbin, J. (1990). *Basics of Qualitative Research: Grounded Theory Procedures and Techniques*. Newbury Park, CA: Sage Publications.

Witten, I., Moffat, A., & Bell, T. (1994). *Managing Gigabytes*. Van Nostrand Reinhold: New York.
Yee, M. (1991). System Design and Cataloging Meet the User: User Interfaces to On-line Public Access Catalogs, *Journal of the American Society for Information Science, 42*(2), 78-98.

Using Advanced Search Operators on Web Search Engines

Bernard J. Jansen
School of Information Sciences and Technology
The Pennsylvania State University
001 Thomas Bldg
University Park, PA, 16801, USA
Phone: 814-865-6459 Fax: 814-865-6426
Email: jjansen@acm.org

Abstract Studies show that the majority of Web searchers enter extremely simple queries, so a reasonable system design approach would be to build search engines to compensate for this user characteristic. One hundred representative queries were selected from the transaction log of a major Web search service. These one hundred queries were then modified using the complex search operators supported by 5 major search engines. Overall, 1900 queries were submitted to five Web search engines, returning 18,256 documents. The results obtained using the complex queries from each search engine were compared to the results obtained by the original 100 simple queries from that search engine. In general, increasing the complexity of the queries had moderate effect on the results, with an average 66% exact match between results from the simple and complex queries. Implications on the effectiveness of current Web search services, for future search engine design and for future research are discussed.

Introduction

Searchers rarely use advanced techniques, such as Boolean operators or phrase searching, (Borgman, 1996) when using information retrieval (IR) systems. This characteristic has been especially true for Web searchers, with the vast majority of Web queries containing no advanced query techniques. Several Web studies have noted this near absence of complex query operators (e.g., AND, OR, NOT, must appear operators, paraphrases, etc.) in Web queries (Hoelscher, 1998; Jansen et al., 2000; Keily, 1997; Silverstein et al., 1999). The use of Boolean operators, typically about 8%, in these Web searching studies is lower than the rates reported in studies of searchers using traditional IR systems such as DIALOG or LEXIS/NEXIS, sometimes substantially. For example, Siegfried et al. (1993) reported Boolean usage of over 36% on the DIALOG system, which the researchers considered a low rate of usage.

Many IR professionals would probably say that the correct use of advanced searching operators would increase the effectiveness of Web searches. Advanced searching techniques are well known, and one can find numerous articles and books on advanced searching strategies (Korfhage, 1997), tutorials on searching training (Sullivan, 2000), and numerous educational courses on searching strategies. Many of these techniques (e.g., phrase searching and must appear operators) are easy to employ. However, based on the Web searching studies, it appears that the majority of Web searchers continue to use very simple queries, with little to no use of advanced searching operators. These searchers seem to be employing an ineffective and inefficient strategy for finding information.

This line of reasoning leads to the to the question: Why aren't Web searchers using more advanced queries? Some researchers have stated that Web searchers are just lazy (Kapur and Zhang, 2000) or that there is a design flaw with Web search engines (Clark, 2001).

Neither of these assertions seems likely. Studies and data suggest that Web users may be finding the information they want using these simple queries. A survey of users on a major Web search engine reports that almost 70% of the searchers stated that they had located relevant information on the search engine (Spink et al., 1999). Additionally, Web search engines continue to attract large numbers of Web searchers. Of the top ten Web sites in terms of number of visitors, in June 2000, eight were Web search engines (CyberAtlas, 2000), implying at least that search engines are the best alternative available for finding information on the Web. Obviously, something is amidst. Web searchers are not utilizing advanced searching operators, but they appear to be finding information using a technique that should be ineffective or at least inefficient. Although Web search engines are providing seemingly naive methods for searchers to employ, they still continue to attract a large number of customers.

To shed some light on these apparent paradoxes, we investigate the effect of complex queries (i.e., those using advanced syntax, such as Boolean operators) on the results retrieved by Web search services relative to the results retrieved by simple queries (i.e., those with no advanced syntax). Our research aim is to investigate (1) what would the effect on search engine results be if Web searchers used more advanced searching techniques, (2) whether or not the use of complex queries would be helpful for the typical Web and (3) by implication, whether or not Web search engines are somehow compensating for the simple searching techniques of Web users. We present an overview of Web searching, the study methodology, and research results from various perspectives, followed by conclusions.

Research Design and Methodology

Overview

One hundred queries were randomly selected from a transaction log of a major Web search engine. These hundred original queries, referred to as simple queries, contained no advanced query operators. Each simple query was initially submitted to a Web search engine; the query was then modified using an advanced query operator supported by that particular search engine. The results from the complex query were then compared and contrasted to the results from the simple query. The query was modified for each advanced query operator supported by the search engine. The modified queries are referred to as complex queries. The process was repeated for each of the 100 simple queries. This entire process was performed on five Web search engines.

Selection of Queries

Key to the success of this research was the selection of queries that accurately reflected the structure of Web queries. Research shows that Web queries generally have two terms (Jansen et al., 2000; Silverstein et al., 1999), cover a variety of topics (Wolfram, 1999), and are primarily noun phrases (Jansen et al., 2000; Kirsch, 1999). These criteria were used in selecting queries from an Excite search service transaction log. Specific Web query lengths reported by Jansen et al. (2000) are listed in Table 1.

Table 1: Query Length.

Terms in query	Number of queries	Percent of all queries
More than 6	1018	2
6	617	1
5	2,158	4
4	3,789	7
3	9,242	18
2	16,191	32
1	15,854	31
0	2,584	5
Total	51,453	100

The mean for query length (i.e., the number of terms in the query) was 2.21 terms with a standard deviation of 1.05 terms. These statistics are in line with those reported by other Web studies (Kirsch, 1999; Silverstein et al., 1999).

Based on the general distribution from Table 1, the queries of the following lengths were selected for this study: 10 queries of 4 terms, 31 queries of 3 terms, and 59 queries of two terms. The terms from the original queries were all lower case. Queries were selected to ensure a variety of topics since it has been reported that some search engines specialize in certain subjects (Neilsen/NetRating, 2000). Queries that appeared on the popular query lists (Searchwords, 2000) or that referenced popular entertainers, popular locations, popular songs, etc. were eliminated since Web search engines sometimes cache results from these highly queried topics (Lesk et al., 1997). For similar reasons, all queries that were obviously queries for pornography were eliminated. These goals and constraints were the guidelines for selecting the 100 queries.

Along with selecting the queries, there was also the question of what results to compare. Studies show that most Web searchers, usually about 80%, never view more than ten results (Hoelscher, 1998; Jansen et al., 2000; Silverstein et al., 1999). Based on this overwhelming evidence of Web searcher behavior, only the first ten results in the results list were selected for comparison. Moreover, we examined these results only for changes in the first ten results; relevance judgments were not made concerning the results. The ability of Web search engines to successfully retrieve relevant documents has been investigated several times (Leighton and Srivastava, 1999; Zumalt and Pasicznyuk, 1998).

Searching Environment

Many Web sites offer searching capabilities; however, this research focuses specifically on Web search engines. Search engines are the major portals for users of the Web, with 71% of Web users accessing search engines to locate other Web sites (CommerceNet/Nielsen Media, 1997). One in every 28 (3.5%) pages viewed on the Web is a search results page (Alexa Insider, 2000). Search engines are, without a doubt, the major IR systems of the Web. There are approximately 3,200 search engines on the Web (Searchengine Watch, 2000); however, only a handful of these dominate the market in terms of Web traffic. Among the better known, and those utilized in this research, are Alta Vista, Excite, FAST Search, GoTo, and Northern Light.

Searching Rules

These five search engines offer a variety of advanced searching options. Some searching options are available from each search engine's main search page. For other searching options, one must go to a 'power' searching page. For this research, only those advanced searching options available from the search engine's main page were utilized. Of the five search engines, two offer four advanced search options (+, ", AND, and OR) from the main page. Three search engines offer two advanced searching options (+, and "). All of the search engines offer dropdown boxes (e.g., language of results, document collections to search) for refining the search. When dropdown boxes were present on the main search page, the default options were utilized.

Research Structure

Each of the 100 original queries was submitted to the five search engines for a total of 500 queries. The query was then modified with the advanced searching operators supported by the various search engines. The entire process, of submitting the simple and advance queries, took 5 minutes or less. For example, the simple query *palomino horse breeder association* could be modified using the must appear operator *(+palomino +horse +breeder +association)*, phrase searching operator (*"palomino horse breeder association"*), the AND operator (*palomino AND horse AND breeder AND association*), and the OR operator (*palomino OR horse OR breeder OR association*). These modified queries are the complex queries.

Results

Of the simple queries, 498 returned at least 10 results. One query returned 3 results, and one query returned no results. Therefore, there were 4983 results to use as the baseline (i.e., 498 x 10 + 3). As mentioned earlier, results that appeared higher than 10 in the results list were not utilized.

There were a total of 1400 complex queries submitted. With each search engine offering different search options, the number of complex queries varied for each search engine, as outlined in Table 2.

Table 2: Number of Queries by Search Engine and Operator.

Search Engine	**Total Number of Queries**	**Number of Simple Queries**	**Number of Complex Queries**	**Search Options Supported and Number of Queries**			
				+	**"**	**AND**	**OR**
Alta Vista	300	100	200	100	100		
Excite	500	100	400	100	100	100	100
FAST Search	300	100	200	100	100		
GoTo	300	100	200	100	100		
Northern Light	500	100	400	100	100	100	100
Total Queries	1900	500	1400	500	500	200	200

From Table 2, all search engines supported the must appear (+) and phrase searching (") operators for a total of 1000 queries. Excite and Northern Light support the Boolean operators AND and OR for a total of 400 queries. Submission of each set of queries on a given search engine took about 5 to 10 minutes. Therefore, the opportunity for the index on a given search engine to change during the test was limited.
Table 3 presents data on the number of results returned.

Table 3: Results from Complex Queries Results

Number of Results	**Number of Occurrences**	**Number of Results**
10	1,325	13,250
9	0	0
8	2	16
7	1	7
6	5	30
5	1	5
4	4	16
3	2	6
2	3	6
1	13	13
0	44	0
Total	1,400	13,349

Of the 1400 complex queries, 1325 returned ten or more results. There were 31 queries that returned fewer than ten results but more than zero results. There were 44 queries that returned no results. Altogether, there were 13,349 results returned by the complex queries. Combined with the 4,983 results from the simple queries, a total of 18,332 results were used in the analysis.

The match had to be exact when comparing the results between the simple and complex queries; that is, the documents listed had to be the identical page at the same site. Different pages from the same site were not counted as matches. The identical pages at different sites were not counted as matches. Furthermore, if results appeared in both lists but in a different order, they were counted as matches as long as both were displayed in the first ten results.

Simple Versus Complex Query Comparison

The aggregate results of the analysis of the 18,256 results are displayed in Table 4.

Table 4: Comparison of Simple versus Complex Queries on Major Web Search Engines.

Category	Average Number of Results that Appear in Baseline	Standard Deviation	Mode	Paired sample t
Simple Queries	9.99	0.03	10	-
Complex Queries	6.55	3.77	10	40.287
				p < 0.01

The baseline mean for the simple queries was 9.99, and the mean for the complex queries was 6.55. This means that, on average, 6.55 of the ten results retrieved by the complex queries also appeared in the baseline results for the corresponding simple query on that search engine. The results were analyzed using a paired sample t test, as reported in Table 4. The analysis revealed a significant difference between the two groups ($t=40.287$; $p<0.01$).

Results by Search Engine

A comparison was conducted for each search engine. These results are displayed in Table 5.

Table 5: Comparison of Results by Search Engine.

Search Engine	Mean of Simple Queries	Average Number of Results that Appear in Baseline	Standard Deviation	Mode	Paired sample t
Alta Vista	10	4.5	4.2	10	18.143
Excite	10	7.8	3.8	10	12.304
FAST Search	10	7.1	3.7	10	10.759
GoTo	9.93	8.4	2.8	10	7.704
Northern Light	10	5.4	3.9	10	23.433
					p < 0.01

From examining Table 5, we can see that Excite, FAST Search, and GoTo will on average return approximately seven to eight identical results, regardless of whether the query is simple or complex. The means for Alta Vista and Northern Light are lower at approximately four and five, respectively. Alta Vista has the largest standard deviation at 4.2. The modes of all five search engines were ten. The results from each search engine were analyzed using a paired sample t test, reported in Table 5. The analysis revealed a significant difference between the groups of simple and complex query results for all search engines.

Discussion of Results

The 100 original queries used for this research structurally represent the majority of Web queries that are more than one term. These 100 queries were submitted to five search engines. These queries were modified with advanced searching operators and also were submitted to the same five search engines. Approximately 66% of the results were identical regardless of how the searcher entered the query. Referring to the data displayed in Table 4, a paired sample t-test ($t= 40.287$, $p<0.01$) shows that the results from the simple queries are significantly different from the results for complex queries. However, as with all tests of statistical significance, one must ask what different does this make in the 'real world'?

Does it make sense to learn and utilize the more complex searching operators if on average it is only going to present the searcher with about three or four results that are different from those retrieved by just entering the query terms? Are the three or four different results worth the increased probability of entering a complex query incorrectly? As the complexity of queries increases, so does the probability of error.

The findings of this research suggest that the use of complex queries is generally not worth the trouble for the typical Web searcher (i.e., who uses two terms and is interested only in the first ten results). Based on their conduct, it appears that most Web searchers do not think it is worth the trouble either. One can say that the behavior of Web searchers adheres to the principle of least effort (Zipf, 1948), which postulates that there are "useful" behaviors that are quick and easy to perform. The very existence of these quick, easy behaviors causes individuals to choose them, even when they may not necessarily be the best behavior from a functional point of view. However, these useful behaviors are good enough, and people will generally expend the least amount of effort to achieve what they want. Zipf's theory can explain the behavior of Web searchers. The results obtained from Web search engines via simple queries are good enough. In IR jargon, the precision of simple Web queries meets the information needs of most Web searchers.

The use of simple queries versus complex queries is also compelling when one compares the modes presented in Table 4. The modes for the simple and the complex queries are both 10, meaning that more than any other occurrence, the results from a simple and complex queries will be the same.

Naturally, we acknowledge that there are cases where one is interested in all possibly relevant results. In these cases, the three or so new results may be worthwhile. Even in these cases, it would make sense to enter the simple query as well as the complex queries. Nevertheless, this type of information need, where one is interested in recall as well as precision, does not appear to be the typical information need for Web searchers. Not only are Web queries short and simple and the number of results viewed small, but the session length (the number of queries submitted during a session) of the typical Web searcher is one or two queries (Jansen and Pooch, 2000), reinforcing the notion that Web searching is a precision-based service. By their characteristics, the typical Web search does not represent a recall-based information need.

In reviewing the analysis by search engine, outlined in Table 5, there was a great deal of overlap between query results for most search engines, ranging from 45% for Alta Vista to 84% for GoTo. The mode for all five search engines was ten. Studies and presentations show that the failure rates among Web searchers using advanced syntax are high (Jansen et al., 2000). Why give searchers the opportunity to make mistakes? This rule seems to be the tactic followed by FAST Search and GoTo, which both limit the searcher's options. It also appears to be the tactic pursued by Excite where at least 78% of the results are identical, regardless of the present or absence of advanced searching operators.

These results would seem to indicate that system designers have developed the Web search engines so as to minimize the need to utilize advanced searching operators. Web searchers seldom utilize advance searching techniques, so designing IR systems to account for this characteristic seems like a reasonable course of action.

Concerning the lower mean of Alta Vista (4.5), it appears that this search engine uses a different ranking algorithm when the must appear operator (+) is used. Based on the rather random results retrieved with this operator, Alta Vista may adhere to the theoretical model of no ranking feature when Boolean-like operators are used in a query.

Conclusions and Future Research

This research indicates that use of complex queries appears to have a moderate impact on the results retrieved. On average, approximately 66% of the top ten results will be the same, regardless of how the query is entered. The approximately three or four different results on average may not be worth the increased effort required to learn the advanced searching rules or the increased risk of making a mistake. One can say that the typical Web searcher is adhering to a reasonable course of action by entering simple queries when using Web search engines.

These results also indicate that Web search engine designers are doing a proper job of designing Web interfaces and ranking algorithms. Given that the typical web searcher seldom uses advanced operators, web search engines are to be compensating for the naïve the searching characteristics of their customers. Based on the results of this research, one can conjecture that the ranking algorithms of these search engines adhere, albeit loosely, to the following rule: *Place those documents that contain all the query terms and that have all the query terms near each other at the top of the results list.* Naturally, this is an over simplification of the complexity of searching and ranking algorithms. However, a ranking rule like this, the use of or lack of use of advanced search operators would have little impact on the results at the top of the list.

There are several avenues for future investigation. One would be to examine the effect of longer queries. The research from this study focused on the dominant behavior of Web searchers, short queries (generally about two to four terms) and viewing ten or fewer documents. It would be interesting to see if these same results hold as the query length increases. The present study would indicate that the results would not hold for query length, based on the observed decline in overlapping results in four-term queries relative to two-term queries. However, the impact in terms of explaining Web searching behavior would be less, addressing only about 7% of Web searching. Also, more discrimination would need to be made in what advanced searching operators to utilize. For example, one can make a case that the use of phrase searching might decline as the query length increased. It would also be interesting to see if these same results hold as the number of results viewed increased.

Returning our research questions, it appears that the increased usage of advanced searching techniques by Web searchers has only moderate effect on the results from Web search engines. Therefore, the use of these operators by Web searchers may not be that helpful. It also appears that the designers of Web search engines understand the searching patterns of their typical customers and are designing IR systems to compensating for the simple searching techniques of Web searchers.

References

Alexa Insider. 2000.. Alexa insider's page. Available at: http://insider.alexa.com/insider?cli=10. (30 March 2000).

Borgman, C. 1996. Why are online catalogs still hard to use? *Journal of the American Society for Information Science. 47*, 7, 493-503.

Clark, P. 2001. Solving Internet Overload. The Net Economy, 2, 3. (Note: Published electronically with no page numbers at www.theneteconomy.com.)

Commerce Net/Nielsen Media. 1997. Search engines most popular method of surfing the Web. Available at: http://www.commerce.net/news/press/0416.html (30 August 2000).

Hoelscher, C. 1998. How Internet experts search for information on the Web. Proceedings of the *World Conference of the World Wide Web, Internet, and Intranet, Orlando, FL. July 1998.* Association for the Advancement of Computing in Education. (Note: Published on CD-ROM with no page numbers.)

Jansen, B., Spink, A., Batemen, J., & Saracevic, T. 1998. Real life information retrieval: a study of user queries on the Web. *SIGIR Forum, 32*, 1, 5 - 17.

Jansen, B., & Pooch, U. 2001. Web user studies: a review of and framework for future research. *Journal of the American Society for Information Science. 52*, 3, 235 - 246.

Jansen, B., Spink, A., & Saracevic, T. 2000. Real life, real users, and real needs: A study and analysis of user queries on the web. *Information Processing and Management. 36*, 2, 207-227.

Jones, S., Cunningham, S. & McNab, R. 1998. Usage analysis of a digital library. Proceedings of the *Third ACM Conference on Digital libraries, Pittsburgh, PA.* June 1998. 293 - 294.

Keily, L. 1997. Improving resource discovery on the Internet: the user perspective. *21th International Online Information Meeting, London, UK*, Learned Information Europe Ltd. 205 – 212.

Kirsch, S. 1998. The future of Internet search (keynote address). Paper presented at the 21st Annual International ACM SIGIR Conference on Research and Development in Information Retrieval, Melbourne, Australia. Available at: http://www.skirsch.com/stk.html/presentations/sigir.ppt (16 August 1999).

Korfhage, R. 1997. *Information Storage and Retrieval*. New York, NY: Wiley.

Leighton, H., & Srivastave, J. 1999. First 20 Precision among World Wide Web search services (search engines), *Journal of the American Society for Information Science*, *50*, 1, 870-881.

Lesk, M., Cutting, D., Pedersen, J., Noreault, T., & Kolli, M. 1997. Panel Session on "real world" information retrieval. *SIGIR Forum*, *32*, 1, 1 - 4.

Nielsen/Netrating 2000. Top Web Properties. Available at: http://www.nielsen-netratings.com/ (11 August 1999).

Searchwords.com 2000. Top Search Words. Available at: http://www.searchwords.com (30 May 2000).

Siegfried, S., Bates, M., & Wilde, D. 1993. A profile of end-user searching behavior by humanities scholars: the Getty online searching project report no. 2. *Journal of the American Society for Information Science*, *44*, 5, 273-291.

Silverstein, C., Henzinger, M., Marais, H. & Moricz, M. 1999. Analysis of a very large Web search engine query log. *SIGIR Forum*, *33*, 1, 6 -12.

Spink, A., Bateman, J., & Jansen, B. 1998. Searching heterogeneous collections on the Web: behavior of Excite users. *Information Research*, *4*, 2, 317 – 328. Available at: http://www.shef.ac.uk/~is/publications/infres/paper53.html (30 August 2000).

Spink, A., Wolfram, D., Jansen, B., & Saracevic, T. 2001. The public and their queries. *Journal of the American Society for Information Science*. *52*, 3, 226 - 234.

Wolfram, D. 1999. Term co-occurrence in Internet search engine queries: An analysis of the Excite data set. *Canadian Journal of Information and Library Science*. *24*, 2/3, 12-33.

Zapur, K. & Zhang, J. 2000. Searching the Web Using Synonyms and Senses. WebNet *Journal: Internet Technologies, Applications & Issues*. *2*, 3, 54 – 61.

Zumalt, J. & Pasicznyuk, R. 1998. The Internet and reference services: a real-world test of Internet utility. *Reference and User Services Quarterly*, *38*, 2, 165 – 172.

Facing the Unknown: Distributed Project Team Guidelines

Abstract

Teams working in distributed projects go through the same stages and encounter the same problems as typical face-to-face teams. The main difference when the environment is moved to a distributed setting is that some problems become more complex, other problems become less noticeable, and some new obstacles occur. One of the main problems with distributed work is getting to know each other and build trust. But there are other, more practical issues that also need to be dealt with when you are working together at a distance. In this article we present a set of guidelines developed from research with various distributed project based courses. Our conclusions are that students are not conscious of the difficulties of distributed communication and collaboration. They need guidance in resolving and avoiding common problems.

Background

We have conducted research in three different graduate courses, on five occasions, from 1999- 2001. The courses were held at Stanford University (USA) and KTH (Sweden), and in some cases with involvement from NUS (Singapore) and TMIT (Japan). The participant have mainly been engineering students, but there were a few business students in one of the courses. The students participated in globally distributed projects and collaborated by using ICT.

The research was conducted by observing teamwork, meetings, classes, etc., by conducting focus groups and interviews with faculty, students, and other people involved with the courses, through formal written surveys, and through an analysis of student papers about lessons learned during the collaborations.

It is normally easier to work together if you are co-located and see each other face-to-face regularly. Nardi and Whittaker (in press) argue that face-to-face communication will persist not only because it provides rich information, but also because it is the surest way to establish and nurture the human relationships that underlie business relationships. The relationships are grounded in social bonding and expressions of commitment that are most easily accomplished through face-to-face communication.

Cheesman and Heilesen (1999) point out that a real life meeting is hard to replace with photos, CVs, home pages and the like. All of the examples that they give are static ways of giving information about yourself, though, and do not really give any opportunities for team members to interact. Synchronous activities that involve virtual interactions may have richer results, although they may never fully replace in-person meetings. And even if pictures and biographies do not replace face-to-face interactions, they can still be valuable for helping teammates get to know each other better.

In the case of distributed team work, in-person meetings may not be possible, due to limited budgets or time. Problems arise due to the confusions that come from not seeing, knowing, and/ or trusting distant project participants. However, with simple means it should be possible to decrease some of the most common problems and make distributed teamwork easier to handle. It is interesting to consider whether it possible to work together without meeting at all. How might a team better handle working in projects at a distance? What concerns should be addressed, and what are the most important differences and difficulties that need to be solved?

Some researchers have their doubts about whether distributed teams will ever reach the same level of collaboration as face-to-face teams, that collaboration requires collective action, and such action is unlikely in virtual teams. Knoll and Jarvenpaa conducted a study with students in distributed teams without any face-to-face interaction. They found that a majority of the teams took collective action and that distance collaboration without face-to-face meetings can not only work, but can also be very successful. It just takes some extra effort to get it started.

One of our initial research interests was to examine whether it was possible to work together in a project at a distance without meeting at all. However, all teams that were observed eventually choose to meet in person. All teams emphasized the huge improvement the face-to-face meeting had on their project work. Interestingly, none of the teams put any real effort into trying to get to know each other and make the collaboration work before meeting. Thus from this research, while we show further evidence that face-to-face meetings make distributed teamwork easier, we are not able to prove whether there are other ways to achieve the same goals.

Even though meeting face-to-face helped the teams work together, they still had problems. Many of these problems could have been solved before they met. Simply discussing the specific difficulties that accompany distributed work at the outset, would have made collaboration much easier. We therefore gathered some concrete distributed team suggestions, to help the students become more aware of the problems they might encounter, avoid some of them, and help them know how to get started in this new situation.

The problems we found might seem obvious and easily solved, but our research has shown that they are often not initially observed or understood by team participants. The interesting thing is that these problems seem to recur and were noticeable in all the teams observed. None of the problems are impossible to avoid and they are easier to overcome if considered and discussed early in a project. We therefore believe that the following suggestions can be of use for distributed teams in general.

Even if you set up norms, rules, and guidelines, it doesn't necessarily mean that you have improved the collaboration. Knoll and Jarvenpaa conducted two studies where the students in one study were explicitly told to set process rules and in the other they weren't, but the students set up norms and rules to the same extent in both studies. The studies also showed how important the setting of the rules were. "When teams did not realize they had to evolve a way of working together that was amenable to all, too much time was spent on process issues disguised as content issues." To make any guidelines useful, you have to make sure they are presented in a way that is adapted to the experience and knowledge of the participants. There should also be some follow-up after presenting the guidelines to ensure they are understood and applied throughout the project. In our research, we found that students often were so immersed in details of project content, that organizational and process concerns were neglected. We propose the following guidelines to enhance virtual team collaboration.

Guidelines for Distributed Project Teams

Synchronize the Teams

Distributed team members coming from different universities probably have different schedules, requirements, and deadlines that will affect the team work. When you are working, make sure the other members of your team know what you are planning on doing, when your holidays are, your local course deadlines (if you are not part of the same course), etc., so fewer misunderstandings will occur. It is important to try to synchronize the work as much as possible, but if you can't do that, you will at least know why. Particularly, if there are multiple faculty and/ or courses involved, the faculty should, as a first step, try to synchronize the courses and their objectives. Faculty should then inform everybody involved about the differences that still exist. The students should also synchronize their particular activities.

Choose Technology That Works

Use the most stable technology possible for communication with your distributed teammates. If the technology is experimental, always have a backup plan. This is especially important if you are in a synchronous situation, like video conferencing. Make sure you have the phone number of a contact person that is usable during the time of the conference. Establish who will be reachable over email (and at what address) during the meeting. Be on time (so it is clear whether you don't have communication because of failing technology or because people are late) and set a time (e.g. 15 minutes after the conference start time) to give up or start using some other technology.

Choose the Right Technology for the Right Activity

Think about when to use what kind of media. For example, email may not be the best medium for decision-making, since it is slow and asynchronous. Email may be useful for file-sharing, updates, (light-weight) discussion, personal information, questions, planning, and briefings. Video or telephone conferences may be useful for decision making, clarifications, confirming email discussions, updates, allocations of work, and planning. These examples may or may not hold true for your team. As a team you should discuss when you will use chat, file sharing systems, web forum, telephone, videoconferencing, email, etc., and for what activities.

Discuss Norms and Rules for Behavior and Communication

You can expect that there will be conflicts, sooner or later, in your collaboration. By discussing how to deal with the problems before they actually occur, you can avoid a lot of conflicts, and establish ways to address those that do arise. You might state norms, or informally discuss expectations for behavior. This is important regarding the content of the communication, handling for example gender, personality types, cultural issues, humor, etc. Knoll and Jarvenpaa mentioned that the need to structure and making things clear is important in all teams, but absolutely necessary in a distributed team, since students don't see what their teammates are doing and can't solve the problems as they come up.

It is also important to decide how to use the different media. For example how late you can call, how and in what formats you should send files, and how many emails you can send per day without creating information overload or flooded mailboxes. You might also consider rotating roles for group meetings, such as facilitator, agenda planner, recorder, etc. This works well also because it spreads the responsibility throughout the team, which makes everybody feel more involved. Rotating roles also keeps one talkative person from monopolizing the conversation. Also try to avoid slang and talking too fast if you have non-native speaking members in your team.

Discuss and Carefully Plan any Face-to-Face Visits

Before you get to see each other face-to-face, you should discuss what the purposes are for the meeting and what you should have done by the time of the meeting, to get the most out of it. If you meet early in the collaboration you have the advantage of getting to know each other faster and therefore have the possibility to get more out of the collaboration at an early stage. If you wait until you have done some background reading, have suggestions of possible approaches or solutions, and know more what you are talking about, you have a higher chance to get more out of the collaboration in the face-to-face meeting, and you will make a better impression. The fact that the participants normally get motivation and energy out of a site visit should also be considered when you decide if you should have a face-to-face visit, and, if so, the time and place for the meeting.

Have Team Building and Social Activities

For the collaboration to be as smooth as possible, it will help if you get to know each other as well as possible. This will help you know what to expect from the other members of the team, to learn about special skills of different team members, and to be able to have fun working together. It is advisable to have some form of personal presentation in the beginning of the collaboration. This can be done for example by making a short video about yourself, your team and your campus; by making a web page where you introduce yourself; and/ or by presenting each other at a video conference. Remember- a picture is worth a 1000 words, so try to use pictures in your presentations.

Duarte and Snyder point out that when you are planning teambuilding activities, it is important to take into consideration that it might be subject to cultural bias. Experienced virtual team members might think of the activities as a waste of time. This only makes it even more important to think about choosing the right activity for the specific participants, environment, and project, and also to use the right activity in the right phase of the team development.

Think Proactively!

When you come to, especially the first, telephone or video conference, make sure you know what you want to get out of it. Make a list of what topics you want to cover, things that are uncertain and need to be clarified. Ask your distance teammates what they want to discuss and tell them what you want to get out of the meeting, so you can come to a mutual agreement. If possible, this should be shared before the meeting. Also remember, when you first start meeting, you can set the tone, and even if you have to remember that cultural and personality differences also play a big role in deciding how people will prefer communicating, being relaxed and positive yourself will help creating a good atmosphere.

Conclusions

Students working in distributed projects are facing challenges and problems they might not have encountered before, but the knowledge they can get out of this kind of work will be useful working in any line of business where you have work with or encounter other people. Just putting students in teams together with participants from different universities and countries without giving them any motivation or guidelines for the collaboration, will not give them the full advantage of the experience. Project work is in a lot of ways opportunity learning and without giving the students guidance to go in the right direction, the opportunities might only appear as problems, and the students will never get or feel the full advantage of the collaboration.

Our conclusions are that most students are not conscious of the difficulties of distributed communication and collaboration. They need guidance in resolving and avoiding common problems. Handing out simple guidelines and concrete suggestions can help the students avoid some of the worst pitfalls and put them on the right track earlier, and a small effort and careful thought can make a collaboration successful. The guidelines you find in this article point to problems that have recurred in all classes observed, and they provide a simple method to start helping distributed students get a better work situation and improve their learning situation.

It is important to synchronize members and sub-groups of a team as much as possible. For student teams, initial synchronization should be arranged by the faculty. The faculty should help the students continue to synchronize as the project proceeds. The choice of technology is very important when you are working at a distance, since most of the communication will be conducted via technology. Choose technology that works and is easy to use. It is important to choose the right technology for every specific activity. Discuss how you should use the different media and how to behave in different situations when using it. Since there are fewer natural ways of socializing when at a distance, make sure to have teambuilding and trust building activities. Discuss if, when, and why you should meet face-to-face. One of the most important things to create a good working and learning environment is to be proactive and work for the changes you want to see. Working at a distance can be very rewarding, but only in the context of active and thoughtful organization and synchronization of team activities.

Future work

Future research on distributed teams should explore methods for minimizing the need for meeting face-to-face. One method could be to compare teams that meet, with those that don't meet at all (but have a strategic plan for how to build trust and get to know each other at a distance). Such analysis could help both completely distributed teams, but also help teams that will meet occasionally, to get a better start. This would make it possible to observe what improvements teams have (if any) after discussing guidelines for behavior and distributed work, having teambuilding activities, etc.

Acknowledgements

We would like to thank Wallenberg Global Learning Network for supporting this research.

References

Cheesman, Robin, and Heilesen, Simon, "Supporting Problem-based Learning in Groups in a Net Environment", *Computer Support for Collaborative Learning (CSCL) Designing New Media for a New Millenium: Collaborative Technology for Learning, Education, and Training*, Conference at Stanford University (December 1999)

Duarte, D. L., and Snyder N. T., *Mastering Virtual Teams: Strategies, Tools, and Techniques that Succeed*. San Francisco: Jossey-Bass (1999)

Jansson, Eva, *Facing the Unknown: Working in a Distributed Project* (in press)

Knoll, Kathleen and, Jarvenpaa, Sirkka, "Learning to work in Distributed Global Teams", *Global Virtual Team Exercise- Spring 1999* (1999) http://www.bus.utexas.edu/~jarvenpaa/gvt/gvt99/hicss.html

Miller, Judith, Trimbur, John, and Wilkes, John, "Group Dynamics: Understanding Group Success and Failure in Collaborative Learning ". In K. Bosworth and S.J. Hamilton (Eds.), *Collaborative learning: Underlying processes and effective techniques*. San Francisco: Jossey-Bass (1994)

Nardi, Bonnie, and Whittaker, Steve, "The Place of Face to Face Communication in Distributed work", in P.Hinds & S. Kiesler (eds.) *Distributed Work: New Research on Working Across Distance* (in press)

Ybarra, Carolyn, and Jansson, Eva, *Transnationally Distributed Project Collaboration: Technology, Teams and Trust*, presentation at the National Anthropology Conference November 10th 2000

New Trends in Web Usage Patterns and Web Traffic

Abstract: As the Web is expanding, the Web traffic is changing, and so are the users. To get an adequate understanding of the Web as a medium, it is of paramount importance to know the users and the dominant usage patterns. The purpose of this paper is to map important aspects of Web usage patterns, Web traffic and Web search behavior. Issues dealt with are, among other things, time spent per month, number of sessions per month, time spent during surfing session, page viewed per session and per month, duration of page viewed, number of unique sites visited, concentration of and the recent developments in Web traffic, given sites' shares of total page views, and significant aspects of Web users search behavior (e.g., frequency, time spent searching, kind of information search for, most popular search terms, satisfaction etc.).

[If you read this file from the screen, please choose the 'Page Layout'-option in the View-menu to view the figures and charts. The final version of the paper will include updated figures and graphs for the year 2002.]

In the paper "Mapping the Web. A Media Typology for Information Traffic Patterns on the Internet Highway" (Jensen, 1996) I delineated a basic typology for information traffic patterns and media types on the Internet; in the paper "WWW - Who? Where? Why?" I outlined a media sociological analysis of demographics, consumer trends and content trends on the Web (Jensen, 2000a); and in "Trends in interactive Content & Services on the Web" (Jensen, 2000b) I summarized seven major new trends concerning content and services on the Web. In the context of this paper, I want to proceed with this line of action and sketch a number of new trends in Web usage patterns, Web traffic and users search behavior.

The Internet is growing fast. According to Inktomi there are now more than one billion unique documents on the Internet. The total number of servers is well over 6 million. And the total number of users surpassed the 400 million mark in 2000 and will continue to grow exponentially in the years to come. As the Internet and the Web are expanding, the content is changing too, and so are the users. To achieve an adequate understanding of the Web as a medium, it is of paramount importance to know the users and to understand the dominant Web usage pattern.

The purpose of this paper is to track changes in the Internet: to map Web usage patterns and Web traffic, thereby establishing an understanding of the new Web user. Due to limited space, among other things, this study will focus only on three aspects:

- Web Usage Patterns
- Web Traffic
- Web Search Behavior

Web Usage Patterns

Figures on average Web usage from Nielsen//NetRating from the last couple of years show that the total time spent per month on the Web has gone down lately and that it seems to stabilize around 10 hours per month. At the same time the number of pages viewed in a month and the number of page views in a session is going up. Consequently, the duration of a page viewed is going down.

Table 1 shows the growth in time spent per month over the last year and a half. From 7:34:28 (hr:min:sec) in July 1999, 9:26:51 in January 2000, to a height of 10:04:05 in October 2000, the time spent per month has now fallen to 9:37:25 (February 2001). Thus, it seems as if the time spent per month on the Net has stabilized just below 10 hours per month.

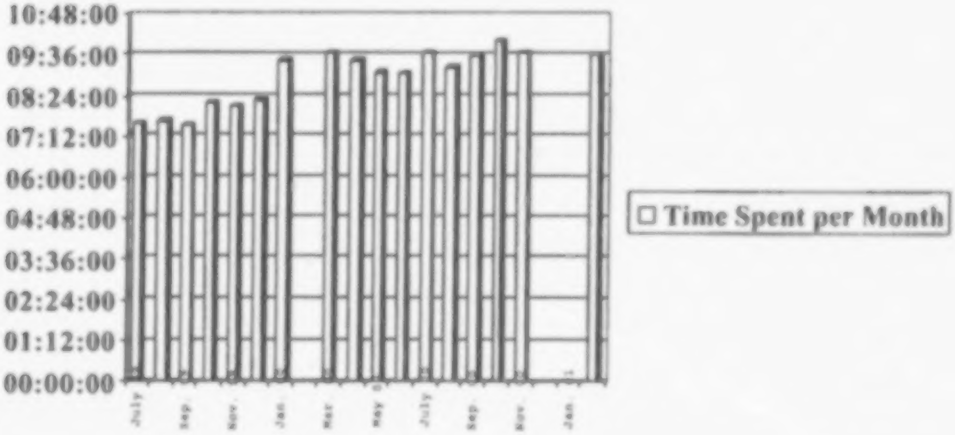


Figure 1: Time Spent per Month [Nielsen//NetRatings 1999, 2000, 2001, The reported Internet Usage estimates are based on a sample of households that have access to the Internet and use platforms such as Windows 95/98/NT and MacOS8 or higher]

Likewise, the figures estimate that the number of sessions per month is down to 18. From an average of 16-17 sessions per month in 1999, and an average of 18-19 sessions per month in 2000, the number seems to have stabilized around 18 sessions per month in the recent period (cf. Table 2).

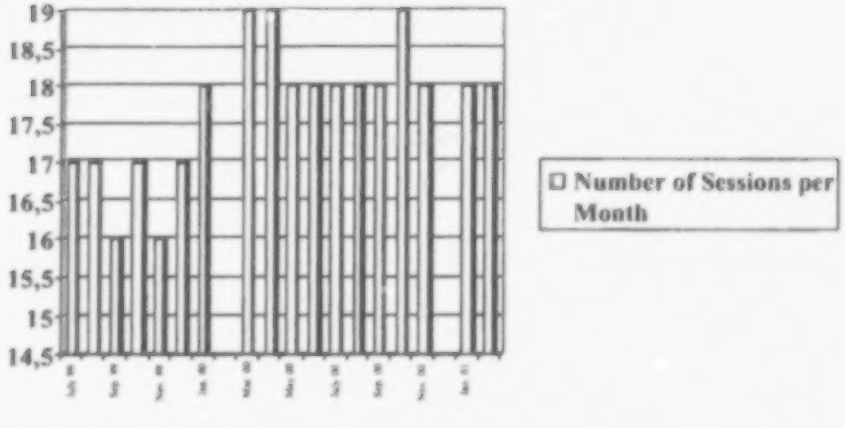


Figure 2: Number of Sessions per Month

The average time spent during a surfing sessions has been steadily increasing from 26:44 (min:sec) in July 1999 to 32:22 in February 2001. However, over the last year or so, the figures have been rather stable.

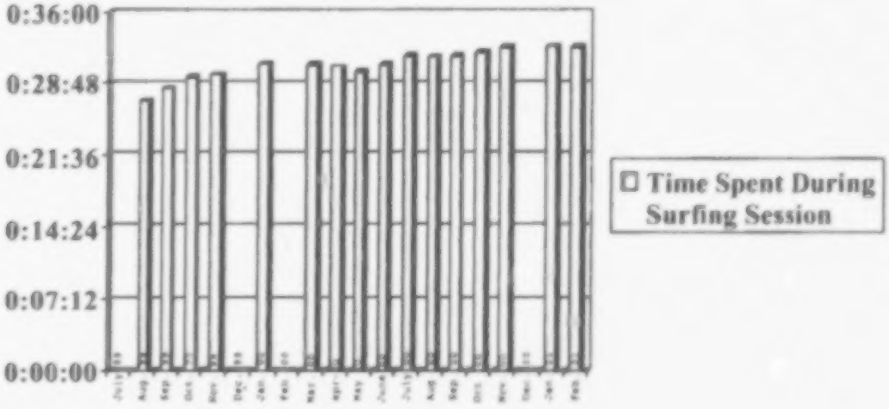


Figure 3: Time Spent During Surfing Session

Figures, which seem to be constantly increasing, concern the number of pages viewed per session and the number of pages viewed per month. Concerning the number of pages viewed per session, it has gone up from 20 pages in July 1999 to a height at 41 pages in August 2000, falling again to 38 in the fall of 2000. (It has not within the deadline of this preliminary paper been possible to get the data from Q4, 2000 and

Q1, 2001. They will, however, including the new data from Q2 and Q3, 2001, appear in the final version of the paper.)

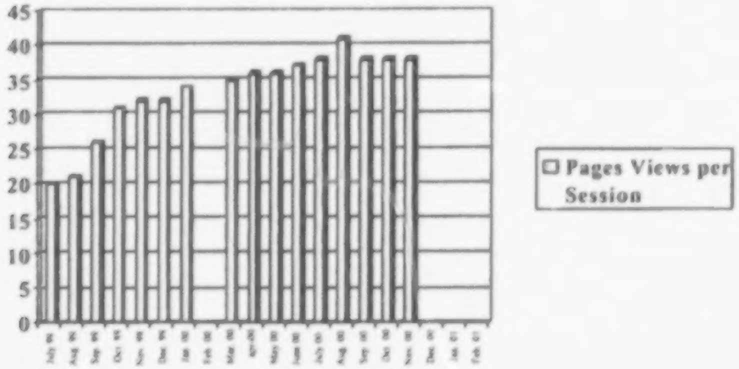


Figure 4: Pages Views per Session

Correspondingly, concerning the number of pages viewed per month, it has grown from 332 in July 1999 to 720 in October 2000 and 689 in September 2000. Thus, the number of pages viewed per month has more than doubled in a year. (It has not within the deadline of this preliminary paper been possible to get the data from Q4, 2000 and Q1, 2001. They will, however, including the new data from Q2 and Q3, 2001, appear in the final version of the paper for the proceedings.)

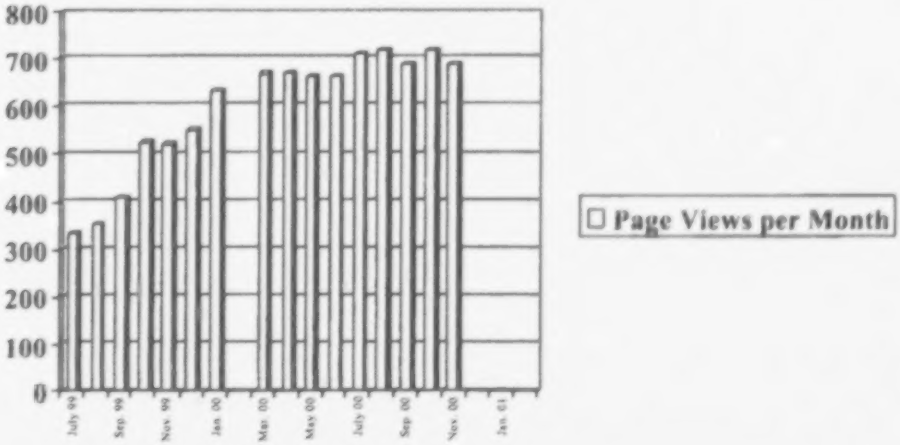


Figure 5: Page Views per Month

Following from the above, the duration of a page viewed has gone down. From an average of 1 minute and 20 seconds per page in July 1999 the duration has now stabilized around 50 seconds (February 2001).

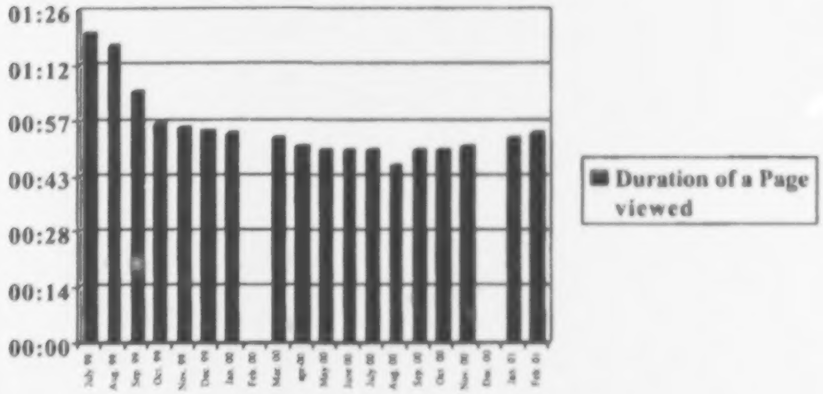


Figure 6: Duration of a Page Viewed

The average number of unique sites visited in a month is down to 10 and this figure seems to be one of the most constant. While the number of unique sites visited was around 12 in July-August 1999 it has been fixed on 10 sites the last year or so. This indicates that irrespective of how many sites there are on the Web, users tend to find their favorites and stick with them. That is, users are beginning to show loyalty to a limited number of sites: The Internet surfers are turning into Internet settlers. Each user has preferences for and loyalty to Web sites they visit.

Coincidentally, this number of unique sites visited is comparable to the number of channels actually viewed in a TV household. While the number of channels and viewing options available in the average TV home continues to grow, the number of channels actually viewed in the average household has not grown beyond 13 (Nielsen Media Research 1999).

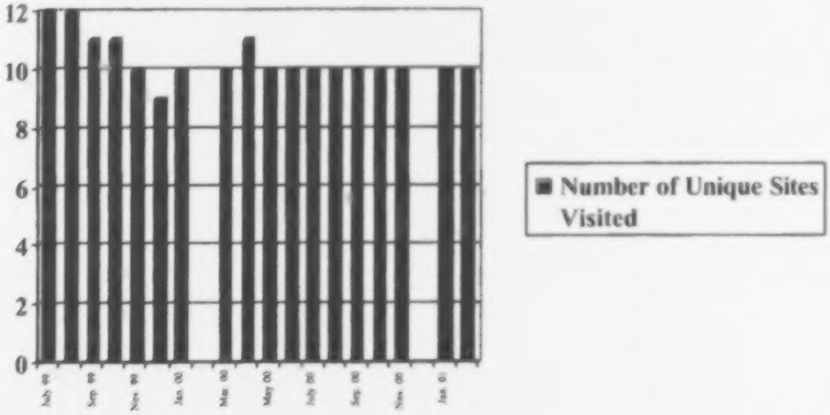


Figure 7: Number of Unique Sites Visited

Web Traffic

Although the Web is enormous there is still a significant concentration as regards content and Web traffic. In 1999, OCLE Research reported that the largest 25.000 sites represented 50 percent of all available content on the Web. Likewise, in 2000 Netcraft reported that 80 percent of all traffic on the Web ends up at only 0,5 percent of all URLs, corresponding to approximately 15.000 URLs.

Although Web traffic, as these figures indicate, is highly concentrated, a new survey by Alexa Research reports that the Web has become more dispersed in the past seven months. Based on a comparison of Web traffic in June 2000 contra January 2001, the study shows

- that the top 10 sites accounted for 11 percent fewer page views in January 2001 than they did in June 2000, i.e., the Web was 11% less concentrated in January compared to June
- that the top 100 sites accounted for 12.2 percent fewer page views in January 2001 than they did in June 2000, i.e., the Web was 12.2% less concentrated in January than it was in June
- and that the top 1000 sites accounted for 9.4 percent fewer page views in January 2001 than they did in June 2000, i.e., the Web was 9.4% less concentrated in January as compared to June

Looked at from another perspective, we could say that, in January 2001,

- 1 in 6 (16.6%) page views occurred at one of the top 10 sites
- nearly 3 in 10 (29.6%) pages was viewed at one of the top 100 sites
- and nearly half (48.3%) of all pages viewed on the Web was viewed at one of the top 1,000 sites.

All the above-mentioned figures are down from June, designating a less concentrated distribution of page views across the Web (cf. Table 1).

The Top...	**% of all page views in June 2000**	**% of all page views in January 2001**	**% dilution b/w June & Jan.**
10 sites	18.6 %	16.6 %	11.0 %
100 sites	33.7 %	29.6 %	12.2 %
1000 sites	53.3 %	48.3 %	9.4 %
accounted for			

Table 1: Top Sites Percentage of all Page Views

Thus, the top sites' share of overall Web traffic is being watered-down. In this way the Web is becoming more distributed, more equalized and balanced, and perhaps even more democratic. And yet, the majority of all Web traffic is still ending up on a very small part of the millions of sites on the Web.

BEST COPY AVAILABLE

An alternative way of indicating the reduced concentration of Web traffic is to contrast the number of sites that accounted for a certain share of the total page views in June and January (cf. Table 2)

Of the total pages viewed on the Web ...	**Number of Sites in June 2000**	**Number of Sites in January 2001**	**% Change in No. of Sites**
1 in 5	13	21	61.5 %
1 in 4	27	50	85.2 %
1 in 3	95	169	77.9 %
1 in 2	695	1,210	74.1 %
occurred at the top			

Table 2: The Number of Sites that Accounted for a Given Share of Total Page Views in June Versus January

This means that, in June 2000, 13 sites accounted for 1 of every 5 pages viewed on the Web. In January 2001, that number grew to 21, which means an additional 8 sites or 61.5% more sites shared that fifth of the web. Likewise, in June 2000, 27 sites represented 1 of every 4 page views, whereas that number was up to 50 in January 2001, meaning that 85.2% more sites sha red that forth of the web. Finally, in June 2000, 695 sites accounted for half of all Web traffic, whereas in January 2001, 1,210 sites shared that half, signifying that 74.1 % more sites shared half of the Web.

A final indication of the more dispersed Web traffic is that a larger collection of sites is showing high counts of visitors. Whereas only four sites had more than one billion page views in June 2000, that number had grown to 17 sites in January 2001.

However, despite this decreasing concentration of Web traffic, the leading sites are still attracting the lion's share of all page views.

Conclusions

This study shows, among other things,

- that the Web is changing and so are the Web traffic and Web usage patterns
- that the total time spend per month on the Web is going down but, at the same time, that the number of pages viewed in a month and the number of pages viewed in a session is going up, and, consequently, that the duration of a page viewed is going down
- that the number of unique sites visitedin a month is down to 10 and this figure seems to be relatively constant
- and that Web traffic is highly concentrated, but that the Web has become more dispersed in the past months.

References

BEST COPY AVAILABLE

AlexResarch. 2001. Web Traffic Becoming less Concentrated. March 5, 2001
CyberAtlas. 2001. Search Engines, Browsers Still confusing Many Web Users
Jensen, Jens F., 1996: Mapping the Web. A Media Typology for Information Traffic Patterns on the Internet Highway, in Herman Mauer (ed.): Proceedings of WebNet 96. World Conference of the Web Society, San Francisco.
Jensen, Jens F., 2000a. "WWW – Who? Where? Why? A Media Sociological Analysis of Demographics, Consumer Trends, and Content Trends with Special Reference to Entertainment & Entertainment Seekers on the Web", in Proceedings of the WebNet 2000 World Conference on the WWW and Internet, San Antonio, Texas.
Jensen, Jens F., 2000b "Trends in Interactive Content & Services on the Web", in Proceedings of the WebNet 2000 World Conference on the WWW and Internet, San Antonio, Texas.
Jensen, Jens F., & Cathy Toscan (eds.), 1999: Interactive Television. TV of the Future or the Future of TV?, Media and Cultural Studies 1, Aalborg: Aalborg University Press.
Lewis, Mobilio & Associates, LLC . 2001. Consumer Daily Question Study.
Netcraft. 2000. Internet Survey.
Nielsen Media Research. 1999. TV viewing in Internet Households, Survey.
Nielsen//Netratings. 1999. Usage Stats.
Nielsen//Netratings. 2000. Usage Stats.
Nielsen//Netratings. 2001. Usage Stats.
Nua Internet Surveys, 1999. World Wide Web Home to 3.6 Million Sites, OCLC Research
Nua Internet Surveys, 2000. How Many Online
Nua Internet Surveys, 2001.
Sullivan, Danny. 2001. Internet Top Information Resource, Study Finds

Virtual Reality: The Future Of Animated Virtual Instructor, The Technology and Its Emergence To A Productive E-Learning Environment

Juhanita Jiman
Center for Interpretation and Expression,
Faculty of Creative Multimedia, Multimedia University
Cyberjaya, MALAYSIA
juhanita@mmu.edu.my

Abstract: The promise of Virtual Reality (VR) has caught our imagination and reliable networks will make it all a reality. VR will draw from and affect the entire spectrum of culture, science, and commerce, entertainment, and education industry. It will be multi-national, and will introduce new hybrids of experience for which descriptors presently merely exist.

In this paper, my major discussion will be the use of VR in e-learning environment where an intelligent 3D virtual person will play a role of an instructor. With the existence of this virtual instructor, it is hoped that the teaching and learning in the e-environment will be more effective and productive. This virtual 3D animated character can actually be programmed to have a natural human touch to help breaching the gap between a machine and student. A virtual instructor that has an almost true look and feel of a human being will make the students feel more comfortable and confident to learn.

Keywords: E-learning, Virtual Instructor, Intelligent Agent, Character Animation, Virtual Reality, Avatar, Collaborative Learning, Artificial Intelligence, Facial Expression.

Introduction

There are as many definitions as there are applications of "virtual reality". For most people, this technology is more seen like something magical, with endless possibilities. The best definition would be: "Virtual Reality is a way for humans to visualise, manipulate and interact with computers and extremely complex data. It is supported by advances in simulation technology that allow linking human capabilities and computational resources, sensor systems and robotics devices for real-time tasks." This was taken from the book "Silicon Mirage: The Art and Science of Virtual Reality". [1]

We foresee that computing environments in the near future will be very widely distributed and mutually connected. New services will be added from time to time, while old services will be replaced. Network topology and capacity will be changing almost continually. Users will demand much better user interfaces, so that they will be able to communicate with computers as if they are communicating with humans. VR technology can be applied to many tasks that would be more difficult to do by other methods. With VR technology, a human and a computer operate together as a combined system, one that is far more capable than either taken individually when performing a large variety of tasks. It offers a multitude of ways to improve productivity. VR will not serve only to create hit video games or other applications of that sort, but, more importantly, this technology is put towards more functional applications.

In education, VR would allow collaborative and distance learning to occur more successfully and make students to travel to places that may not be feasible otherwise. They could do scientific experiments in a simulation even though they could not afford to do the real experiment because of the cost of the equipment. Furthermore, in the educational domain, VR without any doubts has played an important role to assist teaching. There has long been a philosophical gap between distance education and efficient training skills, and because of these difficult tasks, VR has increasingly become an important teaching aid. With the emergence of this technology, education and training are now getting their feasible and better solution. Education's goal which has traditionally been to impart high-level cognitive skills that would tie a lifelong learning process and training's goal which was to bring performance up to a skill level that would let people successfully carry out new tasks can now be improved with the help of VR solutions.

Content

LEARNING WITHOUT LIMIT

Collaborative Learning and Virtual Reality Learning Environment

Collaborative Learning in VR provides an environment to enlighten and enrich students' learning process. This will be a better place where they could benefit it the most without having to go to a real classroom or a training place. Introducing interactive virtual instructor or partners into an educational system creates more realistic social contexts, thereby it will increase the effectiveness of the learning system. This almost 'true human' virtual learning environment would definitely help sustain the student's interests and would provide a more natural learning habitat.

As Piaget [2][3], pointed out, collaborative learning has a major role in constructive cognitive development. His theory is consistent with the other popular learning theory [4] in emphasising the importance of collaboration. Piaget felt that interaction between peers has to be equally shared in a collaborative environment to maintain performance.

In one-to-one computer-based tutoring, the system interacts with one student and attempts to personalise the tutoring to the needs of the student. On the other hand, in a one-to-many collaborative learning environment, the system interacts with a group of students, imparting the subject knowledge using a collaborative learning strategy. It should be distinguished that a one-to-N environment is not a combination of many one-to-one learning environments. Collaborative learning presents an environment in which a student interacts with one or more collaborating peers to solve a given problem. The interactions among the students are monitored and controlled by a collaborative learning system and in this case this monitoring or mentoring system will likely doing its best if it is supervised by an animated character as a virtual instructor.

In general, collaborative learning is found effective in domains where peers are engaged in skill acquisition, joint planning, categorisation, and memory tasks. The idea is that peers learn the prerequisites of the topic to be learned and reinforce the topic using the collaborative environment. There have been a number of studies that proposed collaborative learning to help learners understand complex tasks. For example, Miyake[5] shows that the complex understandings of the working of a tailoring machine is better understood when the peers interacted collaboratively and attempted to understand the problem. Connah et al. [6] believe that the co-operative behaviour supports higher cognitive learning, based on a simulated physical world domain.

LEARNING WITH ASSISTANCE

The Needs for Virtual Instructor

In a traditional classroom, out-spoken and active students can easily dominate class discussion. Even a skilful educator should learn how to cut this off without alienating the over-talker, but time is still lost in the process. In the asynchronous online course, with the existence of a virtual facilitator, each participant is given equal time for participation. Verbose response can be skimmed or ignored. In addition, students can benefit equal information sharing and the learning environment will somehow becomes more productive.

It is obvious that in any e-learning environment, the instant availability of a human tutor would be the most ideal way to help out if there's any complications occur involving the course materials, however, providing this capability is no more realistic than continuously providing a human tutor for the traditional classroom-based learning experience. Cost and availability are limiting factors in supplying continuously attentive human tutors. Often students simply want questions answered and would be happy with any type of effective immediate feedback, it does not matter whether it comes from a human or machine. It is still under intensive research to 'create' an avatar as an intelligent agent who is capable to give any type of on-demand feedback for certain types of information requirements.

In most cases of e-learning delivery systems, a virtual instructor is foreseen to play an important role to enhance the overall e-learning activity. It is hoped that in the nearest future, an 'almost human' virtual instructor would help the advancement of e-learning technology. An intelligent agent here, is a 'programmed' character which is considered by e-learning user as an assistant or facilitator. This agent does not function as a tool that is normally use in a conventional direct-manipulation interface, but, it serves the user with a more personal assistance. This agent should be able to illustrate characteristics that are associated with human intelligence: learning, judgement, adaptability, independence, creativity, emotion, etc.

While students are in the e-learning environments, there are risks of losing cohesiveness and spontaneity of the classroom experience, therefore, it is essential to understand how to improve the e-learning experience, and hopefully this virtual 'facilitator' will even exceed traditional teaching and learning methods.

Virtual Reality Learning Environment

Virtual reality simulation environments can also be part of e-learning delivery method which offers exciting opportunities and challenges for intelligent tutoring systems. Students, immersed in a 3D computer simulation of their work environment, improve their skills through practice on realistic tasks. Computer tutors can inhabit the virtual world along with students, allowing them to physically collaborate with students on tasks, and they can interact and communicate in non-verbal or verbal communication.

The research reported for ALN courses stated that electronic or computer based learning can be improved by the introduction of autonomous intelligent software agents. This finding has been shown in several ALN (Asynchronous Learning Networks) venues [7], [8]. Intelligent Agents (IAs), can perform the duties of online facilitators for routine tasks. Checking computer code, responding to simple questions, reminding learners about the need to turn in assignments and potentially even grading essays [9] are among the types of things that intelligent agents can accomplish.

With this advent of intelligent agents, it enables learners to be trained, manipulate and work within the 3D virtual world, which finally led to the interactive learning systems of the new millennium.

Animated Virtual Instructor that Has Intelligence

In the midst of needing a mentor in e-learning environment, it comes to attention that a virtual instructor would be the answer to all the woes. This virtual instructor would be in a form of animated human being. This animated agent will play a role of a *'Virtual Instructor'*.

This *'Virtual Instructor'* as an intelligent agent is programmed to have a natural human touch to help breaching the gap between a lifeless machine and the student. As a character that has an almost true look and feel of a human being, this agent will make the students feel more comfortable and confident to learn. While students are interacting to this agent, they will experience a sense of equality. Nervous or slow students will feel more comfortable in any of the learning activities and feel more secure when communicating with this virtual person instead of speaking in an actual training place. As a whole, this agent is programmed to be more accessible, patient, understanding and most of all efficient in all aspects.

Getting the right information is crucial for the emotional process and for this agent to generate an accurate or desirable answer. Therefore, this agent is designed to have abilities to 'learn' and later to track the history of events that have happened, then, link it to the most likely solution.

Desirable Qualities of 3D Character as an Intelligent (Software) Agent

Etzioni and Weld defined the term "software agent" as a computer program that behaves in a manner analogous to a human agent [10]. In essence, the term refers to software that supports a social interface metaphor, a dialogue between a person and the agent. Various researchers proposed the following characteristics as desirable qualities of software agents :

- Autonomy: An agent initiates and exercises control over its own actions in the following ways:
    - Goal-oriented: accepts high-level requests indicating what a human wants and responsible to decide how and when to satisfy the requests.
    - Collaborative: does not blindly obey commands but can modify requests, ask clarification questions, or even refuse to satisfy certain requests.
    - Flexible: actions are not scripted; the agent is able to dynamically choose which actions to invoke, and in what sequence to do the action.
    - Response to the state of its external environment.
    - Self-starting: unlike standard programs directly invoked by the user, an agent can sense changes in its environment and decide when to act.
- Temporal continuity: An agent is a continuously running process, not a one-shot computation that maps a single input to a single output and then terminates.
- Personality: An agent has a well-defined believable personality that facilitates interaction with human users.

- Communication ability: An agent can engage in complex communication with other agents, including people, to obtain information or enlist help to accomplish its goals.
- Adaptability: An agent automatically customises itself to the preferences of its user on the basis of previous experience. It also automatically adapts to changes in its environment.
- Mobility: An agent can transport itself from one machine to another and across different system architectures and platforms.

Virtual Instructor in VR Learning/Training Environment (Farieda)

- ***Farieda in General***

As it was said earlier, virtual reality can be used for any training needs, from linguistics, mathematics, sciences, computer skills, engineering and many others. To master complex tasks in different kinds of training, students definitely need hands-on experience and they have to face a wide range of situations. They also need a mentor/instructor that can demonstrate procedures, answer questions, and monitor their performance, while on the other hand, they may also need other students' participation (team-mates) if their task requires multiple people.[11] It was hypothesised that face-to-face professor-student interaction is crucial to test performance. However, the data indicate the reverse, that virtual interaction produces better results. [12]

Medicine will probably be the most commonly known area that VR is used for training, but, apparently, it is not the only area that can utilise VR in its applications. There are also many branches of other scientific and non-scientific fields to adopt virtual reality for diverse applications. In other words, it means that this enabling technology can be used to improve productivity in many important areas. There are numerous applications in the domains of health care, education and lifelong learning, manufacturing and other areas where this technology shows great promise.

In the midst of needing a mentor in collaborative VR learning environment, it comes to attention that a virtual instructor would be the answer to all these problems. This virtual instructor would be in a form of an animated human being and it will play a role of an 'intelligent instructor'. The agent is given a name as Farieda (Friendly And Reliable, Intelligent E-Learning Development Agent). Farieda integrates methods from four primary research areas: intelligent tutoring systems, computer graphics, agent architectures and speech recognition. This novel combination results in a unique set of capabilities.

Farieda is programmed to have a natural human touch to make the communication between a machine and student to occur more successfully. As a virtual instructor that has an almost true look and feel of a human being, she will make the students feel more comfortable and confident to learn. While students are interacting to Farieda, they will as if that they are interacting with a natural human tutor. In addition, nervous or slow students will feel more comfortable in this training because they will feel more secure when communicating with this virtual person instead of speaking in an actual training place. As a whole, Farieda is programmed to be more accessible, patient, understanding and efficient in all tasks given to her as a 'tutor or facilitator'.

- ***Farieda Architecture and Capabilities***

Farieda's artificial intelligence is designed to allow more human-like interactions among synthetic agents and humans. Her speech recognition makes her appeared to be more human than other virtual instructor. Farieda's architectural capabilities on the other hand, allows her to energetically handle a dynamic virtual world, where this becomes a place where people and other agents meet. She will continually monitor the state of the virtual world, always maintaining a plan for completing her current task, and revising the plan to handle any unexpected situations.

Getting the right information is crucial for the emotional process and for this agent to generate an accurate or desirable answer. Therefore, Farieda is designed to have abilities to 'learn' and later to track the history of events that have happened, then, link it to the most likely solution. She has many instructional capabilities one would expect of an intelligent tutoring system. For example, she can answer questions such as: "***What should I do next?***" and "***Why?***". On the other extreme, by using her voice recognition capabilities, she can also give responses if she's sensing that the student is not paying attention or confused, she will say ***"Are you ok there? Why are you keeping quiet?"*** or if she's sensing that the students are having fun, she will say ***"That's enough let's go back to our topic!"***. Moreover, because she has an animated body, and cohabits the virtual world with students, she can provide more human-like assistance than the disembodied tutors. For example, she can demonstrate actions, use gaze and gestures to direct the student's attention, and guide the student around the virtual world.

More importantly, Farieda is designed and programmed to have a set of domain-independent capabilities that utilise a declarative representation of domain knowledge. To teach students about the tasks in a new domain, Farieda will be

BEST COPY AVAILABLE

programmed with the appropriate domain knowledge in detail and she has to 'know by hard' whatever topic or content that is relevant to what she is going to teach. It is assumed that Farieda will be a course author, a person with enough domain knowledge to create a course for teaching others. Importantly, people should not aware that Farieda has any programming skills or being programmed, ensuring that Farieda only relies on types of knowledge that a course author can provide imposes strong constraints on Farieda's design. Farieda is designed to coexist with other people and agents in a virtual world. Her goal is to support team training and collaborative learning, where teams of people, possibly at different locations, can inhabit the same virtual world and learn to perform tasks as a team.

- ***Farieda's Gesture, Look and Feel***

As a virtual instructor who has to have a look and feel like a natural human beings, Farieda is modelled with a detail human character and her gesture is more or less have to reflect on what natural human is capable of doing. Farieda will not only show a set of different facial expressions to show her so-called 'emotion', her body movement or gesture will also be an important part in her existence.

As an intelligent agent, Farieda is supposed to be sensitive towards her virtual collaborative learning environment. For example, if Farieda is sensing that one of her students or trainees is not paying attention, she will show that she cares by giving a positive comments and ask the student to pay more attention, but if repeatedly the same student is doing the same thing and this is distracting other students who are engaged in that collaborative learning, she will be more firm and has the authority to log out the destructive student.

- *Farieda's Facial Expression*

Farieda's artificial intelligence is designed to allow more human-like interactions among synthetic agents and humans. One of the particular strengths of animated characters is their ability to express emotions in a believable way by combining facial expressions with body gestures and affective speech. [13]

Farieda's personality is represented by a vector of discrete values along a number of psychological traits, such as extraversion, openness or agreeableness, that uniquely characterise an individual. These personality traits are not influenced by current events, but remain stable over a longer period of time. [14] Thus, this agent becomes more personal and individual, where it would be almost 'human' who has feeling and emotion. Within these agents' believable human 'personality', they can give comments within their domain knowledge, show dedication through their friendly approach, show their sensitivity through voice intonation (if not happy the intonation would be higher and vice versa), able to make simple laugh and show appreciation but most of all they are better than human because they will never be tired, bored or incline to favouritism and discrimination.

It has come into researchers' attention that ability to express emotions is important for creating believable interactive characters. To simulate emotional expressions in an interactive environment, an intelligent agent needs both an adaptive model for generating believable responses, and a visualisation model for mapping emotions into facial expressions. [15]

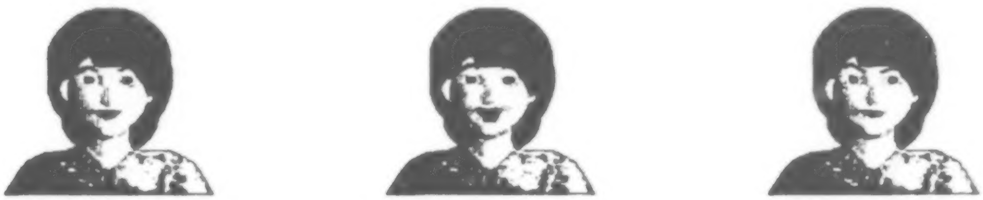


Figure 1,2 & 3 : Farieda's normal expression, laughing and curious.

BEST COPY AVAILABLE

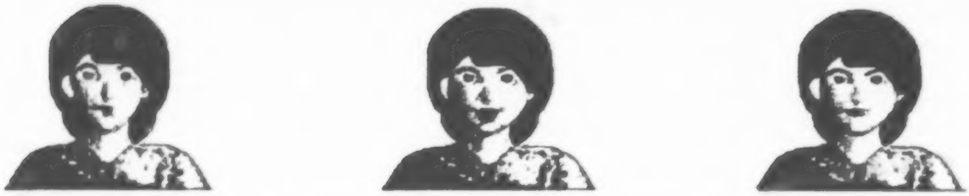


Figure 4,5 & 6 : Farieda's saying 'o', she's talking and feeling uncomfortable.

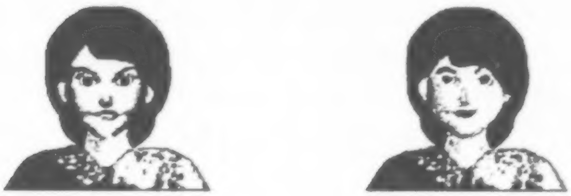


Figure 7 & 8 : Farieda's angry and thinking.

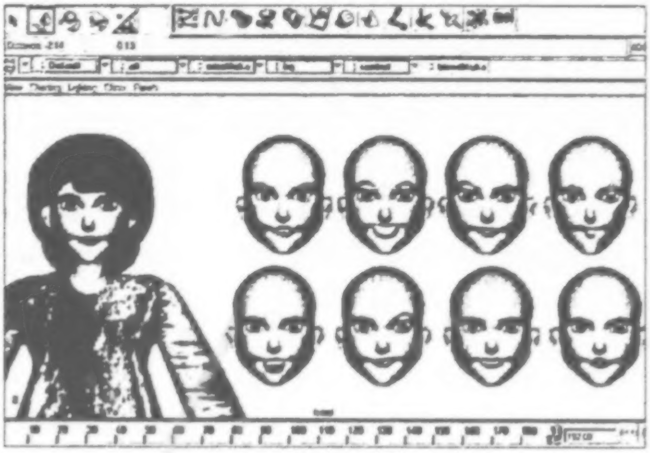


Figure 9 : Farieda's facial anatomy

Conclusion

VR enabling technology can be used to improve productivity in many important areas. There are numerous applications in the domains of health care, education and lifelong learning, manufacturing and other areas where this technology shows great promise. Early results have shown increased productivity and a dramatic reduction of resource requirements in many instances and from there the future of VR is seen more encouraging.

In many cases of VR applications, virtual training is one of the highly demanded solutions. Self-paced training is known to be responsive to every learner's needs and with the help of a virtual instructor in a form of animated 3D character, the learning process can be more interesting and effective.

Teaching and learning in a conducive environment definitely will help students/learners to benefit the most from the learning process. Optimal learning satisfaction has been proven to give a major impact on the emotional process, therefore, satisfied students will not only be motivated to learn but in a way they will be 'hooked ' and committed to their study. Guided lessons can be enriched by having "somebody" to who the learner can refer. This implies the provision of a

BEST COPY AVAILABLE

'virtual instructor'. A talk agent as a virtual instructor could replace streaming video instruction and act like a 'true' human instructor.

Even with the existence of this virtual instructor, it is still a student-centered teaching approach where the students themselves determine what their needs are. The virtual instructor's most crucial job is to accommodate different learning styles and provide them with opportunities for exploration. It is hoped that the ability of the virtual instructor to communicate with the learner will advance e-learning to a higher level.

References

1. Silicon Mirage: The Art & Science of Virtual Reality. Aukstakalnis, S. and Blatner, D. Berkeley, CA: Peachpit Press, 1992.
2. Judgement and Reasoning in the Child., Piaget, J., Harcourt Brace, New York, 1928.
3. The Moral Judgement of the Child., Piaget J., Routledge and Kegan Paul, London 1932.
4. A multi-media, computer-based model for learner-directed, collaborative problem-solving. In Woolf, B., et al., eds., *Working Notes of 1990 Spring Symposium Series on Knowledge-Based Environments for Learning and Teaching*, 68 -- 71. Stanford University. Thomas, J. W., and Funaro G.M, 1990
5. Constructive interaction and the iterative process of undertanding. Cognitive Science 10:151--177. Miyake, N. 1986.
6. A testbed for research on cooperating agents. In Proceedings of the Eighth European Conference on Artificial Intelligence, Munich, 445 -- 447. Connah, D.; Shiels, M.; and Wavish, P. 1988.
7. Kashy. E., Morrissey, D.J., Tsai, Y., and Wolfe, S.J., An Introduction to CAPA: *A Versatile Tool for Science Education*, MSUCL-971, September 1995.
8. Sapir, M., *The WebTester and the Linear Algebra WebNotes*, The ALN Magazine, Vol.3, Issue 1, July 1999. www.aln.org.
9. McCollum, K., *How a Computer Program Learns to Grade Essays*, The Chronicle of Higher Education, September 4, 1998.
10. Etzioni, O., and Weld D. S., *Intelligent Agents on the Internet: Fact, Fiction, and Forecast*, IEEE Expert, pp. 44-49, August 1995.
11. Animated Agents for procedural Training in Virtual Reality: Perception, Cognition, and Motor Control Je_ Rickel and W. Lewis Johnson, USA, 1999
12. Virtual Teaching in Higher Education: The New Intellectual Superhighway or Just Another Traffic Jam? Jerald G. Schutte, USA, 1996
13. Selker, T., *Coach: A Teaching Agent that Learns*, Communications of ACM, Vol. 37. No. 7.
14. Elisabeth André, Thomas Rist, Presenting through Performing: On the Use of Multiple Lifelike Characters in Knowledge-Based Presentation Systems, 1999
15. Magy Seif El-Nasr, Thomas R. Ioerger, John Yen, Donald H. House, Frederic I. Parke, *Emotionally Expressive Agents*, A&M University, Texas, 1999.

An Instructional Strategy Framework for Online Learning Environments

Scott D. Johnson
Human Resource Education
University of Illinois at Urbana-Champaign
United States
sjohnson@uiuc.edu

Steven R. Aragon
Human Resource Education
University of Illinois at Urbana-Champaign
United States
aragon@uiuc.edu

Abstract: The rapid growth of web-based instruction has raised many questions about the quality of online courses. It appears that many online courses are simply modeled after traditional forms of instruction instead of incorporating a design that takes advantage of the unique capabilities of web-based learning environments. The authors present a conceptual framework that can guide the development of online courses. Specific examples of instructional strategies that fit the framework are described in detail.

Introduction

Distance education is an instructional delivery system that allows students to participate in an educational opportunity without being physically present in the same location as the instructor. Although print-based correspondence study is the traditional method of distance education, more contemporary approaches rely heavily on various forms of instructional technology (Garrison, 1987). The reason for much of the growth in distance education programs in recent years is due to the development of the Internet and improvement of technologies that support online learning environments. For example, among higher education institutions offering distance education, use of two-way interactive video and one-way prerecorded video was essentially the same in 1997–98 as in 1995 while the use of asynchronous Internet-based technologies nearly tripled in that same time period (Lewis, Snow, Farris, Levin, & Greene, 1999). This change is not new to the distance education community, which has seen technology-based educational innovations come and go with much fanfare. The instructional films of the 1940's were expected to radically change the educational delivery system, as were instructional radio and television. While each of these technology innovations had some impact on educational programs, they did little to change the fundamental nature of education. The Internet and computer technology, as the next generation of technological innovation to impact distance education, appears to have the power to significantly alter the education landscape.

In spite of the rapid growth of distance education, there is considerable concern about the effectiveness of this educational innovation. Numerous studies comparing traditional classroom-based instruction with technology-supported instruction have found no significant differences on critical educational variables such as learning outcomes and student satisfaction (Clarke, 1999; Johnson, Aragon, Shaik, & Palma-Rivas, 2000; Navarro & Shoemaker, 1999; Smeaton & Keogh, 1999). A popular web site (http://teleeducation.nb.ca/nosignificantdifference) contains a listing of over 300 research reports on technology for distance education (Russell, 1999). This comprehensive bibliography spans seven decades and highlights studies that found little or no significant impact of instructional technology on various educational variables.

The obvious conclusion of many scholars in the field is that the technology used to support instruction has little impact on students' attainment of educational outcomes. The primary factor in any instructional initiative, irregardless of format or venue, is the quality of the instructional design that is ultimately implemented.

This paper describes a research and development effort that evolved during the creation of an HRD graduate program (*HRE Online*) that was taught entirely online. The learning environment that was created to support *HRE Online* was based on the assumption that learning is a complex event that cannot be explained with a single theory of learning. Instead, we hypothesized that quality learning environments should be based on instructional principles that are derived from multiple learning theories. Through an analysis of existing literature and experienced-based practices throughout the development of *HRE Online*, we sought to answer the following questions:

1. What instructional principles for online learning environments can be derived from a fusion of multiple theories of learning?
2. Based on those principles, what specific instructional strategies or techniques can be applied in an online learning environment?

Instructional Principles for Online Learning Environments

The pedagogical model used to develop the *HRE Online* master's degree program was created by building on specific aspects of adult learning theory (Bandura, 1971; Skinner, 1968; Thorndike, Bregman, Tilton, & Woodyard, 1928; Vygotsky, 1978). Two conceptual models that were developed from an extensive study of the literature were reviewed. These two models were then synthesized into seven general principles that appear to be critical for quality learning environments (Johnson & Thomas, 1992; Johnson, 1997). We contend that powerful online learning environments need to contain a combination of these principles: (1) address individual differences, (2) motivate the student, (3) avoid information overload, (4) create a real-life context, (5) encourage social interaction, (6) provide hands-on activities, and (7) encourage student reflection (see Figure 1). This pedagogical model for online instruction was used to create the design template that is followed for each course in the *HRE Online* program. The following section provides specific examples of instructional strategies that have been used in the *HRE Online* program. Each of these strategies highlights the importance and practical application of the seven principles of quality online learning environments.

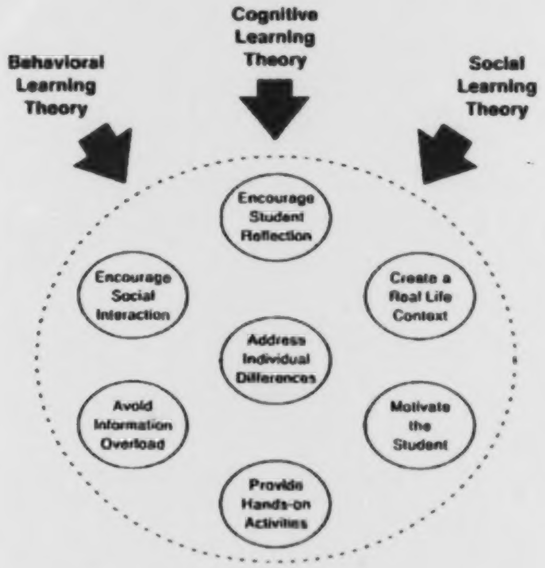

Cognitive Learning Theory
Behavioral Learning Theory
Social Learning Theory
Encourage Student Reflection
Encourage Social Interaction
Create a Real Life Context
Address Individual Differences
Avoid Information Overload
Motivate the Student
Provide Hands-on Activities

Figure 1. An Instructional Strategy Framework for Online Learning Environments

Using the Framework to Create Instructional Strategies for Online Courses

Individual Differences

Individual differences specific to learning and instruction can be found within intelligence, cognitive controls, cognitive styles, learning styles, personality types, and prior knowledge (Jonassen & Grabowski, 1993). Each dimension helps us understand 1) patterns of thinking and reasoning about information, 2) how individuals process information to make sense of the world, 3) preferences for information processing, and 4) how past knowledge, skills, or ability influence the learning process. Each of these dimensions, collectively, helps to describe one's personality.

Recognition of individual differences has, for the most part, been taken into account and promoted through the instructional design template used in *HRE Online*. The following techniques and strategies have been used in our online courses to address individual differences.

1. *Provide content in multiple formats*. This is done through the use of various communication technologies. Lectures are audio streamed and synchronized with the applicable PowerPoint presentation. These lectures are additionally transcribed and posted in the course website. Content is also presented through WebBoard discussion groups. Each course also has links to outside web sites that provide supplemental material on the current topic.

2. *Allow for individual locus of control*. All courses provide various means of navigation within the online course. Content can be accessed through links or a graphical organizer. An individual can be as systematic or random in his or her access of course material as they desire. Although the course is built and presented in a hierarchical sequence, it does not have to be accessed in the same way. While it is not necessarily encouraged, students are also not discouraged from moving through the course in a random order.

3. *Encourage active and collaborative interaction*. Recognizing that "the whole is greater than the sum of the parts," each course is designed with activities that are both individual and group based. Working within "virtual teams," students work together to solve problems, analyze cases, and develop group deliverables. These assignments allow individual ideas, perspectives, and experiences to be heard and collectively considered.

Motivation

The ARCS Model of Motivation is a practical way for instructors to address the issue of student motivation (Kellar & Suzuki, 1988). This model breaks motivation into four major concepts; (1) Attention, (2), Relevance, (3), Confidence, and (4) Satisfaction. Instructors must be able to gain and maintain students' attention by providing an environment that is interactive and participative. While keeping the students' attention is critical, it cannot be maintained unless the students feel that the course material is relevant. Students must also feel confident that they can achieve the expected outcomes of the course; therefore instruction should be flexible to compensate for individual student needs. The final component of the ARCS Model is satisfaction, which corresponds to whether or not students derive satisfaction from the instruction.

Strategies for enhancing student motivation in a web-based environment can best be characterized as either novel and entertaining approaches or attempts to personalize the instruction. We have successfully used to following techniques to enhance the motivation of our online students.

1. *Incorporate games into the online environment*. An example of a successful game for an online course is the popular television show called "Who Wants To Be A Millionaire." We have used this game during live synchronous sessions to summarize course content covered previously and to provide a sense of community among the students. The instructor plays the role of Regis Philbin, the game show host, and reads a question that requires the students to put a sequence of answers in the correct order. The students then type the correct order (e.g., B, C, D, A) as quickly as they can into a WebBoard chat window. The student who first answers

correctly becomes the contestant who calls a toll free number so their voice can be patched through to the class. This provides live dialogue when the instructor asks a student the first of several multiple-choice questions.

2. *Simulate a radio talk show with multiple DJs and "call-in" guests*. In many online courses the students spend much of the "class time" listening to the instructor through streaming audio or video technologies or during a live "web cast" during a synchronous class session. As we all know, it can be both boring and difficult to listen to one voice for any length of time, especially when there are few visual cues to accompany the audio. To provide variety and a livelier online atmosphere, we have been successful having multiple speakers interact during these broadcasts to liven up the synchronous sessions.

3. *Use multimedia when appropriate*. Online courses tend to be primarily textual-based forms of instruction. We have found that graphic images, photographs, and videos enhance student motivation. For example, in several of our courses we have created short QuickTime clips from popular movies and television shows that can be streamed over the web. These clips provide entertaining examples that support the concepts and procedures being discussed in class and provide a nice break from the textual format that dominates current online environments.

Information Overload

Providing too much information in a short period of time contributes to memory overload, which makes learning difficult and leads to confusion and poor retention. Psychological studies show that most people can manage about seven "pieces" of information at one time without too much difficulty (Miller, 1956). Instructional designers need to follow the *Rule of Seven*, which suggests that the amount of information presented at one time should be limited to no more than seven pieces of content (Clement, 1985). The Rule of Seven suggests that instructional designers "chunk" instructional content into small groups and give students the opportunity to learn each "chunk" thoroughly before being presented with new information. The following strategies have been used successfully in our online program.

1. *Limit the amount of content and activities*. By following the Rule of Seven, we help avoid memory overload by purposely limiting the amount of information and activities we provide in a course. For example, we ask instructors to break their lectures into 10-12 minute "chunks" or segments. These short lectures are recorded and converted into streaming media for delivery to students. These short lectures make it easier for students to complete in one sitting and it forces the instructor to concentrate on only a few main concepts in each "mini" lecture.

2. *Organize instruction around learning cycles*. The instructional design model used in the *HRE Online* program utilizes learning cycles at the core of its modular approach. Each learning cycle is comprised of three components. The first component provides the student with access to new content through a streamed audio or video file or by reading an online article. The last component of the learning cycle involves evaluating the learning outcomes through an activity involving self-assessment, peer-assessment, or formal instructor assessment and feedback.

3. *Provide a graphic organizer for the course*. It is very easy for students to get lost in any hypertext environment as they navigate through online courses that contain extensive layers of content distributed over multiple locations. To avoid the frustration and memory overload that can occur in a web-based environment, we provide a visual representation of the course structure. This graphic organizer serves as a map for students as they navigate through various portions of the course. The graphic is also hyperlinked so students can quickly move to a desired location in the course by clicking directly on the image.

Contextual Learning

Context is an essential central element in learning because knowledge is a product of the activity, context, and culture in which it is developed and used (Brown, Collins, & Duguid, 1989). Wilson (1993) identifies three major premises of context and how these affect knowing and learning. The first is the idea that learning and thinking are social activities that are structured by constant interpersonal interaction. Second, the available tools within the particular situation significantly structure an individual's ability to think and learn. Finally, "human thinking is profoundly structured by interaction with the setting" (p. 72). We offer the following recommendations to online instructors to promote contextual learning in the virtual classroom.

1. *Create virtual learning teams.* At the start of each new course, students are placed in a virtual learning team consisting of three to four other classmates. This allows the instructor to replicate the group experience found in face-to-face settings. Students work together on weekly assignments and projects via conferencing systems, conference calls, e-mail, and Instant Messenger.

2. *Simulate reality using appropriate case studies.* Regardless of the delivery format, the more "real-life" examples that can be utilized, the better students will learn. Case studies are an excellent way to provide the context through which new learning can be developed. As with any situation where a case study is used, it is critical to choose cases that relate to the content of the course.

3. *Require collaborative projects with schools, businesses, or other organizations.* Students are encouraged, where possible and appropriate, to develop course projects within the context of their work environment. This provides a real-life context in which to imbed application of the material. For example, in the online instructional design course, students develop a training package that represents 6-8 hours of training time. The majority of the students choose to develop a training package that addresses a performance issue within their organization.

Social Learning

Social learning theory combines elements from both behaviorist and cognitive theories and posits that we learn best by interacting with others in social settings (Merriam & Caffarella, 1999). Social learning is manifested through socialization, social roles, mentoring, and locus of learning.

For the social learning theorist, the purpose of education is for the learners to have new roles and behaviors modeled for them. Instructors and peers serve as a model for new roles and behaviors within an educational context. The following strategies have been successfully used by online faculty to promote this perspective.

1. *Create a personal connection with students.* Our goal is for instructors to be perceived as a real person in mediated communication. This is promoted several ways. Each course has an audio-streamed welcome message from the faculty member. This helps the student to put a face with the voice. Additionally, actions such as humor, vocal variety, personalizing examples, addressing students by name, questioning, praising, initiating discussion, and encouraging feedback all help make this connection. Personal connection can also be made through the use of "relational icons" or "emoticons" made by combinations of punctuation marks.

2. *Peer review and feedback.* Feedback from fellow students is as important as instructor feedback. Therefore, students in many online classes are asked to provide a meta-evaluation of another student's work. The purpose of the activity is to help their peers by providing comments that help the person understand the areas that are clear and well done and the parts that need further development.

3. *Require and facilitate interaction.* This may not seem like a new approach, however, in the online environment, it is much easier for students to be passive both in weekly assignments involving the group as well as during synchronous chat sessions. In addition to basing a percentage of the course grade on participation, other initiatives can be taken as well. One is to post an agenda of the upcoming week's synchronous session. Another technique is to post discussion questions prior to a synchronous session. Both approaches encourage students to think about the topic and be ready for a discussion.

Active Learning

Active learning can occur in many forms in an online environment. Discovery learning, project-based learning, and cooperative learning are common techniques for engaging students in activities that involve considerable amounts of creativity, decision-making, and problem solving. The following are specific examples of how active learning can be applied in an online environment.

1. *Organize online courses around projects.* Since HRD is a constantly evolving applied field of study, it is reasonable to design an online HRD course with a heavy emphasis on the application of the skills and procedures needed by the HRD professional. The best way to accomplish this in an online environment is through a project-based approach. Application-rich courses can be designed around major projects and specific activities to be completed in order to create a final product.

2. *Think-Pair-Share in a virtual environment.* Having online students work in groups of two or three within a virtual environment is a great way to keep students active and focused on their learning. Think-pair-share is an active learning technique used in many face-to-face classes but is rarely used in a virtual environment. The goal is to help students organize prior knowledge, brainstorm questions, or summarize, integrate, and apply new information. This strategy can be used in both synchronous and asynchronous situations.

3. *Use small group discussions during synchronous sessions.* We conduct weekly synchronous sessions in our program where the instructor performs a live audio broadcast to the students over the web while the students interact with the instructor and other students in a group chat space. While this in itself encourages active learning, incorporating small group interactions into the large group discussions further enhances it. This is accomplished by having the instructor describe a discussion activity to the class and then asking them to enter their private "virtual team" chat space to discuss and complete the assignment. A specific time is given when the students are expected to return to the class chat space and share the major points of their discussion with the rest of the class.

Reflective Learning

Mezirow (1990) defines learning as "the process of making a new or revised interpretation of the meaning of an experience, which guides subsequent understanding, appreciation, and action" (p. 1). Reflection allows individuals to correct distortions in their beliefs and critique "the presuppositions on which our beliefs have been built" (Mezirow, 1990, p. 1). The process of reflection enables the ideas, understandings, and experiences of individuals and groups to be reviewed (Preskill & Torres, 1999). Watkins and Marsick (1993) see reflection as a key to continuous learning. The following three strategies can be used to promote reflective learning.

1. *Provide extensive and timely feedback.* While this is something most instructors already know, it is important to remember that the online environment removes some of the human "checks and balances" that face-to-face students have with the instructor. While the opportunity to ask questions and have interaction with the instructor is relatively equal, feedback received through physical distance, eye contact, facial expressions and personal topics of conversation is not present for these individuals. Therefore, it becomes even more important that the instructor take time to provide feedback that is detailed enough to paint a complete evaluative picture.
2. *Incorporate "One Minute Papers" and "Muddiest Point" into class.* "One Minute Papers" are short writing exercises in which students are asked to reflect on a particular topic as a form of knowledge assessment activity. Students are asked to post a quick list of the new knowledge they gained through a particular session. The "Muddiest Point" activity allows students to identify the areas of confusion or uncertainly and/or to raise additional questions around the content of the session. Both of these activities benefit the students and instructor by providing feedback on what was clear and what may need further attention through the use of reflection.

3. *Online diaries or reflective journals.* Diaries and journals promote continuous reflection throughout the course. Entries can be self-directed or promoted by an issue, question, or experience posed by the instructor. Journals allow students to reflectively interact with various course topics and experiences and, as noted earlier, critically examine how their values, beliefs and attitudes fit with the material. This is a way that promotes growth beyond what regular instructor and student interactions provide.

Concluding Thoughts

The instructional strategy framework discussed in this paper is clearly a work in progress. Although the framework is based on well-recognized theories of learning and represents a synthesis of ideas from multiple perspectives, it is not fully developed, nor is it all-inclusive. Additional principles will be added as the online program continues to develop and evolve. The specific techniques for applying the instructional principles highlighted in this paper are currently in use in the *HRE Online* courses and continue to be enhanced each time they are implemented. The possibilities for application of the instructional strategy framework are only limited by the creativity and energy of the instructional designers and course instructors.

Formalized research efforts need to be conducted to validate and improve the strategy framework and the instructional techniques that evolve from it. Studies that examine the effectiveness of instructional strategies in online courses are lacking in the educational technology literature. Most literature provides anecdotal comments on experiences with online courses and empirical research that compares face-to-face and online delivery methods. Instead of comparing two dissimilar learning environments, future studies should empirically test the effectiveness of different instructional techniques in maximizing learning opportunities and achievement in online environments.

References

Bandura, A. (1971). *Social learning theory*. New York: General Learning Press.

Brown, J. S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher, 18*(1), 32-42.

Clarke, D. (1999). Getting results with distance education. *The American Journal of Distance Education, 12*(1), 38-51.

Clement, F. J. (1985). The rule of seven revisited. *Performance & Instruction Journal, 24*(2), 6-8.

Garrison, D. R. (1987). The role of technology in distance education. *New Directions for Continuing Education, 36*, 41-53.

Johnson, S. D. (1997). Learning technological concepts and developing intellectual skills. *International Journal of Technology and Design Education, 7*, 161-180.

Johnson, S. D., Aragon, S. R., Shaik, N., & Palma-Rivas, N. (2000). Comparative analysis of learner satisfaction and learning outcomes in online and face-to-face learning environments. *Journal of Interactive Learning Research, 11*, 29-49.

Johnson, S. D., & Thomas, R. G. (1992). Technology education and the cognitive revolution. *The Technology Teacher, 51*(4), 7-12.

Jonassen, D. H., & Grabowski, B. L. (1993). *Handbook of individual differences, learning and instruction*. Hillsdale, NJ: Erlbaum.

Kellar, J. M., & Suzuki, K. (1988). Use of the ARCS motivation model in courseware design. In D. Jonassen (Ed.), *Instructional designs for microcomputer courseware*, (pp. 401-434). Hillsdale, NJ: Erlbaum

Lewis, L., Snow, K., Farris, E., Levin, D., & Greene, B. (1999). Distance education at postsecondary education institutions: 1997-98 [Report No. NCES 2000-013]. Washington, DC: U. S. Department of Education, National Center for Education Statistics.

Miller, G. A. (1956). The magical number seven, plus or minus two. *Psychological Review, 63*, 81-97.

Merriam S. B., & Caffarella, R. S. (1999). *Learning in adulthood: A comprehensive guide* (2nd ed.). San Francisco: Jossey-Bass.

Mezirow, J. (1990). How critical reflection triggers transformative learning. In J. Mezirow (Ed.), *Fostering critical reflection in adulthood* (pp. 1-20). San Francisco: Jossey-Bass.

Navarro, P., & Shoemaker, J. (1999). The power of cyberlearning: An empirical test. *Journal of Computing in Higher Education, 11*(1), 29-54.

Preskill, H., & Torres, R. T. (1999). *Evaluative inquiry for learning in organizations.* Thousand Oaks, CA: Sage.

Russell, T. L. (1999). *The no significant difference phenomenon.* Raleigh, North Carolina: North Carolina State University.

Skinner, B.F. (1968). *The technology of teaching.* New York: Appleton-Century-Crofts.

Smeaton, A., & Keogh, G. (1999). An analysis of the use of virtual delivery of undergraduate lectures. *Computers and Education, 32,* 83-94.

Thorndike, E. L., Bregman, E. O., Tilton, J. W., & Woodyard, E. (1928). *Adult learning.* New York: Macmillan.

Vygotsky, L. S. (1978). *Mind in society.* Cambridge, MA: Harvard University Press.

Watkins, K. E., & Marsick, V. J. (1993). *Sculpting a learning organization.* San Francisco: Jossey-Bass.

Wilson, A. L. (1993). The promise of situated cognition. *New Directions for Adult and Continuing Education, 57,* 71-79.

ECO TECH LINK
PT3 Grant Builds Technology Circles in the K-18 Community

Abstract: *Through the vehicle of the PT3 grant program, ECO TECH LINK has built a strong consortium to support technology circles of government, education and business in order to raise student achievement scores, shorten the time it takes to earn a teaching credential, and enhance the quality of teacher credential courses. The ECO TECH LINK grant enables targeted teacher candidates, including women, minorities, military and high tech professionals, to earn a preliminary teaching credential using a combination of online, face-to-face, video and extended field experience. Math and science curricula with environmental themes are the "real world" framework for online courses providing anytime and anyplace access. This paper describes the need, design, structure, progress and evaluation of the PT3 grant during the first year of implementation.*

Almost a decade ago, Goodland (1994) felt that "very little attention has been given to the role of reforming teacher education." Concurrently, the Office of Technology Assessment, in its report about teachers and technology to Congressional committees, acknowledged that the "interaction between K-12 schools and teacher education programs is an important, generally overlooked variable". (OTA, 1995) Recently President Bush projected in a press release, "A Quality Teacher in Every Classroom", that school districts across the nation will need to hire 2 million teachers over the next ten years. He announced an initiative that will provide a $2.85 billion grant program to enable school districts to recruit and train teachers and principals. In order to meet this challenge, educators have to be willing to accept that "our world is far more complex than ever before, and those who succeed are those who find new and creative ways to solve problems and open up new opportunities." (Segal, 2000)

With this background in mind, a strong consortium for reform in education consisting of government, education and business designed the ECO TECH LINK grant as a technology circle in order to raise student achievement scores, shorten the time it takes to earn a teaching credential in California, and enhance the quality of teacher credential courses. ECO TECH LINK builds upon the current capacity of the National University, the San Diego Natural History Museum and two high need school districts: Cajon Valley and Carlsbad. The PT3 (Preparing Tomorrow's Teachers to Use Technology) program awarded the grant to National University in July 2001 for a three-year implementation. Specifically, the grant restructures the online teacher preparation program at National University in California by implementing an intensive seven-month teacher-training program. The ECO TECH LINK grant enables targeted teacher candidates, including women, minorities, military and high tech professionals, to earn a preliminary teaching credential using a combination of online, face-to-face, video and extended field experience. Additional partners include Cox Communications; Datel Corporation; the Resource Conservation District of San Diego; U.S. Forest Service; the Environmental Trust; and the San Diego Water Authority. TELESIS Corporation will serve as the external evaluator.

National University along with Cajon Valley Union School District, San Diego Natural History Museum and Carlsbad School District modified present teacher education courses to create interactive web-based units. Math and science curricula with environmental themes are the "real world" framework for online courses providing anytime and anyplace access. Teacher candidates and college professors work with veteran K-12 master teachers to create meaningful standards-based methods courses using California State Content Standards and National standards for teaching and learning. ECO TECH LINK created training sessions that will be disseminated statewide using the thirteen National University regional campuses. During the second year of the grant, the California Commission on Teacher Credentialing (CCTC) will validate the seven-month teacher credential program and provide accreditation. Cox Communications will provide the infrastructure to connect the San Diego Natural History Museum and all classrooms via the new museum facility. Cox has agreed to donate video studio time and equipment for filming video clips as well as staff time, and Datel Corporation is committed to providing deeper orientation and training for existing and new hardware supplied to National University. Two groups are the main targets of recruitment for this unique program (1) military professionals who are transitioning to civilian life; and (2) high tech professionals who are transitioning from businesses that have had to down size. All teacher candidates will be working on graduate degrees. National University will assist candidates in establishing student loans and encourage placement of graduates at employment sites that qualify for loan reimbursement due to high levels of poverty based on statistics from the California State Department of Education.

Prior to selecting the sequence of courses and the avenue of recruiting, this PT3 grant held a Design Session workshop for all grant consortium members. The daylong session brought people together in a unique way as it provided the environment for participants to work in three teams to "Build-A-Model" using "Cause and Effect" diagrams based on the work by Dr. Edwards Deming in Japan. The diagrams describe each team's view of the effects they wanted to create through the grant process by carefully analyzing the causes of philosophy, culture, policy, and strategy on the possible success of the grant design. A booklet was developed from the workshop recording all concepts and key ideas. After the grant management team digested the information gleaned from the booklet, it became apparent that the original grant design needed to be refined to facilitate evaluation of objectives and their matching indicators for the PT3 Performance Reports.

Logic Model for PT3 ECO TECH LINK Project Evaluation

<table>
<tr><td colspan="7">Goal 1.0 To increase the use of technology in National University credential courses to produce pre-service teachers capable of delivering a technology infused curriculum focusing on science and math.</td></tr>
<tr><td>Resources</td><td>Activities</td><td>Outputs</td><td>Customers Reached</td><td>Short-term Outcomes</td><td>Intermediate Outcomes</td><td>Long Term Outcomes</td></tr>
<tr><td colspan="7"></td></tr>
<tr><td>NU Teacher Prep Courses;
MSP/CAN Curriculum budget;
Staff;
Partners</td><td>Planning sessions; collaborations for revisions, blending & technology enhancement to NU & MSP/CAN curricula</td><td>Prototype curriculum; Procedures to revise, evaluate against CTAP and National Standards; & improve effectiveness</td><td>NU Faculty & K-12 Master Teachers</td><td>Pilot NU and MSP/CAN pilot curricula are completed & ready for delivery</td><td>Model curriculum for Teacher Credential program created that integrates math & science skills with technology</td><td>Use of technology in NU credential courses increases to produce pre-service teachers who can deliver a technology infused curricula focusing on math & science</td></tr>
</table>

Goal 2.0 To increase the level of technology integration and application skills and resources in the K-18 classroom.						
"Teaching Digitally" curriculum; NU ed tech experts and Two school district & technology company partners; budget	e-College delivery via Internet; inventory & ed-tech equipment upgrade in targeted K-18 classrooms planned	# of NU faculty & # of master teachers trained via e-college; classroom technology upgrades completed	University Faculty; K-12 Master Teachers & Teacher Candidates; K-18 students	# Faculty and # Master Teachers Available to train/ mentor & evaluate teacher candidates increases	All participants have access to training via technology rich environments at the K-12 target schools	Level of technology integration, NU Faculty and Master Teacher skills and resources in K-18 classrooms increases

The logic model provided a road map for the management team to follow as they struggled with the scope of the project as each consortium member assumed responsibility for his or her part of the grant process. One of the greatest concerns became the infrastructure the consortium would have to put into effect as support for the pre-service teachers. In an attempt to put the task of recruitment of master teachers and pre-service teachers into perspective, the following questions were explored by the grant management team:

1. What are the roles, processes, purposes, and timelines required to modify the program sequence and enhance (revise) the courses? (See Inspiration Software document)
2. What are the criteria for selecting the Master Teachers? Who determines the criteria?
3. Who are involved in the selection process of Master Teachers?
4. When are Master Teachers selected?
5. When and how are Masters Teachers prepared?
   (create a community of learners that meet continuously)
6. How are NU and K12 course designers/enhancers selected?
7. Are teacher candidates placed in a few selected schools? Would such placements encourage a strong learning community?
8. How can we create on-ground and online community of learners among and between teacher candidates and Master Teachers?
9. Are multiple subject AND single subject teacher candidates recruited?

The next step was to clearly define the possible course sequences that would ensure high quality and rigor in the teacher credential program while shortening the students' timeline for completion. During each month for the first two months, pre-service teachers take two online methodology courses a month. In the third month, they begin their student teaching during a full day of school activities in the classroom. In the afternoon they take one online theory course per month in the computer lab at the school where they are doing their student teaching. The paradigm shift in this model is two fold: 1) students take the methodology courses before they take their theory courses; and 2) the curriculum from the theory courses in the afternoons can be implemented the next day in the classroom. After adding the Student Teaching Seminar, plus the fact that student teaching is 18 weeks long in California, the original plan of 6 months for training became 7 months, as shown in the table below.

Month	Multiple Subject Certificate	Single Subject Certificate
Prior to 1	CLD 600 Early Field Experience	CLD 600 Early Field Experience
1	CLD 615 Educational Foundations EDT 608 Computer Based Technology	CLD 615 Educational Foundations EDT 608 Computer Based Technology
2	CLD 605 Diverse Classroom CLD 611 Applied Psychology to Teaching	CLD 605 Diverse Classroom CLD 611 Applied Psychology to the Teaching ...
3	CLD 629 Student Teaching Seminar	CLD 629 Student Teaching Seminar
4	CLD 630A Student Teaching CLD 621A Methods for Language Development in 1st and 2nd Language	CLD 630A Student Teaching CLD 623 Teaching English Language Development
5	CLD 630B Student Teaching CLD 621B Methods for Language Arts and Teaching of Reading	CLD 630B Student Teaching CLD 624 Reading in the Content in Subject Area
6	CLD 630C Student Teaching CLD 622A C and I: History-Social Science, PE, and Visual and Performing Arts	CLD 630C Student Teaching CLD 625A Curriculum and Instruction
7	CLD 630D Student Teaching CLD622B C and I: Math and Science	CLD 630D Student Teaching CLD 625B Classroom Management

The decision making process modified the original grant logic model to include a pilot cohort of student teachers as a baseline instead of the larger group of 50 students initially planned. A new university policy mandating that students must pass applicable subject matter exams prior to the 5th credential course was one factor in this decision. The pilot cohort began with 10 teacher candidates, with the anticipation that grant program would enroll at least 50 teacher candidates each time at National University. Cajon Valley Union School District provided master teachers and K-8 school site placements for the pilot teacher candidates. Carlsbad School District provided master teachers and assisted in the placement of teacher candidates. The San Diego Natural History Museum – Museum to School Partnership Program: Communities Alive In Nature (MSP/CAN) provided science and ecology training to master teachers in order to help National University professors rewrite methods courses during the technology training sessions.

Three collaborative technology sessions were planned for the first year of the grant, with the agenda being driven by the technology needs of the master teachers in integrating multimedia and critical thinking skills into their daily curriculum. During the technology training sessions, participants formed small working groups with at least one master teacher, one student teacher and one National University professor. Each working group selected a grade level to write for, based primarily on the master teacher's area of expertise. This classroom grade-level experience was then integrated into the National University technology courses, making the courses more practical and useable for the teacher candidates. The master teachers knew the types of information that would be most directly useful in the classroom situation. The university teachers knew what outcomes were expected in the university course. The student teachers provided a point of view based on their freshness, enthusiasm and lack of exposure to the classroom.

At this point, the excitement began to build. The technology training provided by the workshop was viewed as beneficial for all participants. However, the real excitement was having time to work with peers on a technology project that would have a positive effect on thousands of future teacher candidates while developing working relationships among public school teachers, student candidates and university teachers. The master teachers were pleased their expertise was valued, and their voices were heard. The university teachers were most appreciative of these voices from the front line: the classrooms. The student teachers quickly immersed themselves in the technology project and steadily developed a feel for what was needed in the classroom, both at the public schools and university level. The "give and take" experienced by participants was such a pleasant energizer that all participants agreed to continue the process with other projects.

As a result of this technology training, the university courses now contain specific threads and assignments at distinct grade levels. Thus a candidate who is interested in teaching at the fifth grade level can follow the thread for that level and develop practical, as well as theoretical, knowledge specifically designed for fifth grade students. This knowledge becomes the beginning of a portfolio for student teaching. It is information based on actual classroom knowledge, and the master teachers are able to see their work become part of university courses.

Eco-Tech Link Outcomes Evaluation Plan Progress

The following information lists the goals, outcomes, and major activities during the first year of the grant implementation.

Goal 1.0 To increase the use of technology in National University credential courses to produce pre-service teachers capable of delivering a technology infused curriculum focusing on science and math.

Outcome: Model blended curricula for the National University (N.U.) teacher-credentialing program and K-12 classrooms are created which meet the State of California (CTAP) and national standards for educational technology competencies.

Major Activities: During the first technology training session, master teachers and NU faculty were divided into teams to evaluate the NU designated clearing credential course for California pre-service teachers: EDT 608 (Computer-Based Technology in the Classroom). They were given access to the online class template and asked to take the course as if they were a pre-service teacher in an interactive technology environment. Their feedback on how to enhance the course with science and math curriculum was discussed as a group, recorded on paper and provided to the management team for implementation. Many of the recommendations involved integrating student activities at multiple grade levels of K-3, 4-6, and 7-8 into the teacher-credentialing course to facilitate transference of material from the online courses into the classroom the next day.

During the second technology training session, emphasis was put on enhancing a teacher education credential courses. The first online course was reviewed, and the collaborative group applied their recommendations for enhancing CLD 625A (Curriculum and Instruction) in the areas of science and math as a model for three other classes: CLD 625B (Classroom

Management), CLD 622A (History-Social Science, PE and Visual and Performing Arts), and CLD 622B (Math and Science). Grant participants researched sources on the Internet on how to use technology to integrate science and math activities into curriculum that addresses standardized assessment tools, self-esteem, trends in assessment, and instructional planning skills. Application software skills became the successful organizational tools for this training session as the teams worked together on a beginning outline for each course. A ten-hour homework assignment completed the training session, allowing for reflection and additional research.

Goal 2.0 To increase the level of technology integration and application skills and resources in the K-18 classroom.

Outcome: ECO-TECH LINK Program participants have access to training via technology-rich environments in the K-12 target schools.

Major Activities: Technology training sessions were held to assess and increase the computer literacy levels of the master teachers and NU faculty in this grant. The grant participants, using the California Technology Assessment Profile (CTAP), took an online Pre-Test to measure their level of technology integration and application skills. The CTAP measures basic hardware; software packages and terminology; research tools; ethics and policies; information literacy; integration, student learning, and classroom management; communication through print media; and instructional technology in the areas of analyzing best practices, selection of appropriate technology resources, matching student learning styles to appropriate resources, effective learning environments, and security issues. A Post-Test will be given in June to complete the evaluation and research.

The grant management team performed a technology need assessment of master teachers in Cajon Valley School District and for NU faculty and later for the Carlsbad master teachers. The decision was to hold the training sessions in both Macintosh and PC labs to accommodate both levels of education. The first technology training session was held in a middle school setting with Macintosh computers; materials were developed for multiple levels of expertise among the master teachers. The first training included: follow-along exercises in PowerPoint with extensive screen captures and instruction; CD ROMS with text, videos, music, graphics and sounds for teachers to use as resources in the training and later in their own classrooms; a PowerPoint show based on the Wizard of OZ, demonstrating advanced skills in multimedia; an Internet Scavenger Hunt to teach research skills for a K-8 classroom setting; "value-added" Internet research using Web Quests; new web resources with images to meet the needs of developing Natural History Museum MSP/CAN projects with science emphasis for K-8 classrooms; file management; creating hyperlinks in documents; Acceptable Use Policies (AUPs) for school districts; digital camera usage; inserting images and sounds into projects; research on "how to design" rubrics based on examples from the Web; Web page creation in Word with graphics, text, tables, hyperlinks and HTML format, coupled with hands-on technical assistance. A wrap up session occurred at the end of each day to read the participant feedback forms to determine what went well and what would be needed in the next training session for both master teachers and NU faculty.

The second technology training session was held at the state of the art NU facility with a PC classroom. The change in platforms went seamlessly. The participants were amazed at how easy the PCs were to run and were able to cross platforms immediately. Information sessions and follow along structured exercises supported such topics as: search engines for the Web; Show and Tell presentations for Natural History Museum MSP/CAN electronic projects; a supervised library tour focusing on electronic databases, resources and ebooks; creating matrices and calculating percentages with graphs in Excel; web research for multimedia projects for the K-12 classrooms; and a videotaped walkthrough unveiling the improvements to the EDT 608 course, which they had evaluated and enhanced with activities in the first training session in January 2002.

The third technology training session was held to provide student teachers with similar technology skills and resources to integrate immediately into the student teaching classroom. It focused extensively on advanced PowerPoint multimedia and Web Quests, using screen captures again in the training materials with detailed, hands-on instruction. Master teachers and NU faculty were invited but not required to attend this session. In addition, the focus was on creating PowerPoint presentations that could be integrated into their daily lesson plans.

Goal 3.0 To expand and sustain the ECO-TECH LINK partnerships over the next 3 years.

Outcome: ECO-TECH LINK model is institutionalized statewide via nine regional National University sites and partnerships.

Major Activities: Enhancing just one of the teacher credential courses through this grant (EDT 608) has already benefited hundreds of students over the nine regions of California since the new version is currently being taught online. The enhanced course was offered online in March and April 2002 to a total of over 350 NU pre-service teachers who have to clear their California Clearing credential. The same amount and kind of students at NU will take the course in May and June 2002, raising the number to 700 of pre-service teachers who have completed the course with the new design from the grant. Beginning in July 2002, the EDT 608 course is no longer the clearing course for technology. Instead, at NU, it has been embedded in all teacher education credentialing programs, with an anticipated enrollment of 7,000 students a year, meeting the needs of school districts for science and math curriculum integrated with technology.

Goal 4.0 At least 80% of the pre-service teacher grant candidates will complete the ECO-TECH LINK program in seven months.

Outcome: At least 80% of the pre-service teacher candidates will complete the ECO-TECH LINK program in seven months. This goal will be measured every seven months on completion of a cohort group through their teacher credentialing cycle.

Major Activities:
None at this point because the grant management team redesigned the grant design process and inserted a prototype group of 10 pre-service teachers as a baseline group.

Goal 5.0 To expand the population of women and minority candidates who become fully credentialed pre-service teachers able to infuse technology in a science and math based curriculum.

Outcome: 80% of women and minority teacher candidates in each cohort will complete pre-credential requirements in seven months.

Major Activities:
None at this point, but plans are being made for innovative ways to support this population to ensure a high level of completion such as mentoring, cohort leaders, family oriented activities, and a new course in classroom behavior management taken prior to the student teaching experience.

References

Goodland, J. I. (1994, April). The national network for educational renewal. *Phi Delta Kappan*.

Office of Technology Assessment. (1995). Teachers and technology: making the connection. OTA-HER-616.

Segal, B. (2000). Technology and education: what's around the corner? *ECCO Output*. Retrieved April 10, 2002 from http://www.ecoo.org/e/output/feature221.html .

U.S. Department of Education. (2002, March 4). White House fact sheet: a quality teacher in every classroom. Retrieved April 6, 2002 from http://www.ed.gov/PressReleases/03-2002/wh-020304.html .

The Instructional Instrument SL-EDGE
Student Library-Educational DiGital Environment

Antonia Kyriakopoulou, PhD Candidate
Department of Informatics
Athens University of Economics and Business
76 Patission St., Athens, GR 104.34
tonia@aueb.gr

Theodore Kalamboukis, Professor, Computer Science
Department of Informatics
Athens University of Economics and Business
76 Patission St., Athens, GR 104.34
tzk@aueb.gr

Abstract: An educational digital environment that will provide appropriate methods and techniques for the support and enhancement of the educational and learning process is a valuable tool for both educators and learners. In the context of such a mission, the educational tool SL-EDGE (Student Library-Educational DiGital Environment) has been developed. The application employs, amongst others, a standardized metadata structure and collaborative filtering techniques in order to provide a set of educational services oriented towards users' needs for the discovery and reuse of educational resources for a reliable, efficient and effective assessment and also for communication, distribution and exchange of ideas and opinions. To this effect, it consists of two main modules: an educational digital library and an assessment tool for teachers and students. All the functions implemented are fully web-based and the application deploys technologies such as Java, JavaServer Pages and JavaBeans, transforming it to a powerful and robust educational tool.

Keywords: digital library, assessment, metadata, standards, collaborative filtering, education.

Introduction

The Internet and its software applications have become the de-facto information access and distribution system of the new millennium. However, the exponential growth of the World Wide Web and the continual augmentation of the available information resources have resulted to many problems due to the lack of standardized structures and typologies for content description. Moreover, the coverage of Web content by search engines is continually decreasing, and the full-text approach to searching has become increasingly ineffective due to the rise in non-textual information online. As a result, the search engine approach generally suffers from low precision and problematic information retrieval.

To address these problems, much recent research has focused on building web-based digital libraries containing vast repositories of information resources. Within educational applications, a primary goal of these libraries is to provide users (teachers and students) with a way to search for and display digital learning resources commonly called "learning objects". Examples of such educational digital libraries include the instructional system for the science, mathematics, engineering and technology education SMETE community (Dong et al., 2001), the open-source digital library software Greenstone (Witten et al., 2001), the Digital Libraries Initiative Project by the University of Illinois (DLI), the Libraries Special Collections Project by the North Carolina State University (LSC), the Pennsylvania Education Network Digital Object Repository (PEN-DOR) system by the University of Pittsburgh (Fullerton et al., 1999) and many more.

As part of these efforts, researchers are developing digital library systems that provide descriptive summaries intended to convey the semantics of an object. Together, the data elements of these summaries usually comprise what is called a metadata structure. Hence, in typical educational digital library applications, learning objects are stored and labeled with a metadata record. This metadata record usually contains basic information about the object including, for instance, technical requirements, rights management, and author details. Metadata structures are searchable and thus provide a means for discovering, sharing, and reusing learning objects, even when these objects are non-textual.

In this paper, we examine key assumptions underlying the design of an educational digital library coupled with a metadata structure and we demonstrate an implementation of the ideas discussed above within a system called SL-EDGE (Student Library-Educational DiGital Environment). In particular, we present the fundamental notion according to which a learning object can be effectively described with metadata elements and then retrieved via these descriptions in order to be used or reused in a new learning context.

As far as the effective description of learning objects is concerned, we argue that this incorporates the use of an appropriate metadata structure that will describe the semantics of a learning object and will also ensure the desired syntactic and semantic interoperability among other similar applications. Many efforts have been accomplished by organizations, groups and committees for the creation of standardized metadata element sets, which can offer these important capabilities to the applications that use them. The most important efforts include ADL organization (ADL) with SCORM specification (SCORM), ARIADNE project (ARIADNE) with a corresponding specification (ARIADNE version 3.1), CEN/ISSS Learning Technology Workshop (CEN/ISS), IEEE Learning Technology Committee (IEEE) with the Learning Object Metadata specification (LOM), IMS Global Leaning Consortium (IMS), ISO Joint Technical Committee (JTC1) SC36 (SC36) and many more. These efforts focus on issues such as controlled vocabularies, architecture, educational activities, metadata for learning objects, systems for course administration and technologies for student and teacher communication, cooperation and collaboration. The metadata structure used by SL-EDGE complies with the metadata element set that has been established by the Dublin Core Metadata Initiative (DCMI), a group of scientists that are responsible for the development, standardization and promotion of the corresponding Dublin Core Metadata Element Set (DCMES)(Baker, 2000).

We also argue that the semantic information about each learning object captured by the metadata structure described is critical in supporting effective discovery and reuse of learning objects for instructional purposes. A mechanism that uses this information in order to offer extended search capabilities, using expanded queries and corresponding browsing facilities, should be and is indeed provided by our application.

Furthermore, the application captures information about the users and their preferences, which is further exploited by a suitable collaborative filtering algorithm. We describe and discuss the application of a collaborative filtering technique in order to support automatic filtering and recommendation of relevant learning objects for SL-EDGE and we illustrate how the information about a learning object can be comprised of community-contributed information as well as usage metrics. This approach supports the automatic recommendation of relevant learning objects and allows the user to locate other users with whom shares similar interests for further communication and collaboration. The result is the creation of communities through evaluating and using learning objects and the reinforcement of the reusability of the learning objects.

As an essential and supplementary tool for the educational digital library with the above characteristics, an assessment module has also been introduced. Its purpose is to complete the learning procedure and provide evidence of good implementation of teaching methods and teachers' practices and of the overall comprehension and understanding of a certain educational domain on behalf of the students.

In the next sections we will discuss in detail the two modules presented above, the procedures they include, the practices they implement and the benefits they provide to teachers and students, the two major links in the educational chain.

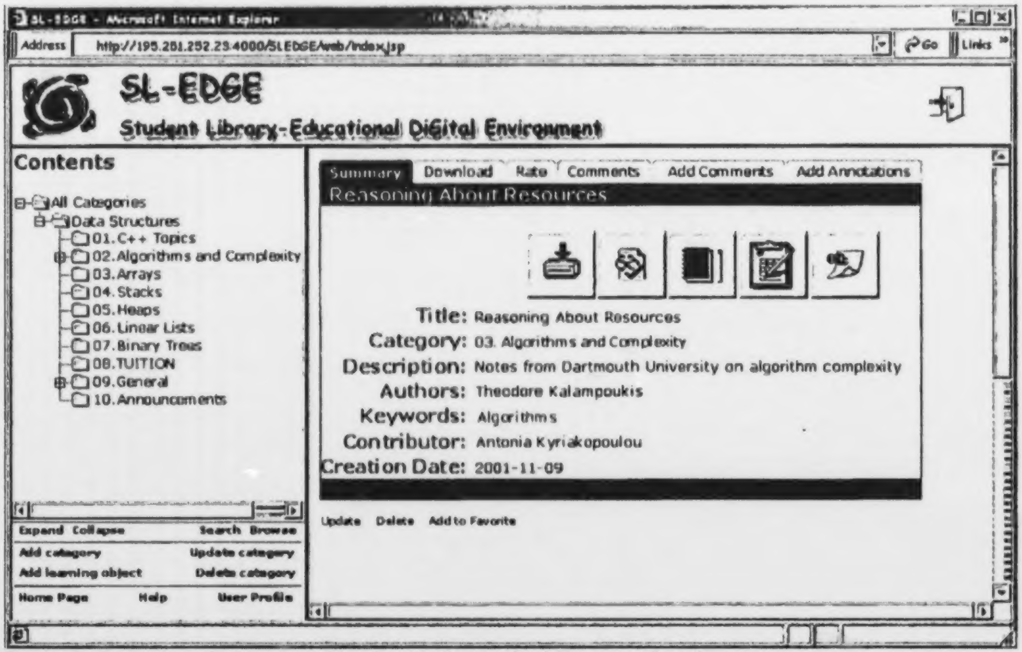
Educational Digital Library Module

The main function of the educational digital library module is the dynamic construction and presentation of collections of educational materials, commonly known as learning objects. The system gives teachers the ability to build such collections with effective full-text searching and metadata-based browsing facilities that are attractive and easy to use. Moreover, they are easily maintained and can be enriched and administered in a semi-automatic way.

A learning object is any digital entity, which can be used, reused or referenced during a learning activity (LOM). It can be text, pictures, or other multimedia formats. The application collects learning objects and semantic information about them using a number of metadata. As mentioned above, in order to ensure the desired semantic interoperability, the standardized Dublin Core Metadata Element Set is being used. According to this set, metadata such as author, title, description, date, keywords, category and technical features (resource size and format) are associated with each learning object. These are the raw material for indexes and are used to support searching and browsing facilities. They are explicitly provided by the contributor who completes the corresponding forms.

Searching utilizes indexes from the above metadata such as title, description, author names of learning objects and also category title and keywords, the selection of which is used to create expanded queries. The search interface is a simple one, suitable for casual and advanced users. It allows term and phrase searching and also stemming control.

Browsing utilizes metadata such as category title and subject. Users when browsing, examine a dynamic hierarchical classification scheme, in the form of a tree structure, created by these metadata. Each learning object is classified into the categories and subcategories of this scheme (Fig. 1). Browsing is particularly helpful for inexperienced users not familiar with a subject, its structure and terminology (Koch et al., 1999).


SL-EDGE - Microsoft Internet Explorer
Address
http://195.251.252.23:4000/SLEDGE/web/index.jsp
Go
Links
SL-EDGE
Student Library-Educational DiGital Environment
Contents
All Categories
Data Structures
01.C++ Topics
02.Algorithms and Complexity
03.Arrays
04.Stacks
05.Heaps
06.Linear Lists
07.Binary Trees
08.TUITION
09.General
10.Announcements
Expand
Collapse
Search
Browse
Add category
Update category
Add learning object
Delete category
Home Page
Help
User Profile
Summary
Download
Rate
Comments
Add Comments
Add Annotations
Reasoning About Resources
Update
Delete
Add to Favorite

Title: Reasoning About Resources
Category: 03. Algorithms and Complexity
Description: Notes from Dartmouth University on algorithm complexity
Authors: Theodore Kalampoukis
Keywords: Algorithms
Contributor: Antonia Kyriakopoulou
Creation Date: 2001-11-09

Figure 1: Summary of a learning object's metadata and relevant user functions

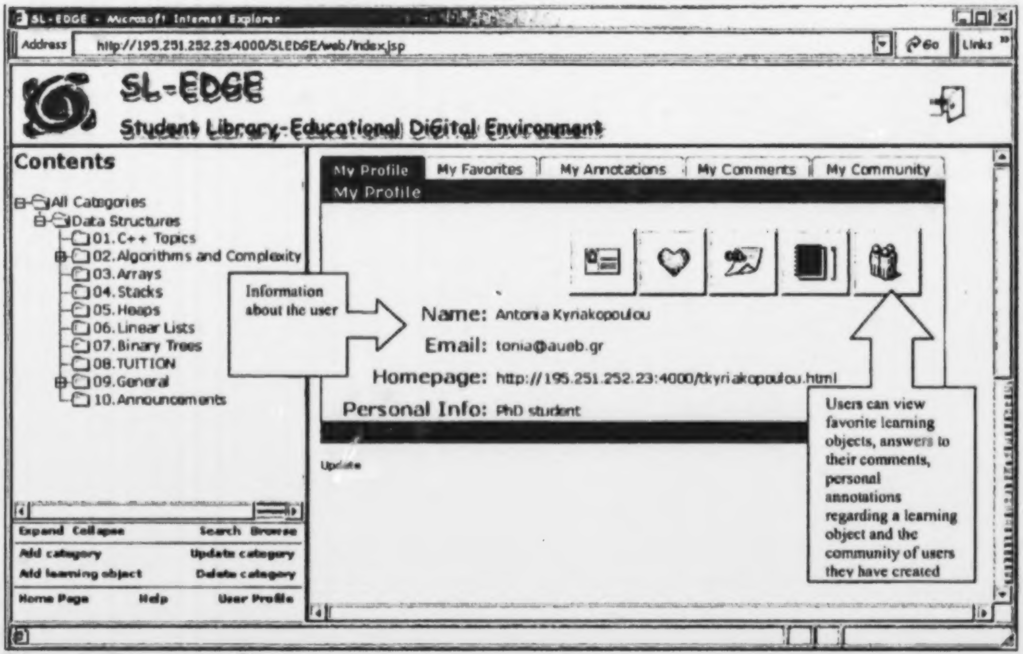
The result from searching or browsing is a number of learning objects. In case of searching, the retrieved learning objects are displayed ranked according to the number of occurances of the search terms in the metadata records. In case of browsing, the system retrieves the learning objects that are classified under the category selected by the user and under the children-categories by traversing the branches of the tree structure. The displayed learning objects are sorted by metrics related to their popularity, i.e. their visiting rate.

The selection of a learning object displays the summary of metadata associated with it (Fig. 1), and gives the user the ability to add it to "My Favorites", to view and reply to existing comments or create new ones, to create personal annotations and to download the resource to his/her system. Last but not least, the user can rate the learning object using a Likert scale from 1 (minimum) to 5 (maximum), and can also find relative statistical evidence such as the total number of users who have rated it, the percentage of users who have rated it at each point of the scale, and the average attained variation.

The above capabilities and information create what we call "user profile" for each user (Fig. 2). This contains information about the user (name, surname, e-mail, etc.), links to "My Favorites", replies to comments created by him/her and corresponding personal annotations. The most important aspect of a user profile is that it captures non-visual information concerning the learning objects visited by the user and the rates awarded.

BEST COPY AVAILABLE

A suitable collaborative filtering algorithm based on the approach of the "nearest-neighbor" (Recker & Wiley, 2000) further exploits the above information about the users and their preferences. This particular approach concerns the selection of a subset of users according to their similarities in certain parameters. Specifically, users with high correlation in relation to their rating of the same learning objects are treated as having the same interests and they construct the so-called user's "active neighborhood". After the creation of the user's active neighbor, the learning objects that have received high marks from the users of the neighborhood are recommended to him/her as relevant learning objects. In this way, the approach supports the automatic recommendation of relevant learning objects and allows the user to locate other users with whom shares similar interests for further communication and collaboration. The result of the above procedure is the creation of communities through evaluating and using learning objects, as well as the reinforcement of the reusability of the learning objects.


SL-EDGE - Microsoft Internet Explorer
Address
http://195.251.252.23:4000/SLEDGE/web/index.jsp
Go
Links
SL-EDGE
Student Library-Educational Digital Environment
Contents
All Categories
Data Structures
01.C++ Topics
02.Algorithms and Complexity
03.Arrays
04.Stacks
05.Heaps
06.Linear Lists
07.Binary Trees
08.TUITION
09.General
10.Announcements
Expand Collapse Search Browse
Add category Update category
Add learning object Delete category
Home Page Help User Profile
My Profile
My Favorites
My Annotations
My Comments
My Community
My Profile
Update

Name: Antonia Kyriakopoulou
Email: tonia@aueb.gr
Homepage: http://195.251.252.23:4000/tkyriakopoulou.html
Personal Info: PhD student

Information about the user

Users can view favorite learning objects, answers to their comments, personal annotations regarding a learning object and the community of users they have created

Figure 2: The user's profile

The system also includes an "administrative" function whereby users with administrative privileges can register new users and also manage the classification scheme and the collection of the application by inserting, updating and removing categories, subcategories, learning objects, authors and keywords. The interface of the application appropriately supports these functions. The module has many automatic features allowing simple, novice users to use it and make the most of it.

Assessment Module

The assessment module provides two interfaces, one for the teacher and one for the student, with appropriate functionalities and capabilities. Specifically, the teacher creates questions, constructs assessments and tests from sets of questions, assigns them to particular students or groups of students, reviews results and sees statistics and other evidence of comprehension and progress. The student on the other hand, sits for the test online on dates that have been set by the teacher and sees the automatically generated (where possible) results. The results are presented in various ways (graphically, etc) and the student can also see the right answers to the

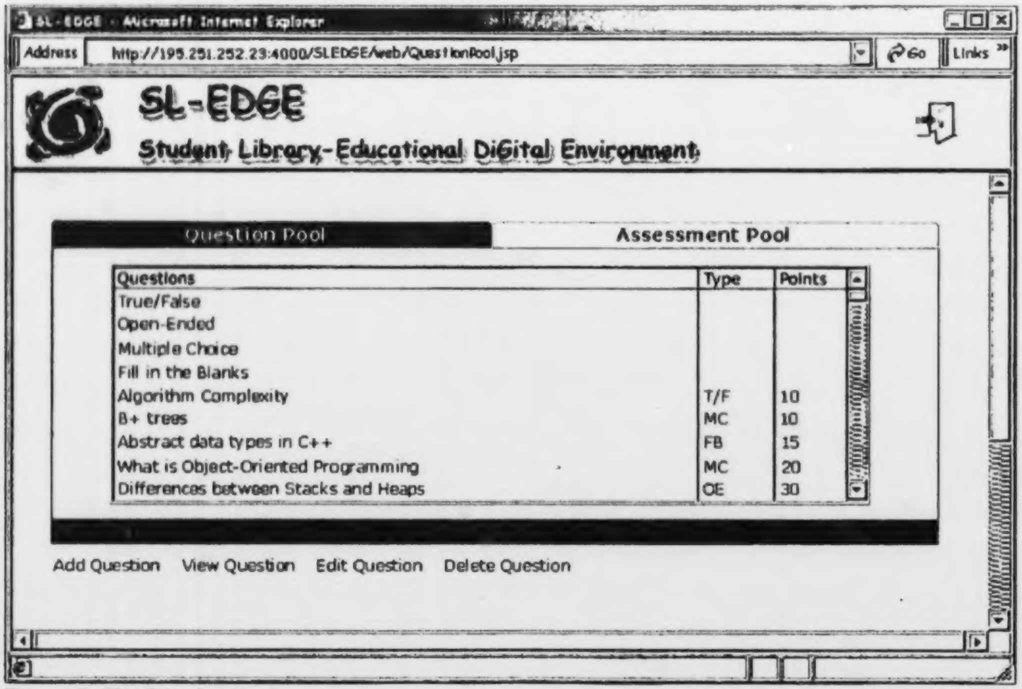
BEST COPY AVAILABLE

tests already taken and any available feedback given by the teacher. Last but not least, the system lets the students keep track of their progress and compare their overall performance with that of their classmates.

Going into details, the process of constructing an assessment includes a set of steps. First, the teacher creates the questions of the test. The types of questions currently supported by SL-EDGE are (Fig. 3):

- Multiple choice
- True/False
- Fill in the blanks
- Open-ended

The process of creating a question includes composing the question itself, the possible answers, the right answer(s) and the marks that will be added to the student's final score if answered correctly. Also, the teacher has the option to add feedback to each question to be supplied to the student after test completion. According to the type of question selected, a corresponding form with appropriate guidelines is presented to the teacher to fill in. After being created, the question is submitted to the central point of the module, the question pool. Assessments and tests are created by drawing questions from the question pool (Fig. 3). The teacher can choose from the new questions that he/she has submitted following the procedure discussed above, and/or from the already existing questions. This means that a question can be used for the construction of various tests, something that is in favor of reusability, achieving minimum authoring time and maximum flexibility. An assessment consists of an open-number of questions and also includes information such as title, date of fulfillment and guidelines for the students. Assessments can be viewed from the corresponding assessment pool.


SL-EDGE - Microsoft Internet Explorer
Address
http://195.251.252.23:4000/SLEDGE/web/QuestionPool.jsp
Go
Links
SL-EDGE
Student Library-Educational DiGital Environment
Question Pool
Assessment Pool
Add Question
View Question
Edit Question
Delete Question

Questions	Type	Points
True/False		
Open-Ended		
Multiple Choice		
Fill in the Blanks		
Algorithm Complexity	T/F	10
B+ trees	MC	10
Abstract data types in C++	FB	15
What is Object-Oriented Programming	MC	20
Differences between Stacks and Heaps	OE	30

Figure 3: The Question Pool

All assessments can be removed or updated by adding or removing questions and updating related information. Accordingly, questions can be removed and updated too. These functions require that their executor is indeed the creator of the assessment and/or question. The deletion of a test doesn't lead to deletion of the questions that form it; questions that are included in assessments cannot be erased.

The teacher's interface also includes a mechanism for receiving and evaluating the answers to the open-ended questions that a test might have and for sending back the corresponding scores.

BEST COPY AVAILABLE

The student's interface is where the tests are taken. All questions of a test are presented in the appropriate format. The student can navigate back and forth the questions and give his/her answers. Immediately on completion, the results are automatically extracted along with the right answers and the feedback supplied by the teacher. Only open-ended questions are sent back to the teacher for review and evaluation.

Both interfaces include a mechanism for viewing the results of the tests and keep track of the progress. The system provides for the creation of reports of progress in many formats (charts, graphical representations, etc).

In conclusion, the assessment module provides an automated, wizard-like environment for the creation of questions, the construction of a test and its assignment to specific students or groups of students and the review and extraction of results after its completion.

System's Architecture and Technical Features

The system follows the 3-tier architecture model with a relational database for the data storage layer, Java, JavaBeans and JavaServer Pages (JSP) for the application layer and HTML and JavaScript for the presentation layer.

Also, the system adopts the Struts framework for building Web applications that integrates with standard technologies like the ones mentioned above. This encourages application architectures based on the Model-View-Controller design paradigm (Struts).

Last but not least, the Unicode character set is used throughout so that learning objects, tests and interfaces can be in any language. Learning objects and tests have been produced in English and Greek, and SL-EDGE has interfaces in both languages.

Conclusions and Further Research

The increase of the available information on the World Wide Web and the penetration of web technologies into the educational sector have led to an imperative need and an absolute requirement for the development of tools that will support effective searching and indexing capabilities and will offer rich environments for the uplift of the learning process together with a knowledge management potentiality.

Digital libraries are good examples of the investigation and research of new approaches related to the effective use of huge information repositories, due to the tradition shared by the simple conventional libraries on supporting the information needs of their users. The digital library module of SL-EDGE incorporates a variety of technologies that provide consolidation, organization and access capabilities on large information volumes and presents heterogeneous information resources distributed over the Internet to look like a unified, homogeneous and integrated information resource. The system not only successfully supports the storage of learning resources but also the systematic knowledge acquisition related to its content and the user's preferences and behavior.

The use of metadata for the description of the classification scheme and the learning objects provides adequate support for the searching and browsing mechanisms. The metadata records created, describe in a successful way the educational context in which a learning object is to be used, reused or referenced. Also, the standardized Dublin Core Metadata Element Set adopted ensures the desired syntactic and semantic interoperability. This particular set has turned out to be simple but adequate for the library's needs; it is now one of the most popular and well-known standards and is given great support from the market (DC projects)(DC tools). To eliminate the time consuming procedure of metadata creation for each learning object, we only used a subset of the DCMES for the administration of our collection. The use of a number of automated forms with pop-up windows, drop-down lists, etc. optimized the process.

The implementation of the collaborative filtering approach adds a knowledge management view to the content and the library that derives from recording and further analyzing the user's "behavior". The approach manages to support the automatic recommendation of relevant learning objects and gives to the user the ability to locate other users with whom shares the same interests for further communication and collaboration. The result of the above procedure is the creation of communities through using and evaluating the learning objects of the collection and also the increase of the reusability of learning objects. However, for the further exploitation of this capability we suggest that in the future the system should provide a mechanism that will give greater motivation to the users in order to rate the learning objects they visit and provide more feedback for the collaborative filtering approach (Jones, 2001).

As far as the assessment module is concerned, this tool has succeeded beyond our expectations. It has been proved easy to use and manage for both teachers and students, optimizing the assessment procedure in all its phases, from the creation of a test until its final evaluation. The preparation time has been minimized by the ability of reusing already existing questions and tests whereas the wizard-like environment permits even casual users make the most of it.

Further research encompasses fundamental issues surrounding the concept of ontologies and knowledge acquisition. An ontology can be used to describe a piece of reality; it is referred to as "a specification of a conceptualization" (Uschold, 1996)(Uschold & Grüninger, 1996). It is typically conceived and expressed as a set of concepts (for example entities, attributes and processes), their definitions and their inter-relationships (RichODL-OU-3/1999). In the next version of SL-EDGE we are planning on creating an ontology that will describe the educational domain and will maximize the results from the use of the techniques and methods described above. In particular, we are concerned with how to incorporate the concepts of personalization and adaptability to the users' needs into the services offered by our application.

Another future extension of SL-EDGE is the development and integration of digital portfolios. Research up to now, has revealed that digital portfolios' main purpose is to constitute an alternative way of assessing students' progress by storing their scores and other material results. This information is then used as evidence of the learning acquisition and outcome. However, we believe that digital portfolios can be of wider use than just used for the assessment of the students' progress. If we approach digital portfolios from a knowledge management point of view, the results that they contain can be shared and distributed over the intranet and/or the Internet (Tillema, 1998).

SL-EDGE has been being used for over six months as a pilot program hosting learning resources from the courses of "Data Structures" and "Information Retrieval Systems" held in the department of Informatics in our University. The users registered are students that attend the courses and reach the number of 150. These are the simple users of the application with capabilities of searching and browsing learning objects and conducting assessments. Also, there is a number of users registered that play the role of the authors and/or contributors of the learning objects and that of the creators of the assessments. These are the professors of the courses and the assistants conducting the corresponding tuitions. Until now, up to 70 learning objects appropriately described with metadata records have been inserted and three assessments per course have been conducted. The general feelings we received from the users were very encouraging since they remarked on an increase of productivity and a very easy adaptation to the features and functions of SL-EDGE. Also, its property for keeping track of progress turned out to be very helpful.

We believe that the capabilities, techniques and user services presented in this paper contribute to the success of an application like SL-EDGE, which constitutes a useful and essential tool for tutors and learners.

SL-EDGE official site:
http://195.251.252.23:4000/SLEDGE/web/CheckCredentials.jsp

References

ADL. *Advanced Distributed Learning*. http://www.adlnet.org/

ARIADNE version 3.1. *ARIADNE version 3.1 Educational Metadata Recommendation, May 2001*. EPFL (Lausanne, CH), K.U.Leuven (Leuven, B) and the ARIADNE Foundation, http://www.ariadne-eu.org/3_MD/ariadne_metadata_v31. htm

ARIADNE. *Alliance of Remote Instructional Authoring and Distribution Networks for Europe*. http://ariadne.unil.ch/

Baker, T. (2000). A Grammar for Dublin Core. *D-Lib Magazine*, Vol. 6, No 10, October 2000.

CEN/ISSS. *European Committee for Standardization/Information Society Standardization System*. http ://www.cenorm.be/isss/Workshop/LT

DC projects. *Dublin Core Projects*. http://dublincore.org/projects/

DC tools. *Dublin Core Tools and Software*. http://dublincore.org/tools/

DCMES. *Dublin Core Metadata Element Set*. http://www.dublincore.org/documents/dces/

DCMI. *Dublin Core Metadata Initiative*. http://www.dublincore.org/

DLI. *Digital Libraries Initiative Project at the University of Illinois*. http://www.canis.uiuc.edu/news/ieee_2_99.html

Dong, A., Agogimo, A.M. (2001). Design Principles for the Information Architecture of a SMET Education Digital Library. *Proceedings of the 2001 ACM/IEEE Joint Conference on Digital Libraries JCDL'01*, June 24-28, 2001, Roanoke, VA, USA, New York, New York: The Association for Computing Machinery, 314-321.

IEEE. *IEEE Learning Technology Standardization Committee (LTSC)*. http://ltsc.ieee.org/

IMS. *IMS Global Learning Consortium*. http://imsproject.org/

Jones, P. (2001). Open(source)ing the doors for contributor-run digital libraries. *Communications of the ACM*, Vol 44, No 5, 2001.

JSP. *JavaServer Pages*. http://java.sun.com/products/jsp/

JTC1. *ISO/IEC JTC1 Joint Technical Committee*. http://www.jtc1.org/

Koch, T., Zettergren, A.S., Day, M. (1999). Provide browsing using classification schemes. *EU Project DESIRE II*. http://www.lub.lu.se/desire/handbook/class.html

LOM. *IEEE Learning Object Metadata*. http://ltsc.ieee.org/doc/wg12/scheme.html

LSC. *Libraries Special Collections Project at North Carolina State University*. http://www.lib.ncsu.edu/archives/tech_serv/ead.html

Fullerton, K., Greenberg, J., McClure, M., Rasmussen, E., Stewart, D. (1999). A digital library for education: the PEN-DOR project. *The Electronic Library*, Vol. 17, No. 2, pp. 75-82, April 1999

Recker, M.M., Wiley, D.A. (2000). A non-authoritative educational metadata ontology for filtering and recommending learning objects. *Journal of Interactive Learning Environments: Special issue on metadata*, September 2000.

RichODL-OU-3/1999. Introduction to Ontologies. *RichODL-OU-3/1999*, September 1999.

Roes, H. (2001). Digital libraries and education: trends and opportunities. *D-Lib Magazine*, July/August 2001.

SC36. *ISO/IEC JTC1 SC36*. http://jtc1sc36.org/

SCORM. *Sharable Content Object Reference Model*. http://www.adlnet.org/Scorm/scorm.cfm

Struts. *Struts Framework*. http://jakarta.apache.org/struts/

Tillema, H.H. (1998). Design and validity of a portfolio instrument for professional training. *Studies in Educational Evaluation*, Vol. 24, No 3, 1998.

Uschold, M. (1996). Building Ontologies: Towards a Unified Methodology. *Proceedings of Expert Systems '96, the 16th Annual Conference of the British Computer Society Specialist Group on Expert Systems*, Cambridge, UK, 16-18 December 1996.

Uschold, M., Grüninger, M. (1996). ONTOLOGIES: Principles, Methods and Applications. *Knowledge Engineering Review*. Vol. 11, No 2, June 1996.

Witten,I.H, Bainbridge, D., Boddie, S.J. (2001). Greenstone. Open-Source Digital Library Software. *Communications of the ACM*, Vol.44, No 2, May 2001.

Means and Methods in Automatic Courseware Production: Experience and Technical Challenges

Tobias Lauer, Thomas Ottmann
Institute of Computer Science
University of Freiburg
Germany
E-mail: {lauer, ottmann}@informatik.uni-freiburg.de

Abstract: Experience has shown that the production of rich-media content for web-based courses tends to be extremely cost and time consuming. One way for campus-based universities to reduce authoring costs is to automate the production process by using suitable tools for capturing live lectures. In this paper, we describe different technical approaches to presentation recording. Recording systems can be evaluated with respect to a number of criteria, such as recordable input formats, automatic structuring of captured contents, synchronous replay of graphical annotations, and many more. We present a list of these criteria and give an overview of several existing software tools. We also address features which are not supported by the currently available systems but which we consider important for a widespread acceptance of presentation recording, such as more comfortable system-user interaction or a both powerful and efficient representation of electronically captured handwriting.

1. Introduction: Online vs. Offline Teaching

Campus-based universities are used to offering their courses in the traditional, time and space bound mode to their students. At least in systematically structured subjects like science and engineering, including computer science, the whole organization of the curriculum follows the traditional workflow: Lecturers present contents in ex-cathedra lectures; we call this the presentation phase. These lectures are usually accompanied by tutorial sessions where weekly or biweekly assignments submitted by the students are discussed. Finally, in a third, also clearly identifiable phase of the learning cycle, students apply their acquired knowledge in project and thesis work. This way, universities are able to adapt their knowledge mediation to recent research developments in a quick and flexible way.

On the other hand, the ubiquitous availability of the Worldwide Web has had the effect that even campus-based universities are increasingly trying to loosen the time and space constraints of their studies by offering web-based courses. However, they experience that running courses in a distance mode requires a complete structural change of the traditional workflow. The different phases of the learning cycle are interweaved in a fine-granular manner; not only tutorial guidance over the net but all administrative and management tasks have to be handled in a new way for off-campus students. The most unpleasant experience, however, is that courseware production and implementation can be extremely expensive and time consuming. Experience gained in several large-scale projects in Europe has shown that production costs for rich-media content in the range between 50,000 and 100,000 EUR per weekly lecture hour are no exceptions. A successful strategy to virtualize parts of the curriculum at campus-based universities should therefore not only follow the traditional workflow more closely but must also drastically reduce the production costs of web-based courses.

One first step in this endeavor is to capture the media streams occurring in live presentations and integrate them to form synchronized multimedia documents for offline use. In the following, we describe different technical approaches to this process known as presentation recording. We provide a list of criteria according to which presentation recording tools may be compared and give an overview of several existing systems. We will draw on our own experience from the past years of capturing real-life university courses using our own recording technology. Finally, we shall address some challenging aspects that are unsolved in most of today's presentation recording systems. The technical problems to be solved in this context also concern the user interface for lecturers and methods to represent and compress electronically captured handwriting efficiently.

2. New Option: Presentation Recording

Presentation recording is by no means restricted to one particular technical approach. There is, in fact, a variety of technologies used in the systems that can be found in research projects and on the market today. When talking about presentation recording, the first thing coming to a lot of people's minds is taping a course with a video camera. That way, even traditional blackboard-and-chalk lectures can be made available by turning the recording into a streaming-media document and storing it on a streaming server. This way of recording is pleasing for the lecturers. They can keep to their usual way of teaching, do not have to adapt to new technology and are thus able to fully concentrate on the contents. We have experimented with this method and made the experience that acceptable quality can be achieved only if a large amount of personal and technical effort is invested both during and after the lecture: Skilled technical staff must be present for taking the video and audio recordings, the video must be enhanced by high resolution digital images of the blackboard in order to increase readability, and the recording has to be structured into meaningful sections manually. We do not see how all the necessary steps may ever be fully automated such that videotaping will become a feasible method for virtualizing live lectures. Similar arguments also apply to videotaping lecturers using overhead slides.

Using a computer-based presentation system fortunately offers more attractive alternatives for presentation recording: Instead of a video camera, the computer can take care of capturing the lecture, and in much better quality. Of course, some additional hardware is required, such as a (wireless) microphone and a suitable input device like touch-sensitive whiteboards or pen-sensitive LCD tablets. Occasionally, a small amount of extra preparation may also be necessary, like converting slides to a different format, but in general, the workload remains the same as it is without recording, and no support personnel is required during the lecture.

Regarding the recording software, there are at least three different alternatives. One is to make use of existing presentation systems and add a recording functionality. Examples include PowerPoint's built-in narration option, or MS-Producer for PowerPoint (Microsoft 2002). The resulting documents may preserve all the features of the original presentation or just consist of static pictures, depending on how the slides are processed during recording.

Another approach is screen grabbing. The capture software records any screen or window content together with the instructor's audio, producing a synchronized video output. An examples hereof is Camtasia (TechSmith 2002). The definition of this approach can be extended to include "output grabbing" in a more general sense. Instead of recording bitmaps, it is also possible to store transmission protocol information, as is done in the University of Trier's VNC-based TeleTeachingTool (TTT 2002) and in the University of Mannheim's RTP/I-based Interactive Media on Demand system (Hilt et al. 2001).

A third approach is to use a tool specifically designed for the presentation and recording of course contents, providing features that are particularly useful for this task. Our own recording system, Authoring on the Fly (Müller & Ottmann 2000), and its commercial descendant, imc Lecturnity Suite (imc 2002), are examples of such an approach, as are PresenterONE (Accordent 2002) and Georgia Tech's eClass project (Brotherton 2001).

Blendings of different approaches can also be found such as the system proposed in (Dal Lago et al. 2002), which synchronizes the instructor's video with a second video stream for class materials, which can be imported from any video source like overhead camera, PC, VCR, or others.

3. Criteria for the Evaluation and Comparison of Presentation Recording Systems

One of the common features of all presentation recording systems is the capture of the instructor's verbal narration. It is quite obvious that without this, an essential and substantial part of the information will be missing. In addition, all presentation recording systems include the presented slides in the recorded documents. The major goals are to capture as many of the relevant media streams as possible, to preserve

602

the live character of a presentation, and to provide a comfortable navigation within (and in between) recorded documents. This also means that a tightly synchronous replay of all media streams must be possible regardless of the machine used to play back the recording. Simply capturing starting times of events (such as launching an application) can result in streams drifting apart, depending on the performance of the replay machine.

All of the recording should be done with the highest possible degree of automation and the lowest possible degree of obtrusiveness. Note that most presentation and recording systems require the instructor to directly interact with the computer during the lecture. One of the challenges to be solved in general is how the user interface for the lecturer can be designed such that it deviates as little as possible from the traditional blackboard-and-chalk paradigm.

The following criteria illustrate the differences between particular software approaches to presentation recording, leaving out all the hardware aspects that might be involved. While we do not claim our list to be complete, it contains the features which we consider most important, judging from our experience of using presentation recording in a university environment (see Datta & Ottmann 2001). We will also mention systems which provide a good sample of each particular criterion listed.

Representation of Contents

Simply videotaping lectures does not only lead to unacceptable quality of the filmed blackboard or slides. Even if this shortcoming might be improved with better technology, standard video formats have one additional major drawback: the information is not represented symbolically but as a series of bitmaps over time. Thus, it will involve tremendous effort to retrieve information from such a recording and to allow, for instance, full-text search within a lecture document.

It is therefore desirable to preserve all symbolic information of the original contents wherever possible. Apart from searchability, this representation yields some more advantages. First, text and vector graphics can be scaled without loss in quality to fit different screen resolutions on replay machines, while bitmap images will always suffer when enlarged or scaled down from their original size. Second, symbolic representation facilitates later manipulation of contents, for example, to remove errors or change attributes of objects. And third, it is also likely to reduce the amount of data compared to video formats.

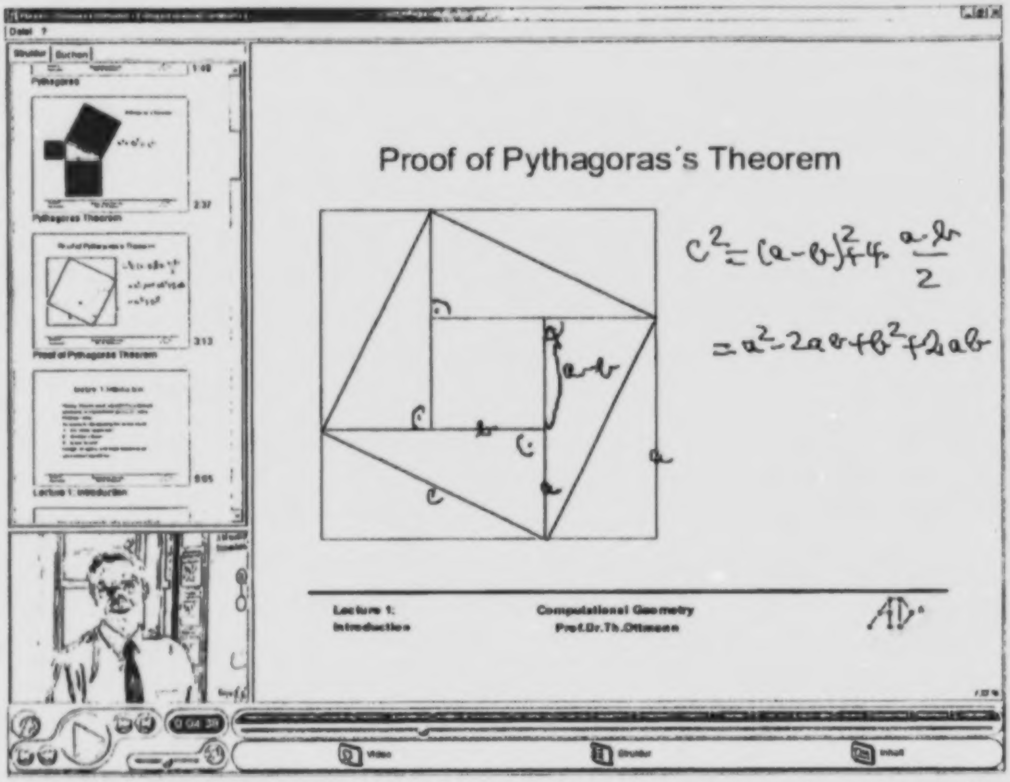
Very few of the recording systems known to us preserve the symbolic representation. Of these, Lecturnity is the only one that also provides an integrated full-text search to find slides containing search strings.

Dynamic Capture and Replay of Annotations

In the educational domain of the natural sciences but also many others, instructors do not confine themselves to the presentation of pre-produced material. Rather, they will annotate the slides presented or even start from a completely empty page (or blackboard) and gradually develop complicated lines of thought using handwriting and graphical objects. In computer-assisted presentations, some dynamics may be introduced through animations provided by commercial presentation systems (such as MS-PowerPoint). The possibility of handwritten annotations, however, allows for much more flexibility; examples include answering student questions, addressing new aspects, detailing a mathematical proof (see Fig.1), and many more. It is one important requirement that it should be possible to dynamically record handwritten annotations such that they can be replayed synchronously with the verbal narration.

Of course handwritten annotation requires suitable hardware. Currently we are still far away from input devices providing the look and feel of traditional blackboards and chalk. Fortunately, new input devices such as electronic whiteboards or pen-sensitive displays have somewhat improved the situation.

Although PowerPoint itself allows free-hand annotation on the slides, the recording plug-ins we know of, surprisingly, do not capture those annotations at all. Desktop grabbing tools naturally record all the dynamics on the screen or, like Camtasia, even offer their own annotation feature. One significant disadvantage of such a solution, however, is that the notes have to be erased manually since the recording tool does not "know" when a new slide or application is being shown. In systems like AOF, eClass or Lecturnity, where annotations are associated with the slide on which they were made, all notes will automatically disappear when the slide is changed and be visible again when returning to that slide later in the presentation.



Proof of Pythagoras's Theorem

$$c^2 = (a-b)^2 + 4\cdot\frac{a\cdot b}{2}$$

$$= a^2 - 2ab + b^2 + 2ab$$

Figure 1: Replay of a lecture recorded with Lectumity, featuring a thumbnail overview, a video or still picture of the instructor, the content frame with slides and annotations, and a navigation unit.

Structured Overview of Recordings

Comfortable navigation within the recorded documents must be one major goal. An overview or table of contents showing the structure of the captured session is an important method to facilitate navigation (Brusilovsky 2000). One way of implementing this can be thumbnails of the individual slides with links to the respective parts of the recording. Of course, such an overview should be generated automatically if possible. However, automatic structuring can only be achieved if the recording mechanism has some information about the presented contents, such as the timing of slide changes. A conventional screen recording tool does not have this information. The TeleTeachingTool tries to overcome this problem by identifying major changes in the captured images (which are likely to reflect slide changes), thus allowing the user to jump to the next slide. The video-based system in (Dal Lago et al. 2002) extracts slide titles to automatically index a video stream, but depends on the use of PowerPoint slides.
An automatically created, fully linked thumbnail overview is provided by AOF and Lecturnity (Fig. 1), which even supports different image sizes for the thumbnails.

Visible Scrolling During Replay

Another feature enhancing navigational comfort is fast visible scrolling, which allows students to browse through a recorded presentation by dragging a slider along a scrollbar. Of course, for this scenario to be user-friendly, the frame updates must display instantly during scrolling without a noticeable delay. In order to achieve this kind of navigation (which is similar to skimming through a book), the document format

BEST COPY AVAILABLE

must support real-time random access. Note that if continuous media are delivered via a streaming server they cannot at the same time provide fast visible scrolling. This is because only a small part of the document is buffered locally at any given time. In order to make random access work in real time, the document as a whole must be stored locally.

Examples for systems supporting visible scrolling include AOF, Lecturnity, and some video formats if replayed locally (i.e., not streamed) using a suitable player.

File Format and Size of Recorded Documents

As mentioned above, if recordings are delivered to the end user via a streaming server, the feature of visible scrolling cannot be supported at the same time. On the other hand, if the files are to be downloaded by the students, file size should not be neglected, even though the increasing availability of broadband connections is likely to make this a minor problem in the future.

It is, of course, desirable that the recordings have a platform-independent format, or even better, a standard "web-based" format (such as HTML, Flash, MPEG, RealMedia, etc.). That way, users will not have to install additional software on their computers, as most operating systems or web browsers will be ready to replay the documents. On the other hand, many of those formats do not support real-time random access which is necessary for visible scrolling, and therefore lack an important navigational feature.

Producing a video from a computer presentation by screen grabbing, i.e. by taking a series of, say 10 screen shots per second and compressing the resulting movie using the standard video codecs of the MPEG family does in most cases neither lead to acceptable quality nor to a reasonable size of the compressed file. Special lossless codecs are required to compress this kind of video (Deshpande & Hwang 2001).

Camtasia offers a great variety of formats for the export of grabbed videos and, with TSCC, provides a very powerful lossless codec particularly suited for videos resulting from recorded screen contents.

Formats of Materials Which Can Be Captured

The ultimate goal of presentation recording is to record all relevant media streams occurring in the live session. This includes the support of any given file format or application used by the instructor. Tools recording desktop contents, like Camtasia, can capture virtually any material displayed on the screen.

However, there will always be a trade-off between the number of usable raw formats and other features. For example, in order to automatically create a fully linked table of contents, the recording tool has to "know" the materials in the sense that slide changes, annotations, or calls of external applications all have to be done from within (or at least be recognized by) the recording system. A tool which simply grabs screen or window contents, although it can capture virtually any material displayed on the screen, will not be able to automatically generate a structured overview of a recording.

Capture and Integration of Live Video

A video picture of the instructor provides a visual impression as well as a feeling of the instructor's "presence." On the other hand, in relation to the amount of data video usually conveys very little information, except if showing objects or experiments relevant to the subject discussed in the course. The importance of integrating live video should therefore not be overestimated. A static image of the instructor will often be sufficient and reduce the amount of data drastically.

If live video is to be included, the process should be automated and involve as little manual work as possible. In this respect, the PowerPoint add-ons RealPresenter or Microsoft Producer are among the most comfortable tools.

Post-Editing Facilities

Whether or not recorded presentations can or should be post-edited is not only a matter of available resources but also of personal taste and perfectionism. In order to preserve the live character of a presentation, it might even be the best thing to avoid later changes completely. Nevertheless, some facility for post-editing the recordings is definitely a useful tool.

There are quite a number of editing tools available which make it easy to cut and join parts of different recordings if they are in a video format. However, as mentioned above, the contents of slides can best be manipulated if they are represented symbolically. For example, erroneous text on a slide may hardly be corrected later if the recording is in a video format, while there will be no problem if it is still represented as a text object. However, one might have to edit large files "by hand," since none of the systems featuring symbolic representation offers a user-friendly editor. Among the other tools, Camtasia probably offers the most comfortable solution for cutting and joining recordings.

Turning Recordings into a CD-ROM or Web-Based Course

In order to really make use of the recordings as parts of integrated e-learning modules, there should be an easy way to combine the documents with exercises and other materials and to organize the courses in a web-based learning management system or on distributable storage media like CD-ROM or DVD. Automated processes, interfaces, or metadata are possible methods for facilitating such an integration. Furthermore, the random access capability can provide a convenient way to link presentation recordings to other web-based material.

AOF with its open format can easily be post-processed by batch scripts. Lecturnity and PresenterONE prompt the user to enter metadata such as author, keywords etc. for each recording and also include tools for publishing collections of captured talks on the web or CD-ROM.

	Symbolic representation	Dynamic capture of annotations	Structured overview	Visible scrolling	Standard format for replay	Supported input formats	Live video	Post-editing	Creation of web-based courses
AOF	✓	✓	✓	✓	optional conversion to Real[1) 9)]	ppt[2)], gif, png, jpg, ps[3)]	✓[4)]	✓[5)]	Scripts, metadata
Camtasia	---	✓	---	✓[6)]	avi, wmv, asf, mov, Real etc.	any (screen recording)	✓	✓	---
eClass	—[14)]	✓[15)]	✓	---	HTML, RealMedia	gif, jpg, HTML	✓	—	✓
IMoD	✓	✓[12)]	✓	—	—[7)]	multi[8)]	✓	---	Tools for creating CBTs
Lecturnity	✓	✓	✓	✓	optional conversion to Real[9)]	ppt[2)], gif, jpg, png	✓[4)]	—	Metadata, publishing assistant
MS Producer	✓	—	✓	—	extended HTML (IE5 only)	ppt[10)]	✓	✓	✓
PresenterONE	—[14)]	—	✓	—	RealMedia	ppt[11)], HTML	✓	✓	Metadata, publishing assistant
TeleTeaching Tool	—	✓[12)]	—	—	—[13)]	any (screen recording)	✓	—	—

1) Semi-automatic conversion; dynamic replay of annotations is lost.
2) A PowerPoint 2000 add-on converts slides, retaining basic PowerPoint features.
3) PostScript import possible in the Linux/UNIX versions.
4) No automated process, some manual work is necessary.
5) A basic AOF editor is available for Linux.
6) Depending on the format and player software.
7) Slides are in HTML. Audio and video are replayed in a Java applet. To replay other streams, the applications used for recording must be installed on the replaying machine.
8) The applications used must be RTP/I based.
9) Visible scrolling is not possible in RealMedia format.
10) Including animations and embedded objects (video etc.).
11) PowerPoint Slides are converted to GIF or JPEG images, resulting in loss of most PowerPoint features.
12) No built-in annotation facility, but those provided by suitable applications (e.g., Adobe Acrobat, mb) can be used.
13) Audio is in MP3 format.
14) Slides are imported as GIF or JPEG images, HTML pages remain.
15) No dynamic replay of annotations.

Table 1: Overview of presentation recording systems and supported features

BEST COPY AVAILABLE

4. Overview of Existing Systems

Although a variety of presentation recording systems is available today, none of them can be considered ideal in the sense that all of the features listed above are supported to a satisfying degree. (Tab. 1) provides an overview of a number of existing systems and the criteria they meet.

The major conflict between different criteria is easily identified: Screen grabbing systems are very flexible in that they can record almost any material, while all other systems are restricted in this respect. On the other hand, none of the screen recorders are able to automatically create structured overviews of the courses, a feature which is extremely important for comfortable navigation in web-based lectures (Brusilovsky 2000). Moreover, information retrieval in large repositories of recorded presentations becomes difficult or even impossible if the data of the recordings are not stored symbolically.

One way out of this dilemma of conflicting criteria seems to be a presentation system offering an integrated screen grabbing utility that can capture external applications on demand and automatically link the screen recordings with the rest of the presentation. At the moment of writing, we do not know of any such system.

5. Technical Challenges

Apart from the problem of finding a good compromise for the conflicting criteria indicated above, there is a number of technical challenges which need to be addressed, both hardware and software related.

One example of a desirable feature would be a convincing implementation of an optimal user interface for lectures, including, for example, gesture recognition in order to erase, collapse, or expand handwritten annotations. It is obvious that the currently dominating desktop paradigm is not adequate for a lecturer interacting with a wall-sized interactive whiteboard. A number of convenient tools like an "e-sponge" are required in such a scenario.

Lecturers using a pen-based input device during a computer presentation tend to make extensive use of it. Unfortunately none of the currently available presentation and recording systems maintains the individual and personal flavor of the lecturer's handwriting. In fact, the writing often looks scrawly and childlike. The fact that none of the recording tools is able to use all the information provided by modern input devices (e.g., the weight put on the electronic pen) is only one reason for this.

The more serious problem is that the trace of the pen is often just stored as a sequence of input vertices. Processing the handwritings by anti-aliasing or online smoothing may improve the appearance of the pen trace. However, no satisfying compromise has so far been achieved between the conflicting goals: symbolic, vector-based representation of recorded free-hand writing on the one hand in order to keep the amount of data low, and support of pixel-based operations (such as erasing, insertion, deletion), personalization and adaption to different pen styles (chalk, ink, etc.) on the other hand.

6. Conclusion

Presentation recording can be used as a cost and time saving method to create web-based course materials from live lectures. Our experience gained in two government-funded projects (ULI 2002, VIROR 2002) involving several German universities has shown that lecture recording is well-received both by instructors and by learners. Within the past years, more than 250 hours of computer science classes have been recorded with different tools at our university and have served as a basis for web or CD-ROM based courses.

In this paper we have described several technical approaches and presented a list of criteria by which different recording systems can be evaluated for their use in a traditional university environment. One major problem we have identified comparing the tools available today is the conflict between a symbolic representation of contents in recorded documents on the one hand and flexibility regarding the range of recordable formats on the other hand.

There are features which most currently available presentation recording systems leave to be desired, such as a satisfying support of alternative human-computer interaction paradigms, which would allow instructors to completely maintain their familiar style of teaching. Another area of future investigation is a data structure to represent dynamic handwritten annotations on slides in a both comfortable and efficient way, supporting vector-based as well as pixel-based operations.

7. References

[Accordent 2002] PresenterONE product page. http://www.accordent.com/presenterone/

[AOF 2002] Authoring on the Fly project site. http://ad.informatik.uni-freiburg.de/mmgroup/aof/

[Brotherton 2001] Brotherton, J.A. (2001). *Enriching Everyday Activities through the Automated Capture and Access of Live Experiences*. PhD Thesis, Georgia Institute of Technology.

[eClass 2002] eClass project site. http://www.cc.gatech.edu/fce/eclass/

[Brusilovsky 2000] Brusilovsky, P. (2000). Web Lectures: Electronic Presentations in Web-Based Instruction. *Syllabus* 13 (5), 18-23.

[Datta & Ottmann 2001] Datta, A. & Ottmann, Th. (2001). Towards a Virtual University. *Journal of Universal Computer Science*, 7 (10), 870-885.

[Dal Lago et al. 2002] Dal Lago, S., De Petris, G., Pigazzini, P., Sarti, A. & Tubaro, S. (2002). Real-Time Content Creation for Multimedia Didactics. *4th International Conference on New Educational Environments, 2002*, Network for New Educational Technologies, Lugano, Switzerland, 3.2: 3-6.

[Deshpande & Hwang 2001] Deshpande, S.G. & Hwang, J. (2001). A Real-Time Interactive Virtual Classroom Multimedia Distance Learning System. *IEEE Transactions on Multimedia*, 3 (4), 432-444.

[Hilt et al. 2001] Hilt, V., Mauve, M., Vogel, J. & Effelsberg, W. (2001). Interactive Media on Demand: Generic Recording and Replay of Interactive Media Streams. *ACM Multimedia 2001*, Association of Computing Machinery, Ottawa, Canada, 593-594.

[imc 2002] Lecturnity Suite description page. http://www.im-c.de/homepage/autorentools_lecturnity.htm

[Microsoft 2002] MS Producer product page. http://www.microsoft.com/office/powerpoint/producer/

[Müller & Ottmann 2000] Müller, R. & Ottmann, Th. (2000). The 'Authoring on the Fly' system for automated recording and replay of (tele)presentations. *ACM/Springer Multimedia Systems*, 8, 158-176.

[TechSmith 2002] Camtasia White Paper: Video Screen Capture Tool for Windows. http://www.techsmith.com/products/camtasia/whitepaper.asp

[TTT 2002] TeleTeachingTool project site. http://teleteaching.uni-trier.de/

[ULI 2002] ULI (Collaborative University Education in Computer Science) project site. http://uli-campus.de/

[VIROR 2002] VIROR (Virtual University in the Upper Rhine Valley) project site. http://www.viror.de/

Professional Skills Training for Social and Behavioral Competence: A Corporate Case Study in using a Fictional Video Script for interactive "learning by viewing"

Sylvie Leleu-Merviel, Nicolas Viéville and Michel Labour
Laboratoire des Sciences de la Communication
Université de Valenciennes et du Hainaut Cambrésis, France
sylvie.merviel@univ-valenciennes.fr

Abstract: Faced with a fast changing society, the need to develop versatile instructional materials to update the professional skills of experienced practitioners has become a major necessity. It is in this context that we will outline the framework of how the project called *Je peux vous aider ? (Can I help you ?)* was developed. It concerns the training of all the sales teams of a major chain store in France. A premium was put on helping professionals in the field to be more aware of their verbal and non-verbal behaviors. To do this, a series of hybrid pedagogic techniques was used, which included traditional lectures, role-plays, a self-study video, a DVD-video and e-learning. This involved making the content matter as attractive and varied as possible so that learners can acquire knowledge easily in their own way. It is in using a type of instructional design like the *Scenistic Approach* that one can ensure the appropriateness of both the pedagogic scenario and its content.

Introduction

Encouraging adults to improve their knowledge in areas in which they feel they are already competent can be a particularly challenging task. This is especially true in the field of professional training[1] with experienced practitioners who are considered to be experts of their domain and so tend to see training sessions as a calling into question of their acquired skills (cf. Theory of cognitive dissonance, Festinger 1957), when in fact both research and technological changes induce a natural evolution of their craft. In this sense, this target population is more demanding, less docile, and less receptive to training sessions than, for example, their more inexperienced colleagues.

Given this, one of the challenges of lifelong education is to create instructional materials that facilitate an on-going learning process. Consequently, human resources managers invest a lot of money in staff training with often disappointing results in the quality of the final outcome. This is generally due to an inadequate evaluation of specifications. And while Information Technology (IT) can often play an important role as a solution to this type of training, but not in every case, work in the domain (*e.g.* Leleu-Merviel 1996) shows that "scripting a lesson" is an important strategy in improving the effectiveness of the teaching/learning process.

In this context, we first describe, in Section 2, the framework for analyzing the training needs and its practical implications. This is followed, in Section 3, by an explanation of the chosen aims of the instructional requirements. This involves a discussion of the pedagogic implications of having chosen different approaches to meet the designated requirements. The fourth section details how the five-step *Scenistic Approach* has been used with its *diagesis, narrative canvas, scenation, scenic* and *setting up the situation*, phases in terms of the overall structure of the *Je peux vous aider ?* (*Can I help you?*) training DVD-video, and its role vis-à-vis other teaching tools, like those of IT. Finally, in Section 5, we consider the different "patterns" of practical implementations, and their technical limits, aimed at improving their real effectiveness in satisfying client expectations concerning the required characteristics of the educational product.

---

[1] Definition: "Training" in this context implies a "planned process to modify attitude, knowledge, or skill behaviour through learning experience to achieve effective performance in an activity or range of activities. Its purpose, in the work situation, is to develop the abilities of the individual and to satisfy the current and future needs of the organisation" (Manpower Services Commission, UK, 1981) Lesson 11, *B.A (Hons.) Business Studies*. Bolton Institute, UK cf. http://www.bolton.ac.uk/campus/business/babus/humanresource/restricted/hrm_lesson11/hrm_lesson11.html (Retrieved 9.12.2001. The Welsh concept of *hyfforddi* (to train) offers the complementary notion of "making the way flexible" for the learner, as opposed to *addysgu* (to educate, to instruct) based on the Latin notion of *scala*, (ladder, "a climbing device").

Analysis of corporate needs

In needing to make access to the content matter attractive and varied, one invariably has to comply to a quality-based approach, given that:

Definition : Quality designates the capacity of an entity to satisfy the needs and wants of users (Merviel 1977).

In this particular context, the analysis of the instructional needs can be summarized by three basic questions:

(1) Who are the immediate stakeholders[2]?
(2) What are their expressed needs and wants?
(3) What are the desired outcomes?

The answers to these questions provide a basis for establishing the parameters of the instructional context and the ensuing "pedagogic scenario".

Who were the immediate stakeholders? The principal direct stakeholder was a regional Human Resources Director in charge of training all the sales teams of one of France's major chain stores in the region of *Nord/Pas de Calais*. At the time, he was in a process of giving each and every sales assistant face-to-face training, which was to be followed up by regular refresher courses with the aid of technological supports in order to maintain employees' newly acquired skills. As this was an expensive scheme, he wanted to get value for money from the investment long after the official face-to-face training sessions had been completed. Other major stakeholders were: the managers of each of the different chain stores, of this northern region of France on the border of Belgium; the company's employees, namely the sales assistants as the end-users of the instructional material.

What were the stakeholders' expressed needs and wants? The issue to be addressed was the upgrading of sales assistants' professional skills by regular and varied in-house training sessions after having received face-to-face courses. There was also the challenge of making the training content available to (new) sales assistants that had not attended the face-to-face training sessions. This meant that new instructional material had to be versatile so that it could be used both in a traditional, guided instructional situation, as well as for personal self-study. Furthermore, the technology to be used had to be that which already existed in the work place *i.e.* VHS videotapes, paper-based documents and email. Interactive multimedia resources, like the DVD-ROM, were excluded because it meant buying new equipment (e.g. multimedia computers) that would have exceeded the training budget.

What were the desired outcomes? The essential objective was to show sales assistants how to adapt their verbal and non-verbal behavior to the needs of customers. This was to be done by helping the employees to better understand company policy, in dealing with customers, for whom the ideal sales assistant is someone who is: well groomed, welcoming, polite, open, reactive, available, smiling, courteous, respectful, in a good mood, punctual, responsible, organised, competent, a good listener, silent, curious, dynamic, convincing, honest, lucid, patient, reassuring, motivated and autonomous. In this context, the instructional material had to help learners become more efficient in their sales techniques by focusing on practical problems encountered at the stores.

The instructional objectives

Given that the main pedagogic objective was to modify behavior patterns (procedural knowledge), this meant a more theoretical (declarative knowledge) approach to customer service was to be limited. It therefore seemed appropriate to adopt a pedagogic approach that built on the existing knowledge of sales assistants in such a manner that they could be led to construct, in their own way, what professional behavior needed to be avoided and which were to be encouraged. In this context, it was decided to use an approach of demonstrating key concepts through examples. This implied carefully staging a fictional series of typical professional situations to which learners could easily relate to based on a variety of e-learning and more traditional learning supports.

Our approach is underpinned by the ground breaking work of Treicher (1967) who reminds us in his book, *Are you Missing the Boat in Training Aids? Audio-Visual Communications*, that most people "learn" (retain) 10% of what they read, 20% of what they hear, 30% of what they see, 50% of what they both see and hear, 70% of what they discuss with people whose opinions they value, 80% of what they personally experience, and 90% of what they teach other people. A training program should therefore go beyond providing teaching aids that learners can both "see and hear". The pedagogic scenario of instructional materials needs also to focus on the human interactional elements of learning to include meaningful "discussions" and "teaching" other people (e.g. peer learning), so to transform input into personal learning experiences. In this light, an interactive learning solution based on a video/film format offers some specific advantages, as highlights the film historian Turner.

---

[2] Definition: A *stakeholder* represents groups of people or individuals that can have an influence, in this case, on the training needs. Researchers R. Oudman, A.M. Vos, and J. Biesboer review various methods of "Stakeholder Analysis" at http://panoramix.univ-paris1.fr/CRINFO/dmrg/MEE98/misop001/ (retrieved 27.10.2001).

> ... (with) the abandonment of the idea that there was a core of meaning in a film which the audience had to discover. Meanings are seen as the products of an audience's reading rather than as an essential property of the film text itself. Audiences make films mean: they don't merely recognize the meanings already secreted in them (Turner 1988:121).

A training scenario should then, for example, get learners to discuss how they saw a scene and how this relates to their personal experience and its future implications for them. It is in such domains that network-based technology like the Internet (with its discussion forums, chats, emails, etc.) can facilitate learning by communicating with different people. That said IT, like Internet, is not in itself pedagogic. What makes these tools so, is the appropriateness both of what is put in them (content) and how this is done (method), hence the need for operational frameworks such as the *Scenistic Approach*, and other related ones, aimed at making optimal use of the content.

Using the *Scenistic Approach* to draw up the pedagogic script

Our human resources director was particularly concerned in capitalizing on his investment. So his first request was to ask the audio-visual specialist at the University of Valenciennes to simply film series of traditional talk and chalk, face-to-face training courses.

It would not have been strategic to reject out of hand this first request of the paying client. So we did what we were asked to do. We gave to the company 40 hours of video tapes... that, as it turned out, have never been used, as we had anticipated right from the start. From a pedagogic point of view, the tapes were not, educationally speaking, quality material, because they do not match the needs and wants of the users, *i.e.* the sales assistants (and not those of the human resources director). After this first failure, it was not very difficult to convince our client to try something else, namely a specially written video fiction as pedagogic input to facilitate learner self-critical reflection. This was done based on the principle of the *Scenistic Approach* (Leleu-Merviel 1996) in providing a framework for scripting a series of "events" in a way that it ensures overall coherence and transparency in the design process. The technique has five major steps: (1) diagesis, (2) narrative canvas (3) scenation, (4) scenic, and (5) setting up of the situation.

Why, then, is this type of solution better suited to the needs and wants of users?

Diagesis. The diagesis involves everything that belongs to the imagined/proposed setting of the document as expressed through the (lesson) content. In this case, the universe of the film is exactly the same as the reality of the sales assistants. The story physically takes place in a real store. The employees can therefore identify themselves with the situation. Even if it is simulated by actors, it is a real situation of daily professional life of learners.

The diagesis also includes taking stock of, for example, the different educational paradigms and approaches that could be used to achieve the objectives identified in the analysis of the instructional context. In this case, it was decided that learners would be systematically encouraged to first identify professionaly inappropriate behavior or elements in the scenes presented to them, followed by suggesting a possible solution to remedy the situation. It was hoped that by using such a "constructivist" inspired approach (cf. Jonassen *et al.* 1999) new knowledge would graft itself onto existing knowledge structures.

Narrative canvas. The second step of the scenistic approach is selecting appropriate events that will constitute the narrative canvas. At first sight, the events included in the film seem crudely exagerated. And seeing it for the first time, the sales assistants laugh at the behaviour of their video-clones, because they come across as being so unprofessional. In fact, the corporation has a customer relations quality-reference book where an exhaustive list of *Quality Points* (QP) is given for each type of behavior for sales assistant when dealing with a customer. To be a "perfect" sales assistant, it would be theoritically sufficient to know all the QP by heart and to comply to them. To ensure the company's policy is applied, some "mystery-clients", that is undercover quality-inspectors, regularly go to the store to write up reports about the quality of its customer-relations by enacting a purchase-need situation with a sales assistant, unbeknown to that person. Based on some of these reports, every situation integrated into the narrative canvas of *Je peux vous aider ? (Can I help you ?)* was in fact experienced by a mystery-client.

For instance, when the transaction is not immediatly concluded, the sales assistant has to promote the client's fidelity to the company in writing down the item's references and the client-advisor's name on a special company client "Contact Card". So, for example, what can be seen in Scene 15 of the film, *Je peux vous aider ? (Can I help you ?)*, is not a figment of an author's fertile imagination. Scene 15 depicts a real situation where a sales assistant, called Michel, did in fact write down an item's references and his name, not on the Contact Card, but on the nearest bit of paper on hand, in this case the corner of a page from a stock taking list. The information noted down was then rapidly torn off and given to the "customer". The piece of paper was duly put into the quality-controler's report ,of which a copy can be seen in Figure 1 below.

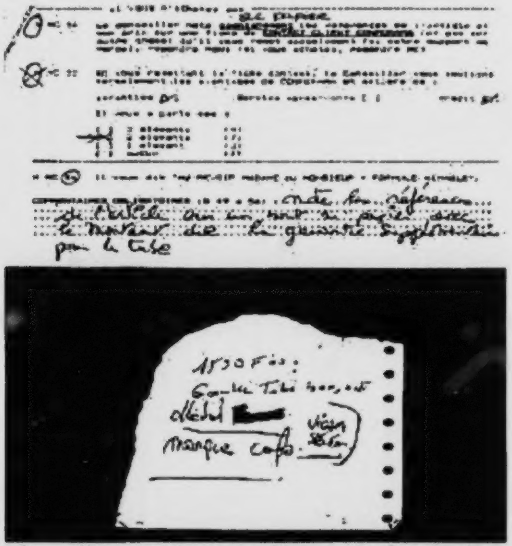


Figure 1: A partial copy of a quality control report, with a scrap of paper given by a sales assistant to a "customer" indicating the name of the client advisor (Michel) and details of an item on sale

The same process was used for other inappropriate behaviour that were then included in the film. In short, everything portrayed in the film happened at least once to the undercover quality control inspectors.

Scenic: The scenic transposes the narrative canvas into concrete, hands on reality. It is at this stage that one makes aesthetic and logistic choices within the limits of the practical and financial constraints, conditions of usage, etc. This includes the choice of appropriate props for the written scenes.

In this case, the shooting of the film was done in a real store of the company. The employees can recognize the familiarity of the surrondings, and can therefore identify themselves with the situation. After shooting and editing, the film is finished, it can now finally be used.

Viewing is not learning : different patterns of pedagogic use

Little can be really learnt by simply viewing the film, because viewing is not learning. This may seem self-evident, but it is all too often forgotten. Pedagogically speaking, it is essential to define a procedure in how to use the material to ensure, in this case, that sales assitants hone their skills to: make clients feel they are the centre of attention; take stock of the clients hopes and dreams; propose the appropriate products; master particular sales techniques; and activily participate in a dialogue with the client.

The first anticipated use of the video was that of a guided learning game. The head of each sales assistant coaches his/her team, and focuses on a theme for each training session. After observing the scene on the VHS-video as many times as necessary, learners are asked to identify recommended behavior ("Positive points") from dysfunctional behaviors ("Negative Points", "Problems related to manners or behavior"). Finally, some "points of reflection and development" are suggested for further discussion. In this way sales assistants have to discover all the good and bad points of a chosen scene. The coach has the teacher's booklet, which identifies the positive points, negative points,

BEST COPY AVAILABLE

problems concerning manners or behavior, and open questions to raise further issues and develop critical self-reflection. For example, the coach's check-list concerning the first scene (Theme: Answering the telephone) can be seen in Figure 2. Of course, learners (players) must never see the check-list. They only know the number of points they need to discover to win. Some QP are easy, but others are very difficult to find *e.g.* a prohibited-open jacket with the company shirt.

Scene 1: Prologue and answering the telephone
Length: 1 minute 30
Start mark: 1mn20. Stop mark 2mn53
Staff concerned: all

☺ **Positive points**

QP1	The person picks up the telephone before the 4th ring (less than 4 rings).
QP3	The person is not chewing gum.
QP6	The waiting time is less than 30 seconds.

⊗ **Negative points**

QP2	The person does not mention the company's name.
QP2	The person does not mention the name of the store where s/he works.
QP2,7	The person does not say "Good morning".
QP2,7	The person does not present him/herself with his/her first name.
QP7	The person does not indicate in which department s/he works.
QP3	The person replies in a muffled voice without articulating.
QP4	The person does not reply to the client's question.
QP4	The person does not connect the person to the correct department.
QP8	The person replies in a disagreeable way, making it clear to the client that s/he is tedious.
QP5,9	The person does not say "Goodbye Madam" at the end of conversation.
QP5,9	The person does not add a friendly word, nor a polite one at the end of the conversation.

✍ **Problems related to manners or behavior**

- The person interrupts the client while s/he is speaking.
- The person asks the client to call back later.
- The person hangs up on the client.

☞ **To go further, points of reflection and development**

(1) The person justifies him/herself by mentioning the problems in the store: "I am alone". How could the person have avoided this situation?
(2) The person gives a negative image: "I don't know". What should the person have said?
(3) One should never ask a client to call back. What should one do?

Figure 2: The coach's check-list of the first scene

In reality, the training material has never been used in this way. This is mainly due to the fact that the "linear reading" paths of the videotape is not appropriate for such educational use. For example, one cannot easily find the exact spot of a scene on a video recorder in order to play the "game" well. The issue of "reading paths" is a matter of the "scenation" (for example a traditional film has a linear scenation) *i.e.* the third phase of the *Scenistic Approach*. The solution to this technical limit of the traditional linear film is to change the scenation, and to convert the linear format into a more flexible support. In this case, the DVD, which allows the film to be to be split up into fragments so that users can access different part of the film directly, and read them in any sequence they wish, and as much as they need to. The DVD-Video was chosen, because the workstation is a standard television-set, a DVD-player and its interface is an ordinary remote-control. Though the DVD-video does not have the flexibility of a key-board, mouse, or computer, its format offers a high quality of images and sounds.

"Setting up the situation", or the fifth and final phase of *Scenistic Approach*, defines the practical ways that the user can in fact access the (video) fragments of the document *via* user-functions. Taking into account the potentially laborious linear and sequential navigation of a remote control box, as compared to a free flow approach of a computer "mouse", special icons were created to help learners go through the DVD-video document efficiently. In this way, the relatively few interactive possibilities of the DVD-video format could be put to profitable use. Given that, the ergonomics of the interface must suggest navigational functions *via* identifying symbols, the colors of the company were chosen as the guiding color scheme to present the interactive pages of the DVD-video. Blue, pink, yellow, green and orange hues were added to identify the five different themes in order to facilitate user-navigation and to make the document more attractive. In this context, 17 icons were designed to be meaningful to the user.

In order to get maximum use of the specially written scenes, a 25-page booklet was also printed for learners to help them use the material. A separate booklet was done for trainers. These booklets were linked to more general guidelines concerning the different skill-based learning tasks that could be done on-line and off-line with the DVD-video. This included ways of making learning less tedious and more motivating, *via* active learning tasks such as role plays, competitive and collaborative activities, for example to win a prize for getting the maximun QP in a minimum of time in using the electronic network and face-to-face situations. In short, the DVD-video is only one aspect of a pluri-media learning package that includes e-learning.

Short of using more elaborate networks like the "Video On Demand" system, the still evolving state of the Internet limits the present use of high quality audio-visual materials, which demand a certain level of fluidity and picture quality. This latter point is particularly important when inciting learners to observe non-verbal behavior and language, *e.g.* a badly knotted tie, where the quality of the images could be a determining factor.

Conclusion

Clearly e-learning is here to stay for better or for worse. From a technical point of view Civanlar (2001 p.433) is optimistic about video delivery on the Internet. He banks on the greater availability of higher access bandwidth, server load and network traffic reduction, and an increase in backbone bandwidth. Indeed, technology like the Synchronized Multimedia Integration Language (SMIL) facilitates video delivery by reducing multimedia content to speed up the time it travels on the Internet. Based on eXtensible Markup Language, SMIL separates multimedia content into different files and streams (audio, video, text, and images), transmits them to individual computers, and then have them displayed together as if they were one multimedia stream (cf. McCannel, 2000, *Multimedia for the Masses*). It is in this direction that our research is being taken to make audio-visual documents a greater part of e-learning, beyond the current, largely written text-based, approach to e-learning. That said, decades of experience in distance learning has unequivocally shown that "the lack of personal contact between the learner and the student is the biggest weakness" of this type of education and training (Noffsinger 1926). In effect, the challenge of e-learning is not only to transmit content, but also to ensure that learners appropriate it from a cognitive point of view, for "viewing is not learning". In short, it is only when the technical possibilities of electronic networks match that of the pedagogic demands of e-learning, that we can truly envisage the possibility of a Global Village that is not only technically efficient but also of high educational quality.

References

- Civanlar M.R. (2001), "Internet video", pp. 433-464, in Sun M-T & Reidman A.M., 2001, *Compressed Video and Netwotks*, Mercel Dekker Incorporated.
- Festinger L. (1957), *A Theory of Cognitive Dissonance*, Stanford University, Stanford California.
- Jonassen D.H., Peck K. L., Wilson B.G. (1999), *Learning with Technology: A Constructivist Perspective*, Merril/McGraw-Hill, New Jersey.
- Leleu-Merviel S. (1996), *La Scénistique : méthodologie pour la conception de documents en media multiples suivant une approche qualité*, Unpublished post-doctorate thesis, Université de Paris VIII, France.
- Leleu-Merviel S. (1997), *La Conception en communication. Méthodologie Qualité*, Editions Hermès, Paris.
- McCannell S. (2000), SMIL: Multimedia for the Masses, *Hotwired*, by 06 Oct, http://hotwired.lycos.com/webmonkey/00/41/index4a.html (retrieved June 8, 2002)
- Noffsinger J. (1926), *Correspondence Schools*, MacMillan, New York.
- Treicher D.G. (1967), *Are you Missing the Boat in Training Aids? Audio-Visual Communications*, United Business Publications, New York.
- Turner G. (1988), *Film as a Social Practice*, Routledge, London.

A Drag and Drop Editor for Interaction and Personalization of Web Pages

J. Lennon
R. Warburton
Department of Computer Science
University of Auckland, New Zealand
j.lennon@auckland.ac.nz

Abstract: In this paper we examine two key issues in Web learning interaction and personalization. We discuss how a simple drag-and-drop application enables users to create and modify Web pages in ways that (1) increase interactive learning experiences and (2) make the best use of their individual differences.

Introduction

The importance of interaction in learning environments is exemplified by the range of research covered by journals such as the Journal of Interactive Learning Research (JILR)[1]. This has led researchers to question how Web learning can be made more interactive (Harasim, 1990, 1997) and hence better support individual differences (Belanger & Jordan 2000; Jonassen, 1997). Many solutions have revolved around networking. However, apart from the inclusion of web links and inline tests, it has been comparatively difficult to make Web pages more interactive. The existing backlog of valuable resources on the Web in the static formats makes the problem significantly worse.

Initially our work focused on addressing issues such as these from an authoring perspective. We aimed at developing a Web application that was so simple that teachers could much more easily incorporate different types of media into their Web pages. However, because the application is so easy to use, students themselves are interacting with pages in ways that reflect their own individual differences.

Catering for Differing Modalities in a Web-based Environment

The number of Flexible Learning centers around the world is increasing and many are well equipped with instructional designers. The dilemma is that there are simply not enough such centers to go around and teachers and academics are pressured to take minimalist approaches to putting "something" on the Web. What we are seeing is a proliferation of PDF and PowerPoint documents. Not only are these hard to cross-index and search, they also offer very little interaction.

At this point we must indicate what we mean by "interaction". Certainly not the flashy gizmos seen all too frequently. Although email, forums, video links, interactive quizzes, etc., all have a place, the challenge is converting existing Website pages, which have static text and maybe a few pictures (probably just for decoration), into pages where students have real choices. Research suggests that students can gain by having alternative representations of media (Hobbs & Christianson, 1997; Reyna et al., 2001). In addition, research indicates that some students prefer visual representations, while others prefer more verbal modalities (Jonassen & Grabowski, 1993; Reyna et al., 2001). In the *Handbook of Individual Differences, Learning, & Instruction* (Jonassen & Grabowski, 1993) the authors give guidelines for supporting students with visual/verbal preferences. They not only list options to capitalize on strengths, but they also ways suggest ways to compensate for deficiencies.

The implications of different learning styles are also complex. Much research follows Gardner's *Theory of Multiple Intelligences* (Gardner, 1985) and Pavio's *Dual Coding System* (Paivio, 1971; Paivio, 1986; Anderson, 2001). More recently, cognitive scientists have thrown considerable light on how our visual memories work (Kosslyn, 1994; Pinker, 1999). However, there are conflicting views on how this applies to learning (Denzine, 2001). Anderson (2001) concludes that "... much depends on the exact nature of the material being presented and the type of media employed".

---

[1] http://www.aace.org/pubs/jilr/default.htm

Notwithstanding the "imagery debate" (Kosslyn, 1994) that still rages (although in a transformed form) (Pylyshyn, 2001), our classroom experience finds that while some students "like" pictures others find them a distraction. Some like sound, others do not. "Some respond to aural cues while others are visual learners" (Smith & Ransbottom, 2000). We believe that there will be interesting research results appearing when tools like the one we introduce in the next section are readily available.

	Capitalize	**Compensate**
Visual Preference	· [2]using images, pictures, graphs o charts · using high-imagery materials · using graphic organizers * using video games	* using multisensory training * using concrete to abstract sequencing * presenting word images * presenting special text in window and boxes * underlining, visual cueing in text
Verbal Preference	· using verbal presentations * using textual outlines * using abstract to concrete sequencing	* using multisensory training * using graphic cues, lines, boxes with text, arrows highlighting images

Table 1: Visual/Verbalizer and Instruction [Redrawn from Jonassen & Grabowski, 1993]

A Simple Drag-and-Drop Web-Page Editor

We have developed a prototype Drag-and-Drop Editor (DDE) that has the following key features:

- Works from within a web browser (Mac IE5 and Mozilla) enabling users to edit pages directly, without having to download any special software or concern themselves with uploading their pages to the server.
- Has drag and drop methods for placing objects on the page. This makes it extremely easy to use. Placement to pixel accuracy. Pictures and text blocks can be placed and dragged to exactly where users want them.
- Automatic recognition of multiple media types (audio, video, text).
- Automatic handling of media storage.

---

[2] The authors use bullet points to indicate that inferences are drawn from research, while stars indicate that they are "drawn logically from descriptive information".

- Easy resize functionality. (Resizable objects have resize tabs.)

Textual alignment (left, right, center and justify).

- Control of Background color
- Color Borders
- Object duplication

Transparency control. (Users have control whether certain layers are transparent.

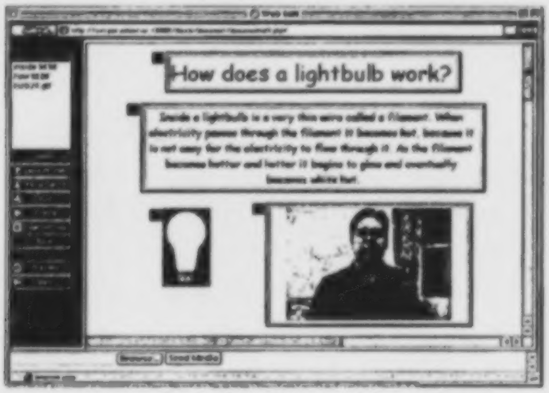


Figure 1: The WebEdit Environment

User Testing

User testing was undertaken at Papatoetoe Central School, Auckland, New Zealand, in three stages. Stage One was an introduction to the system asking teachers how they found WebEdit and whether they had any suggestions to improve it. Stage Two was a follow up session two weeks later with most of their suggestions implemented. Stage Three was testing with a small group of children.

Tests with Teachers

Prior to using WebEdit staff had to use four separate software applications to maintain their class Web pages: Adobe Pagemill for editing web pages, Graphic Converter for image file conversion and resizing, Appleshare for transferring files and Netscape to check how their page looked. As staff had only rudimentary training in these applications, they reported many problems. In addition, some staff asked questions such as, "why can't we place an image 'anywhere' on our pages?" Our aim was to produce an editor that was as simple to use as any word processor.

All 26 teaching staff volunteered to test the WebEdit system in the school's computer suite (17 iMacs running IE5). The session started with an introductory seminar explaining how the system worked, then they were given a short user-testing sheet and encouraged to trial the system. Staff were told in advance that the web pages created in WebEdit were for testing purposes only, there were no expectations on them and it would not interfere with their currently maintained pages. A few staff opted to work in pairs. All staff were successful using WebEdit to make a web page including those who considered themselves "I.T.-unfriendly".

Surveys

Most of the survey questions concerned implementation improvements that have now been implemented. However there were three general questions that we include here:

BEST COPY AVAILABLE

Question One: "Would you prefer using WebEdit over the current system?" All 26 staff members answered positively. However to try and avoid bias the staff were asked to justify their answer. Most said it was "faster" and "easier to use". We believe that this is probably because only one program is used rather than four, which eliminates time spent switching between applications, and minimizes the mental demands of having to deal with multiple applications' operational models. One teacher wrote: "Child friendly, quick and can use in front of class."

Question Two: "Was there anything that you particularly disliked about the system?" All but one answered no. In the latter case the teacher stated that found she found the information button hard to see. It is interesting to note that this button was the only one to use primary blue. The color of the button has now been changed to yellow.

Question Three: "What features would you like added?" Three teachers asked that the alert box, that appeared each time media was loaded, be removed. This is perhaps because the staff did not need to know, how the media was going to be handled.

Tests with Students

We asked 10 children, aged 611, to create a web page that presents, and answers, a single question about light ("How does a light bulb work?"). Their aim was to create a web page that one of their friends could learn from, as quickly and easily as possible. They were presented with a question and an answer in multiple media forms: text, audio and video. The audio was someone reading the text. The video was someone looking at the camera saying the text. As such, each media type provided no more information than any other. The children were allowed to decide which media was most appropriate for the needs of their friend. Multiple media selections were permitted. Additional images were included only to help the aesthetic presentation of the page, but offered no information.

Unfortunately, due to end of semester time constraints, we were not able to survey the children after they had finished their pages. All children created their pages in the allotted time (20minutes). However, what we thought was most interesting was the prominence of the video on the page that 9 out of the 10 children used.

Table 2 indicates that younger children tend to avoid text in preference to audio and video, whilst older children tend to use text, only using other types of media to enhance the page.

Nevertheless, we realize that unknowns such as novelty factors may have biased these findings.

		Question			Answer			Used Video
Student	Age	Text	Audio	Video	Text	Audio	Video	
				X		X		X
			X				X	X
			X	X	X			X
				X	X			X
		X			X		X	X
		X		X	X			X
		X		X	X			X
		X			X		X	X
		X	X	X	X			X
		X			X	X		

Table 2 Student Testing Results

Two Examples of Children's Pages

Figure 2 shows two screen shots of web pages designed by children aged 6 and 11. All objects are moveable and scalable. The sound and video icons are playable.

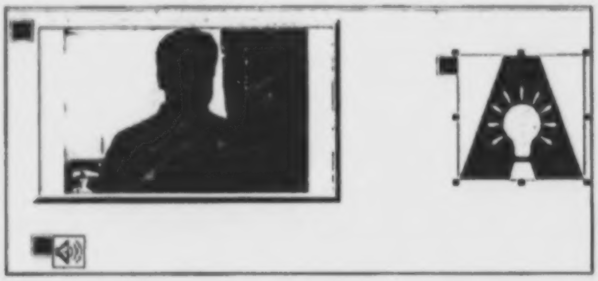


Figure 2a: Page by a six year old.

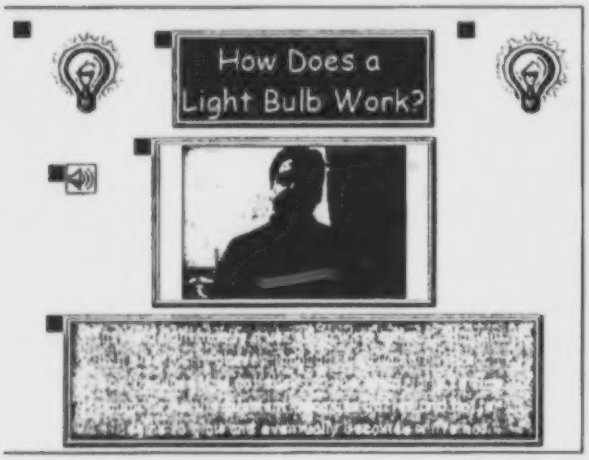


Figure 2b Page by an eleven year old.

Conclusion

Our initial aim was to provide authors with a simple drag-and-drop tool so that busy teachers could more readily add alternative representations such as text, images, sound, and video to their Web pages. It is noteworthy that some teachers moving to different schools next semester want to take WebEdit with them. However, perhaps of greater interest, is that since the editor is so simple to use we now see children interacting with the pages to a much greater extent than they did before. They can change the relative importance, as they see it, of the various media objects by increasing the size of some objects while demoting (or deleting) representation that they do not need.

BEST COPY AVAILABLE

References

Anderson, M. (2001). Individual Characteristics and Web-Based Courses. In *Learning and Teaching on the World Wide Web*, Wolfe C. (Ed), Academic Press, SD.

Belanger, F., & Jordan, D. (2000). *Evaluation and Implementation of Distance Learning: Technologies, Tools and Techniques.* Idea Group Publishing, Hershey USA, London UK.

Denzine, G. (2001). The Existence of Learning Styles: Myth or Reality, http://jan.ucc.nau.edu/~dlk/Learn.styles.html

Gardner, H. (1993). *Frames of Mind: The Theory of Multiple Intelligences.* BasicBooks, HarperCollins, US.

Reyna V., & Brainerd C., & Effken, J., & Bootzin, R., & Lloyd, F. (2001). The Psychology of Human—Computer Mismatches. In *Learning and Teaching on the World Wide Web*, Wolfe C. (Ed), Academic Press, SD.

Harasim, L. M. (1990). *Online Education: Perspectives on a New Environment.* New York: Praeger.

Harasim, L. M. (1997). *Learning Networks: A Field Guide to Teaching and Learning Online.* MIT Press, MA.

Jonassen, D., & Grabowski, B. (1993). *Handbook of Individual Differences, Learning, & Instruction.* Lawrence Erlbaum Associates, NJ.

Jonassen, D. A. (1997). Model for Designing Constructivist leaning Environments. In proceedings of ICCE 97, Malaysia, AACE, 72-80.

Hobbs, V., & Christianson, J. (1997). *Virtual Classrooms: Educational Opportunity Through Two-Way Interactive Television*. Technomic, Publishing Co., Lancaster.

Kosslyn, S. M. (1994). *Image and Brain: The Resolution of the Imagery Debate.* Harvard University Press, Cambridge, MA.

Smith, T., & Ransbottom, S. (2000). In *Distance Learning Technologies: Issues, Trends and Opportunities*. Lau, L. (Ed) Idea Group Publishing, Hershey USA, London UK.

Paivio, A. (1971). *Imagery and Verbal Processes* Holt, Rinehart and Winston, New York NY.

Paivio, A. (1986). Mental Representation: A dual coding approach. Oxford University Press, New York NY.

Pinker, S. (1999). *How The Mind Works.* Penguin Books.

Pylyshyn, Z. (2001). Mental Imagery: In search of a theory. **http://ruccs.rutgers.edu/faculty/zpimagery.htm** .

HWONS: A Hyperwave Online Negotiation System

J. Lennon, H. Liu
Department of Computer Science, University of Auckland, NZ
Email: j.lennon@auckland.ac.nz; lhdh_h@hotmail.com

H. Maurer
Technical University and KNOW Center, Graz, Austria
Email: hmaurer@iicm.tu-graz.ac.at

Abstract: We have developed a Web-based negotiation system that is closely modeled on real-world transactions. In this paper we illustrate the generality of the system by discussing two disparate applications of the system: one taken from business and the other from collaborative e-learning. In the business context we look at online employment negotiation. In the e-learning case, we discuss a scenario where a large (or small) class of students interacts with team leaders to form groups for project work.

1 Introduction

Since our application is built on top of the Hyperwave (HW, 2001; HWTW, 1999; Maurer, 1996) knowledge management system (Borghoff & Pareschi, 1997), it inherits the adaptability of a commercially robust hypermedia system, with advanced access rights and document attributes. This paper shows how, building on these features, an online negotiation system can be designed to be interactive, personalized and scalable, while supporting user-controlled degrees of privacy. Interestingly, the negotiations can be supported in ways that more closely resemble traditional methods. These processes aim to find the "right person for the right job/team" – and it is usually an iterative process.

The application generates, in real time, transparency-controlled networks of virtual connections between users. We shall first look at the general features of such a system before applying them to employment negotiations. We shall then describe how the same system can be used in an e-learning environment for matching team leaders/mentors/tutors with groups of students.

The effectiveness of our system is based on three factors:

A good knowledge management system (see Section Two).

User-determined levels of privacy (see Section Three).

Iterative, computer-supported interactions between users (see Section Four).

2. The Hyperwave Knowledge Management System

Hyperwave[1] was developed to store high-volume hypermedia resources, which can be spread over multiple servers (HW, 2001; HWTW, 1999). Hyperwave has a more sophisticated design model than most Web server systems (Maurer, 1996). For example it supports the following attributes:

---

[1] http://www.hyperwave.com/index.html

- Read and write permissions for groups and individuals
- Extra search keywords
- Titles in different languages
- Display properties
- Custom attributes
- Setting of a time period during which the document is visible to the public.
- Version control
- Similarity recognition of documents

Since attributes are not stored within the objects (as in most Web servers) but in a separate database, they can be efficiently extracted and manipulated. In addition, objects can be locked to ensure they are not updated concurrently. It is features such as these that are utilized in our negotiation system.

2.1 The Hyperwave Online Negotiation Environment.

The three main parts that form the environment for our Online Negotiation System (ONS) are illustrated in Figure 1, reading from left to right.

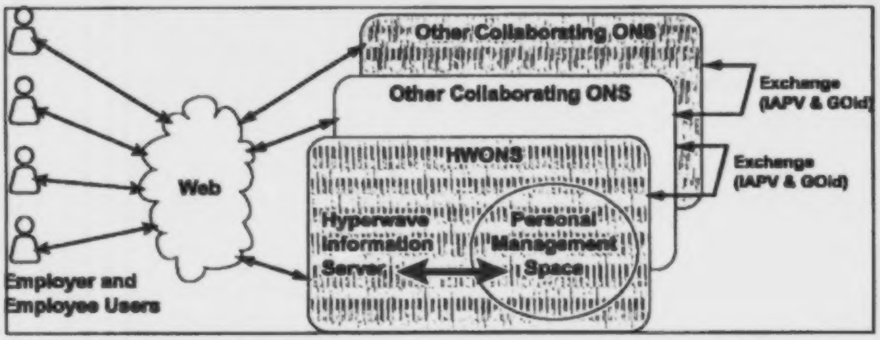


Figure 1: An Overview of the Hyperwave Online Negotiation System

The negotiation system receives information via Forms and stores and updates the information in a Personnel Management Space. This is a Hyperwave database that contains personalized records and automatically generated attributes (HWTW, 1999). After storing the necessary data about the negotiation parties it will search through the Personnel Management Space, matching attributes, and return the results. Users can then update or delete any of the details they have already sent to the system and request new services such as further negotiation.

2.2 The Expression of User's Details in a Compact Vector Format

Key attributes for any pair of negotiators are identical but complementary in meaning (what an employer requires is what an employee should posses, and vice versa). To keep things concise, yet meaningful, we choose strings (*UAPVs*) that combine characters for attribute names, and digits as the corresponding values (actually, index-numbers in predefined lists). Using this format, the sequence of attributes in a *UAPV* can be arbitrarily ordered, and the length can be flexible. Hence we can use the same *UAPV* format for the two types of users, and the searching process involves matching vector couples.

BEST COPY AVAILABLE

Since different users will have different priorities (e.g., some people may regard job location is the most important factor, but others may consider salary is more important) we also use a weighting process to assist *UAPV* matching. The *UAPVs*, together with the importance sequence (weighting), and other system-required information, are then stored in the Hyperwave document management system.

3 Transparency-Controllable Virtual Connections

In many negotiation situations privacy can be a key issue. People may have confidence in a human agent but do they trust an online system with just a few lines of privacy policy statement? For example, a statement of privacy may not be good enough if users can just post their background information without any options to "hide" and control them (CntPub, 2000). Neither does it make users feel "safe" enough, if a sufficiently interactive mechanism is not provided. Furthermore, the system should allow users to request services like 'Please let me know what you have found for me before you show my real name (or other details) to the other negotiator ...'. Thus it should be the users themselves who are permitted to set which, and when, private details are visible to the other party in the negotiation. Hence, the virtual connections should be *transparency-controllable*.

Thus, users can keep many details hidden, particularly in the first stages of negotiation. It is important to note that searching and matching can be performed on all stored data and not restricted to the visible attributes – even though users may be unable to see this information.

4 Negotiation Cycles

As mentioned previously, the matching of employers and jobseekers, or moderators and group members, is usually achieved by negotiation. This means that no matter how good the matching algorithms used are, the system must support iterative cycles. For example, a team leader may have set the qualification level too high, with the expectation that they will be lowered if there is a candidate that fulfills other attributes. Similarly, a student may not be experienced enough to even set a reasonable time allocation for a given project. We propose a system that alerts users at login time of any likely new matches. Then, if any of these candidates are of interest, the system can set up virtual connections. Candidates will be alerted and respond if interested. The process is cyclic as shown in Figure 2.

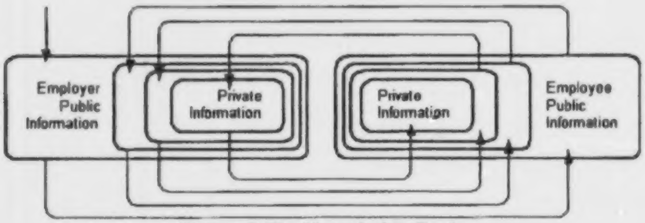


Figure 2 The Negotiation Cycle

Since all matching is done in real time we will avoid out-of-date messages such as those given by CGI scripts and email.

In the iterative negotiation cycle described above, we would expect to see transparency increase. This is because, for example, employer/group leader can invoke the interactive functions of the system to request the employee/student to reveal details appropriate to the stage of negotiation. And, of course, the converse is also true.

BEST COPY AVAILABLE

5. Applications

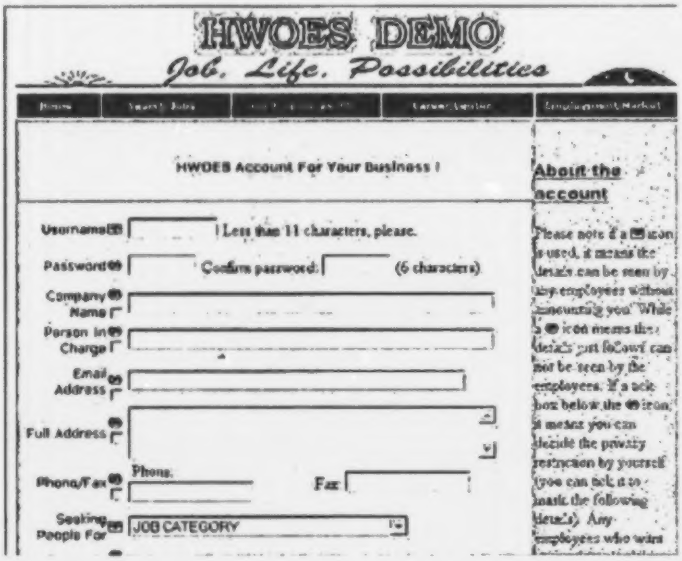
We shall first describe the prototype we have built as an online employment service. This will be followed in Section 5.2 by a discussion of how it can be adapted to an e-learning environment.

5.1 The Hyperwave Online Employment System (HWOES)

The system we have implemented is based on Hyperwave (HW 2001; HWTW 1999; Maurer, 1996) and is called the Hyperwave Online Employment System (HWOES). The implementation details are described in (Liu, 2001; Lennon, 2002). Certainly, online employment systems such as Monster (Mnstr, 2001), HotJobs (HotJ, 2001), Career Mosaic (HeadH, 2001) and The Jobs Company (Jobs, 2001) (to name but a few) handle millions of employment cases annually and are expanding their services steadily. However we have demonstrated that our system has significant advantages, particularly as far as privacy and cyclic negotiations are concerned.

Sign-in Forms for employers (see Figure 3) and employees provide the necessary information items for HWOES. Key attributes that are used to do the matching are clearly pre-defined in option lists to avoid errors. Text, graphics and even videos (e.g. an inaugural television spot for the client) are also supported as attachment documents. Part of the Form for employers is shown in Figure 3.

In the Form, the eye icon ▣ indicates that a prospective employee can see an item, whereas a negated eye ● indicates that, at present, the data is restricted. In the screen shot the icons indicate the default settings for the data. Of course, these settings can be changed by the owners later in the negotiation process. The completed form will then be sent to the Personnel Management Space (*PMS*, the database) to be stored and UAPVs created or updated. Naturally, there is a corresponding Form for employees.



Less than 11 characters, please.

Confirm password: (6 characters)

Please note if a ▣ icon is used, it means the details can be seen by any employees without contacting you. While a ● icon means the details just follow can not be seen by the employees. If a tick box below the ● icon, it means you can decide the privacy restriction by yourself (you can tick it to mask the following details). Any employees who wish

Figure 3: Part of a Form for Employer information entry and update (Liu, 2001)

BEST COPY AVAILABLE

5.2 E-Learning Negotiation

By changing the fields on the two basic data entry and update Forms we can readily transform the application into an e-learning negotiation tool. Let us consider the example of a class that has to form groups for project work in multimedia. Instead of using Forms with fields such as Job, Location, Salary etc., we will have Forms with 'Project name', 'Experience', 'Time to Complete' etc. Now we will have the project leaders negotiate with class members to form the best team for their particular project. For example, under 'Experience' the system may list Instructional designer, Graphic artist, Systems Analyst, Programmer etc. The leader can select and prioritize these requirements. The system will then find the students with the best matching attributes.

Of course there will be competition and here we can see that we have a very good "role-playing" scenario where all the players have to carefully consider how they prioritize their options. For example students will have to carefully consider what they have to offer when they select various projects and, most importantly, just how much time they are prepared to commit to the project. The project leaders on the other hand will be competing for students and they will have to similarly choose the attribute values that they are looking for with care.

6 Conclusion

The proposed system and prototype gives users significant control over the levels of privacy they need during online negotiations. Virtual connections supporting cyclic negotiation between negotiators are set up in real time and can be modified in real time. We have prototyped an online Employment service and now we propose minimal changes to adapt it to other types of negotiations such as those that occur in group learning.

7 References

Borghoff, U., & Pareschi, R. (1997). Information Technology for Knowledge Management; *J.UCS* 3, 8, 835-842.

CntPub, (2000). *How Online Recruitment Is Shaking Up Its Own Industry, New Media Age*, Centaur Publishing Ltd., April 13, p41.

HeadH, (2001). The HeadHunter Company - http://www.headhunter.net/, October 2001.

HotJ, (2001). The HotJobs Company - http://www.hotjobs.com, May 2001.

HW, (2001). The Hyperwave portal http://www.hyperwave.com.

HWTW, (1999). The Technical White Paper of Hyperwave Information Server
V5.0.

Lennon, J., & Liu H., & Maurer H. (2002). HWOES: A Hyperwave Online Employment System; To appear in *J.UCS* April.

Maurer, H. (1996). *Hyperwave: The Next Generation Web Solution*. Addison-Wesley, UK.

Jobs, (2001). The Jobs Company - http://www.jobs.com.

Liu, H. (2001). *Hyperwave Online Employment System*. University of Auckland, New Zealand thesis.

Mnstr, (2001). The Monster Company - http://www.monster.com, May 2001.

Diagnostic Cognitive Assessment and E-learning

Kit H. Leung
Department of Educational and Counselling Psychology
Faculty of Graduate Studies and Research
McGill University
Canada
kit.leung@mail.mcgill.ca

Abstract: Diagnostic Cognitive Assessment (DCA) is an alternative dynamic assessment. It aims at measuring cognitive processes for effective learning support & coaching. DCA is embedded in a digital coaching system (DCS) as an executive director. It contains three sub-models: Expert Knowledge Model, Inference Models, & Student Model. While Expert Knowledge Model emulates human tutoring by modeling expert tutor's knowledge, probabilistic inferences of knowledge acquisitions are derived from Inference Models that are driven by Psychometrics and Bayesian Networks. By observing the students' performances, the Inference Models examine & interpret how learners learn as they trace, track, and record learning activities. Student Model delivers customized diagnostic analysis to learners, guidance to DCS's Scaffolding function to map learner's knowledge structure and schema, immediate dynamic diagnosis to Real Time Evaluation of DCS, and aids to collaborative learning in the E-Learning Community.

Introduction

E-learning is expected to provide environments that promote metacognition: thinking about thinking via electronic conferencing, and collaborative learning in the virtual learning communities. It can entail the transformation of learning: from a product to a process. While knowledge is being constructed by individual learners, and co-constructed and shared with peers and experts globally via the Information Communication Technology, it is represented and re-engineered through innovations and creativity with high end technology such as simulations, and electronic coaching system. This continuum involves cognitive processes, learning, and knowledge and skill development. This phenomenon coincides with the contemporary theories of cognition and social constructivism that "emphasize the way knowledge, organized, and processed in the mind" (Pellegrino et. al., 2001, p.3) in a social context in which knowledge is actively manipulated for problem solving.

However, the rise of e-learning also intensifies what Frederiksen (2002) has described as the incompatibility between the conventional measurement models that underlie current practice in educational assessment and modern theories of the cognitive and social processes that are involved in learning and skilled performance, particularly in the dynamic holistic e-learning context. Why? Shepard (2000) stated that the current practice assesses learning achievements as products. It focuses on a) component skills rather than proficiency in solving practical problem in authentic settings, and b) discrete bits of knowledge rather than critical thinking and knowledge application. The assessment goal mostly focuses on giving grades or to satisfy accountability demands. Does this type of assessment support and enhance learning? Shepard (2000) advocated that assessment is for learning, and pointed out that in-depth and ongoing assessment genuinely increases learning. Frederiken and Donin (1999) declared that there has been a growing recognition of the needs for an alternative assessment - more authentic cognitive assessment. This is an assessment that measures performance and achievement, and assists learning and instruction.

Cognitive assessment has been recognized as one of the great challenges for the field of measurement and evaluation (Snow and Lohman, 1989 & 1993; Embretson, 1990; Samejima, 1995; Pellegrino, James W., Chudosky, Naomi, and Glaser, Rober, 2001). I attempt to formulate an assessment framework addressing the assessment of students' cognitive processes and knowledge structures. In this paper, I will describe a cognitive assessment framework that integrates measurement into both learning processes and performances as a vehicle to enhance learning and instruction to the fullest potential. It is named as Diagnostic Cognitive Assessment (DCA). It will be developed and embedded in a digital coaching system (DCS).

BEST COPY AVAILABLE

Diagnostic Cognitive Assessment (DCA)

Taking the advantage of technological as well as substantive theoretical advances, assessments can improved education. On the one hand, psychometric theory and test design principles are reviewed and expanded, new cognitive assessment theories and models emerge to deal with different measurement issues (Samejima, 1995; Embretson, 1990; Sijtsma, & Verweij 1999; Lesgold et. al. 1989; Junker & Sijtsma; 2001). On the other hand, technological advancement enables rapid and potent measurement potentially. The rise of e-learning as a buzzword for innovative approaches to education implies that I cannot reiterate, or summarize adequately the extensive reports on interesting thesis, promises, cautions, and criticisms that have been published on e-learning. Among all these reports, assessments in e-learning are important but its focus is not on assessing cognitive abilities and cognitive achievements of the students but rather on cost effectiveness. The current assessments in e-learning mostly still remain within the conventional assessment models.

Furthermore, although a learner-center approach, e.g. Veen, Collis, Santema & Genang , (2000), and constructivism, e.g. Hoddinott. (2000), are often the basis for centers investigations, good examples of the integration of diagnostic and cognitive assessments into instruction, learning and testing for e-learning was not found during my literature research. Upon my observation, the current focal point of assessments in e-learning is on how to manipulate technology rather than the assessment itself. .

Technology provides e-learning with a powerful tool for a new possibility. Snow & Lohman (1993 stated that: "The possibility now exists to bring new concepts and measures of aptitude, learning, development, and achievement, together with instructional innovations, to create truly diagnostic and adaptive systems."(p.1). The main challenge is how to use all these available technological advances for the creation of such a diagnostic adaptive system. DCA is to be a response to this remark for a truly diagnostic and adaptive system of assessment.

DCA is generated from cognitive and diagnostic assessments. It focuses on inferences about learning competence. It aims at measuring learners' cognitive processes, learning, knowledge and skill development for diagnostic purposes. Using a medical analogy, a diagnostic assessment is to detect and define an existing learning problem before providing a cure for the problem (Lesgold et. al., 1989).

Diagnostic assessment emerges from theories of instruction, aptitude and cognition (Embretson, 1990; Glaser, 1985). It has been considered as a redesign of testing for the 21st Century. Embretson (1990) associates diagnostic assessments with dynamic testing that is defined as a measurement of learning processes by examining the consequences of instruction. Marshall (1990) and Lesgold et al (1989) point out that this assessment involves identifying causes or sources of resulting phenomena, decision making about intervention, and specifying a treatment to a problem. Instruction is changed to be adaptive and responsive to students' personal styles and conceptions (Snow and Lohman, 1993) in specified learning situations for a domain.

DCA extends the arena of diagnostic assessments from improving instruction and testing to the development of an effective learning environment. Students learn as they are solving problems for the tests (Shepard, 2000) in which they are challenged to perform. DCA re-conceptualizes assessments as an adaptive assessment-learning system. It is conceived as a coaching, learning and testing tool that is responsive to the student's individual characterizations and to the situation. It not only includes the mechanism for a) deciding characteristics of learning by examining the students' performance, b) careful investigation of the facts of knowledge acquisitions and skill mastery levels, c) formulating diagnostic interventions based on inferences of evidences, but also an agent for learning - students are coached to learn by solving the given problems that are in the form of tasks as test items of an assessment. Computerized assessment offers DCA can integrate diagnostic cognitive assessments into e-learning. It supports, directs instructional interventions and learner-centered learning, and operates the digital coaching system (a system that assist/coach learning in an electronic environment) with three models: Expert Knowledge Model, Inference Model and Student Model. In synchrony, these models interconnected with and are interdependent on each other.

1) Expert Knowledge Model

The expert Knowledge Model is built as presentations to a) explain the characterizations of how the mind of an expert works, and b) predict about what are the best strategies and knowledge an expert uses to solve problems and how these strategies and knowledge are applied within a defined circumstance.

The model plays two roles of experts in subject matter and pedagogy. As a subject matter expert, it provides DCA and the digital coaching system with the content knowledge of a domain. It also organizes and validates concepts and principles of a domain. As a pedagogical expert, the model supports the coaching activities with "pedagogical reasoning and action" (Donald, 2000, p.37) -- the capacity to transform content knowledge into forms that are pedagogically powerful and yet adaptive to students of various abilities and background (Donald, 2000). The model uses the expert knowledge and produces its knowledge representations for testing, instruction, and learning. These representations can be elucidated with three kinds of learning schemata described by Donald (1987): cognitive structure, curriculum structure, and content structure. Based on the learning schemata introduced by Donald (1987), a graphical representation of the learning schemata of the Expert Knowledge Model explains the constitution of its knowledge representations (see Figure 1 below).

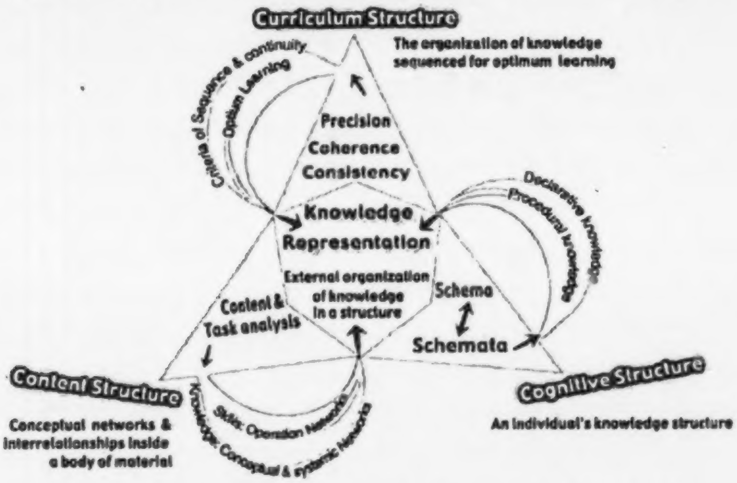

Curriculum Structure
The organization of knowledge sequenced for optimum learning
Criteria of Sequence & continuity
Optimum Learning
Precision
Coherence
Consistency
Declarative knowledge
Procedural knowledge
Knowledge Representation
External organization of knowledge in a structure
Content & Task analysis
Schema
Schemata
Content Structure
Conceptual networks & interrelationships inside a body of material
Knowledge: Conceptual & systemic Networks
Skills: Operation Networks
Cognitive Structure
An individual's knowledge structure

Figure 1: Learning Schemata of the Expert Knowledge Model

As figure 1 indicates the curriculum, cognitive and content structures are interrelated with and interdependent on each other for an effective knowledge representation made for the optimization of coaching and learning. At the base of the triangle, as a support to Curriculum Structure, an expert schema, i.e. data structure for representing generic concepts (Donald, 1987), directs the operations of content and task analysis. This analysis decomposes the domain knowledge into procedural and declarative knowledge for formulating tasks as learning activities and test items. With the inputs from content and cognitive structures, a curriculum structure represents an optimization of learning by determining what steps to should be taken to a) optimize learning, b) sequence the content knowledge, pedagogical and learning activities in continuity, and c) limit or delimit the knowledge domain. While depicting how learning is measured, in order to be accountable, it ensures its learning schemata is acceptable to other experts in the domain and meet criteria of Precision (the accuracy of the representation), Coherence (the components of the representation are closely related internally), and Consistency (the components of the representation are related to existing knowledge in an overall cognitive structure) (Donald, 1987).

Expert models have been used in Computer Based Learning in various terminology in different forms with different purposes. Upon my observation, although this kind of model is not new, a model that integrates assessment into instruction and learning have not yet been established, e.g. BioWorld (Lajoie, 2001)

In forming the basis for developing diagnostic assessments, Frederiksen and Donin (1999) point out that conceptual knowledge and problem-solving procedures in a domain essentially derive from an expert model. A computer coach can be engineered to combine dynamic assessment of learning with diagnostic assessment of student's problem-solving processes (Frederiksen and Donin 1999). The goal for the future research will be to examine how expert models can be constructed to support diagnostic cognitive assessments.

2) Inference Models

> "In any inference task our evidence is always incomplete, rarely conclusive, and often imprecise or vague; it comes from sources having any gradation of credibility. As a result conclusions reached from evidence having these attributes can only be probabilistic in nature." (Schum, 1994, p.xiii; cited in Mislevy, 1996)

The inference models aim at making inferences about students and how knowledge and skills are acquired for the provision of guidance to student learning and adaptive instruction. Its task involves capturing, storing, and communicating the multitude of evidence resulted from inferences to the digital coaching system (DCS) for actions, and formulating the Student Model. Those tasks are harnessed by psychometrics and Bayesian Networks that take a statistical probabilistic approach to reasoning from evidence. How do they conduct the tasks? Observing the processes of testing and the test results, based on derived evidence, inferences are made from: a) a statistical psychometric model that characterizes the patterns in the data for students at varying levels of competence, b) Bayesian Networks that produce causal networks by tracing, tracking and recording student performances and strategies of problem solving during the learning process. The conclusions drawn from these inferences are probabilistic assumptions about the underlying cognitive constructs of the students' performances (Pellegrino et. al., 2001). Figure 2: Statistical Inferences shows how probabilistic prediction is concluded from inferences derived from evidences that are generated from data.

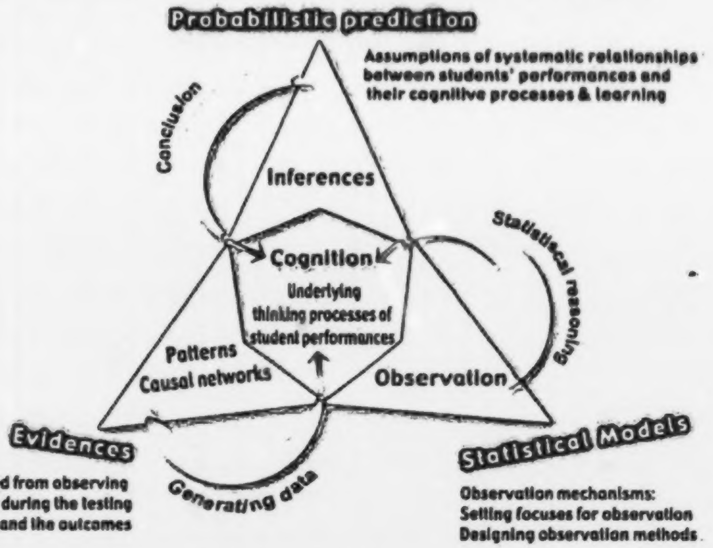

Probabilistic prediction
Assumptions of systematic relationships between students' performances and their cognitive processes & learning
Conclusion
Inferences
Statistical reasoning
Cognition
Underlying thinking processes of student performances
Patterns
Causal networks
Observation
Evidences
Statistical Models
Evidences derived from observing students' behaviour during the testing processes and the outcomes
Generating data
Observation mechanisms:
Setting focuses for observation
Designing observation methods

Figure 2: Statistical Inferences

During the process of diagnosis, on the one hand, psychometrics provides observers with task-based observations for making probabilistic inferences about the mastery level of the domain knowledge. After the identifying specific features of problems or difficulties learners have during the learning process, psychometrics examines the consequences of coaching before defining intervention characteristics. On the other hand, Bayesian Network traces, tracks, and records all the learning performances. From these accumulated processed experiences, Bayesian Networks formulates "causal structures" (Tian & Pearl, 2001) to a) interpret the effects in a defined situation and search for their causes, b) decide for intervening actions in real time, c) adapt to changes and learn from experience (Jensen, 2001) for updating diagnosis and the provision of coaching and learning guidance d) provide assessors or administrators a reliable graphical representation of instructional and learning processes that will allow them to make informed decisions (Martin, & VanLehn, 1995) .

The combined use of psychometrics and Bayesian Networks provides DCA with advances in probability-based reasoning advocated by psychometricians, such as Junker & Sijtsma (2001) and Samejima (1995) and graphical statistical modeling recommended by Pearl (2000). Mislevy, (2000) pinpoints that these advances extend the principles that underlie familiar test theory to more varied and complex inferences from more complex data.

Using psychometrics in conjunction with Bayesian inference networks diagnostic testing is considered as new testing approach advocated by Mislevy (1993), and Frederiksen, Missley & Bejar (1993). Missley (2000) states that: "Opportunities borne of new technologies, desires borne of new understandings of learning—a new generation of assessment beckons." (http://www.ncme.org/about/awards/mislevy.html). This vision is shared by others. For examples, VanLehn, Niu, Siler and Gertner (1995 a) take this approach in the research on determining a fine-grained size of knowledge representation in diagnostic testing. Junk and Sijtsma (2001) employ similar approach in the research of usability and interpretability issues for single-strategy

BEST COPY AVAILABLE

cognitive assessment models. Mislevy, Steinberg, & Almond (2000) also incorporated this conjunctive approach into their Evidence-Centered Assessment Design. This Inference Model of DCA can emerge as a new generation of assessment if it is supported by future research.

3) Student Model

Understanding students' knowledge acquisition and cognitive processes is essential for diagnosis. Explicit representations of these attributes are required at a level of cognitive complexity that facilitates successful performance and understanding (Kieras, 1988). However, these attributes are unobservable variables that are subjected to inferences derived from evidence (Pellegrino, Naomi, & Rober, 2001). Three kinds of reasoning are employed to construct these representations with advanced computer technologies, e.g. interactive interface, and inference tools, i.e. Bayesian Networks and Psychometrics. They are a) deductive reasoning that flows from generals to particulars, b) inductive reasoning that takes the opposite direction of from effects to possible causes and 3) abductive reasoning that proceeds from observations to new hypotheses, new variables, or new relationships among variables (Mislevy & Gitomer. 1996).

The constructed representations formulate the student model that is composed of dynamic profiles about students characterizations. The model is built as representations that a) explain the characterizations of the learners' cognitive processes, i.e. the schema b) infer, and identify the mastery level, errors, misconceptions, and knowledge gaps, c) predict about what is the best to coach the learners, d) confirm such predictions. Figure 3: Student Model depicts how the Student Model is supported, and functions within DCA.

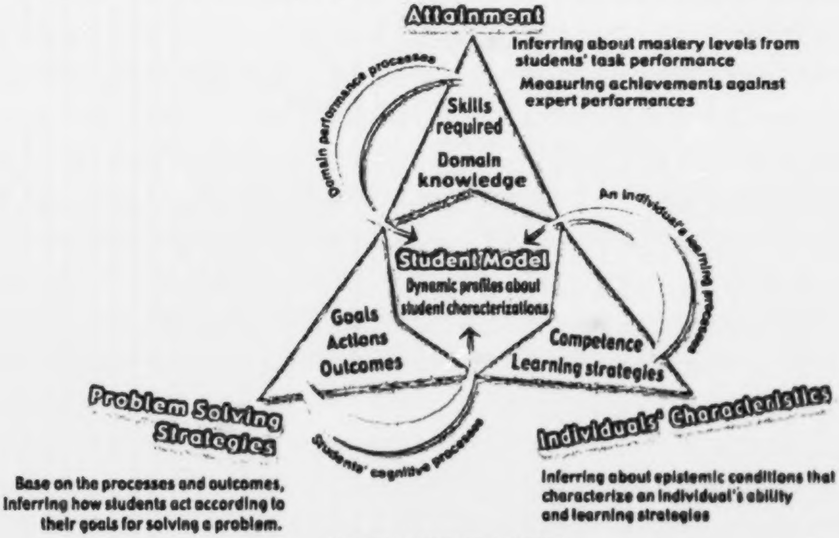

Attainment
Inferring about mastery levels from students' task performance
Measuring achievements against expert performances
Domain performance processes
Skills required
Domain knowledge
An individual's learning processes
Student Model
Dynamic profiles about student characterizations
Goals
Actions
Outcomes
Competence
Learning strategies
Problem Solving Strategies
Students' cognitive processes
Individuals' Characteristics
Base on the processes and outcomes, inferring how students act according to their goals for solving a problem.
Inferring about epistemic conditions that characterize an individual's ability and learning strategies

Figure 3: Student Model

The student model is comprised with three components: Attainment, Problem solving strategies, and individual characteristics. Each of them addresses different functions of the model. Attainment approximates beliefs about the level of the students' competence and task performance of a domain and their interrelationships. The comparison between the students' and an expert's problem solving task performance is an indicator for identifying accomplishment, errors or misconceptions, and knowledge gaps. The resulted inferences will form the basis for generating appropriate content materials, sequencing tasks and learning units for coaching and diagnostic testing.

Next, the Problem Solving Strategies deals with particular knowledge states of individuals. It makes inferences about how students use goals to guide their actions for expected outcomes, i.e. solutions for given problems. This epistemic process involves hypothesis making that generates goal establishment, testing hypothesis leads to actions, and outcomes resulted from actions taken. Students' problem solving strategies suggest an explanation of how the students think when they learn. This explanation will pinpoint cognitive information about an individual student. It can serve as inputs to pedagogical reasoning and action.

BEST COPY AVAILABLE

Finally, Individuals' Characteristics contains the schema of individual students. Based on inferences, it presents students' epistemic conditions that characterize ability and learning strategies for each individual students. It can provide information to suggest how to customize learning tasks and scaffolding, and testing that are adaptive and responsive to each student's characterizations. The knowledge about an individual's characterizations supports a) collaborative works by matching different students of different competence, b) finding the most competent peer who has good knowledge of a specific topic in a domain for peer support or peer review, c) generating modeling (examples) that map with the needs of a student for coaching d) pedagogical decision making, e.g. when and how to apply fading in which situation during the scaffolding process.

Student model is used in ITS to support flexible individualized learning and instruction, for example, SHERLOCK ITS (Lesgold et al., 1992) and HYDRIVE (Mislevy & Gitomer 1996). However, in e-learning, i.e. web-based learning systems, student model is underdeveloped, most of the so-called e-learning system is nothing more than a network of static hypertext pages. Interactivity in and adaptations to learning are limited (Brusilovsky, 1998).

DCA concerns the essential role of assessment for improving instruction, learning and testing in DCS. DCA is conceptualized as a) a tool to approximate student proficiency through the combination of detailed epistemic analysis of student performances within the Inference model with probability-based inference; b) an environment in which inferences of students' cognitive processes formulate the foundation of accurate prediction on students' proficiency and attainment. This prediction is validated by inferences derived from students performances and the dynamic Student Model; c) a crucial support to pedagogical reasoning and action. It enables DCS to provide coaching that is adaptive and responsive to the students' level of competency, and characterization.

DCA and Digital Coaching System (DCS)

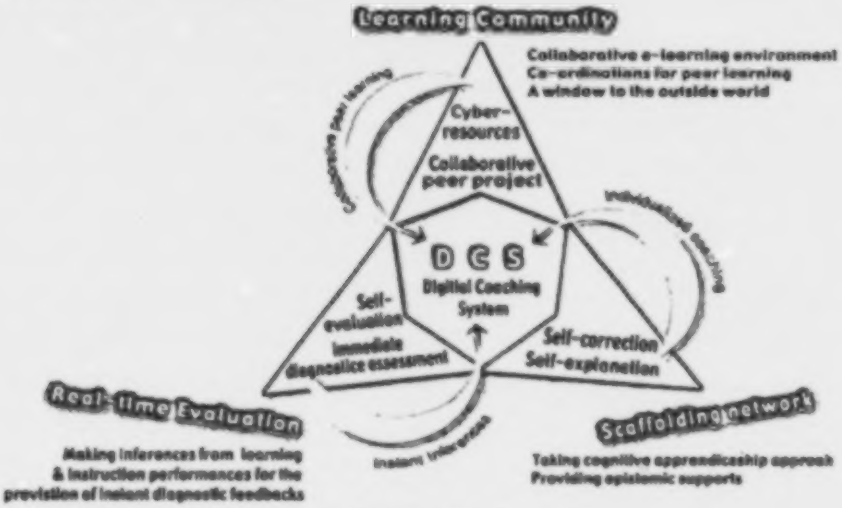

Learning Community
Collaborative e-learning environment
Co-ordinations for peer learning
A window to the outside world
Collaborative peer learning
Cyber-resources
Collaborative peer project
Individualized coaching
DCS
Digital Coaching System
Self-evaluation
Immediate diagnostice assessment
Self-correction
Self-explanation
Real-time Evaluation
Making inferences from learning & instruction performances for the provision of instant diagnostic feedbacks
Instant inferences
Scaffolding network
Taking cognitive apprendiceship approach
Providing epistemic supports

Figure 4: Digital Coaching System

The DCA is embedded in DCS as a monitor of the coaching activities. DCS resembles to an intelligent tutoring system (ITS) but it is not ITS because it is not merely an automated system. DCS is a) learner-centered – learners are in control of their learning, and b) dynamic – DCS has the capability to learn from its coaching experiences and observation of the learners' performances, it customizes coaching based on individual learners' needs and characterization. As Figure 5 illustrates, the system is composed of three interrelated and interdependent mechanisms: Scaffolding Network, Learning Community and real time evaluation.

The Scaffolding Network is devised to mediate individualized coaching that takes cognitiveapprenticeship approach. Based on an understanding of a student's characterization and competence, the Scaffolding Network models the domain knowledge as examples, and generates prompts and hints to stimulate and scaffold self-explanation and self-correction. The scaffolding processes are traced and recorded by the Bayesian Nets that a) supports the decision making of the Scaffolding Network, b) provides real time diagnostic evaluation of the student

BEST COPY AVAILABLE

performance and instructional intervention for self-correction of both parties, and c) co-ordinate scaffolding activities in the learning community for collaborative works.

Real-time Evaluation is a computational framework driven by Bayesian Networks with the support of an Internet server. It makes inferences from instruction and learning performances for a) generating diagnostic feedback and achievement assessments, b) updating the Student Model, and c) matching students to form collaborative work group.

Learning community is a collaborative e-learning environment for peer reviews, group projects, and posting of the students' knowledge representations, such as papers, simulations, and presentations. It is also a window for outreaching on-line resources, such as interactions with international experts, on-line conferences, and virtual libraries and journals.

These three mechanisms interact with each other and work together simultaneously. Their functions and interactions are described below in Table 1.

Pillars	Scaffolding network	Learning Community	Real Time Evaluation
Scaffolding Network	Fns: - Elicitation of knowledge from the learners - Explanation of knowledge and concept - Demonstration of skills - Generating hypothesis for testing	- Setting up reasoning tactics - Defining the problem space - Representation of knowledge - Setting up and testing hypothesis - Consolidating & reinforcing learning - Formulation of comprehension via collaborative learning, e.g. discussions	- Providing immediate advice & guidance - Recording time spent on each task - Recording &tracking learning performances as evidence - Based on evidence inferring causes and predicting the effects of a performance - evaluating & inferring learning by studying changes shown in the evidence
Learning Community	Fns: - Provisions of a) learning resources, such as on-line libraries, b) a collaborative learning environment, c) a stage for demonstrating/illustrating knowledge representations, such papers, simulations, and presentation.		
Real Time Evaluation	Fns: - Tracking and recording learning performance, - Providing real time guidance to learners, & diagnostic information to coaching during learning		

Table 1: Functions and Interactions of the Pillars Fns:Functions

Conclusion

The DCA framework described here offers an e-learning environment for coaching, learning and assessment simultaneously. As an evaluation, the framework shall be able provide objective and cognitively valid measurement of learning performance. As a diagnostic assessment, it should support instruction (coaching) and learning with reliable and valid inferences and predictions in real time. Moreover, the real time evaluation can be used to provide the coaching system and learners with diagnostic information about learners' comprehension and problem solving, including errors and misconceptions. To sum up, DCA does not only integrate assessment into instruction for the collaborative learning and problem-based learning, it also provides an innovative framework of cognitive assessment with the advanced technologies effectively for the sake of learning, not merely for using technologies. If future research can show this model can be implemented, then, it may offer one solution to the problem of assessment that is valid and reliable in measuring learning performances and learning processes for the enhancement of both instruction and learning to their best potential.

Reference

Brusilovsky, P. (1998). Adaptive Educational Systems on the World-Wide-Web: A Review of Available Technologies. Computer Networks and ISDN Systems. *Proceedings of Seventh International World Wide Web Conference*, 30 (1-7), pp. 291-300. http://manic.cs.umass.edu/~stern/webits/itsworkshop/brusilovsky.html.

Donald, J. (2002). The Pedagogue:Creating Designs For Teaching. In J.L. Bess & Associates (Eds.). *Teaching Alone Teaching Together: Transforming The Structure Of Teams For Teaching.* San Francisco:Jossey Bass, pp. 35-61.

Donald, J. (1987). Learning Schemata: Methods Of Representing Cognitive, Content And Curriculum Structures In Higher Education. Instructional Science 16, pp. 187-211.

Frederiksen, C. (2002). Seminar in Applied Cognitive Psychology. Topic: Cognitive Assessment and Learning. Class Notes.

Frederiksen, C. & Donin, J. (1999). Cognitive Assessment in Coached Learning Environments. The Alberta Journal of Educational Research. Vol.XLV(4). P. 392-408.

Frederiksen, N., Missley, R and Bejar, I. (1993). Test Theory for a New Generation of Tests. Hillsdale, NJ: Erlbaum.

Glaser, R. (1985, October). The integration of instruction and testing. Paper presented at the ETS Invitational Conference on Redesign of Testing for the 21st Century. New York.

Hoddinott, J. (2000). Biggs' Constructive Alignment: Evaluation of a Pedagogical Model Applied to a Web Course. Proceedings of World Conference on Educational Multimedia, Hypermedia and Telecommunications, Vol.000(1), pp.1666-1667

Jensen, F. V. (2001). Bayesian Networks and Decision Graphs. NY:Springer-Verlag.

Kieras, D.E. (1988). What Mental Model Should Be Taught: Choosing Instructional Content For Complex Engineered Systems. In M.J. Psotka, L.D. Massey, & S.A. Mutter (Eds.), Intelligent tutoring systems: Lessons learned (pp. 85-111). Hillsdale, NJ: Lawrence Erlbaum.

Lajoie S., Lavigne N., Guerrera, C.& Munsie, S. (2001). Constructing knowledge in the context of BioWorld. Instructional Science 29, pp. 155–186.

Lesgold, A., Lajoie, S., Logan, D. & Eggan, G. (1989). Applying Cognitive Task Analysis And Research Methods To Assessment. In N. Frederiksen, R. Glaser, A. Lesgold & M.G. Shafto (Eds.). Diagnostic Monitoring Of Skill And Knowledge *Acquisition*. Hillsdale, NJ: Lawrence Erlbaum, Pp. 325-350

Martin, J., and VanLehn, K. (1995 a). A Bayesian approach to cognitive assessment. In Nichols, P., Chipman, S., and Brennan, R. L., (Eds.), Cognitively Diagnostic Assessment. Hillsdale, NJ: Erlbaum.

Martin J. and Vanlehn K., (1995 b). Student assessment using Bayesian nets. Int. J. Human-Computer Studies 42, pp. 575-591.

Mislevy, R.J. (1993). Foundations Of A New Test Theory. In N. Frederiksen, R. Missley & I. Bejar (Eds.), Test Theory for a New Generation of Tests. Hillsdale, NJ: Erlbaum, pp,19-38..

Mislevy & I Bejar (1993), *Test Theory For A New Generation Of Tests*. Hillsdale, NJ: Erlbarum, pp. 1-17.

Mislevy, R.J., & Gitomer, D.H. (1996). The role of probability-based inference in an intelligent tutoring system. User-Mediated and User-Adapted Interaction, 5, 253-282.

Mislevy, R., Steinberg, L., and Almond, R. (2000). Evidence-Centered Assessment Design: A Submission for the NCME Award for Technical or Scientific Contributions to the Field of Educational Measurement. http://www.ncme.org/about/awards/mislevy.html

Pellegrino, James W., Chudosky, Naomi, And Glaser, Rober (Eds.) (2001). Knowing What Students Know: The Science And Design Of Educational Assessment. Washington D.C.: National Academy Press.

Samejima, F. (1995). A cognitive diagnosis method using latent trait models: Competency space approach and its relationship with DiBello and Stout's unified cognitive-psychometric diagnosis model. In P. D. Nichols, S. F. Chipman & R. L. Brennan (Eds.) Cognitively Diagnostic Assessment. Hillsdale, NJ: Erlbaum.

Schum, D.A. (1994). The evidential foundations of probabilistic reasoning. New York: Wiley.

Shepard, L.A. (2000). The Role of Assessment in a Learning Culture. Educational Research. Vol.29 (7). P. 4-14.

Snow, R.E. & Lohman, D.F. (1993). Cognitive Psychology, New Test Design, And New Test Theory: An Introduction. In N. Federiksen, R.

Tian, J. And Pearl, J., (2001). Causal Discovery From Changes: A Bayesian Approach. UCLA Cognitive Systems Laboratory, Technical Report (R-285), February 2001

Vanlehn, K., Niu, Z., Siler, S. And Gertner, A. (2002). Student Modeling From Conventional Test Data: A Bayesian Approach Without Priors.

Veen, W., Collis, B., Santema, S. & Genang, R. (2001). Learner Led Learning In An Online Community - The Central Role of the Learner and Its Benefits. Proceedings Of World Conference On Educational Multimedia, Hypermedia And Telecommunications, Vol. 2001(1), Pp. 563-566.

Wade, P. V. & Lyng, M. (1999). Experience Improving WWW Based Courseware Through Usability Studies. Proceedings of World Conference On Educational Multimedia, Hypermedia and Telecommunications, Vol. 1999 (1), Pp. 951-956

THE 3D LAOKOON — Visual and Verbal in 3D Online Learning Environments

Dr. Gunnar Liestøl
Associate Professor
Dept. of Media & Communication
University of Oslo
Norway
gunnar.liestol@media.uio.no

Abstract

This paper reports on a project where 3D online gaming environments were exploited for the purpose of academic communication and learning. 3D gaming environments are media and meaning rich and could provide inexpensive solutions for educational purposes. The experiment with teaching and discussions in this setting, however, proved that media complexity is not a sufficient condition for successfull online learnig environments.

Background and presuppositions

The project had two founding presuppositions, one concerning economy and popular conventions and the second related to the potential of a rich media form: (1)

1. Just a few years ago several online gaming environments emerged on the market with great success. It soon became obvious that 3D-based online games made it possible to conduct extensive communication and collaborative action in relatively rich graphical environments on the Internet. Thus an interesting opportunity arose in the combination of ICT and learning: Instead of developing expensive 3D-environments from scratch for specific learning purposes it should be possible to exploit existing 'off the shelf' game software. This would mean that we used the online gaming environments contrary to their intention, so to speak, not for leisure gaming but for organized learning. Would it be possible to intervene in such environments, not for the sole purpose of learning the game, but for learning in general? If this assumption was correct time and money could be saved, and at the same time one could benefit from some of the popular interface- and userconventions already developed within game genres, conventions which are often related to problem solving and learning.

2. My interests in 3D online gaming environments was not primarily motivated by their game-structure, but by the potential of 3D itself, as a form of representation. 3D, we might say, is a new kind of sign or sign system. Dynamic and navigable 3D documents is the inherent information type of the computer as a medium, and thus different from more traditional information types such as writing, still images, sound and moving images, which all have emerged within analogue, non-computerized media. Dynamic 3D has the

fascinating feature that it is capable of re-presentation and may include any of the traditional information types (Liestøl 1999). 3D is situated on top of a hierarchy and embraces the underlying and less inclusive information types. At the bottom of this hierarchy we find writing, which is not capable of representing any other information type. The still image on the other hand is capable of including writing. Further, moving images may include both writing and still imagery. Audio constitute a separate, independent system of various information types and may be synchronized with moving images as in film and television. However, I would argue that inclusion of audio in another information type is only made possible when we operate with sources of sound 'inside' virtual spaces, that is inside dynamic navigable 3D spaces. Thus, 3D documents may include all traditional information types (and more), and as representational forms they serve as places where other information types may appear and interact as combined and integrated units. Given these features the potential complexity of expression and meaning in 3D environments is beyond comparison in the history of media and representation, and consequently it should be of relevance for communication and learning. My interests were particularly focused on how the interplay between information types could be exploited. The following assumption forms the basic motivation for the experiment reported and discussed in this paper: Because 3D is the all-inclusive representational form it should — in theory — be better suited for the purpose of communication (and learning) than for example purely verbal environments like MUDs and MOOs.

Selecting an environment

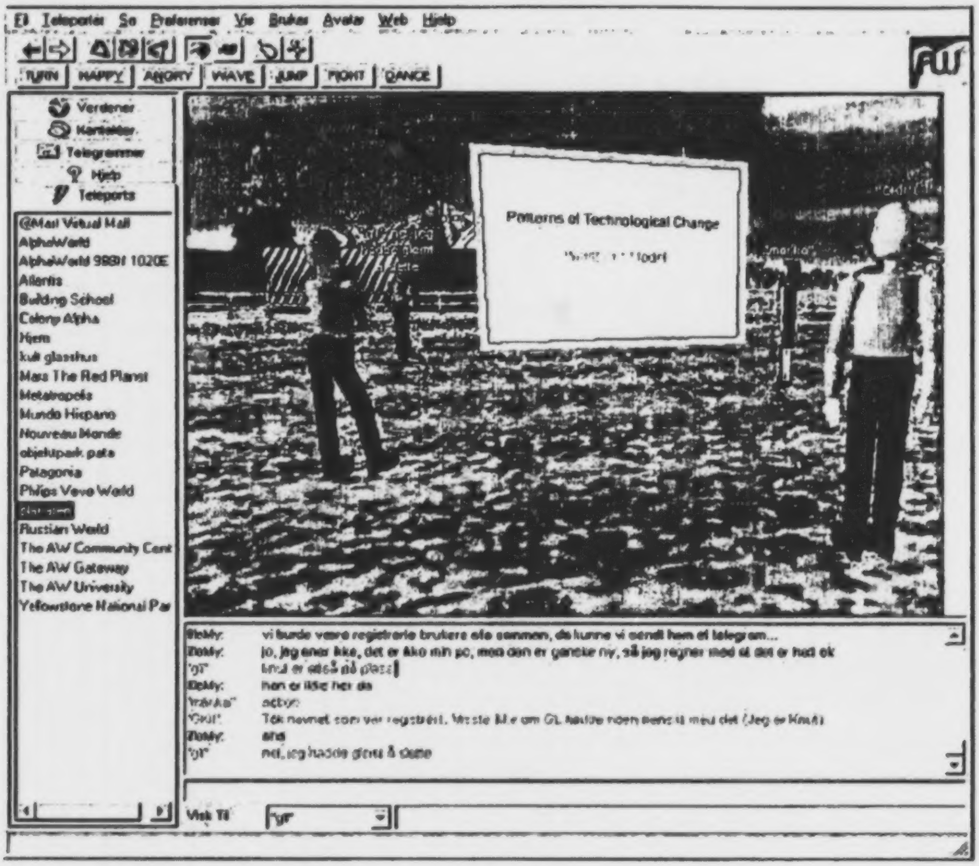
In order to find a suitable 3D online environment to test this hypotesis several online games and gamelike environments were examined: *Diablo*, *Ultima Online*, *Online traveller*, *Virtual Places* and *Everquest*. (2) To brake with the intentional purpose of the established online environments, it was important for us as users to be able to make imprints in the environments, for example by means of imported custom made graphics. Common to the popular online games, however, where the fact that they exclusively were open to verbal and navigational input, and that the user only to a very limited extent was capable of 'fitting out' the environment (selection of avatar elements, that is the user's graphical representation in the 3D environment). It was not possible in any of the games to import externally produced graphics. This, of course, would limit our expressive means, like a classroom without a blackboard. After experimenting with and evaluating various systems available, *Active World* (AW) was selected. (3) AW is not a traditional online game, but it supports import of various graphical elements (images, movies etc.) and thus would meet our needs for an environment rich on expressive means.

Format/genre

Our activity in *Active World* began by testing the basic functionality. The purpose was to decide which kind of communicational formats or learning genres could be realized in this environment. The initial idea was to recreate some kind of roundtable discussion/seminar where every participant could view all the other participants, in order to communicate both by means of (written) verbal utterances and 'body' (avatar) behaviour. All participants should be equally represented and positioned in the setting, nobody was supposed to have neither priviliged perspective nor functionality. The purpose was thus to recreate and reconfigure a format inspired by traditional oral forms of academic communication, such as the seminar and the colloqvium.

The investigation of the conditions for creating a roundtable configuration developed into a project of problem solving itself. After a process of trail and error the participants experienced some basic constraints for this kind of mutual communiction in the chosen environment. In order to fulfill the egalitarian premisses and for everyone to see each other, the number of participants, unfortunately, had to be limited to three due to the restricted view of the 'wideangle' perspective. The result was dissapointing and the idea of recreating the 'colloqvium' was abandoned. We were forced to use a configuration that was sequential and a mode of communication that had a one-way, broadcast-like structure. The traditional position in the auditorium/classroom with the teacher in front of the students was therefore chosen.

The *Active World* Interface


Fil Teleporter Se Preferanser Vis Brukere Avatar Web Hjelp
TURN
HAPPY
ANGRY
WAVE
JUMP
FIGHT
DANCE
AW
Verdener
Kontakter
Telegrammer
Hjelp
Teleports
@Mall Virtual Mall
AlphaWorld
AlphaWorld 989N 1020E
Atlantis
Building School
Colony Alpha
Hjem
kult glasshus
Mars The Red Planet
Metatropolis
Mundo Hispano
Nouveau Monde
objektpark.pata
Patagonia
Philips Vevo World
Russian World
The AW Community Cent
The AW Gateway
The AW University
Yellowstone National Par
Patterns of Technological Change
Vis Til

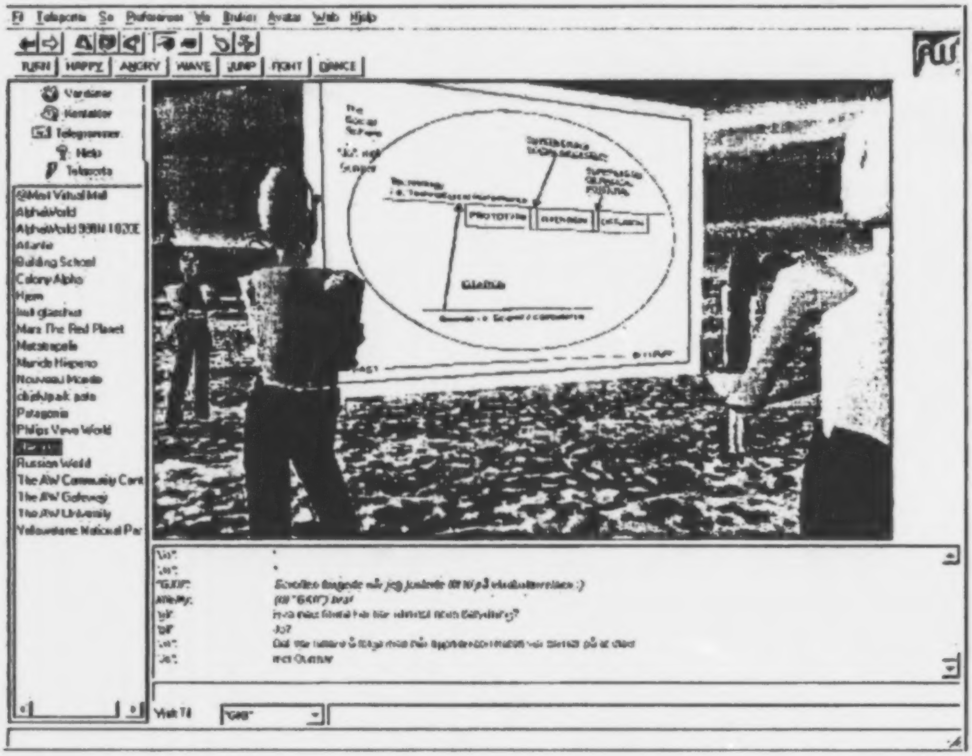
The interface in AW consist mainly of two windows: one for graphics that represents the graphical 3D -environment, and one for chat where the exchange of words and sentences are shown in temporal sequence as they are produced. Below the dialogue window there is an input area, where each and every participant write their messages. In the graphical window (into the 3D soace) the actual utterances of the participants are shown as 'bubbles' based on comic strip conventions. The dialogue is displayed both isolated in the chatwindow and intergrated in the graphic environment. On the left side of the picture there is a list of some of the hundreds of different accessable AW worlds. In addition there are several pre-programmed functions related to how avatars move and 'behave' in relation to others. AW also presents opportunities for direct linking to web-pages which may be opened in separate windows.

The Session

The session was conducted as a 'traditional' academic lecture. The topic was 'Brian Winston's theory of media innovation'. (4) A series of five slides were produced in advance and mada available in sequence as visual support for the verbal presentation. At

BEST COPY AVAILABLE

any time the students were invited to ask questions etc. by showing a (double) sign: waving their hand and at the same time typing the sign '*'. Then the teacher (the author of this paper) presented the talk while at the same time showing the various slides on a large blackboard next to him. Several of the comments and explanations of the slides were written in advance and copied to the text field. Due to the coarse of the discussion many of the ready made sentences had to be rewritten and used in a different order.


TURN
HAPPY
ANGRY
WAVE
JUMP
FIGHT
DANCE
AlphaWorld
Building School
Colony Alpha
Mars The Red Planet
Metatropolis
Mundo Hispano
Nouveau Monde
Patagonia
Philips Vivre World
Russian World
The AW Community Cent
The AW Gateway
The AW University
Yellowstone National Par

The talk lasted for approximately 30 minutes, interrupted by questions and discussion. After the presentation we commented upon and discussed our experiences during the session. We all agreed that the session worked well and that the outcome of the talk, in regard to the combination of verbal presentation and use of illustrations, were comparable to a traditonal lecture. Further, it was argued that the spatial dimension added to the experience of relating to persons in different positions, particularily when compared to verbal chat.

However, several of the participants noted that the attention directed towards the 3D graphic window was constantly interferred by the need to look at the chat window. As the dialogue developed, and to catch up with who said what and in which order we more and more focused on the information in the verbal only chat wndow.

Conclusion: Ffgurative versus Verbal

BEST COPY AVAILABLE

It was not surprising to find that the participants had a fascinated experience and felt some kind of surplus gain from being represented 'inside' the navigable 3D space. What was rather surprising, though, was that the experiment clearly demonstrated that the written verbal information dominated the process, even though the graphical and figurative aspects had high priority. One of the main premisses for the investigation had been the potential of extended complexity and richness of meaning in 3D-environments. This premiss was explicitly employed in the experiment: Only the graphical window allowed a view of the slides (the central element of the representation) parallell to the written information, while the chat window below only displayed the verbal information. Why did the verbal representation get more attention by the participants, in spite of the fact that the graphical window showed a more complex content, and inspite of the expressed surplus value of spatial positioning? I think the answer to these questions consists of two parts:

1. The chat-convention is supported by a well-established practice from other applications, such as different forms of IRC, and dialogue in verbale solutions. Most of the participants are experienced with verbal only chat-solutions, thus 'bubble' based chat in 3D-displays is a rather new phenomenon. But this cannot be the full explanation.

2. Even if 3D in the opening of this paper was described as a potentially richer environment and form of representation compared to other types of information, it passes on constraints that other and seemingly simpler forms of communication does not have or have defeated. The preliminary development of conventions exploited in 3D have a strong focus on realism, driven forward by the development of the computer game tradition. The recreation of the real world in a representation with continuum in space and time, the highest possible resolution and faithfulness according to the law of physical and visual reality, seems to have the highest priority. This kind of priority does neither gain the user-friendlieness nor an efficient handling of information. In IRC the dialogue is saved as a linear sequence and the structure is therefore easy to navigate. Thes stored conversation also becomes a collective memory. 3D-surroundings lack both these dimensions. Assuming the demand on spatial realism, 3D has so far no convention for displaying history or stored actions and events. 3D-environments are not able to supply the user efficiently with information along the temporal axis. The bubbles do not indicate succession, and it becomes difficult to distinguish between question and answer. The relationship between utterances are disrupted by the spatial organisation.

This shows that for the purpose of communication the illustration or display of temporality is more important than spatiality, in spite of the fact that the 3D environment consists of both unique and more diversified and meaningrich information. Wheather this can be explained as a temporary fenomenon due to an immature medium, is not easy to say, but it indicates the efficiency of verbal communication. (5) And that is worth thinking about when one consider the high priority multimedia currently has.

Notes:

1. This project was part of the Computer Games and Learning project at the Department of Media and Communcation, University of Oslo 1998-2001, funded by ITU <www.itu.uio.no>
2. Several master students at the Department of media and Communication, University of Oslo participated and made substantial contributins to this project: Thanks to Kristin Grønli, Jo Siingstad, Knut Augedal and Marika Lüders.
3. Active Worlds can be found at <www.activeworlds.com>.
4. The topic of the lecture was based on Brian Winston's book Media Technology and Society: A History: From the Telegraph to the internet. London: Routledge 1998.
5. Interessting experiments has been conducted with representation of user histories ini 3D environments, which clearly transcends the reality paradigm (Greenhalgh et al. 2000)

References:

Greenhalgh, Chris et al. 2000 'Temporal Links: Recording and Replaying Virtual Environments' in *Proceedings of the 8th AMC International Conference on Multimedia*, marina del Rey, CA USA, s 67-74

Liestøl, Gunnar 1999 *Essay in Rhetorics of Hypermediaq Design*. Oslo: DEpartment of Media & Communication, University of Oslo, pp. 191-221.

Winston, Brian 1998 *Media Technology and Society: A History: From the Telegraph to the Internet*. London: Routledge.

E-Learning: In Search of a Total Learning Experience (TLE)

Eric Lim Tze Kuan
School of Communication and Information
Nanyang Technological University
Singapore
emani@singnet.com.sg

Ian Weber
School of Communication and Information
Nanyang Technological University
Singapore
tigweber@ntu.edu.sg

Abstract: This paper provides a holistic approach to viewing the e-learning phenomenon from a theoretical perspective. It constructs a framework for e-learning development by drawing upon the literature for learning models, knowledge management and utilization of technology for electronic education. In so doing, it conceptualizes the continuous and progressive phases of infrastructure, infostructure and knowledge-structure integration to leverage Information & Communication Technologies (ICTs) more efficiently and effectively for the delivery of a holistic learning experience. By applying this developmental model, the e-learning practitioner possesses an evaluative tool to enable an upward spiral process of continuous feedback and improvements to the e-learning architecture and contribute more strategically to the development of a total learning experience. For the learner, the model generates strategic value from knowledge creating and sharing activities.

Introduction

Decisions to embrace the use of learning technologies for managing and working in the new digital and knowledge economics have fundamentally changed global business and social landscapes. With this increasing emphasis on a knowledge-driven e-based society, learning has been given center stage for its potential in developing the individual through instilling a proactive learning attitude essential for dealing with the dynamism of a complex environment (Sangster, Maclaran and Marshall, 2000). Educators such as Rosenberg (2001) have advocated the merger of Infocomm Technologies (ICT) with educational. philosophies to create an integrative virtual learning or "e-learning" environment. Most research in the area of e-learning has focused on the pivotal role of ICT in the process of learning (see Davies, 2000; Lee, 2000; Collis et al., 2000). Others dismissed such emphasis on the technical aspect of elearning and instead, contended that technology serves merely as a facilitator. Though insightful, these arguments exist on extreme ends of the e-learning continuum and represent a constrained perspective of an otherwise dynamic field. Considering the extensive implications of e-learning on the digital economy, this paper suggests an alternative holistic approach of viewing the e-learning phenomenon, resulting in a framework for e-learning development. The proposed model will draw upon available literature on learning models, knowledge management issues and the utilization of technology for electronic education.

E-learning: Integrating Learning, Knowledge and Information Technology

E-learning is gaining momentum in the managerial and academic arena. Organizations are actively searching for effective e-learning strategies whereas researchers have begun their initial explorations into the definitions and perspectives of the e-learning phenomenon.

BEST COPY AVAILABLE

Distance Education

One prevalent definition of e-learning is the use of assisting technologies to create educational opportunities without regards to both time and space (Jarvis, 1993). This emerging model of learning whereby learners can access the educational content "anytime, anywhere" has been commonly coined as "distance education" (Mangan, 2001). Distance education has been well received among business organizations and learning institutions for its flexibility in delivering an equilibrium between the need for knowledge acquisition and the fragmented time schedule of individual learners. For example, studies conducted by Pitcher et al. (2000) have demonstrated that substantial cost savings and efficiency can be obtained from the widespread use of distance learning in higher education.

With the progression in ICT, distance education has manifested into various forms, ranging from virtual classrooms (Hiltz, 1992) to the formal delivering strategy of telelearning (Collis, 1996) and the electronic platforms of cyberschools in the new knowledge society (Jones, 1998). Mangan (2001) has intuitively summarized these developments by classifying distance learning into computer-based training (CBT), videoconferencing and Web-based training (WBT). Others such as Sanderson and Scivier (1998) advocate the alternative use of computer-mediated communication (CMC) as the main component of virtual seminars to imitate conventional forums by simulating a digital collaborative learning environment. However, Veen et al. (1998) questions the effectiveness of such virtual seminars. In response, Tansley and Bryson (2000) championed the need for corresponding infrastructural and social changes in order to ensure the overall success of virtual seminars. Furthermore, Persico and Manca (2000) included customizability as a dimension to be considered in designing CMC systems so as to provide a simple and easy interface that is user-friendly and configurable in accordance to different learning principles.

More recently, the popularity of the Internet has attracted its share of advocators, who are quick to propose the W^3 as becoming part of the mainstream infrastructure in distance learning (Cole, 1998; Houlder, 1998). Indeed, the W^3 is hailed as the next revolution in education because of its time and geographical independence; its ease in delivering and updating information; its improved interactivity; its user-centric environment and its capacity to accommodate an almost infinite number of learners (Marchionini and Maurer, 1995; Kapur and Stillman, 1997; Lee et al., 1997; Mudge, 1999). Nevertheless, despite the Internet's ability to transcend time and space, studies by Thomas (2000) have proved that students in practice still prefer to maintain some form of physical contact. Moreover, the Web is often criticized for overloading the user with excessive and irrelevant information (Nielson, 1995). As such, Grabinger and Dunlap (1995) advised that though it is imperative to have the accessibility to the richness and variety of materials available from the Internet, the specific learning goals should not be overlooked.

Though evidence points to distance learning as an efficient technique for offering high quality education for students in any geographical locations (Burke and Gill, 2000), findings by Al-Kodmany et al. (1999) have suggested that technology should supplement traditional teaching methodologies rather than supplant them. Hence, it is necessary to look beyond the technical elements of distance education and examine more closely how such initiatives can be effectively integrated into existing learning philosophies.

Learning Models

The conventional learning model originates as an objectivist model, in which a reality exists and experts instruct individuals of that reality (Belanger and Slyke, 2000). However, the emergence of learner-centric approaches such as constructivism and socio-culturalism has overshadowed conventional ideas and lent weight to the empowerment of individuals to take charge of their own learning environments. Learning theories such as andragogy (Knowles, 1984), minimalism (Carroll, 1990; Van der Meij and Carroll, 1995), experiential learning (Rogers, 1969; Kolb, 1984) and action learning (Revans, 1980) have established strong links between learning and the practicality of doing.

Although these constructs of learning may differ in their perceptions towards the provision of education, they share two common objectives: to emphasize the value of learning by doing and the importance of ensuring an enriching learning experience for the learners. Moreover, as highlighted by Alavi (1994), learning is most effective when it involves the process of problem solving through collaborative brainstorming. With the improved connectivity and increased interactively of ICT, these commonalities will prove to be pivotal to the delivery of a holistic learning experience for the students.

A comparison between the different learning philosophies is summarized in Table 1 below:

Learning Model	Advocators	Characteristics
Experiential Learning	Rogers, 1969; Kolb, 1984	- Application of knowledge to address the specific needs and requirements of the learner. - Learning is primarily focused on problem solving and the learner is totally involved in and has control over the nature and direction of the learning experience
Andragogy (Adult Learning)	Knowles, 1984	- Learning is facilitated when adults learn experientially in a self motivated, problem-solving approach to grasp topics of immediate value.
Minimalism	Carroll, 1990; Van der Meij and Carroll, 1995	- Describes a framework for learning that emphasizes the value of unobtrusive learning content in facilitating self-directed learning activities.
Constructivism	Tobin and Tippins, 1993; Leidner and Jarvenpaa, 1995; Brandt, 1997	- A learning process whereby knowledge is created from using what is known to find sense in experiences. - New information gathered through experiences is integrated with existing mental models to result in expanded, more complex mental models.
Cognitive Information Processing	Bovy, 1981; Leidner and Jarvenpaa, 1995	- A learning model, which proposes learners as having their own individual learning frame of references and only information that has been processed can result in actual learning. - Individuals tend to rely on their prior knowledge obtained from their mental models of the particular domain of expertise to process new information.

Table 1: A Comparison of Learning Models

Apparently, from the table, learning is most efficient when the learning environment is customized to meet the specific needs of individual learners and most effective when learning is facilitated through collaborative problem solving. In other words, learning efficiency is enhanced when learners require the least effort to access the learning facilities such as in the situation where e-learning is accessible "anytime, anywhere" (Rosenberg, 2001), making it convenient for learning to occur within fragmented time schedule and thus conserving substantial time resources. Effectiveness on the other hand, refers to the capacity of learning to generate value for the learners and this can be best addressed when learning is seamlessly integrated into the solution of learner-centric problems such as the case where e-learning can provide for collaborative infomation and knowledge sharing activities tailored towards topic-specific discussions. Hence, the merger of efficiency and effectiveness in learning completes the universe of an enriching, directional learning experience and embodies the fundamentals of knowledge creation, retention and utilization. It is, therefore, imperative to examine the integration of knowledge management into the learning process and understand how they can complement each other in the provision of an e-learning future.

Knowledge Management (KM)

As pointed out by Nonaka (1991), the management of knowledge plays a pivotal role in the heart of any organization's human resource strategy. Nonaka (1994) devised what he termed as the "Spiral of Knowledge", which explains the creation of knowledge through conversions between tacit and explicit knowledge. Explicit knowledge refers to the visible, expressible form of information that can be transmitted in a formal, systematic manner whereas tacit knowledge is often associated with intangible individual experiences. Nonaka proposes that there are four different modes of knowledge conversion and for each of these modes; Nonaka (1994) attaches a method of knowledge creation. Socialization is the activity that binds individuals from differing backgrounds and experiences to create tacit knowledge because the mere transfer of information would be meaningless without some form of common understanding (Nonaka, 1994). However, this tacit knowledge must be transformed into explicit knowledge through the process of externalization such that the knowledge can be organized in a logical, systematic format, which can be easily conveyed and comprehended to a wider audience. When different bodies of explicit knowledge are combined through the use of social processes, the reconfiguration of existing information through sorting, adding, re-categorizing and re-contextualizing can lead to the creation of new explicit knowledge. Internalization is the last mode of knowledge conversion within the cycle and involves the creation of tacit knowledge from explicit knowledge whenever individuals make use of the shared explicit knowledge as a basis upon which to broaden, extend and reframe their own tacit knowledge base. By injecting ICT into the fundamental knowledge

BEST COPY AVAILABLE

architecture that supports these knowledge-creating activities, the learning experience can be effectively enhanced and strategize.

The "learning organization", as described by Prokesch (1997), is one such example that has successfully made ICT an integral component of knowledge management activities. In essence, the learning organization is structured to leverage knowledge by replicating it efficiently amongst the individuals with the use of ICT such that each participant is not learning in isolation (i.e. knowledge sharing activities are facilitated through a single information infrastructure). This notion of a learning organization is also shared in the works of Leonard-Barton (1992), who further emphasizes the importance of empowering individuals so that they may have the self-confidence, freedom and motivation to continuously solve problems and learn to reinvent in the process. In this way, the level of knowledge can be homogenized throughout the community and, thus, bridging the widening knowledge gap.

Communities of Practice (CoP) is another management strategy that focuses on the effective sharing of knowledge to generate strategic learning value (Wenger and Snyder, 1999). CoP refers to groups of people informally bounded by shared expertise and passion for a joint purpose. A community of practice may not have an explicit agenda and within it, people share their experiences and knowledge in free-flowing, creative ways that foster new approaches to problems. Hence, a familiar, conducive learning environment is fostered within CoP that encourages the creation of new knowledge through collaborate learning and develops the individuals' ability to build and exchange knowledge.

From the previous discussion, e-learning can be perceived to be one of the following:

- *The Integration of Technology into the Process of Learning.* In this case, e-learning is explained as an innovation of technological advancement and dismisses the intangible qualities of the dynamic learning process for greater efficiency in information diffusion capability. Nevertheless, literature from such technical perspectives of viewing elearning supplies insights that can be adapted to characterize the **technical infrastructure** required for an effective e-learning experience.
- *The Extension of Student-Centric Learning Models onto Virtual Environment.* This practice is simply concerned with the wholesale shoveling of traditional learning models onto new communication mediums and does not consider the possibilities of innovative learning opportunities that are present through the marriage of ICT with conventional educational philosophies. A true learner-centric model does not perform the mundane task of providing stagnant educational material through new communication media. Rather, by having students as the center of attention, e-learning must be able to appreciate individual learning requirements and supply educational content that can best match those needs. In other words, any learning information provided over the underlying infrastructure should be timely, accurate and relevant; the core of a **sound infostructure**.
- *The Management of Knowledge Activities using ICT.* This area of study only focuses on the issues of knowledge creation and sharing but does not provide an explicit link between the knowledge activities and the underlying information structure (infostructure) that is required to support these activities. Given the dynamism of the new economy, the value and lifespan of any form of knowledge is ultimately decided by the characteristics of the information upon which the knowledge is obtained. Moreover, despite the fact that existing knowledge literature is based primarily on organizational studies, it does not imply that these knowledge practices cannot be adopted on an individual learner level. Such organizational knowledge initiatives represent viable options for e-learning to generate strategic value for the individual learner as well. The **knowledge-structure** examines the ways in which knowledge practices can be applied to enhance learning on a larger social scale.

Nonetheless, each of the above perspectives represents just one dimension from which to examine an otherwise multi-faceted discipline and as such e-learning should be considered from a more holistic perspective. The discussion section provides an e-learning model that encompasses the various aspects of ICT, learning models and knowledge management into a singular educational architecture.

Discussion

From the discussions, a holistic view of e-learning would then be the integration of the above three dimensions into a unified strategic educational framework (i.e. e-learning involves the leveraging of ICT to deliver efficient and effective learning to individuals so as to generate strategic value from knowledge creating and sharing activities and in so doing, provide a *Total Learning Experience (TLE)* to the learners). Specifically, the e-learning developmental and evaluative framework should comprise three continuous and progressive phases: the *infrastructure*, the *infostructure* and the *knowledge-structure* (see Figure 1).

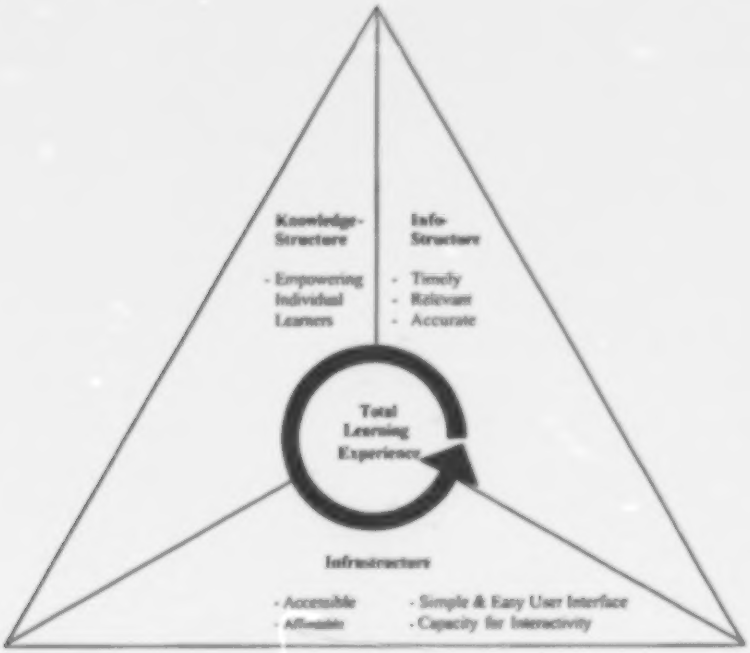

Knowledge-Structure
- Empowering Individual Learners
Info-Structure
- Timely
- Relevant
- Accurate
Total Learning Experience
Infrastructure
- Accessible
- Affordable
- Simple & Easy User Interface
- Capacity for Interactivity

Figure 1: Total Learning Framework

Depicted in the above diagram, Infrastructure refers to the supporting technologies upon which the subsequent info- and knowledge-structures rest. It represents the foundation of e-learning by clearly defining the characteristics of ICT that should be present to facilitate a total learning process:

1. The technology should be accessible to all interested parties. Accessibility in learning is not constrained to pure geographical proximity; it is also the ability to transcend time in the delivery of learning content. As suggested by Rosenberg (2001), the requirements of learners with different time restrictions can be best met if learning can be done "anytime, anywhere". In this respect, the improved connectivity brought about by advancement in ICT acts as a convenient platform for educators to efficiently disseminate their materials to audiences of a greater reach.
2. In addition, the user interface, through which the educational content is being delivered, should be simple to navigate and easy to master. As suggested by the minimalism learning model, navigation is an important factor of effective learning because even if the educational materials are made readily available for the learners, their intended purpose will be defeated if the learners find difficulties in locating them. The degree of complexity in mastering the use of the delivery mechanism is another area of concern. If the technicalities involved in receiving the learning content require a substantial level of technical competence, then potential learners may be deterred.
3. The third characteristic of an effective learning infrastructure is the affordability of the supporting technologies. As evidenced in the study by Carville and Mitchell (2000), technologies such as video conferencing exist as "a relatively inexpensive way of providing remote students with the nearest thing to 'face-to-face' teaching". This observation bears practical implications for e-learning since the value of e-learning is derived primarily from participative learning and as such, it shares similar characteristics with the Internet in the sense that the degree of benefits to be reaped from the learning process is directly proportional to the level of participation. Hence, a cost-effective infrastructure for the learners is an essential

condition for e-learning to maximize its potential in the creation of knowledge by encouraging critical mass participation.

4. Finally, the technical infrastructure for e-learning should possess the capacity for significant interactivity. Interactivity among learners is not a new trend in learning. Since the birth of student-centric education, classroom discussions have already been incorporated as an integral part of the curriculum and in recent years, collaborative brainstorming has become a recognized technique in problem-centric learning (Alavi, 1994). However, interactions of such have long been constrained by the need for physical presence and can only occur on a fixed or limited scale. With the latest changes in ICT, interactivity in e-learning can now take place virtually at almost infinite capacity, which in turn has contributed substantially to expansions in the scope of educational discourses.

Despite an effective infrastructure, a TLE would not have been possible without an equally effective infostructure. Infostructure is the normative structure of information for e-learning that builds on the foundations of infrastructure and acts as the facilitating architecture for the ultimate aim of knowledge creation. In particular, the infostructure defines the characteristics of educational content that will blueprint an efficient and effective learning process:

1. Firstly, the learning content of an effective educational process should always be timely. As illustrated by Rosenberg (2001), speed is the essence of the digital society and time can either be a competitive asset or liability. In other words, the lifespan of information has been substantially shortened with rapid progression in ICT and learning can no longer be a dormant process. In fact, long gone are the days when educational content can remain stagnant for years to come as information is updated constantly. Hence, a crucial component of an effective e-learning framework would be the timeliness of the information being disseminated to the learners.
2. The second aspect of an efficient infostructure would be the relevance of the learning materials. In an age where information is the social currency, learners are often bombarded or even confused by the overwhelming amount of information available from multiple sources. Termed as information overload, this chaotic phenomenon posed a threat to effective education because learners' resources would be wasted in sifting out the required information. It is, therefore, in the basics of e-learning to understand the learners' objectives through interactions and then supply the relevant learning materials that best match their expectations and specific needs. In essence, the relevance of the learning information is associated to the learning model of cognitive information processing (Bovy, 1981; Leidner and Jarvenpaa, 1995) where it is commonly believed that learners possess their own individual perceptions of what constitutes relevant learning information and as such, learning is most effectively managed in e-learning since the same educational content can be effortlessly and inexpensively personalized to suit the needs of individual learners.
3. The third and last characteristic of an e-learning infostructure is the accuracy of the educational content, which must be ensured in the learning process. Similar to the case of relevancy as discussed above, the huge and disorganized flow of information places a question mark on the value of every piece of information and erodes the confidence of e-learners. As such, for e-learning to take off, the accuracy of information contained within the pages of the learning materials should not be compromised. Moreover, constructivism (Tobin and Tippins, 1993; Leidner and Jarvenpaa, 1995; Brandt, 1997) assumes the creation of new knowledge as the integration of new information into existing knowledge base and hence, underlining the dangers of misguided information towards the expansion of an individual learner's knowledge base.

Once the supporting infra- and info-structures are in place, it is now viable to develop the knowledge activities (knowledge-structure) that support the total learning process. As opposed to the previous two phases, the knowledge-structure is not a tangible process with definitive characteristics. Instead, the knowledge architecture emphasizes the cultivation of an inherent knowledge management mentality within each learner so as to actualize the full potential within each individual. This knowledge-structure builds upon the physical learning foundations and considers the mannerism in which such mentality can be realized in the very nature of individual learners. Typically, empowerment of the individual is derived from the cultivation of such thinking to create the self-confidence, freedom and motivation that is necessary to continuously solve problems creatively and to reinvent in the process (Leonard-Barton, 1992). However, empowerment is not attained simply by delivering educational content to the doorsteps of the learner through electronic media; rather, it is the induction of a proactive approach to the learning process and it can only occur through the realization of an effective infra- and info- structure. Without connectivity to a wider and more diverse group of learners through the use of ICT, the individual would be synonymous to that of an everyday classroom student. It is only with the accessibility of a much greater reach brought about by ICT that individual learners are truly empowered to interact freely with one another. Furthermore, empowerment is not truly complete without the sound and reliable supporting role of the infostructure. The exchange of information during interactions must obey the characteristics of the infostructure presented above in order to solve problems not only creatively, but also timely and accurately.

Summarizing the above discussion, e-learning can be conceived to be an unbiased collaboration of the Infrastructure, Infostructure and Knowledge-structure to deliver a TLE to learners. Each of these phases possesses definitive characteristics that act as the governing boundaries for the development of a TLE and together, these characteristics constitute an evaluative framework for e-learning practitioners. As illustrated in the model, the evaluative analysis is an upward, spiraling process of continuous improvements to the e-learning architecture, which are governed by the dynamics of the three structures so as to realize the full potential of a TLE. Moreover, it should be emphasized at this point that the evaluation of any e-learning development can be performed at any phase of its development, be it the infrastructure, infostructure or knowledge-structure, so long as the characteristics of the overall e-learning architecture are fulfilled.

Conclusion

The total learning framework presented is a preliminary model for the practical development of e-learning. By projecting the framework as a combination of three spiraling structures and defining their essential characteristics, the total learning model serves as guiding principles for practitioners in the development of e-learning modules. However, considering the dynamism of economic and social changes, the model is never intended to be fully comprehensive. Full empirical studies are required to support and expand on this model so as to fine-tune it to make it applicable for the effective management of e-learning initiatives. An important emphasis of this paper is the subtle but crucial message that learning is never meant to be a mono-dimensional and static process. Instead, it must feed on the capabilities of technology and the limitless potential of the mind to develop and expand into a strategic, creative routine of society.

References

Alavi, M. (1994). Computer-mediated collaborative learning: an empirical evaluation. *MIS Quarterly*, **18**, 2, pgs. 159 – 174.

Al-Kodmany, K., George, R. V., Marks, A., and Skach, J. (1999). A case study of teaching an urban design course on two campuses simultaneously. *ALN Magazine*, **3**, 1.

Belanger, F., and Slyke, C. V. (Spring 2000). End-user learning through application play. *Information Technology, Learning, and Performance Journal*, **18**, 1, pgs. 61 – 70.

Bovy, R. (1981). Successful instructional methods: a cognitive information processing approach. *Educational Computing and Technology Journal*, **29**, 4, pgs. 203 – 217.

Brandt, D. (1997). Constructivism: teaching for understanding of the Internet. *Communications of the ACM*, **40**, 10, pgs. 112 – 117.

Burke, R. H., and Gill, M. (2000). The experience of distance learning at the scarman centre: the realities and the prospects. *Innovations in Education and Training International*, **37**, 3, pgs. 286 – 289.

Carroll, J. (1990) *The Nurnberg funnel*, Cambridge, MA: MIT Press.

Carville, S., and Mitchell, D. R. (2000). 'It's a bit like star trek': the effectiveness of videoconferencing. *Innovations in Education and Training International*, **37**, 1, pgs. 42 – 49.

Cole, G. (1998). New wave learning. *Times Educational Supplement*, 9 January.

Collis, B. (1996). *Tele-learning in a Digital World: The Future of Distance Learning*. London, UK: International Thompson Computer Press, pgs. 541 - 588.

Collis, B., Peters, O., and Pals, N. (2000). Influences on the educational use of the WWW, Email and Videoconferencing. *Innovations in Education and Training International*, **37**, 2, pgs. 108 – 119.

Davies, P. (2000). Computerized peer assessment. *Innovations in Education and Training International*, **37**, 4, pgs. 346 – 355.

Grabinger, R. S., and Dunlap, J. C. (1995). Rich environments for active learning: a definition. *Association of Learning Technology Journal*, **3**, 2, pgs. 5 – 9.

Hiltz, S. R. (1992). Constructing and evaluating a virtual classroom. In Lea, M. (ed.), *Contexts of Computer Mediated Communication*, Harvester Wheatsheaf, London.

Houlder, V. (1998). Information technology: an appetite for high tech. *Financial Times*, 19 January.

Jarvis, P. (1993). The education of adults and distance education in late modernity. In Keegan, D. (ed.), *Theoretical Principles of Distance Education*, Routledge, London and New York.

Jones, R. G. (1998). *Cyberschools*. Jones Digital Century, Incorporated.

Kapur, S., and Stillman, G. (1997). Teaching and learning using the World Wide Web: a case study. *Innovations in Education and Training International*, **34**, 4, pgs. 316 – 322.

Knowles, M. (1984). *The Adult Learner: A neglected species* (3^{rd} ed.). Houston: Gulf Publishing.

Kolb, D. A. (1984). *Experiential Learning*. Eaglewood Cliffs, NJ: Prentice Hall.

Lee, D. (2000). The Effect of Using a Hypermedia Learning Model for a CBI Design Course. *Innovations in Education and Training International*, **37**, 2, pgs. 120 – 128.

Lee, S., Groves, P., and Stephens, C. (1997). Existing tools and projects for online teaching. *JISC Technology Application Programme*.

Leidner, D. E., and Jarvenpaa, S. L. (1995). The use of information technology to enhance management school education: a theoretical view. *MIS Quarterly*, **19**, 3, pgs. 265 – 291.

Leonard-Barton, D. (Fall 1992). The factory as a learning factory. *Sloan Management Review*, pgs. 23 – 38.

Mangan, P. (Fall 2001). What is distance learning?. *Management Quarterly*, pgs. 30 – 5.

Marchionini, and Maurer. (1995). The roles of digital libraries in teaching and learning. *Communications of the ACM*, **38**, 4, pgs. 67 – 70.

Mudge, S. M. (1999). Delivering multimedia teaching modules via the internet. *Innovations in Education and Training International*, **36**, 1, pgs. 11 – 16.

Nielson, J. (1995). *Multimedia and Hypertext: The Internet and Beyond*. Mountain View.

Nonaka, I. (1991). The knowledge-creating company. *Harvard Business Review*, pgs. 96 – 104.

Nonaka, I. (1994). A dynamic theory of organizational knowledge creation. *Organizational Science*, **5**, 1, pgs. 14 – 35.

Persico, D., and Manca, S. (2000). Use of FirstClass as a collaborative learning environment. *Innovations in Education and Training International*, **37**, 1, pgs. 34 – 41.

Pitcher, N., Davidson, K., and Goldfinch, J. (2000). Videoconferencing in higher education. *Innovations in Education and Training International*, **37**, 3, pgs. 199 – 209.

Prokesch, S. E. (1997). Unleashing the power of learning: an interview with British Petroleum's John Browne. *Harvard Business Review*, pgs. 5 – 20.

Revans, R. (1980). *Action Learning*. London: Blong and Briggs.

Rogers, C. (1969). *Freedom to Learn* . Columbus, OH: Merrill.

Rosenberg, M. J. (2001). *E-learning: Strategies for Delivering Knowledge in the Digital Age*. McGrawHill.

Sanderson, P. and Scivier, J. (1998). Virtual seminars: educational benefits and institutional considerations. CTI Conference, York.

Sangster, A., Maclaran, P., and Marshall, S. (2000). Translating theory into practice: facilitating work-based learning through IT. *Innovations in Education and Training International*, **37**, 1, pgs. 50 – 58.

Tansley, C., and Bryson, C. (2000). Virtual seminars – a variable substitute for traditional approaches?. *Innovations in Education and Training International*, **37**, 4, pgs. 335 – 345.

Thomas, R. (2000). Evaluating the effectiveness of the Internet for the delivery of an MBA programme. *Innovations in Education and Training International*, **37**, 2, pgs. 97 – 102.

Tobin, K., and Tippins, D. (1993). 'Constructivism as a referent for teaching and learning', In Tobin, K. (ed.), *The Practice of Constructivism in Science Education*. Washington, DC: AAAS Press, pgs. 3 – 21.

Van der Meij, H., and Carroll, J. (1995). Principles and heuristics for designing minimalist instruction. *Technical Communications*, **42**, 2, pgs. 243 – 261.

Veen, W., Lam, I., and Taconis, R. (1998). A virtual workshop as a tool for collaboration: towards a model of telematic learning environments. *Computers and Education*, **30**, 1 – 2, pgs. 31 – 39.

Wenger, E. C., and Synder, W. M. (2000). Communities of practice: the organizational frontier. *Harvard Business Review*, pgs. 139 – 145.

Designing ICT Training Material for Chinese Language Arts Teachers

Janet Mei-Chuen Lin, Cheng-Chih Wu and Hsiu-Yen Chen
Department of Information and Computer Education
National Taiwan Normal University
Taipei, Taiwan
mjlin@ice.ntnu.edu.tw

Abstract: The purpose of this research is to tailor the design of ICT training material to the needs of Chinese language arts teachers such that the training they receive will be conducive to effective integration of ICT into instruction. Eighteen experienced teachers participated in a Delphi-like survey that comprised a series of four questionnaires. They were asked to describe the professional tasks they routinely performed. Their responses were compiled into a list of 90 task items. Each item was then associated with one or more hardware/software tools that teachers need to learn to perform that task more productively. A restructuring process reduced the total number of items to 67. There will be one training unit developed for each of the 67 items, with each covering certain hardware and software features that we specified. We have developed six training units in the tryout phase with the help from five teachers. These units are characterized by their subject-specific contents.

Introduction

Teacher training in information and communications technologies (ICT) often uses "general-purpose" or "one-size-fits-all" training material for all teachers. The underlying assumption seems to be that all teachers should be able to benefit from the same set of training material regardless of difference in content areas they teach. This probably results from the fact that most training courses often focus predominantly on general skills in common application software rather than on effective integration of ICT into subject teaching. Researchers have pointed out that dipping staff members in training workshops that emphasize provision of ICT skills is not an effective way to get them to use the technologies, much less so to guarantee that they can become innovative integrators of technology into the curriculum (Hannafin, 1999; Hoffman, 1997; Lawson & Comber, 1999).

Different subject areas vary widely in their content knowledge as well as pedagogical methods. It follows that ICT may most likely be used in different ways and for different purposes by teachers of different subjects. Training programs should, therefore, be tailored to teachers' subject-specific needs. Such programs are possible only if training material could be designed based on a detailed analysis of the pedagogical practices of each subject and on a thorough understanding of what teachers really want ICT to help them. The research reported in this paper is a first attempt and an on-going effort to attain this goal. In the remainder of this paper, Section 2 is a description of our multi-round questionnaire survey and the result we got; then, in Section 3, we explain how we mapped the 90 task items to 67 training units. In the end are the conclusions and a sketch of our future work.

The Questionnaire Survey

This research had been conducted using a modified form of the Delphi technique (Cyphert & Gant, 1971; Weaver, 1971). Eighteen Chinese language arts teachers were invited to participate in the questionnaire survey. All of them met the following two criteria that we set for selecting participants: a minimum of 10 years' experience in Chinese language arts teaching and possession of adequate basic skills in common application software (including word processors, presentation software, and Internet tools such as web browsers and email software). They were from nine different secondary schools. Seventeen of them were female and one was male. The typical Delphi procedure of one multi-round questionnaire was modified into a series of four different, though highly coherent, questionnaires in this study. We preserved the essence of the Delphi technique by assembling the responses of each round and reporting them back to the respondents in the subsequent round for elaboration and/or revisions. The four questionnaires were mailed to the participants between August and November 2001.

The first-round questionnaire contained 16 open-ended questions, as shown in (Tab. 1). The first seven questions focused on the five major aspects of Chinese language arts instruction (i.e., reading, writing, Chinese calligraphy, oral presentation skills, and additional reading instruction). Respondents were asked to describe about the pedagogical practices of Chinese language arts instruction and the problems they had observed. Then we posed six questions related to how teaching aids had been used in classroom teaching. The remaining three questions concerned other routine duties that Chinese teachers were usually required to perform.

	Question
1	According to the official curriculum guidelines, Chinese language arts instruction in the secondary schools is supposed to cover the following five aspects: reading, writing, Chinese calligraphy, oral presentation skills and additional reading instruction. Please describe what is being taught in each of these aspects and the percentage of total lecture hours allocated to each.
2	Please describe common pedagogical practices of *reading instruction*. What do you think are the major problems of current practices?
3	Please describe common pedagogical practices of *writing instruction*. What do you think are the major problems of current practices?
4	Please describe common pedagogical practices of *Chinese Calligraphy instruction*. What do you think are the major problems of current practices?
5	Please describe common pedagogical practices of *oral presentation skills instruction*. What do you think are the major problems of current practices?
6	Please describe common pedagogical practices of *additional reading instruction*. What do you think are the major problems of current practices?
7	What are major difficulties faced by Chinese language arts teachers with regard to classroom teaching?
8	What are the common teaching aids used by Chinese language arts teachers? How often are they used?
9	How effective is the use of teaching aids in enhancing classroom teaching?
10	What are students' feedback on the use of teaching aids in Chinese language arts instruction?
11	What are the major difficulties faced by Chinese language arts teachers when they try to use teaching aids?
12	What teaching aids do you think that Chinese language arts teachers need most?
13	How do Chinese language arts teachers prepare for classroom instruction? What tools do they use most often with regard to preparatory work?
14	Other than classroom instruction and preparatory work, what are other tasks that Chinese language arts teachers' are required to do on a regular basis?
15	Among the various professional tasks carried out by Chinese language arts teachers on a regular basis, what tasks are thought to be most demanding on teachers' time and effort?
16	What do you think that the computer can do to ease Chinese teachers' teaching job?

Table 1: Questions in the First-Round Questionnaire

We compiled the participants' first-round responses and presented the result in the second round questionnaire for further elaboration and/or revisions. The second-round result was then organized into a list of 90 task items. Among them, 55 items were directly connected to teaching, including preparatory tasks (e.g., gathering information for lesson plans), classroom teaching (e.g., teaching formal letter writing), and after-class tasks (e.g., grading exam papers). The remaining 35 items were mainly administrative (e.g., classroom management) and communicative (e.g., mentoring) tasks. (Tab. 2) shows the first 12 teaching-related items that were grouped under the section of "Preparatory Tasks for Lectures."

1.1	*Preparatory Tasks for Lectures*		*Rating*				
	1.1.1	Preparing Course Syllabus	❺	❹	❸	❷	❶
	1.1.2	Planning Review Schedule	❺	❹	❸	❷	❶
	1.1.3	Designing Students' Learning Worksheets	❺	❹	❸	❷	❶
	1.1.4	Gathering Textual Material	❺	❹	❸	❷	❶
	1.1.5	Gathering Pictures	❺	❹	❸	❷	❶
	1.1.6	Gathering Audio and Video Material	❺	❹	❸	❷	❶
	1.1.7	Studying the Articles To be Taught	❺	❹	❸	❷	❶
	1.1.8	Surveying Educational CD Titles	❺	❹	❸	❷	❶
	1.1.9	Browsing Related Web Sites	❺	❹	❸	❷	❶
	1.1.10	Looking Up New Characters and Phrases	❺	❹	❸	❷	❶
	1.1.11	Preparing Handouts	❺	❹	❸	❷	❶
	1.1.12	Making Lesson Plans	❺	❹	❸	❷	❶

Table 2: A Portion of Round 3 Questionnaire

The 90 items were presented to the participants in the third-round questionnaire, asking them to assign a rating of 1.0 (least important) to 5.0 (most important) to each. By this we intended to find out how important teachers thought of each task in terms of needing ICT skills to help them accomplish the task. The 18 participants' ratings for each item were averaged to derive the *priority factor* for it.

The items were ranked from the most important to the least important according to their priority factors. The ratings and the rankings were then provided in the fourth round questionnaire to solicit participants' further comments. In particular, we asked them to explain in more detail about several task items and tell us how they thought ICT might assist in those tasks. For example, one of the eight questions asked was: "Task item 1.2.1.6.7—'teaching of rhetorics' and task item 1.2.1.6.8—'teaching of Chinese grammar' received an average ratings of 3.56 and 3.50, ranking 48 and 50 respectively. What are the specifics of these two task items? What do you think that ICT can help in improving teaching and learning in these two respects?"

Among the 90 tasks items that were presented for rating, Table 3 shows the 10 top-ranking items. It is interesting in noting that only three items, the shaded rows in Table 3, are directly related to teaching. In fact, of the 55 directly teaching-related items, only 25 items (45%) ranked in the top half, compared with 20 of 45 (57%) administrative task items. In other words, the respondents seemed to have regarded ICT skills more relevant to administrative and communicative tasks than to teaching tasks. This finding is not surprising, considering that previous studies, such as the ones done by McCannon & Crews (2000) and Clark (2000), have repeatedly shown that more teachers used the computer for administrative tasks than to enhance classroom instruction. However, given that ICT integration in subject teaching was rarely practiced in Taiwan's secondary schools, much less in Chinese language arts instruction, our participants' awareness of the potential benefits of using ICT within the curriculum might have thus been greatly confined. After all, it is much easier to relate administrative and communicative tasks to ICT skills than to relate teaching tasks to ICT skills. For example, a respondent could have readily connected "computing and analyzing students' grades" (ranked No.1 in (Tab. 3)) with common spreadsheet tools or "publishing students directory" (ranked No.6) with word processing tools. In contrast, it would be much harder for them to see what the use of ICT might have to do with "teaching of Chinese grammar." Realizing this general fact, the teacher training providers in Taiwan should try to offer more training programs oriented toward integrating ICT into instruction so that our teachers can become more educated in the theories and practices of ICT integration. This, in turn, calls for more training material designed to serve that purpose.

Rank	Task Item	Average Rating
1	Preparing Exam Papers	4.94
1	Computing and Analyzing Students' Grades	4.94
1	Preparing Grade Reports	4.94
1	Developing and Maintaining Student Web Site	4.94
1	Developing and Maintaining Chinese language arts Teachers' Web Site	4.94
6	Managing Test Bank	4.89
6	Publishing Student Directory	4.89
8	Preparing Presentation for the Meetings	4.83
9	Designing Students' Learning Worksheets	4.67
10	Preparing Meeting Agendas and Minutes	4.61

Table 3: The 10 Top-Ranking Task Items

While we were pursuing the details of professional tasks involved in Chinese language arts instruction throughout the survey, questionnaires 2, 3 and 4 also contained a second section in which questions were posed to elicit responses concerning how ICT could help in some particular aspects of Chinese language arts instruction. The six questions in the second-round questionnaire asked about how the participants thought of the computer as a teaching aid, especially in contrast to the traditional teaching aids they had used before. The third round questionnaire contained five questions asking the participants to assess the potential benefits and possible obstacles of using the Internet in Chinese language arts instruction. We put special emphasis on the Internet because we considered it the most promising technology in revolutionizing the way of teaching and learning. With the fourth round questionnaire, its Section 2 contained two questions that were related to the use of ICT in keeping students' records and preparing grade reports. All these questions succeeded in generating from our respondents many useful ideas that can be used to enrich our training material, as will be mentioned again in the next section.

Mapping Task Items to Training Units

Since our ultimate goal is to design training material for Chinese language arts teachers based on the task items derived from the survey result, we need to map these 90 task items to a suitable number of training units. We

BEST COPY AVAILABLE

began by making an assignment of software/hardware tools to each task item. That is, we tried to identify the software/hardware tools that teachers would need to learn to perform that task more efficiently or innovatively. The assignment was based on the task description that our respondents gave in their responses to the questionnaires, as well as what they suggested that ICT might help with the tasks. (Tab. 4) shows the software/hardware assignment for the 12 task items that appeared in (Tab. 2). Taking Item 1.1.6 (i.e., "Gathering Pictures") as an example, we assigned three application tools (i.e., web browser, picture viewer, and image editor) and two hardware tools (i.e., scanner and digital camera) to it. Some of the task items that the teachers found not really necessary for involving the use of ICT, and which we also agreed, were omitted from this assignment. For example, Items 1.1.7 and 1.1.10 (ranking 74 and 83 among the 90 items) were dropped during this assignment process.

Task Item	Software	Hardware
1.1.1 Preparing Course Syllabus	Word Processor (e.g., MS Word)	-
1.1.2 Planning Review Schedule	Word Processor	-
1.1.3 Designing Students' Learning Worksheets	Word Processor	-
1.1.4 Gathering Textual Material	Word Processor Web Browser (e.g., Internet Explorer) Chinese OCR Software	Scanner
1.1.5 Gathering Pictures	Web Browser Picture Viewer (e.g., ACDSee) Image Editor (e.g., PhotoImpact)	Scanner Digital Camera
1.1.6 Gathering Audio and Video Material	Web Browser Multimedia Software (e.g, Windows Media Player) Digital Audio Editor (e.g., GoldWave) Video Editor	Camcorders CD-ROM Drive DVD-ROM Drive
1.1.7 Studying the Articles To be Taught	-	-
1.1.8 Surveying Educational CD Titles	Web Browser	-
1.1.9 Browsing Educational Web Sites	Web Browser	-
1.1.10 Looking Up New Characters and Phrases	-	-
1.1.11 Preparing Handouts	Word Processor	
1.1.12 Making Lesson Plans	Word Processor	

Table 4: Software and Hardware Tools for the 12 Items in Table 2

It is apparent from what is shown in Table 4 that more than one task item would end up being assigned the same or similar set of software/hardware tools. For example, popular application tools such as word processor, presentation software and web browser would be used in many of the tasks. In such cases, we grouped the task items that were similar in nature into a single unit. For example, Items 1.1.1, 1.1.2, and 1.1.12, were merged into one. On the contrary, some task items that were found to be too coarse-grained or that involved the use of too many software/hardware tools were split into two or more items. For example, developing student web site was further divided into eight separate units because of the complexity of ICT skills involved; items 1.1.5 and 1.1.6 also required more than one training unit. The guidelines we used were that each unit should contain the right amount of material for a three-hour training session and that each unit should enable the trainees to produce something practical that they could readily use for instructional or other purposes after attending the training session.

The restructuring yielded a list of 57 training units, among which 39 units were related to integration of ICT into Chinese language arts instruction, and 18 units concerned teachers' administrative and communicative tasks. Integration-related units included such units as "Use of Presentation Tool for Theme-Based Writing Instruction" and "Use of Internet Publishing in Writing Instruction." We then added 10 "Getting Started" units to it to cover the basic computer concepts and skills that teachers need to learn before they proceed to latter units. This resulted in a total of 67 units at the end.

As it is not possible to develop training material for 67 units all at once, we selected six of them for implementation in the tryout phase. With this trial implementation, we had intended to demonstrate what we meant by "subject-specific" training material. Other than covering knowledge and operational skills of certain software/hardware tools that we specified for each unit, each unit had contained learning activities and examples/exercises that were closely connected to Chinese language arts instruction. We borrowed many useful ideas from the participants' responses in the survey while we were creating contents for these units. Furthermore, we engaged five of the 18 participants in the design process to help provide subject-specific contents as well as suggest suitable writing style. (Tab. 5) shows one of the learning activities included in a unit entitled "Locating Instructional Material Using Directories and Search Engines." In this activity learners were guided through the steps of searching for resources about Su Shi, a famous poet of Sung Dynasty in ancient China.

Activity 4: Using a directory to locate resources about Su Shi
Go to: http://www.yam.com and click through the following links to narrow your focus:
Step 1: Select "Arts & Humanities" from the directory's broad categories.
Step 2: Select the "Literature" subdirectory.
Step 3: Select the "Chinese Literature" subdirectory.
Step 4: Select the "Classical Chinese Literature" subdirectory.
Step 5: Select the "Poetry & Lyric Songs" subdirectory.
Step 6: Read the short description about each web site and follow the links to desired web sites.

Table 5: A Learning Activity in a Training Unit

Conclusions

In this research we attempted to define the scope of Chinese language arts teachers' ICT needs based on an analysis of the professional tasks they performed routinely. We came up with a list of 90 task items, which were finally mapped to 67 training units. Training material for six of them have been developed in the tryout phase to demonstrate the concept of implementing "subject specific" contents. We have arranged a partnership with a junior high school in Taipei County to field test these six units in a training course offered to 17 Chinese teachers at that school. Feedback collected from this training course will be used to improve our design of other training units in the future.

References

Clark. K.D. (2000). Urban Middle School Teachers' Use of Instructional Technology. *Journal of Research on Computing in Education, 33*(2), 178-193.

Cyphert, F.R. & Gant, W.L. (1971). The Delphi Technique: A Case Study. *Phi Delta Kappan, 52*(5), 272-273.

Hannafin, R.D. (1999). A Book Review on Integrating Computer Technology into the Classroom, *Educational Technology, Research and Development, 47*(4), 91-92.

Hoffman, B. (1997). Integrating Technology into Schools. *Education Digest, 62*(5), 51-55.

Lawson, T. & Comber, C. (1999). Superhighways Technology: Personnel Factors Leading to Successful Integration of Information and Communications Technology in Schools and Colleges. *Journal of Information Technology for Teacher Education, 8*(1), 41-53. Available at: http://www.triangle.co.uk/jit/03.htm.

McCannon, M. and Crews, T.B. (2000). Assessing the Technology Training Needs of Elementary School Teachers. *Journal of Technology and Teacher Education, 8*(2), 111-121.

Weaver, W.T. (1971). The Delphi Forecasting Method. *Phi Delta Kappan, 52*(5), 267-271.

Acknowledgments

This research has been funded by the National Science Council of Taiwan, the Republic of China, under grant numbers NSC 89-2511-S-003-027, NSC 89-2511-S-003-143 and NSC 90-2511-S-003-041.

Beyond the Current E-Learning paradigm: Applications of Role Play Simulations (RPS) - case studies

Contact Author: Roni Linser roni@ausis.com.au
Albert Ip albert@dls.au.com

Current E-learning models have been criticised by constructivists for providing content without a learning social context and have argued that such learning contexts need to be designed into E-learning programs. This paper takes issue with this approach arguing that it unnecessarily imports into E-learning assumptions and strategies from the traditional classroom/lecturing environments.

The paper explores some general pedagogical principles and outlines a pedagogy that takes the next step in redefining the social space of learning enabling educators to leverage the capabilities of the new communicative media as well as enhance and expand current models of E-learning beyond traditional models. This pedagogy is then demonstrated in a number case studies where learning is achieved using Role Play Simulations (RPS). It will be argued that RPS enable diverse learning objectives, from diverse subject domains, and thus constitute a useful pedagogical model of good E-learning.

The Current E-learning Approach and its Discontents

There is increasing concern among researchers, teachers and adminstrators that the new technologies for E-learning are used to deliver content without providing appropriate context for learning. As Kathleen Gilroy from MIT says "The emphasis of most E-learning programs to date has been on the accumulation, organization, and delivery of content." (Gilroy, 2001).

Similarly Professor Stills from Staffordshire University reminds and warns us not to assume that the delivery of content by the computer in virtual learning environments is sufficient – a computer cannot replace a teacher. (Stills 2001). And Tony Featherstone bemoans what he calls the 'transmissive' approach which focuses on transmitting content rather than providing a context for learning (Featherstone, 2001).

The call from these and similar social constructivists is that the social space of learning needs to be addressed in the design of virtual learning environments. Gilroy suggests that it is "the knitting together of content, pedagogy, and community into a unique learning experience, which is what people are buying when they step on to the MIT campus." And thus "E-learning should be first and foremost about creating a social space that must be managed for the teaching and learning needs of the particular group of people inhabiting that space." (Gilroy, 2001). For Professor Stills, virtual learning environments must be separable from content and Featherstone suggests a shift in focus from using the technology as a delivery medium to its use as a pedagogical tool in a constructivist mode.

The crux of these arguments is that we need to somehow integrate the social context of learning with the content delivery capability of E-learning programs in the way that the traditional MIT merges content pedagogy and social context. In effect this approach proposes to design E-learning programs that reproduce the traditional learning environment on-line.

To understand the weakness of this approach we need to more closely analyse and understand the relationship between content, pedagogy and social context or community. On the one hand, and in the general sense, every educational context presupposes three pedagogical objectives with regard to content: the acquisition by learners of (a) knowledge (b) understanding and (c) skills, particular to their fields. Though sometimes the emphasis may be for learners to acquire certain skills, it is more often entwined with particular kinds of knowledge and understanding. At least in the social and human sciences we more often hope that learners also gain an understanding and expand their knowledge. The content of that knowledge, understanding and skills of course depends on the particular discipline and course content.

On the other we have to select the best means to deliver that content so that these pedagogical goals can be achieved, including being pro-active in situating both means and content within the social context of learning. As Gilroy suggests above and as all constructivist models emphasise, apart from the way content is presented on-line we need to create a social context for learning. Indeed, one of the main strengths of the constuctivist approach to E-learning is this demand - the collaborative learner centered approach is another. But is it advisable to re-create the traditional social context of learning on-line?

On the surface, given our experience of traditional modes of learning and the constructivist critique of E-learning, it seems plausible to create an on-line community that will serve the same function in E-learning programs as the traditional social contexts for learning do in traditional modes of learning.

However, there are at least two powerful reasons why creating traditional learning contexts on line is counterproductive. Firstly because traditional learning contexts are based on assumptions regarding communication and social space, authorship and authority, that are too narrow with regard to, or are not reconcilable with, on-line environments. And secondly, there are still technological constraints that actually exclude putting on-line precisely what is the most useful ingredient of the traditional environment - the dynamic intimacy of face to face interaction.

In principle, as George Mead has argued - communication is the organizing principle of a community[1]. Thus to understand the learning environment and the community of learners within it, we must attend to the underlying communicative organization of that environment (Linser & Naidu, 1999).

The social space of learning in traditional learning environments[2] is largely based on face to face communication supplemented and infused by the written medium. By contrast, on-line learning environments, are mostly written and iconographic supplemented by face to face communication and/or virtual synchronous interactions. The types of structural codes and constraints of traditional face to face environments on communicative interaction that lead to both appropriate[3] selection and acquisition of knowledge, understanding and skills by learners, are so intricate and sublime that it is, at least presently, impossible to reproduce them on-line. It is like delivering a not so funny joke in such a way that it is hilarious as opposed to reading the joke.

We are dealing here with a wide gamut of linguistic and para-linguistic codes that sustain the traditional learning environment and are specific to a community of learners. These codes and constraints, relative to specific cultural and locational contexts, define the authority, validity, appropriateness and the allowed and/or required level of learners participation among other things. In short they define who can say what to whom, in what channel, how it is to be interpreted and the degree of reliability.

The many subtleties of face to face interaction that constitute the background to the traditional learning environment are at the very least, at present, very costly to achieve on-line, if not impossible. But that does not mean that we should abandon the constructivist approach. Rather the task is to re-define what constitutes the learning social context. If indeed we can create a social space on-line, why create the traditional learning environment when we can create the social space of the content itself ? And if the tools which the new technologies of communication provide can create the course-content itself as an interacting social environment in which the learner is a participant then there seems no need to create an additional social context. In other words, our suggestion is that rather than reproduce the learning space of traditional paradigm, use a simulated social space in hyper reality to bring to life the course-content itself. And this we suggest can be achieved for every course-content that has as its focus human social relations and organization because the principle underlying these is communication.

---

[1] This is not the place to go into a detailed discussion on theories of communication and power with regard to educational contexts, and so the presentation here is only sketchy and at a very general level. Suffice to say that what is presented here relies on sociological, socio-linguistic and medium theories of communication.

[2] i.e. the traditional space of lecture halls, classrooms, hallways, libraries, administration and lecturer's offices, cafeterias, student union, sports grounds, clubs, societies etc…

[3] i.e pedagogically intended

RPS pedagogical strategy

The question is how to create course-content as an interacting social environment. To do this we are relying on a pedagogy that infuses dynamic goal-based learning, role-play and web-based communication and collaboration into a powerful pedagogical tool based on learner centred and collaborative principles. Elsewhere we have outlined the pedagogical structure of RPS so the exposition here will be brief (Linser, Naidu, & Ip, 1999*)*. Particular examples of how this works in practice will be provided in the next section.

The general idea is to simulate on line aspects of the social context relevant to the course-content by letting learners act out the various roles that constitute the reality addressed or problematized by the discipline.

Dynamic goal-based learning is a strategy that leverages the experience and motivation of participants trying to reach a goal, in the service of pedagogical objectives. The idea is that in attempting to achieve game goals, especially ones set by themselves, in a dynamic and reflexive environment, i.e. one which continuously emerges from the impact of their own actions; participants will be motivated to evaluate, learn, and exercise the necessary skills required to be successful in order to reach these goals and in the process acquire the knowledge and understanding needed.

Taking on a 'persona' in a **role-play** simulation involving multiple roles whose objectives may be in opposition or in alignment with the 'persona's' own objectives, creates such a dynamic and reflexive context for participants. Given that all roles must respond 'in character' to an initial scenario, and further, must respond to the actions of other roles, a reflexive and dynamic process emerges that continuously provides participants with the impact of their own actions on the context. Thus, they must acquire more information, reflect and then adjust their further actions in order to reach their objectives, or indeed perhaps even alter or abandon them and set new ones. The idea of 'play' cannot be over-emphasised and should be understood in its senses of playing a game, playing a role in a play, and in the sense of playing with possibilities (experimenting).

The communicative interaction of such a role-play simulation in the on-line environment of the **World Wide Web**, has the further advantage of providing a space that can be used in both synchronous and asynchronous modes. Moreover, the ability to create a 'persona' as opposed to the real identity of the student has many advantages - not the least of which is to provide a sense of security for the learner. Still more, this on-line environment provides a space where the resources needed for acquiring the necessary knowledge for playing the game, can be made available 'just in time' when they are needed. And this includes moderators who become a resource in the service of game objectives through which they fulfil pedagogical objectives. If moderators are also sensitive and committed, our RPS environment (supported by the Fablusi platform) creates a 'safe' and supportive space for participants to learn from their own experience.

The upshot of playing the game, of attempting to implement different strategies and seeing their outcomes, is that participants learn the subject's content, acquire skills and learn to understand what is involved in the process. And this is precisely the pedagogical utility of RPS [4].

The uniqueness of this pedagogical structure is that it separates the learning space, where participants learn from their experience, from the institutional and organizational environment which provide the resources for learning including moderators or educational facilitators. It does so without reproducing these institutional and organizational aspects of the learning environment e.g institutional hierarchies. The structure of RPS thus creates a flexible space for participants to fill with their own objectives, actions, and results that ultimately relate back to the pedagogical objectives of the course as set down by the institution.

4 Case Studies

So what does a 'social space of the content itself' look like? how does it provide a social space for learning? and is it helpful in reaching the pedagogical objectives of courses in which this is implemented? What follows is a brief description of a number of different applications of role play simulations using the pedagogy above.

---

[4] for more info on the pedagogical foundations of RPS see Linser & Naidu, 1999; 2000, for the role of Moderators see IP Jasinski and Linser, 2002 forthcoming.)

The most important aspect in RPS design is the decision on which roles and what kick-start scenario will best serve the particular pedagogical objectives of the course. The relations between the roles within the kick-start scenario and their differential membership in asynchronous 'forums' modelling institutions and organisations derived from the course content, provide the social space and context for learning. And it is to these which we now turn relative to the particular pedagogical objectives of the different courses.

2 Simulations of International Politics [5]

Over the past 11 years we have conducted RPS for a variety of political science courses at the University of Melbourne, including Middle East politics, World Politics, Theories of Power, Russian Politics, Australian Foreign Policy, and International Politics of the Asia-Pacific. In general the stated pedagogical objectives of all these courses included understanding the political processes and dilemmas faced by leaders in these regions and the theories and explanations that may be useful to understand these processes. All of these courses were originally lecture based with essays and tutorial participation as their mode of delivery. For all these courses students were given the choice between participation in the simulation involving working on roles as teams or individually doing another essay or exam. Significantly in all these courses the majority usually choose to do the simulation despite the fact that they were warned and knew from former students of the course that it involved more work than the other alternatives. (see Ip, A. & Linser R., 2001)

For the sake of brevity I will discuss the content of only two of these simulations. The Russian Politics course focused on the internal political dynamics between the central government of the Russian Federation and the governors of the Regions. Because of the small size of the class (45 students), we decided to focus the simulation on only 3 regions, the internal security forces, the army, the government, 2 opposition parties (to the right and left of the government) and the media (16 roles). The kick-start scenario then provided a short overview of the current situation in Russia with the President calling for reform of the State council – the organization that brought together the leaders of the regions. To this was added a fictional element that during a recent meeting of this council some governors severely criticised both the reform and the president and stormed out. Thus a conflict of interests between the central government and the regions was set in motion, requiring all the roles to take sides, to negotiate, threaten, cajole, back-stab and generally attempt to secure the aims of their respective roles (which they have researched and published on the web-site before being aware of the initial scenario.)

This was a fairly simple simulation focusing on just one set of issues - but the overall effect was the creation of a space of relations, modelled on the real world which the course content addressed as narrative in lectures. A social context was created and developed in the conjunction of research efforts and response to simulated events, that participants themselves set in motion. And this served as a context for learning the historical facts, the organizational relations and some of the possible processes that can occur within Russian Politics.

A more complex simulation involved two different courses in the same department, the Australian Foreign relations course (120 students) and Theories of Power course (45 students), both taking part in a joint simulation [6]. Each of these courses obviously had different contents, so we decided to create two types of roles. One type, like in the Russian Politics simulation, focused on Australian foreign policy issues from the perspective of the government, the opposition parties, the military, and Australia's neighbours in the region including US and European powers. The other type of roles which could only be taken by students in the Theories of Power course, were of theorists, commentators, and advisers. The initial scenario involved a fairly comprehensive overview of real events and process in the region and different fictional crisis in Australia's immediate region - clashes between the Indonesian army and local rebels in Aceh, West Papua and East Timor as well as reports of money laundering in some of the smaller pacific islands.

---

[5] <http://ausis.com.au/polsim>

[6] We have also had simulations that brought together different courses from different universities around the world.

The interesting aspect of this simulation was the cross fertilisations of issues. The 'theory' based roles had to publish explanations of the simulation events as they were occurring from the perspective of different theoretical positions, Weberian, Arendian, Faucauldian etc, and give advice to the more 'political' roles who then accepted or rejected these as basis for action, and used them as justification or condemnation of others relative to their political interests and priorities. Again we see how a social context for learning can be created from the contents of very different courses by creating specific kinds of roles to fit the course content. This in turn shifts the students focus on the contents of their course and from this perspective evaluate and use what other students produce in other courses for their own purposes.

Australian History: the First Fleet 1788 Simulation[7]

Professor Sandra Wills from the University of Wollongong has developed a database of the convicts who arrived on the First Fleet to Australia in 1788 and has added a role-play simulation as an active learning methodology for students to develop a better understanding of the lives of those involved in the early days of white Australian settlement.

In this simulation players adopt the roles of either convicts or officials of the colony in an attempt to solve the problem of theft. Unlike, the political science simulations above, participants do not research their roles but are given a description of their character, which is based on known historical fact found in the database. Depending on their role, each belongs to one of the following camps: Governor's Table, Officers' Mess, or Convict Camp which has two subsections.- female gossip and male gossip. Each character can communicate either privately with a particular character or post a general message for all to 'hear' in their camp. Other camps cannot see these conversations until the group collaboratively decide to share it with others. The scenario, also based on the historical record, revolves around the decreasing food supplies, the action of some to plant vegetable gardens, and others who steal the vegetables because there is nothing to protect the more law abiding community members, who are tired of seeing their gardens raided. How will order be maintained? How will thieves be brought to justice to deter others? Those are the problems that participants tried to solve.

Unlike the simulations discussed above, the pedagogical objective here is to bring to life the records of a database so that students better understand the historical conditions of early white settlement in Australia rather than current affairs and concerns. The social context for learning is developed out of the contents of the database and the interactions between roles within and across 'camps' constitute the collaborative arena for finding a solution. In the process students acquire, knowledge of the facts, an understanding the difficulties and skills for researching this database.

Staff Development and Sexual Harassment[8]

This simulation was developed as a tool for a staff development project at the Douglas Morley Institute of Technology in Adelaide. The pedagogical objective was to provide training in creating and using web-based role play simulations. We decided that the best way to achieve this objective was to actually play a simulation before the training began and then leverage the experience in workshops where participants then worked in teams creating their own simulations for particular courses which they deliver to students - one of these is the Fashion House simulation that was later actually used in a course about fashion design.

We decided that 'sexual harassment' would be a useful topic as participants in this kind of educational context would be familiar with this sort of content and participants would be able to explore this issue in the overall context of training in creating simulations. By not having to do much research in order to act appropriately 'in character', participants would be able to spend more time on thinking through the pedagogy and experiencing the capabilities of the software, as well as their limitations This enabled participants to reach the ultimate objective of being able to create and run such simulations.

---

[7] <http://www.dls.au.com/firstfleet>

[8] <http://www.roleplaysim.com/default2.asp?SimID=rpsim00000123M1B>

Unlike the simulations above the setting (an educational institute) and all roles (16) in this simulation were fictional and so each of the roles was given the position of the role (like head of the Institute, secretary, ceramics teacher, equal opportunity officer etc.) and an outline of the character of role (e.g. the Managing Head of the institute was characterised as authoritative and intellectual, open to rational argument, recognized as a good mate, hates details, gives subordinates lots of freedom and in return, expects them to resolve their own issues. Has an inner circle of trusted colleagues where you can let your hair down and tell it like it is…). The initial scenario, again totally fictional, was designed to bring out possible areas where sexual harassment may become an issue and thus the roles faced the task of collaborating through their 'persona' to identify and resolve these issues where possible.

To what extent are these RPS effective in reaching pedagogical goals?
In the social sciences, I suspect the degree to which any pedagogy actually achieves its objectives will always be contested grounds. Research on the effectiveness of RPS is still scant . What is there suggests that it is a transformative experience for most learners who by enlarge report gains in knowledge understanding and skills specific to their subject (Ip & Linser, 2001; Vincent & Shepherd, 1998). However, the novelty of the approach may be skewing the judgement on the relative effectiveness of this approach as perceived by learners. As a user and observer the impression is that not only does it reach the pedagogical objectives but does so above expectations.

Summary: Good E-learning and how to make it better using role play simulations.
The argument that E-learning programs need to not only deliver content but also a social context for learning is acceptable if the social context for learning is not simply imported on-line from traditional learning contexts. MIT may have a winning formula in its traditional context, but that is because the underlying structures of face to face communication anchor the relationship between the local institutional spaces of MIT to content and pedagogy. But we cannot, and should not attempt, to reproduce this on-line. A different social space already exists in on-line environments and to reproduce another context on-line seems unnecessary if not counterproductive. The social context of learning can be created from the content itself. If we can create social spaces on-line than in so far as disciplines connected with the social sciences are concerned, that content can be created as an interactive learning environments with unique, though simulated, social contexts for learning as our 4 case studies have shown.

Bibliography

Kathleen Gilroy (2001) *Collaborative E-Learning: The Right Approach* ArsDigita Systems Journal 2001
Mark Stiles (2001) *Pedagogy and Virtual Learning Environment (VLE) Evaluation and Selection* Briefing Paper No 5, Joint Information Systems Committee (JISC) Services 28 September 2001 <http://www.jisc.ac.uk>
Robert Tinker (2001) *E-Learning Quality: The Concord Model for Learning from a Distance* Bulletin November 2001 Vol. 85 No. 628
Tony Fetherston (2001) *Pedagogical Challenges for the World Wide* Web Educational Technology Review Vol. 9, No. 1, <http://www.aace.org>
Ip, A., Jasinski M., & Linser R. (2002) *The Zen of being an effective 'Mod' in Role-Play Simulations*, Forthcoming AUSWEB conference July 2002
Ip, A. & Linser R. (2001) Evaluation of A Role-Play Simulation in Political Science The Technology Source, Jan/Feb 2001 <http://horizon.unc.edu/TS>
Linser, R., Naidu, S., & Ip, A. (1999*). Pedagogical Foundations of Web-based Simulations in Political Science.* ASCILITE Conference, QUT, Brisbane, Dec. 5-8, 1999 <http://www.ausis.com.au/Papers/pedagog.html>
Linser, R. & Naidu., S. (1999). *Web-based Simulations As Teaching And Learning Media In Political Science.* Paper presented at AusWeb99 <http://ausweb.scu.edu.au/aw99/papers/naidu/>.
Vincent, A. and Shepherd, J. (1998*). Experiences in Teaching Middle East Politics via Internet-based Role-Play Simulations* <http://www-jime.open.ac.uk/ > Journal of Interactive Media in Education, *98* (11) <www-jime.open.ac.uk/98/11>

Significant Features Of Asynchronous Learning: Summary of a Pilot Study[1]

J. R. Llanes
University of Texas Pan American

Abstract

The development of computer-mediated asynchronous platforms for the delivery of online coursework brings college professors new questions about the features these platforms offer and the degree to which each feature is significant to the achievement of students. Are all features designed in the same way across platforms? Are there some features which are more reliable, easier to operate and more attractive to students who use them? Which of the features can be connected with objective measures of achievement? Is the type of use given to the feature by an instructor a significant element of the feature? This paper relates a pilot study of three courses offered online using three different platforms and in three different campuses in order to explore the range of features in use and their link to student satisfaction and achievement. It also contrasts student outcomes with three onsite courses offered by the same professors. The long-term purpose of this study is to learn about hypothetically significant features that can then be improved.

Review of the Literature

For the sake of brevity in these Conference Preceedings there will not be a review of the literature in asynchronous learning or the meassurement of significance as an element of a learning model. In order to obtain features we tapped a "benchmarking" study conducted by a private research organization, the Institute for Higher Education Policy (IHEP), located in Washington, D.C. The sponsors of the study, Blackboard Inc. the producer of one web platform and the National Education Associationa political organization of teachers, to which I belong, clearly had some interest in the outcome. The method IHEP used, however, closely resembles the standard methodology for securing "benchmarks" in the private sector and in educational quality systems in which State standards are often based. The participants in the study, which were also visited and polled on the crucial elements of the process; were quite diverse institutions of higher education and some were representative of our type of institution. Thus, armed with little but useful knowledge, we began to study. In fuller-length papers the literature on measuring significance and on asynchronous models can be discussed

The Pilot Study

The courses and grading policy

Three professors, who teach graduate courses online and also have the option to teach these courses onsite, offer the same course in the two versions in the same term. The courses are offered to graduate students of educational administration.

Each student is graded in three areas:

1) Student Participation refers to how often a student speaks in class (on the onsite courses) or posts messages on the Bulletin Board or the listserv (on the online courses). There's also a determination made by the graduate assistant on whether or not the comment or question is on-target. There are 15 weeks on each course but the maximum grade is 40, so there is a top limit or "ceiling" to classroom participation.
2) Group Project refers to a cooperative activity in which teams selected by the professor collaborate to obtain a maximum grade of 30. The grade is given for the entire team.
3) A Final Exam is administered containing 15 questions, which can receive a maximum grade of 30.

Measures

The courses are then compared with each other on the following factors:

1) The grades received by students
2) The participation grade
3) The group project grade
4) The final exam.

There are two surveys given to each student, one during the first week and another during the 13th week. In addition, university-prepared course evaluations were given to both groups as mandated by university policy. These results are compared.

Analysis of Data

1) The drop-ad activity for onsite courses was higher than for online Students enroll in the courses as required by their degree plan, without knowing that one of the courses would be held online. At the first meeting, the professor announces the study to those selected to be in the online course. Students could drop the course if they did not wish to take it online and they were then assigned to the onsite course. Of the 43 students who were given this option by the three professors, 3 decided to change the course at that point leaving 40 students and there were no subsequent drops. In the onsite courses, 45 were originally enrolled, adding the three who opted out of the online course, raised this total to 48, however 6 dropped or withdrew during the course leaving 42. The students on the onsite course were not told about the study or the availability of the online course. The drop-add activity for each course was higher for the onsite course. Table 1 shows student retention.

Table 1 Student Retention

Type of Course	First-day Enrollment	After 4 weeks	After 8 weeks	Completed
Online	43 (100%)	40 (93%)	40 (93%)	40 (93%)
OnSite	48 (100%)	45 (90%)	42 (87%)	42 (87%)

This is not typical, dropping online courses is much more prevalent than in onsite courses. This atypical behavior maybe due to the fact that these online students were aware of the research being conducted and were eager to cooperate with it.

2) Females did generally better in final grade across the three course pairs. See Table 2.

Table 2 Comparison of Females versus Males on Final Grade

Gender	C1online	C1oniste	C2online	C2onsite	C3online	C3onsite	Average
Females	80.2	78.7	74.7	86.1	78.3	86.1	80.7
Males	76.4	71.9	71.6	84.3	82.3	88.3	79.1
Average	78.9	72.9	72.5	85.7	80.5	87.1	79.9

3) This was not true however in the variable of Participation. In this variable males, both onsite and online received a better Participation grade than females. The reason for the higher overall grade by females seems to come from a higher grade in the Final Exam. Since Group Projects were carried out, in all but two teams, by mixed-gender teams, it was not possible to compare gender outcomes in this variable. Table 3 contains the data on the Participation comparison.

Table 3 Comparison of Females versus Males on Course Participation

Gender	C1online	C1oniste	C2online	C2onsite	C3online	C3onsite	Average
Females	25.1	15.2	14.3	33.1	21.4	30.9	23.3
Males	27.8	16.2	18.1	31.8	25.9	37.9	26.3
Average	26.6	17.1	16.8	32.5	23.0	34.6	24.8

4) On the Participation variable we found that online Course 1 had a higher student participation grade than the onsite version. In the other two pairs, the onsite classroom participation is considerably higher. The online participation was obtained by counting and evaluating the postings made by students to their discussion group boards and also including e-mails sent to the listserv. However, the onsite course rating was an interpretation made in-class by student assistants. Since we did not conduct inter-rater reliability research prior to conducting this preliminary study, and three different graduate students were used to rate onsite student participation, we cannot be certain that this difference is not related to different raters' perspectives.

5) A review of the online Bulletin Boards was conducted to determine what kind of behavior on the part of the professor contributed to increasing or decreasing participation on the part of students. Like classroom participation, a professor can have an inhibiting effect by either ridiculing, excessively challenging or refusing to accept as valid, comments made by students. It is also the case that a professor can inhibit discussion on a question when she/he provides a quick answer to a question rather than remaining silent or asking others to voice their opinions regarding the question. The same appears to be true in Bulletin Board discussion. In Course 3 online, which experienced the lowest number of postings on the part of students (393), the professor answered nearly all postings containing questions before any other student had a chance to comment. Only when the professor was "disconnected" from the Bulletin Board, either because of travel or other activity, did students take it upon themselves to provide responses or opinions regarding another student's postings. Conversely, in online Course 1 which experienced the highest number of postings (1,097), student postings were allowed to remain unanswered for at least 48 hours and after the hiatus when the professor intervened, he often responded to questions with other questions which elevated the number of postings per issue raised.

6) This observation led to the development of a formula to estimate student responses to professor's interventions which fits the data from each of the three online courses as follows:

a) If professor waits at least 48 hours, then 40-50% of the students post responses or comments on others' comments;
b) And if professor asks questions about a student's posting (whether a question or a statement) then 70-90% of the students provide responses;
c) If a professor provides responses to each question and/or comment without waiting 48 hours, then 0-20% additional student postings can be expected.

This formula suggests that the professor's use of the Bulletin Board for classroom discussion is similar to professor's onsite interventions on student discussions in its effect on student participation. Given the higher correlation of Participation to Final Grade in Course 1, this feature and its use appears to be significant to overall student achievement. (See Table 11)

7) We expected that online courses would not be as effective as onsite courses on the variable of Group Projects. We hypothesized that, since the onsite classes had facilitated familiarity among students who met with each other every week; this would pave the way for a more effective teaming in the Group Project. This was true in Course 1 where onsite students averaged 28.8 on their group projects while online students achieved an average of 26.7. But the other two courses reflected the opposite of the expectation. See Table 4.

Table 4 Comparison of student grades on Group Projects Online versus Onsite Courses

	C1online	**C1oniste**	**C2online**	**C2onsite**	**C3online**	**C3onsite**	**Average**
Average	26.5	28.8	28.5	26.9	28.8	25.6	27.5

8) All three professors coordinated the preparation of a final exam so that it contained the same questions and was graded by one person, increasing the reliability of the score. Course 1 gave the test onsite to both online and onsite students in one Saturday. Courses 2 and 3 online gave the test using an external server owned by a commercial provider. The onsite versions of Courses 2 and 3 gave their exams onsite the same day the online exam was available to minimize "bleeding" of information from one group to another about the contents of the test. We found that students scored very close to each other when compared within course pairs and across course pairs. See Table 5.

Table 5 Comparison of student grade on Final Exam Online versus Onsite Courses

	C1online	**C1oniste**	**C2online**	**C2onsite**	**C3online**	**C3onsite**	**Average**
Average	25.6	26.9	27.8	26.1	27.40	26.7	26.7

Correlations

We correlated the final grade with the three scored variables, Participation, Group Project and Final Exam. These correlations gave us additional insight on how students construct knowledge using different modalities of delivery.

9) Students Participation scores correlated the highest overall with the Final Grade. In online Course 1, students Participation score correlated 0.944 (<.001) with their Final Grade. On Course 2 online, students Participation score correlated 0.870 (<.002) with their Final Grade. On Course 3 online, students Participation score correlated 0.682 (<.005) with their Final Grade.

10) When Participation scores are compared across online courses, we find that in Course 1 students online contributed 1,097 postings, a much higher number than in Course 2 where students contributed 498 and on Course 3 where students contributed 393. This also coincides with the higher participation score of students in Course 1 online, but it is

not even higher as it is limited by the ceiling placed on the grade the students can receive for this activity

11) The correlation between Participation and the Final Exam in online Course 1 is strong (.654<.001) while the Correlation between Participation and Final Exam in Course 2 online is a negative one (-0.192<.005) and in Course 3 online is very weak (0.063<.001).

12) The correlation between Group Project score and Final Grade were weak or non-existent. We think that the Group Project, intended to practice students in the art of collaborating toward a final product and is not a content objective per-se, therefore contributed less toward the achievement of a higher grade on a content-based exam. Also, since a) groups were organized on the basis of the distance between students' home addresses and not homogenously by previous performance, and b) the group received one grade for all participants; these grouping and grading factors conspired to produce a lower correlation between this factor and the final grade students received. In order to further sustain these hypotheses we ran a correlation between Group Project grade and Final Exam and found weak or no correlations between the two. See Table 6.

Table 6 Correlations Between Students Final Grade and Study Variables

	Final Grade and Participation	**Final Grade and Group Project**	**Final Grade and Final Exam**	**Participation and Exam**	**Group Project and Exam**
C1online	0.944<.001	0.492 <.002	0.774<.005	0.654 <.001	-0.456<.005
C1onsite	0.880<.001	-0.018<.002	0.378<.001	0.012<.001	-0.012<.005
C2online	0.870<.002	0.225<.002	0.250<001	-0.192<.005	0.013<.002
C2onsite	0.897<.001	0.669<.002	0.258<.001	-0.014<.005	0.023<.002
C3online	0.682<.001	0.549<.001	0.447<.001	0.063<.001	0.167<.005
C3onsite	0.755<.001	0.353<.001	0.128<.005	-0.382<.002	0.239<.005

Student Satisfaction

13) The level of overall satisfaction, as measured by the student surveys, were fairly high with the online courses (68% of the comments being positive) but slightly lower than the level of satisfaction with the onsite course (71% of the comments being positive). The following Table 7 details the overall satisfaction scores.

Table 7 Comparison of Onsite and Online Courses on Overall Satisfaction

	Course 1	**Course 2**	**Course 3**	**Average**
Online	78%	72%	56%	68%
Onsite	82%	74%	57%	71%

14) The differences between the pre and post surveys are greater for the online course than for he onsite course on the variable of student apprehension. In the pre-course survey 42% of the students expressed High or Very High "stress" stemming from how

they would do in this course, compared to 18% of the students in the onsite course. However in the post-survey the online students apprehension with future course online fell to (15%) more in line with the level of apprehension in the onsite course.

15) The three university-prepared course evaluations cannot be fully compared because each are prepared with different criteria and item construction making them essentially non-equivalent measures. However some of the items are sufficiently similar to allow for some comparison. The following are some of the variables of interest to this study. See Table 8.

Table 8 Comparison of results of university-prepared course evaluation on comparable values across campuses

	Overall rating as Instructor	**Instructor outside availability**	**Courtesy to students**	**Clarity of Course Objectives**	**Encouragement of critical thinking**
C1 onsite	100%	100%	100%	100%	100%
C1 online	90%	90%	100%	80%	100%
C2 onsite	85%	90%	100%	100%	90%
C2 online	80%	70%	80%	70%	90%
C3 onsite	78%	80%	80%	80%	85%
C3 online	76%	70%	60%	70%	85%

Conclusions

At the beginning of this study we had four research questions which we will repeat here and summarize findings in response to these.

Are all features designed in the same way across platforms?

Because different people designed each platform and each is a descendant of platforms designed for differing purposes, the platforms' features are therefore measurably different in design. We lack sufficient data required to make a definitive statement on which design provides the most significant input to student achievement. One might be able to discern differences with large samples over time but not from this small sample. We have become familiar with three platforms, which are essentially effective in enabling the presentation of material. Some are easier to operate by professors unfamiliar with the technology, while others require at least rudimentary knowledge of HTML. Since most professors end up doing their own course design after an all too brief period of institutional support, each platform could use a simpler method for designing and incorporating course materials.

Are there some features which are more reliable, easier to operate and more attractive to students who use them?

Given the levels of actualization reported earlier it appears as if the features of all three platforms have a long way to go before they are able to give students a trouble-free operation. When compared with the use of listserv to engage in dialog, Bulletin Boards are considered superior by students overall. But when compared with the internal e-mail facility of all platforms tested, external listservs were judged by students to be more effective. One course with a CD-ROM of lectures provided a higher level of satisfaction with professor's explanations than the other two. Still, the CD-ROM feature could not be linked with online material in any platform, so the student had to logout of the course and start the CD-ROM before he or she could use the material.

Which of the features can be connected with objective measures of achievement?
We were able to correlate the use of Bulletin Board with both Final Grade and performance in Final Exam. Students rated online Course 1 as Very Effective in conveying information through web pages and Courses 2 as Effective and 3 as Moderately Ineffective. The features are hypothetically linked to achievement but the use given to them by individual professors may be even more important than the construction of the feature itself. In summary, there are no other features than correlate to student achievement.

Is the type of use given to the feature by an instructor a significant element of the feature?
This seems to be the most important area of findings. The simple answer is, yes.

1) Course 1 uses a format for presenting information, which is different than the other two courses. The author calls it Learning Text and it relies on learning theories on how to organize information for adult learning. Students find this format Very Effective when compared with the other two courses that use the more usual lecture notes format independent of any named theoretical construct.
2) As discussed earlier, the level and style of use of e-mail and Bulletin Boards by different professors reveal that the professor's communication style has an impact upon the amount and breadth of the student's communications online. As is the case in classroom instruction, online instructors must allow time for students to respond to the comments or questions asked by other students.
3) Higher levels of Bulletin Board use leads to higher correlations between this variable and final grades as well as higher scores on final exams. We also noted that students who are less participatory onsite are more participatory online.

References

The Institute for Higher Education Policy (2000*) Quality On the Line: Benchmarks for Success in Internet-based distance education.* You can obtain an online copy by requesting it from: http://www.ihep.com

NOTES

---

[1] This paper is one of three papers that will be prepared from the study data. The other two professors will take other elements of the study and report and expand on them. This is the first paper to emerge.

Improving Teacher Effectiveness in e-Classrooms

Jerome Eric Luczaj
Department of ECECS
University of Cincinnati
United States
luczajj@email.uc.edu

Chia Y. Han
Department of ECECS
University of Cincinnati
United States
chia.han@uc.edu

Abstract: Multi-media classroom technology provides a unique opportunity to augment the classroom experience. Coordinating instructional streams with student feedback and assessment will enable instructors to know when and if their intended message was communicated to their students. A system where both instructional and presentational aspects of a lecture can be evaluated promptly will permit instructors and students to react quickly when there is a gap between intent and understanding, improving instruction. Presented here is a multi-media, e-classroom framework where information can be gathered to measure student, faculty and organizational achievement and to assist in improvement. Specifically, this paper focuses on using this e-classroom framework to improve instruction.

Introduction

Many different factors influence whether a student has successfully attained learning objectives. Student performance is rarely homogeneous, resulting in the familiar bell-shaped distribution. Causes for poor student performance are hard to pinpoint. Poor student performance is, in general, due to many factors, which may include: study habits, including test preparation; prerequisite material understanding; attitude toward class, for instance, individual interest in subject matter or attentiveness to class progress; attitude toward instructor; compatibility between student learning style and instructor presentation style; and attitude toward learning. These factors significantly impact how well students understand the core concepts of a course and how many of the learning outcomes they will achieve.

A strategy needs to be defined and tools implemented to provide the instructor with prompt feedback and assessment. According to Reid, "Firstly, it is necessary to develop policy frameworks, quality processes, and online tools to provide comprehensive, timely, and appropriate information that can be acted upon in order to improve the quality of learning. Secondly, such frameworks, processes, and tools should be applied in flexible ways that reflect the nature of the learning environments that they are aiming to improve." (Reid 2001) This framework must demonstrate that the intended content has been delivered to the student and that the student has received it. Further, it must facilitate improved instructor effectiveness. The resulting impact, as seen in Curve 2 (Fig. 1), on student learning should be "A Significant Difference" (Russell 1999).

Educational assessment has multiple, distinct uses in instructional improvement including: school and student accountability for academic achievement, feedback for teachers to revise teaching and administrators to allocate resources, and stimulation for students to receive deeper understanding (Baker 1999).

In most cases, the main criterion for assessing student performance is the degree of subject matter understanding. Student performance is evaluated at irregular intervals, through graded homework, quizzes, tests, projects, and final exams. Too often, students who were confused during lectures would not find out how far behind they were until it was too late to catch up. It is during the classroom contact time that the instructor can exert the greatest impact on student learning. In fact, a study from the University of Tennessee found that teacher effectiveness was the dominating factor affecting student academic gain (Sanders 1997). Thus, it is important to assess learning in the classroom and let instructors take timely measures and make any necessary remedial changes.

BEST COPY AVAILABLE

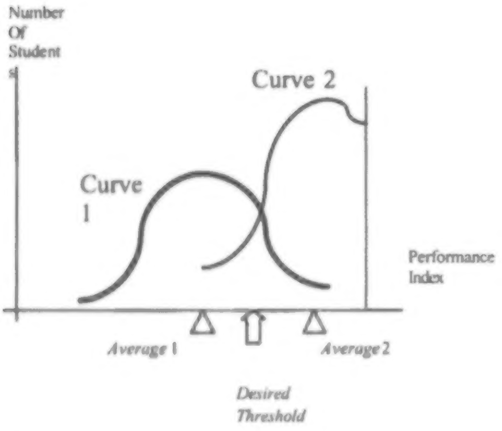


Figure 1. A Significant Difference

In terms of teaching evaluation, especially at the collegiate level, the burden of teacher and course evaluation falls upon the student using either in-class or Web-based survey forms. These evaluations are typically done only once, if at all. Since the survey is normally completed toward the end of the academic term, it does not impact students in the current class, though it may be helpful to future students in the same course with the same instructor. Also, since students may not take the survey seriously, the validity of the student response is questionable.

The important thing to note regarding the usual practices is that there is no correlation between student learning assessment and instructor teaching evaluation. Without timely feedback connecting student learning to instructor evaluation, neither the instructor nor the students have the power to affect change or to correct problems. Frequent feedback to the students advances student learning. According to Brien and Eastmond Cognitive Science and Instruction, "During instructional activities, the competencies taught must be reinforced each time they are adequately used by the learner." (Brien 1994) Further, Brien and Eastmond describe the "ideal" situation as one where the leaner knows the final goal as well as the sub-goals that support the final goal. Therefore, it is important that learning outcomes be explicit and feedback frequent.

Not only is frequent feedback to the student important for effective learning, but frequent feedback is also important to the instructor for effective teaching. As Reid notes, "...it is vital that students can provide feedback wherever they are receiving instruction, in a fashion that is seamless with their learning environment." (Reid 2001) Ovando adds, "...researchers are conceiving of teacher evaluation as a mechanism for improving teaching and learning." (Ovando 2001) Further, "...teacher evaluations 'must analyze teaching on the basis of what students are learning as well as effectively integrate the teacher evaluation and staff development processes with school improvement...'" (Ovando 2001)

With the recent advent of powerful computer technology for delivering media-rich content in classroom settings, many new possibilities are now available for augmenting classroom instruction and learning. Much of the current research using technology in the classroom focuses on innovative ways to use finite classroom resources or to overcome other logistical difficulties. Examples include video learning (Anderson 2001), where courses are video taped as an alternative way to deliver course content; on-line classes, where courses are taught via intranet or Internet sites with bulletin-board and email interaction (such as WebCT (Goldberg 1997)); distance learning and other Web-Based Instruction techniques. Web-Based Instruction is defined both as a delivery medium (Khan 1997) and as a content creation tool (Relan 1997). Unfortunately, in its current state Web-Based Instruction emphasizes content creation (information) and ease of use rather than pedagogy and instruction.

Although many new methods are available, the different formats of material being delivered during lectures may overwhelm students, hindering learning, causing student disengagement in the classroom. A fully engaging classroom technology should leverage, capture, share, and allow others to participate in the experiences (Duffy 1996). Duffy states, "It does not make good economic sense to allow knowledge to evaporate." (Duffy 1996). It is important to "...demonstrate how captured classroom lectures can serve as one part of a rich and dynamic educational repository." (da Graca Pimentel 2001).

BEST COPY AVAILABLE

Research that focuses on getting more out of the classroom experience indicates that student needs and viewpoints have to be taken into consideration when course material is given in technology-based classrooms. (Hannafin 1996) As such, it is important for the instructor to know if and when the students are engaged so that proactive adjustments can be made. In summary, a system is needed for instructors to demonstrate they have provided the content and a feedback system for students to demonstrate that they have received it.

Approach: CaSA System Design

Networked computers or computing/PDA-based terminals are becoming widely available, so they should be used in classrooms to enhance learning through active interaction between students, the instructor and the material. To make use of this new technology, a new generation of instructional software is needed. A new framework, CaSA (Classroom and Student Achievement assessment), brings into focus the issue of matching teacher's goals and course objectives with students' learning and expectations.

CaSA is a flexible framework to augment the classroom experience by coordinating and synchronizing instructional streams, matching class plans to student class experience, and presenting instruction in a variety of media forms. Whereas many current e-classroom technologies augment course delivery or provide alternative means for delivery, CaSA will provide the means to assess and improve course delivery while providing alternative means for and augmenting delivery. The emphasis is on facilitating timely feedback, collecting assessment data, and offering alternatives to students with differing learning styles.

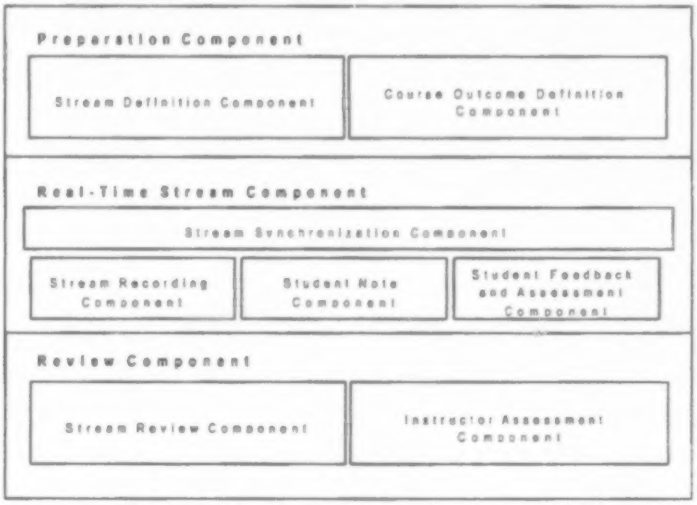

Preparation Component
Stream Definition Component
Course Outcome Definition Component
Real-Time Stream Component
Stream Synchronization Component
Stream Recording Component
Student Note Component
Student Feedback and Assessment Component
Review Component
Stream Review Component
Instructor Assessment Component

Figure 2. CaSA Component Diagram

The CaSA framework will consist of and coordinate three major components: a Preparation component, a Real-Time Stream component and a Review component (Fig. 2).

CaSA will support improved teacher effectiveness by providing immediate classroom feedback through collected student topic marking transmitted to the instructor as progress bars, periodic and frequent electronic concept questions both during and after class sessions, and instructional stream review and evaluation.

Pre-Classroom Preparation

Each lecture supports learning objectives from the course syllabus. Prior to the class, the instructor defines the lecture outline, covered topics, and the lecture notes (ClassPlan), which are associated with the text and course syllabus. The lecture consists of a ClassPlan presentation. As it is delivered, the various streams of presentation will be parsed into lecture segments, each of which is associated with a media type and descriptive

BEST COPY AVAILABLE

labels, such as 'introduction,' 'concept,' 'equation,' 'illustrative example,' etc. derived from the ClassPlan. CaSA will also permit streams to be added or removed interactively. As instructor presentation formats evolve, CaSA will accommodate these changes to electronically capture the class session.

CaSA will capture the data required to support creation of concept maps from the ClassPlans, the covered topics representing core concepts. As instructors and students connect additional material to these core topics, the data available for the concept map grows. There are several ongoing efforts in the area of visually representing concept maps including work by Puntambekar, Stylianou and Jin at the University of Connecticut (Puntambeker 2001) as well as work by Aroyo, Dicheva and Velev (Aroyo 2001). CaSA will collect the data required for concept maps and will facilitate the use of concept map representational systems within an e classroom.

In-Classroom Interaction

During the e-classroom experience, CaSA will coordinate instructional streams, assessments, and feedback and will electronically increase classroom interactivity. CaSA will connect classroom instruction to student feedback, collecting assessment data from student participation (topic marking, quiz and attitude testing), instructional streams, and instructor created course plans. Topic marking data can be used to provide instant feedback to the instructor and provide evidence that all required course topics have been covered during class sessions. Data collected from topic marking will not only be useful as to what topics were marked, but also when the topics are marked.

CaSA will electronically record the instructional content in its various forms, synchronizing the multiple instructional streams, as well as student feedback and assessment. It will provide context and valuable insight during assessment, instructor feedback, and student review.

The instructor's ClassPlan will be made available to students on their computing device at the beginning of each class session. This will accomplish three things. First, it will let the students know what topics will be covered, setting their expectations. Second, it will provide information needed for students to mark topics that will be covered. Third, it will document instructor intent which can them be compared to actual classroom experience.

As the class presentation proceeds, students will be able to indicate when they believe a specific topic has been covered. These marks will individually index the instructional streams. When they wish to review course material, the students can access the Web-delivered instructional streams based upon their individual marks. By allowing the students to use their individual marks to access course material, this system provides an incentive to mark topics as accurately as they can and serves to engage the students during the presentation.

As the students mark topics, CaSA will determine when and how many students believe that the instructor has covered a particular topic. This information will be made available to the instructor on demand as progress bars or via instant notifications based upon predefined thresholds. At a glance, the instructor can tell if students believe that a topic is or has been covered. If the instructor feels that he/she has presented a topic, but student thresholds have not been met, the instructor will know immediately and can make appropriate changes. The instructor will also be able to mark a topic as complete when a topic has been covered. Providing this feedback to the students will enable them to know immediately if they have missed important information.

Student topic marking also serves another purpose. Each student will be able to create personal links from personal material to course material, facilitating self-directed learning. By providing tools that assist students in retrieving, evaluating, comprehending and memorizing information while performing learning tasks the system will provide clear benefits. (Aroyo 2001)

CaSA will use the installed network of computers to permit the instructor to ask frequent, periodic questions to assess student understanding of the main concepts from the ClassPlan. Answers will be collected and immediate feedback regarding the overall state of student understanding can be presented to the student and the instructor. This will permit both student and instructor to take corrective action in a timely matter. In addition, reaction to and general attitude toward the material and class can be surveyed through positive and constructive questions during and at the end of the class.

Post-Classroom Review and Study

Stream review will be performed by students to assist in their self-directed learning, by instructors to critique and improve their material delivery, and by program administrators to insure that programs meet requirements. Also, independent evaluators can assess a course and by extension a program by sampling instructional streams and student topic marking data to verify that all the material necessary to support the course learning objectives was covered.

Questions from students are forwarded to the instructor through an intelligent FAQ (iFAQ). Replies to common questions that already have answers in the system's iFAQ are forwarded immediately to the student, while more elaborate or newer questions are sent to the instructor for a reply through email later. Each new question and its answer are added to the iFAQ and sent to the student automatically. The iFAQ assists both the instructor by filtering repeated questions and students by providing immediate responses to previously answered questions.

System Development

One goal of this system is to provide benefits to the instructor without putting a large preparation load on the instructor. The intent is to give an instructor an easy point of entry—minimal effort for maximum benefit. For example, by entering a course session outline into CaSA prior to a class session, the instructor will be able to publish the topics to students at the start of class, set their expectations for the class session, enable topic marking, stream synchronization and assessment stream data capture. All of this can be received by entering the topic outline, generally created during class preparation anyway, into the CaSA system.

The CaSA system is currently under development. Systems have already been created to provide adaptive learning and iFAQ (Gilbert 1999) and stream storage and playback services (from the UC Stream Media Group). However, these systems have not been integrated. Prototypes have been created to test student stream marking within a Windows Media Player stream and to integrate course topics with student notes.

Towards that end, the underlying software has been written using a layered approach to maximize reuse and interoperability. Figure 3 demonstrates a full communication cycle through presentation, client, clientRMI, serverRMI, server, and data base layers (Fig. 3). The plan is to have a working CaSA syaem with a sub-section of functionality available by the end of 2002. Additional functionality, including learning object support (Learning Object Metadata Working Group 2002) will extend CaSA in the future.

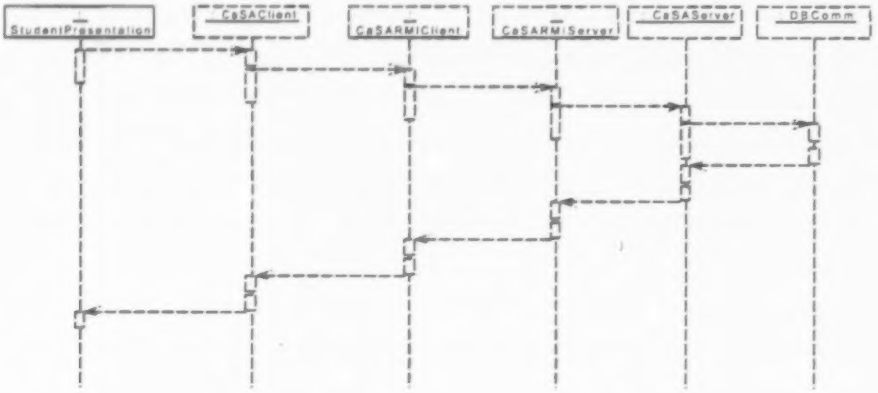


Figure 3: CaSA System Layered Communication Overview

Conclusions

E-classrooms, and CaSA in particular, provide a unique opportunity to augment the current classroom experience, aligning the expectations of students, instructors and institutions. Given a system where both instructional and presentational aspects of a lecture can be evaluated promptly, instructors, students and program administrators can react quickly when there is a gap between program requirements, course objectives and learning outcomes, between the intent of one and the understanding of another.

This framework will improve instructor effectiveness with prompt and iterative feedback, giving information and guidance regarding the kinds of educational materials and practices that most effectively enhance student achievement. It will also increase student engagement, providing an environment that produces demonstrable gain in student achievement.

By developing this framework within an e-classroom, information can be gathered to measure student, faculty and organizational achievement and to assist in improvement. Creation and implementation of projects such as this will track core learning topic coverage, connect course topic delivery with program and curricular goals, provide comprehensive assessment data streams, and produce tools, procedures and measures to assess student learning and achievement and the effectiveness of improvement efforts. Using technology to open clearly defined communication from students, instructors, and program administrators will close the gap from defined, delivered and received content and make "A Significant Difference" (Russell 1999).

References

Anderson, R., Dickey M., and Perkins, H. (2001). Experiences with Tutored Video Instruction for Introductory Programming Course. Proceedings of SIGCSE Technical Symposium on Computer Science Education.

Aroyo, Lora; Darina Dicheva and Ivan Velev. (2001). A Concept-based Approach to Support Learning in a Web-based Course Environment. Artificial Intelligence in Education. Volume 68. IOS Press, 1-13.

Baker, E. L.; Mayer, R. E. (1999). Computer-based assessment of problem solving. Computers in Human Behavior, 15, 269-282.

Brien, Robert and Nick Eastmond. (1994). *Cognitive Science and Instruction*. Educational Technology Publications, 18-33.

Duffy, Jan. (1996). Collaborative computing, groupware and knowledge. Information Management & Computer Security, 4/2, 39-41.

Gilbert, J. E.; Han, C. Y. (1999). Arthur: Adapting Instruction to Accommodate Learning Style. Proceedings of WebNet 99: World Conference on the WW and Internet, Honolulu, HI: Association for the Advancement of Computing in Education, pp. 433-439.

Goldberg, M. W. and S. Salari. (1997). An Update on WebCT (World-Wide-Web Course Tools) - a Tool for the Creation of Sophisticated Web-Based Learning Environments. Proceedings of NAUWeb '97 - Current Practices in Web-Based Course Development. Flagstaff, Arizona.

da Graca Pimentel, M., Y. Ishiguro, B. Kerimbaev, G. D. Abowd, M. Guzdial. (2001). Supporting educational activities through dynamic web interfaces. Interacting With Computers, 13, 353-374.

Hannafin, R. and Sullivan, H. (1996). Learner Control in Full and Lean CAI Programs. Educational Technology Research and Development, Vol 43, No. 1, 19-30.

IEEE P1484.12 Learning Object Metadata Working Group. (2002) IEEE P1484.12/D6.4: Draft standard for Learning Object Metadata 4 March 2002. Available at: http://ltsc.ieee.org/index.html.

Khan, B. H. (1997). Web-Based Instruction (WBI): What Is It and Why Is It? In B.H. Khan (Ed.), Web-Based Instruction. Englewood Cliffs, NJ: Educational Technology Publications, 5-10.

Ovando, Martha N. (2001). Teachers' Perceptions of a Learner-Centered Teacher Evaluation System. Journal of Personnel Evaluation in Education, 15:3, 213-231.

Puntambeker, Sadhana; Agnes Stylianou and Qi Jin. (2001). Visualization and External Representation in Educational Hypertext Systems. Artificial Intelligence in Education, Volume 68, IOS Press, 589-591.

Reid, Ian C. (2001). Reflections on using Internet for the evaluation of course delivery. Internet and Higher Education, 4, 61-75.

Relan, A. and B.B. Gillani. (1997). Web-Based Instruction and the Traditional Classroom: Similarities and Differences. In B.H. Khan (Ed.), Web-Based Instruction. Englewood Cliffs, NJ: Educational Technology Publications, 41-46.

Russell, T. L. (compiled by). (1999). The no significant difference phenomenon as reported in 355 research reports, summaries and papers: A comparative research annotated bibliography on technology for distance education. North Carolina State University: Office of Instructional Telecommunications.

Sanders, William L.; Wright, S. Paul; Horn, Sandra P. (April 1997). Teacher and Classroom Context Effects on Student Achievement: Implications for Teacher Evaluation. Journal of Personnel Evaluation in Education Volume: 11, Issue: 1, 57-67.

Semantics for E-learning:
An advanced Knowledge Management oriented metadata schema for learning purposes

Mr. Miltiadis D. Lytras

Athens University of Economics and Business,
Department of Management Science and Technology, Greece
Email: mdl@aueb.gr

ABSTRACT

In recent years many researchers try to investigate the direct or indirect impact of knowledge management approaches to the achievement of strategic corporate objectives. Several approaches have been promoted, with main emphasis to be paid at the justification of knowledge exploitation processes (Nissen, Kamel et al. 2000), (Binney 2001), (Lee and Yang 2000), (John Garrick 2000), (Martensson 2000), (McAdam and McCreedy 1999). Our research effort is concentrated on the demand for high quality interchangeable knowledge objects capable to support dynamic learning initiatives. The general metadata models (Dublin Core, IMS, LOM, SCORM) for knowledge objects enrichment are been reviewed and a well justified critique is provided in order to claim the importance for the justification of an "interchangeable knowledge objects standard" for learning purposes. The overall objective is the justification of a dynamic learning environment capable of supporting the value diffusion.

Keywords: Knowledge management, E-learning, Semantics, Learning Objects Metadata

1.0 Introduction

The knowledge exploitation in modern era is recognized as a critical phenomenon. Several approaches (Kim and Mauborgne 1997), (Allee 1999) reveal the potential capacity of knowledge to empower the capacity for effective action. The development of dynamic learning environments requires a systematic justification of methods and processes that vary learning (unique value proposition) for every learner. In this direction a number e-learning techniques (Lytras and Doukidis 2000) (Ruttenberg, Spickler et al. 2000), (Bryans and Smith 2000) seem to be a common approach with uncertain performance (Lytras and Pouloudi 2001). This challenging situation sets a context that promotes the research in reusability of knowledge resources. A realization of reusability can be based on semantics that enrich general knowledge resources (e.g. an article, a journal paper, a PowerPoint presentation, e.t.c.). The ultimate objective is to expand the customization capabilities of learning environments,and knowledge management seem to be a well justified mean for the achievement of such a goal (Lytras and Pouloudi 2001), (Lytras, Pouloudi et al. 2002).

1.1 Reusability of learning content and metadata

A major problem in the learning industry is the inability of the dominant e-learning platforms to support knowledge management mechanisms (Lytras, Pouloudi et al. 2002), (Lytras and Doukidis 2000). This causes a number of limitations in the implementation of learning scenarios. Our research intents to justify a metadata schema and a correspondent logical schema in XML that support a dynamic e-learning environment. The current situation on metadata is described by a narrow vision on learning. The analysis of dominant metadata schemas that follows seems to be inadequate to exploit learning content.

Two basic problems concerning learning content are the codification and the diffusion. Traditional knowledge management approaches (Boisot 1987), (Hahn and Subramani 2000), promote critical guidance for the understanding of how these two problems can be solved. Diffusion basically incorporates two dimensions. The carriers of content and the learning scenario. Packaging of learning objects in operational modules or logical settings with relevant value for learners provides an integration of the two facets of key issues. XML language makes the packaging of learning content more flexible as it provides enormous capabilities for Document Type Definitions, or in simplest words a design language for the description of structure of documents or knowledge resources in general. This ascertainment, and the whole path of syllogism can be summarized in the following hypotheses:

H1: Is there a way for the enrichment of knowledge resources that parameterize a dynamic learning environment?

H2: Can we exploit the knowledge management theories of knowledge life cycles in order to present a constructive development of learning content?

H3: Can we justify a way for the packaging of learning content according to a knowledge activities perspective?

H4: Is there a metadata schema that is oriented to the knowledge activities and the learning exploitation?

The case of reusability of learning content is an open issue for the academic community (Zack 1999), (Abecker, Aitken et al. 1998), (Mahé and Rieu 1998), (Tautz and Gresse 1999), (Mentzas, Apostolou et al. 2001). It seems that a hidden convergence formulates a holistic approach. The cornerstone in this approach is the description of a common standard that supports the enrichment of digital contents with metadata or semantics. Our research effort goes a step further. It investigates the justification of a learning objects metadata schema that innovates in two ways. First of all it elaborates the knowledge management theories and second utilizes learning objects hierarchies (Bloom and Krathwohl 1984).

2.0 A synopsis of conceptual abstractions

The organization of knowledge in distinct objects, small structural components, is the basis of reuse. In the case of customized learning the same learning content can be used in many ways due to its integration with other knowledge objects.

Our approach is based on two clear assumptions that initiate the whole research:
A learning object is a synthesis of knowledge and metadata that expand further the learning effect of knowledge. From this perspective an e-learning environment has to utilize a learning objects base. A critical question is which metadata can we use in order to increase the learning effectiveness. A learning process is an abstraction of a logical sequence of learning activities or tasks. The conceptualization of learning processes determines an interface in which the components of a learning object can be realized. This layout is a value container, which is utilized by the embodiment of learning object. The critical

question is which learning processes can we use? And is there any hierarchy of learning processes that determine different value layers.

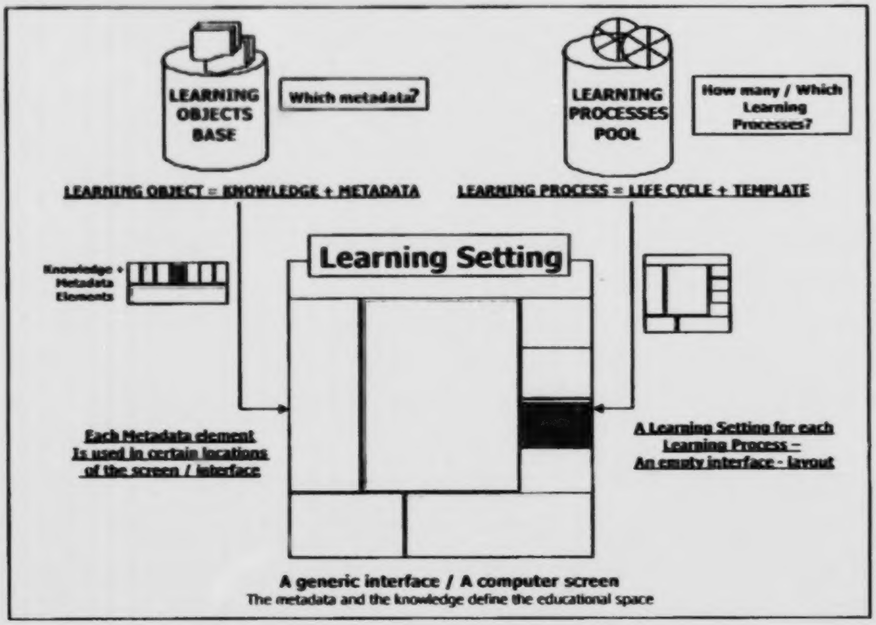

LEARNING OBJECTS BASE
Which metadata?
LEARNING PROCESSES POOL
How many / Which Learning Processes?
LEARNING OBJECT = KNOWLEDGE + METADATA
LEARNING PROCESS = LIFE CYCLE + TEMPLATE
Learning Setting
Knowledge + Metadata Elements
Each Metadata element Is used in certain locations of the screen / interface
A Learning Setting for each Learning Process – An empty interface - layout
A generic interface / A computer screen
The metadata and the knowledge define the educational space

Figure 1: The basic conceptual abstraction

2.1 *Reusability of learning content and Knowledge Management Convergence*

The underlying issue behind the packaging of knowledge is the re veal of a key idea that will support the accomplishment of a metadata scheme. Our proposition that has been developed after many implementations of elearning projects in our research unit, ELTRUN. (www.eltrun.aueb.gr) is that the convergence of knowledge management and e-learning is realized through an integrated life cycle model. Each step in this model that is depicted in figure two represents a value adding process. Each step sets a context for questioning about the required metadata that have to be attached to a generic knowledge source in order to formulate learning object. The first cycle summarizes a general Knowledge management framework where 6 processes / activities (Relate / Value, Acquire, Organize, Enable Reuse, Transfer, Use) make possible the management of knowledge object. The second cycle stands due to the assumptions that learning requires a further adoption of general knowledge sources. The six processes of the second cycle in figure two justify a learning orienting enrichment. The engagement of learners with the e-learning environment is becoming true through the employment of a number of learning processes.

BEST COPY AVAILABLE

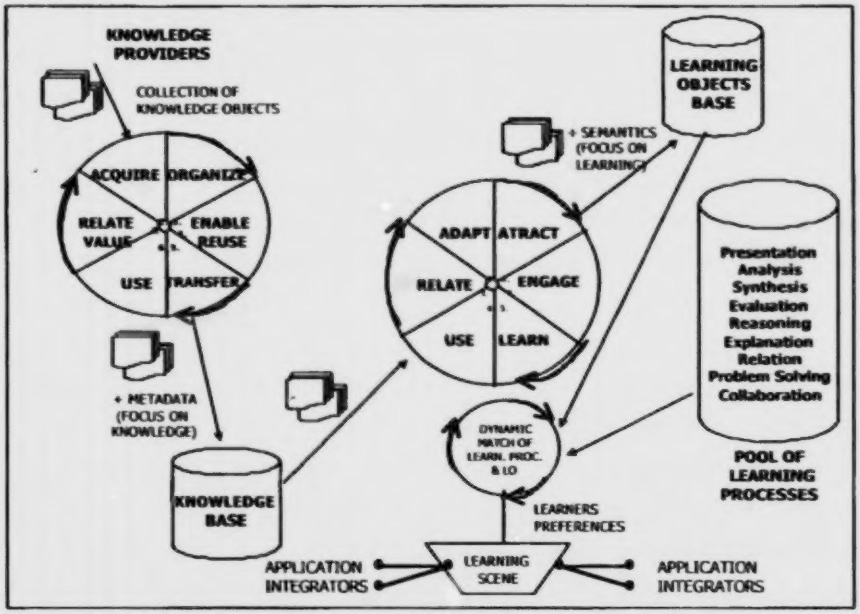

KNOWLEDGE PROVIDERS
COLLECTION OF KNOWLEDGE OBJECTS
ACQUIRE
ORGANIZE
RELATE
VALUE
ENABLE
REUSE
USE
TRANSFER
+ METADATA (FOCUS ON KNOWLEDGE)
KNOWLEDGE BASE
+ SEMANTICS (FOCUS ON LEARNING)
LEARNING OBJECTS BASE
ADAPT
ATTRACT
RELATE
ENGAGE
USE
LEARN
Presentation
Analysis
Synthesis
Evaluation
Reasoning
Explanation
Relation
Problem Solving
Collaboration
POOL OF LEARNING PROCESSES
DYNAMIC MATCH OF LEARN. PROC. & LO
LEARNERS PREFERENCES
LEARNING SCENE
APPLICATION INTEGRATORS
APPLICATION INTEGRATORS

Figure 2: The Interchange Knowledge Flow

The key proposition in our approach is that a number of metadata can supports each step in the whole model and also the learning processes as learning objects containers. For the specification of the elements of this metadata scheme a review of well-known metadata schema has been undertaken.

2.2 Multidimensional Dynamic Learning Proposed Metadata Schema

Metadata are data about data (Brasethvik 1998), (Weitlaner 1999). In the context of learning, metadata are data about learning objects. This definition provides the major characteristic of metadata: They are descriptive indexing labels. Unfortunately for the case of learning this is not enough. The indexing of learning object it seems to be a management facility with limited impact on the realization of engagement of learners. A lot of approaches concerning metadata have been proposed for general or learning purposes. Some of the most well known organizations that work in metadata specifications are the Aviation Industry Computer-Based-Training Committee (AICC), the IEEE Learning Technology Standards Committee, the ARIADNE, the Educause Instructional Management Systems (IMS) Project, the World Wide Web Consortium (W3C), and the ADL. The need to specify metadata elements is translated to a two-fold requirement:(1). The specification of general metadata capable of supporting our theoretical proposition of general Knowledge Management Framework (see figure 2) and (2) the determination of metadata focusing on learning processes. The critical review of several metadata schemas including IEEE Learning Objects Metadata, IMS, Dublin Core, SCORM, GEM provides a rather superficial support for the second requirement and a sufficient support for the first one. The complexity of learning causes significant problems to the clarification of the practical dimension of what it means the achievement of different

BEST COPY AVAILABLE

educational goals. This gap in the propositions of the famous metadata schemas sets a context for significant contribution. The two advantages of the presented metadata schema s that cannot be explained further due to the limited space include:

(1). Shifts the key justification idea from indexing categories direct related to distinct roles or properties (e.g. Author, Technical Characteristics, Pedagogy) to value delivering processes (Knowledge & Learning Processes). (2). Provides advanced capabilities for extension. The 9 learning processes specified based on the work of Bloom (Bloom and Krathwohl 1984), and Tom Shuell are only some of the learning processes that can be modeled and used. For new learning processes modeled are required a number for new metadata schema elements.

If we justify the two sets of metadata then we can define in XML structures every knowledge resource. Potentially each knowledge resource can be enriched using a all the specified metadata elements. It can be also enriched to a limited extend. This incremental approach where a general knowledge resource can be exploited through the attachment of metadata secures a dynamic elearning environment.In the next section two tables present the proposed elements of the Multidimensional Dynamic Learning Metadata Schema. The first table summarizes the general metadata elements derived from a critical synthesis and evaluation of four famous metadata approaches. The second table summarizes the metadata elements that support the defined learning processes.

The usage scenario of these proposed metadata elements includes the manipulation of general knowledge sources and the attachment of all the required metadata. It is easily understood that potentially a knowledge provider can provide the whole metadata set accompanied to a resource. The learning process that will finally became the value driver and the mean for the diffusion of learning objects will specify the subset of metadata that will fill the layout of the specific learning process. It is obvious that the acceptance of this approach requires enormous efforts from the knowledge providers. This seem to be the most critical success factor since the dynamic development of a learning scenario requires the selection of some learning processes that deliver learning objects to the trainees. The next three tables provides a synopsis of the 3-level metadata specifications.

Metadata for general KM life cycle	
Relate / Value	Language, Subject, Quality, Main Concept
Acquire	Purpose, Title, Description, Creator, Publisher, Contributor, Identifier, Authors, and Institution
Organize	Date, Format, Location, Type, Source, Relation, Discipline, Sub discipline, Main concept, Main concept synonyms, other concepts, granularity
Transfer	Cost, Copyright & other restrictions, rights, Document type, Document handle, Document format, File size
Use	Operating system type, OS version, other platform requirements, Installation remarks, Access rights, restrictions, Usage remarks

BEST COPY AVAILABLE

Metadata for learning exploitation	
Relate	Interactivity Type, Interactivity Level, Intended End user role, Learning context, Typical Age Range, Typical Learning Time, Language, Relation, Coverage, Audience, Grade, Pedagogy, End user type, Didactical context
Adapt	Metadata (author, creation date, last modified date, language, validator, validation date)
Attract	Semantic density, difficulty, Description, Standards, Quality, Duration, Difficulty Level, Interactivity Level
Engage	Essential Resources, Pedagogy, and Pedagogical Duration
Learn	Pedagogy teaching methods, pedagogy. Assessment, semantic density, annotation (annotator, creation date, content)

Metadata for Learning Processes	
Presentation	Summary, Purpose, Essential Resources, Annotation, Topics, and Search Guidance
Analysis	Summary, Purpose, Conceptual Components, Typical Relations, Annotation, Relevant Topics, Search Guidance, Analysis conclusions, Collaboration Details
Synthesis	Summary, Purpose, Relevant Knowledge Objects, Typical Relations, Conceptual Components, Annotation, New Meaning, Draw Relations, Search Guidance, Recommended Conclusions, Conclusions, Collaboration Details, Guidance
Evaluation	Purpose, Relevant Knowledge Objects, Summary, Collaboration Details, Guided Theories, Guidance, Application Session, Simulation Session, Annotation, New Meaning, Conclusions, Recommended Conclusions
Reasoning	Summary, Purpose, Relevant Knowledge Objects, Annotation, New Meaning, Guidance, Conclusions, Recommended Conclusions, Starting Points, Collaboration Details
Explanation	Summary, Purpose, Relevant Knowledge Objects, Topics, Typical Relations, Draw Relations, Annotation, New Meaning, Guidance, Collaboration Details, Recommended Conclusions
Relation	Summary, Purpose, Relevant Knowledge Objects , Main Concepts, Draw Relations, New Meaning, Annotation, Guidance, Typical Relations, Conclusions, Collaboration Details
Problem Solving	Summary, Purpose, Relevant Knowledge Objects, Present Problem, Sub problems, Main Concepts , Collaboration Details, New Meaning, Annotation, Guidance, Conclusions
Collaboration	Summary, Purpose, Recording, Annotation, Findings

3.0 Conclusions

The overall approach described in the limited space of this paper provides a context for exploitation focusing on learning. The incremental refinement of conceptualization drives to a set of metadata that can assist the transformation of knowledge resources to reusable learning objects. This step-by-step justification finally drives an extensive XML specification of the metadata schema. The selection of learning processes as the carrier of value expands the dynamic nature of an e-learning system. The whole approach seems to integrate the two well-defined and distinct approaches to knowledge management, the knowledge artifact and the knowledge activities approaches. Future research is concentrated on the analysis and the development of a dynamic e-learning environment based on the key ideas of Knowledge Interchange Concept. For this scope an IST proposal is going to be prepare. We welcome any collaboration that will support the refinement of this proposal.

References

Abecker, A., S. Aitken, et al. (1998). KARATEKIT: Tools for the knowledge-creating company. Knowledge Acquisition for Knowledge-Based Systems Workshop (KAW'98), Banff, Alberta, Canada, April 18-23., http://ksi.cpsc.ucalgary.ca/KAW/KAW98/abecker.

Allee, V. (1999). "New tools for new economy." Perspectives on Business and Global Change, World Business Academy Vol. 13(No. 4).

Bloom and Krathwohl (1984). Taxonomy of Educational Objectives, Handbook I: Cognitive Domain. New York, Addison-Wesley and Co.

Boisot (1987). Information and Organizations: The Manager as Anthropologist. Fontana/Collins, London.

Brasethvik, T. (1998). A Semantic Modeling approach to Metadata. CAGIS project, funded by the Norwegian Research Council.

Bryans, P. and R. Smith (2000). "Beyond training: reconceptualising learning at work." The Journal of Workplace Learning Vol. 12(6): pp. 228-235.

Hahn, J. and M. Subramani (2000). A Framework of Knowledge Management Systems: Issues and Challenges for Theory and Practice. 21st Annual International Conference on Information Systems, ICIS 2000,, December 10-13, 2000 at the Brisbane Convention and Exhibition Centre, Brisbane, Australia.

Kim, C. and R. Mauborgne (1997). "Fair process: Managing in the knowledge economy." Harvard Business Review 75(4): 65-75.

Lytras, M. D. and G. I. Doukidis (2000). Applied Knowledge Management in Education: E-school Architecture. In Dan Remenyi (Eds) proceedings of the 1st European Conference on Knowledge Management (ECKM 2000), October 26-27, 2000, Bled, Slovenia, pp. 115-122.

Lytras, M. D. and G. I. Doukidis (2000). 'E-learning evaluation criticism. The Multidimensional Dynamic e-Learning Model'. The Fourth IASTED International Conference on Internet and Multimedia Systems and Applications (IMSA 2000) [CD Proceedings], ,November , 20-23, 2000, Las Vegas, Nevada, USA, pp. 368-373.

Lytras, M. D. and A. Pouloudi (2001). E-learning: Just a Waste of Time. In Strong, D., Straub, D. & DeGross, J.I. (Eds) Proceedings of the Seventh Americas Conference on Informaton Systems (AMCIS), Boston, Massachusetts, pp. 216-222.

Lytras, M. D. and N. Pouloudi (2001). "Expanding e-learning effectiveness. The shift from content orientation to knowledge management utilization". Word Conference on Educational Multimedia, Hypermedia and Telecommunications (ED-MEDIA 2001), June 25-30, 2001, Tampere, Finland (CD Proceedings).

Lytras, M. D., N. Pouloudi, et al. (2002). "Implementing knowledge management in learning: an advanced framework for technology and learning convergence in work environments." Journal of International Forum of Educational Technology & Society and IEEE Learning Technology Task Force, (accepted for publication in the special issue of April 2002).

Lytras, M. D., N. Pouloudi, et al. (2002). "Knowledge Management Convergence: Expanding Learning Frontiers. Journal of Knowledge Management," Journal of Knowledge Management Vol. 6(1): 40-51.

Mahé, S. and C. Rieu (1998). A Pull Approach to Knowledge Management. Using IS as a knowledge indicator to help people know when to look for knowledge reuse 2nd International Conference on Practical Aspects of
Knowledge Management (PAKM98), Basel, Switzerland, 29-30 Oct. 1998.

Mentzas, G., D. Apostolou, et al. (2001). "Knowledge networking: a holistic solution for leveraging corporate knowledge." Journal of Knowledge Management Vol. 5(1): pp. 94-107.

Ruttenberg, B., G. Spickler, et al. (2000). E-learning: The engine of the knowledge economy, MORGAN KEEGAN, http://www.internettime.com/itimegroup/morgankeegan.pdf.

Tautz, C. and C. Gresse (1999). A Representation Formalism for Supporting Reuse of Software Engineering Knowledge. Expertensysteme 99 (XPS-99), Würzburg, Germany.

Weitlaner, E. (1999). Metadata Visualization. Institute for Information Processing and Computer Supported New Media (IICM). Graz, Austria, Graz University of Technology.

Zack, M. H. (1999). "Managing Codified Knowledge." Sloan Management Review , **Volume 40**(Number 4): pp. 45-58.

Synchronous, Remote, Internet Conferencing with Unique Populations in Various Settings

James R. Mallory, MS, Associate Professor
Applied Computer Technology Department
jrmnet@rit.edu

Douglas MacKenzie, M.A., Associate Professor
Audiology Department
djmnca@rit.edu

National Technical Institute for the Deaf
Rochester Institute of Technology
United States of America

Abstract: This paper focuses on the authors' experiences with interactive, synchronous internet video conferencing using Microsoft's NetMeeting software with deaf and hard-of-hearing students in two different settings. One setting involved teaching and tutoring computer programming to remote deaf and hard-of-hearing students in a remote situation using synchronous Desktop Video Conferencing (DVC) using Logitech cameras mounted on the computer of each participant. A second setting involved the use of NetMeeting by deaf and hard-of-hearing students enrolled in an Internet Communication course. Students in this course were introduced to the various communication tools contained within NetMeeting and provided with experiential lab activities designed to simulate the work environment and facilitate communication with hearing colleagues. In addition, online office hours were offered to provide additional experience with NetMeeting and promote access from remote locations.

Introduction

In the past, distance learning with two-way video was out of reach for many remote students and institutions. Recent innovations in telecommunications have lowered equipment and transmission cost, making two-way desktop video feasible for businesses, classrooms, libraries, and even homes. In the education of deaf students, video conferencing is also becoming more prevalent due to the inexpensive pricing of desktop cameras and hand-held camcorders as well as the increased access speed at which the deaf and hard-of-hearing audience is accessing the Web. The terrible events of September 11th have also discouraged travel and encouraged the use of remote interactions.

In this paper, the authors share their experience in two different arenas. One area is teaching computer programming courses to deaf and hard of hearing students in remote locations. In these courses Desktop Video Conferencing (DVC) was used in remote, synchronous tutoring sessions. A second area where DVC technology is being used extensively is in instructional efforts designed to facilitate communication between deaf, hard-of-hearing and hearing colleagues in the workplace. Through the use of DVC technology, communication barriers imposed by traditional telephone technology can be overcome to facilitate communication and collaboration. Knowledge and experience gained by deaf and hard-of-hearing students enrolled in the NTID Internet Communication course can be directly applied to the workplace to enhance communication.

Affordable broadband connections and technologies at home, work and school are rapidly growing. These high-speed connections are changing the capability of carrying large amounts of text, voice and video data over existing telephone and cable lines. Microsoft summarized the technology in a very concise manner: "For years now, computer networks such as the Internet have been carrying text-based messages around the world. Most often, these messages take the form of electronic mail, though real-time chat programs are also used. As the quality and speed of computer networks increase, so do demands for higher levels of interaction that include voice, graphics, and video exchange in real-time. This growing trend toward richer communications via computer is known as Internet Conferencing." (Microsoft, 2001, USA-L_News@yahoogroups.com)

Various researchers have investigated the transmission of sign language, which features significant motion of the arms and hands, and requires a frame rate high enough for smooth motion perception (Schumeyer, Herrdia, & Barner, 1997). Science teachers such as Mary Ellsworth at the Model Secondary School for the Deaf in Washington, DC (http://csc.gallaudet.edu/soarhigh/SHMAHOM.HTM), have also previously experimented with computer-based videoconferencing over ISDN lines. Such research and instructional efforts are pioneering. Educators of deaf students eagerly await progress with the new technologies.

The Study

The experiments reported in this paper were action research projects conducted in search of ways to enhance distance learning. The "findings" are thus tentative and provide suggestions for more formal research.

Synchronous Tutoring in Distance Learning Computer Programming Courses

Most of the Distance Learning (DL) courses at Rochester Institute of Technology (RIT) and the National Technical Institute for the Deaf (NTID), one of RIT's colleges, have focused on asynchronous (any time, any place) delivery of instruction. After teaching multiple remote, DL computer programming courses to a deaf and hard-of-hearing audience, however, it was found that both synchronous and asynchronous types of online instruction are necessary for some students to have a successful distance learning experience.

One author tutored remote deaf and hard-of-hearing students via a QuickCam Desktop Camera in conjunction with Microsoft's NetMeeting as an asynchronous tool for clarifying concepts with one deaf student and one teacher. This is often referred to as point-to-point video conferencing, where only two people can talk and see each other at a time. Although this hardware and software can easily incorporate group conferencing of remote students by the instructor, the project reported on in this paper involved only point-to-point video conferencing. The students selected were tutored on an individual basis in a credit-bearing DL course in Visual Basic Programming.

Desktop Video Conferencing (DVC) is one of many different types of conferencing tools. The DVC components include a video conferencing camera, such as the QuickCam camera used for this project, an Internet telephony application, a microphone, and speakers mounted to the local computer (the microphone and speaker built into a laptop computer were found to be adequate). DVC links two or more participants at different sites by using computer network(s) to transmit data. DVC is based on Codec (compressor-decompressor) technology. A Codec works via a mathematic computer algorithm to compress and decompress digital data. The data can be video, audio, or text based. A Codec is an important part of any Internet telephony application such as Microsoft's Netmeeting.

To use Desktop video conferencing, the student and instructor both need to have a computer, a camera, and an Internet connection to send and receive the video. From the authors' experience, the computer should be a Pentium-based PC running on Windows 95, 98, NT or Windows 2000. The authors have no experience with the new XP, Linux or other operating systems yet. The faster the processor speed the better the video will run. All the Pentium based processors are more than adequate to handle DVC. The user should have at least 32 MB RAM, although more memory will be better, especially if the user plans to have other applications open when using DVC. The PC should have enough hard disk space for file swapping; at least 20 MB would be a minimal requirement. A video capture card is also necessary.

The Internet connection for conferencing should be as fast as possible. It is recommended that both users be connected at speeds much faster than the Plain Old Telephone System's (POTS) 28.8 kb per second. A Local Area Network (LAN) with RoadRunner™, Integrated Services Digital Network (ISDN™), the Digital Subscriber Line (DSL™), or T1 connection would be optimal. Temasek Polytechnic does an excellent job of laying out system requirement and step-by-step instructions on how to set up DVC on their website. (Temasek Polytecnic, 2001, http://eicu.tp.edu.sg/DVC/index.htm)

The camera chosen should be a desktop type of camera that easily interfaces with the computer. Although the QuickCam had many features for storing photographs, it was the video feature of the DVC and the low price that was the most appealing for the project discussed in this paper. The QuickCam camera is capable of recording video at up to 30 frames a second.

NTID Telecommunications Curriculum

NTID has a long history of providing technical and communication training to deaf and hard-of-hearing students. Initially, curriculum designed to provide communication training in the area of telecommunications focused exclusively on the use of traditional telephone/TTY technology to facilitate remote communication in the workplace. In more recent times, with the advent of DVC and text-based communication technologies utilizing the Internet, curricular offerings have expanded to reflect the vast array of technologies that are now available to facilitate communication between deaf, hard-of-hearing, and hearing employees in the workplace.

DVC technology has been a major component of the NTID telecommunications curriculum since the early to mid 90's. At that time, instructors began experimenting with a beta version of Cornell University's CU-SeeMe videoconferencing software. When used in conjunction with a grayscale Connectix QuickCam and Ethernet connection, students were able to place point-to-point videoconference calls throughout the world via the Internet. As an example, calls were regularly placed between deaf students at NTID and those attending the Tsukuba College of Technology in Japan. Although quite unsophisticated by today's standards, this technology opened door for deaf and hard-of-hearing students seeking employment by providing an inexpensive means of facilitating communication through the use of real-time video and text-based chat.

A survey of students conducted at NTID revealed many positive attributes regarding this technology (MacKenzie & Clymer, 1999). In particular, students commented on how DVC allowed them to visually identify a caller and gain information on their mood and emotions by analyzing facial expressions and body movement. In addition, they found it extremely beneficial having both video and text-based chat available for real-time remote communication.

Since then, several newer DVC systems have been incorporated into the NTID telecommunications curriculum for students to evaluate. Of these, NetMeeting has quickly become popular among students since it offers an inexpensive means of establishing point-to-point videoconference calls. As part of NTID's Internet Communication course, students are introduced to NetMeeting and its wide array of communication/collaboration tools including video, text-based chat, file transfer, whiteboard, and application sharing capabilities. Through the use of structured lab assignments designed to simulate situations common to the workplace, students gain first hand experience with NetMeeting with the ultimate goal of enhancing communication and collaboration with their hearing colleagues. Instructors have also begun offering online office hours using NetMeeting, provide students with additional opportunities to evaluate the software and promoting greater access for those who desire to discuss course information or review class assignments outside the traditional class schedule.

Conclusions

DVC is both inexpensive and easy for instructors and students to implement. The technology significantly enhanced remote tutoring sessions by making remote interactions more personal. Communication with the deaf and hard-of-hearing relies heavily on facial expressions, body language and gestures. DVC, when combined with the other tools mentioned in this paper, provided an adequate environment for successful remote tutoring sessions.

In distance learning tutoring for the deaf and hard-of-hearing, DVC is often too slow and choppy for fluid, extended sign language conversations, but it does allow the sharing of some limited sign language, gestures, facial expressions and body language. This real-time interaction significantly enhances chat sessions and white board viewing of instructional material such as text explanations or computer program source code. Netmeeting also allows the use of highlighting and drawing on top of instructional materials, which can easily be posted on the online white board or even saved later in an electronic conference.

Video conferencing is becoming more affordable as use of broadband connections and technologies such as ISDN, DSL and Road Runner at home, work and school increase. These high-speed connections will change the capability of carrying large amounts of text, voice and video data over existing telephone and cable lines. Videoconferencing systems also incorporate compressed digital video. This compression technology makes the transmission of video less costly by reducing the size of the video needed to be transmitted.

Broadband access has also impacted DVC and other types of video conferencing. A survey taken last year of 2000 online RIT students, of which 50 were deaf, gathered a 10% response rate and found that 70% of these students had access to broadband Internet access at home, work or school. (Fasse, 2000) Of the 20 respondents to a fall , 2001 academic quarter survey of exclusively 33 RIT deaf and hard-of-hearing online students, 85% of these learners had access to high-speed internet access while 100% of all on-campus students have capability to this access. (Mallory, Long, 2001) According to AOL, Americans with online access has increased from 45 million users in 1998 to 105 million users in 2001. Of these online users, those with home broadband access has grown from 6% in December, 1999 to 19% as of September, 2001. (Mount, 2001, pp. 44-45) This shift in the access speed of the student population makes video streaming an increasingly viable option for delivering synchronous communication and instruction.

Desktop Video Conferencing (DVC) is a widely available, low cost, practical technology that can be used in synchronous, online tutoring/teaching sessions. Although the limited throughput on the Web makes it challenging to observe sign language in a fluid and practical manner as a primary instructional or conversational tool in online courses, it has been useful as one means of tutoring remote deaf students when used in conjunction with a complete DVC package. A DVC package with a desktop camera allows the sharing of some sign language, gestures, facial expressions and body language. This real-time interaction significantly enhances chat sessions and white board viewing of instructional material such as programming code. Netmeeting also allows the use of highlighting and drawing on top of instructional materials, which can easily be posted on the online white board along with a chat session interaction.. When the DVC video was combined with Microsoft NetMeeting's other features, the total package was found to be an excellent communication and instructional tool.

The hardware, software, and Internet connections are now available to provide a complete Internet conferencing solution such as DVC at a very reasonable price. DVC incorporates the use of desktop cameras and software that can provide an adequate environment to perform remote, synchronous tutoring for deaf and hard-of-hearing students. With the increase in digital compression technology and students increased connectivity at high-speed, broadband access speeds, use of digital video conferencing will continue to grow.

Literature References

Fasse, R. (2001, May). *Survey of Online Students.* Rochester Institute of Technology Online Survey. Available E-mail: rfasse@firstclass.rit.edu Message: 2001 Student Survey.

MacKenzie, D. & Clymer, E.W. (1999, July). Evaluation of a Desktop Videoconferencing System with Deaf Students. *The ENDEAVOR* (a publication of the American Society for Deaf Children).

Mallory, J. R. (2001) *Designing Distance Learning Instruction for the Deaf and Hard-of Hearing Learner*, DEOS News, of The American Journal of Distance Education.

Mallory, J. R., & Laury, D. J. (2001). *Using Desktop Video Conferencing with Deaf Students in Online Classrooms.* Instructional Technology and Education of the Deaf Supporting Learners, Rochester, NY. [Online]. Available: http://www.rit.edu/~techsym/

Mallory, J.R., & Long, G.L. (2001, December). *20011 Survey of RIT online students.* Available E-mail: jrmnet@rit.edu Message: 20011 RIT Deaf Online Student Survey.

Microsoft. (2001) *Microsoft NetMeeting and the Role of Internet Conferencing for Deaf and Hard-of-Hearing Users.* Business Wire [Online]. Available: USA-L_News@yahoogroups.com

Mount, I. (2001, December). *Not Down, Not Out.* Business 2.0, (pp. 44-45).

Schumeyer, R.P., Heredia, E.A., & Barner, K.E., (1997). *Region of Interest Priority Coding for Sign Language Videoconferencing.* IEEE Signal Processing Society 1997 Workshop on Multimedia Signal Processing June 23-25, Princeton, New Jersey.

Temasek Polytechnic. (2000). *Temasek Desktop Video Conferencing (TDVC)* [Online] Available: http://eicu.tp.edu.sg/DVC/index.htm

Voice vs Text-based Discussion Forums:
an Implementation of Wimba Voice Boards

Philip Marriott
School of Communication, Information and New Media
University of South Australia
Australia
Philip.Marriott@unisa.edu.au

Jane Hiscock
School of Communication, Information and New Media
University of South Australia
Australia
Jane.Hiscock@unisa.edu.au

Abstract: This paper reports on a 2 year exploratory study to determine the viability of voice-based threaded discussion forums as a means of stimulating discussion and understanding of weekly readings as part of a large undergraduate communications course. It was found that most students preferred to make text rather than voice postings. The factors contributing to this preference are examined and discussed and recommendations for further research are made.

Introduction

It is often difficult in an asynchronous online environment to express ones thoughts using text alone (Kouki and Wright 1999). Ong (Ong 1982) in his study of orality vs literacy argues that oral communication requires a different and more extensive use of thinking which is more immediate compared to text. Often text is inefficient in expressing ideas quickly. Asynchronous online communication has been predominantly text-based until recently. This was out of bandwidth limitations rather than any pedagogical or communicative imperatives (Palloff and Pratt 1999; Pettit 1998)

Now that we are in a position to use voice-based asynchronous online tools in educational contexts it is important to begin trials and evaluations to determine how to make the best use of these tools. This paper presents the results of an exploratory trial of voice-based discussion forums over a 2 year period (2001–2002). The objective was to determine whether voice-based discussion forums were viable as a means of stimulating discussion and understanding of weekly readings as part of a large undergraduate communications course.

The study reported in this paper is influenced by Donald Shon's 'Reflective Practitioner' approach (Schön 1991) as part of an overall Action Research strategy (Kemmis and McTaggart 1988) . "How you see the world is largely a function of where you view it from, what you look at, what lens you use to help you see, what tools you use to clarify your image, what you reflect on and how you report your world to others." (Anderson and Arsenault 1998: 3)

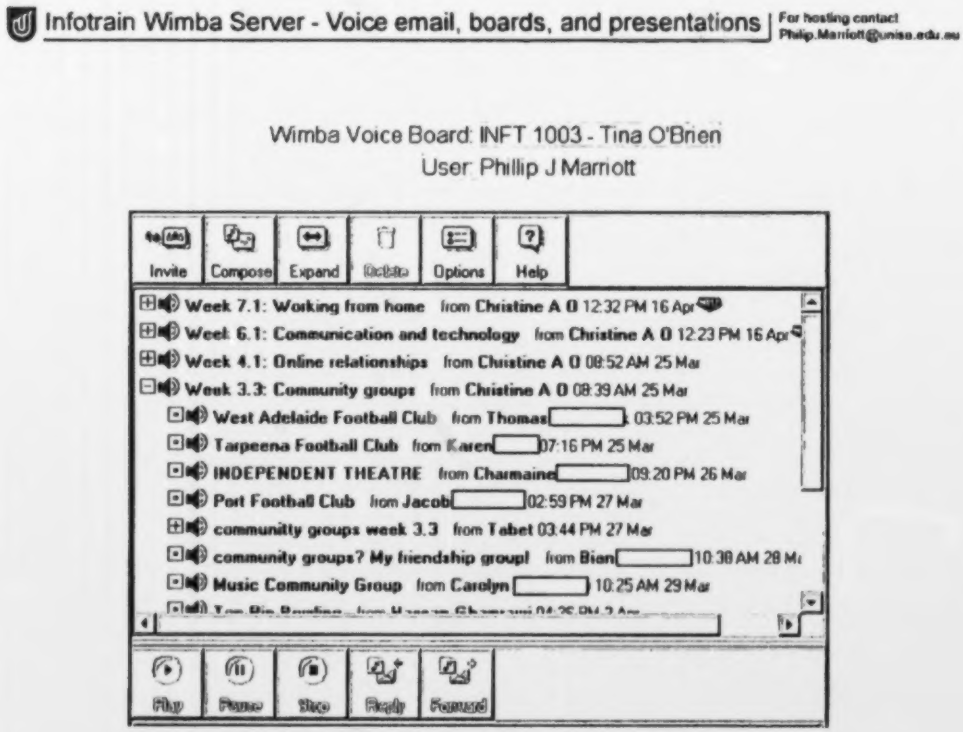
Method

In March to June 2001, 600 Students participating in a large introduction to communication course at the University of South Australia were required to post a summary of their readings each week to a threaded online voice/text forum. Forums varied in size from 20 to 80 participants. The intention was to provide an incentive for students to complete required readings before each weekly tutorial and to stimulate discussion.

The course is delivered face-to-face with considerable online support. The course is constructed according to principles of active learning (Brooks 1997, Forsyth 1998, Palloff and Pratt 1999).

Wimba Voice Board software (www.wimba.com) (fig 1) was used to facilitate the forums. This software has both a client and server component. The server component was installed on a server at the university. Participants then connected to the server through a web browser and automatically downloaded the client software which ran embedded in their web browser. The client installed seamlessly into most participants' web browsers.

Fig 1: Wimba Voice Board screen capture



Infotrain Wimba Server - Voice email, boards, and presentations

For hosting contact
Philip.Marriott@unisa.edu.au

Wimba Voice Board: INFT 1003 - Tina O'Brien
User: Phillip J Marriott

Week 7.1: Working from home from Christine A 0 12:32 PM 16 Apr
Week 6.1: Communication and technology from Christine A 0 12:23 PM 16 Apr
Week 4.1: Online relationships from Christine A 0 08:52 AM 25 Mar
Week 3.3: Community groups from Christine A 0 08:39 AM 25 Mar
  West Adelaide Football Club from Thomas [redacted] 03:52 PM 25 Mar
  Tarpeena Football Club from Karen [redacted] 07:16 PM 25 Mar
  INDEPENDENT THEATRE from Charmaine [redacted] 09:20 PM 26 Mar
  Port Football Club from Jacob [redacted] 02:59 PM 27 Mar
  community groups week 3.3 from Tabet 03:44 PM 27 Mar
  community groups? My friendship group! from Bian [redacted] 10:38 AM 28 M
  Music Community Group from Carolyn [redacted] 10:25 AM 29 Mar

This experiment was conducted in a context where participants are computer literate (to at least a basic level), predominantly young, and motivated to participate. Participants could choose to make contributions to the forums in either text or voice or a combination of both. Text was input through the keyboard. Voice was typically input using a microphone/headphone headset through the computer's sound card. Participants could make contributions from any location on the Internet. For most participants the choice was between using computers at university or a computer at home. All participants were required to purchase headsets prior to commencing the course.

Information on the usage of the forums was gathered by examination of server logs and a questionnaire survey of participants at the completion of the trial. The survey administered online and was voluntary and

BEST COPY AVAILABLE

anonymous and all members of the cohort were invited to participate. A response rate of 154/582 was achieved.

We noticed that, over time, as participants used the forums, the frequency of text postings increased with a proportional decrease in the frequency of voice postings. We wanted to explain this difference and this provided the motivation for this study.

In 2002, the experiment was repeated with the next cohort of 587 students (response rate of 124/587). These students used voice forums in exactly the same way as the previous year's students with the exception that they were not shown or informed about the ability to use text or a combination of text and voice. Consequently all postings to the voice forums were voice-only in 2002. It was our belief (Marriott 2001) that given sufficient experience with voice posting, students would be more inclined to use this method of posting.

Results

Server logs

In 2001, according to the server logs, participants made 3943 postings with a voice component compared to 2392 postings with a text component. Postings with a voice component were clearly more popular.

Participants consulted text postings 25463 times and voice 11313 times. So while the voice postings were more numerous it was far more common for participants to read the text postings of other participants.

In 2002, participants made 5839 voice postings compared with 132 text postings. It is likely that these text postings can be attributed to headings posted by tutors to organize their groups. It would be reasonable to say that no students posted a text posting in 2002. Clearly the policy of silence on the ability to post text had a significant effect.

Survey

At the completion of the trial period all participants were surveyed using a questionnaire containing 5 Likert scale questions and 2 free response questions.

Fig 2 contains the 5 Likert scale questions that were given to both the 2001 and 2002 cohorts. The charts are arranged for easy comparison of groups. It should be noted that no attempt has been made to test for statistical differences between groups. Samples were not randomly selected and no information is available about differences between the 2001 and 2002 populations. Despite these limitations the charts provide an interesting basis for discussion, in keeping with the interpretive nature of the study.

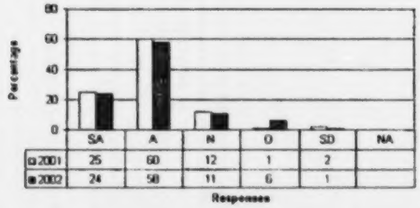
Participants were also asked to explain why they preferred one method of posting over the other in the form of 2 free response questions. Table 2 is selection of representative responses to the 2 free response questions given to both the 2001 and 2002 cohorts. In this case only 2002 responses are given. The intention is to give an indication of the range of responses received. Analysis of free responses is given in the discussion section of this paper.

Fig 2: Likert Scale Questions: Voice Forum Survey

SA = Strongly Agree, A = Agree, N = No Strong Opinion, D = Disagree, SD = Strongly Disagree, NA = Not Applicable

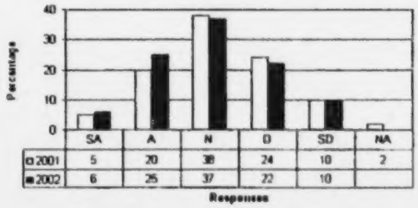
Sample size (n) 2001 = 154, sample size (n) 2002 = 124; population 2001 = 582, population 2002 = 587

Question 1: I found the Wimba Voice Forums easy to use



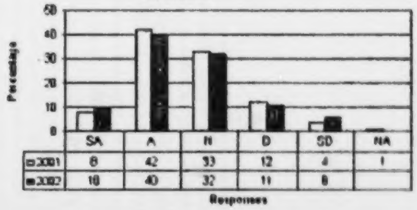
	SA	A	N	D	SD	NA
□ 2001	25	60	12	1	2	
■ 2002	24	58	11	6	1	

Question 2: I like posting to the Voice Forums each week



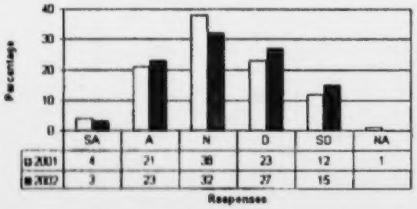
	SA	A	N	D	SD	NA
□ 2001	5	20	38	24	10	2
■ 2002	6	25	37	22	10	

Question 3: I think the Voice Forums are a useful part of the course



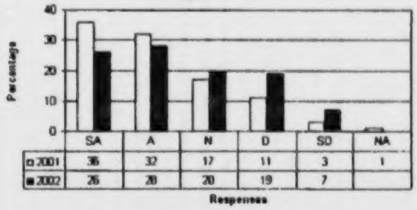
	SA	A	N	D	SD	NA
□ 2001	8	42	33	12	4	1
■ 2002	10	40	32	11	6	

Question 4: I would like to use Voice Forums more in my studies



	SA	A	N	D	SD	NA
□ 2001	4	21	38	23	12	1
■ 2002	3	23	32	27	15	

Question 5: I would prefer to post text rather than voice messages



	SA	A	N	D	SD	NA
□ 2001	36	32	17	11	3	1
■ 2002	26	28	20	19	7	

Table 2: Sample of survey free responses

Date	The Wimba voice forums allow postings to be made as text or voice or a combination of both. In this course students made mainly voice postings. Which would you prefer to post, text or voice or a combination of both?	Why did you prefer one type of posting (voice / text)? Give reasons.
2/05/2002 10:22:53 PM	Mainly text, but voice is OK if REALLY necessary.	Probably because I become very self-conscious when recording my own voice. It is much easier for me to type it, erase it, re-type it ad infinitum, until I get it just right. As well as that, to have an effective voice posting you need the Uni's LAN connection. To do it from home is VERY slow and inefficient.
3/05/2002 7:35:04 AM	text	to me, it is more anonymous, and is easier to edit the information so that what you actually post is full of relevent information rather than um's and ah's.
3/05/2002 8:28:24 AM	Text only	You can think out your postings more with text entry. Even though the technology for voice messages is here now I believe that it is not fully evolved, which makes for on some occations hard to hear messages.
3/05/2002 8:40:52 AM	text.	I prefer text by far because I type much faster than I would speak on the Wimba voice forum. Also, when we were required to listen to other student's postings, their voices were sometimes unclear or hard to understand. Text is much easier in this respect!
3/05/2002 9:00:08 AM	Text	Easier to do, doesn't take up much of your time.
3/05/2002 9:43:27 AM	voice	it is easyer to use and faster.
3/05/2002 10:36:23 AM	either,or a combination	I was a bit shy to post voice messages when there were lots of strangers in the room, also voice messages sometimes needed to be redone because I didn't do them properly or there was lots of background noise, text eliminates these elements, but text is less fun too

BEST COPY AVAILABLE

Discussion

In the analysis of the 2001 results (Marriott 2001) it was clear that by the end of the trial most students preferred to post text messages. And while nearly all students initially posted voice messages, most drifted back to text. It was thought that many of the students had not given voice a fair go. Perhaps, we mused, if only they had persevered for longer with voice, they may have developed a greater preference for it. In 2002 it was decided to put this assertion to the test. Student in 2002 were not told of the Wimba software's ability to post text messages. Consequently all student postings in 2002 were voice-based.

Fig 2 shows the remarkable similarity between the 2001 and 2002 groups on all questions. In particular questions: 1 'usability', 2 'like making postings', 3 'useful part of studies' have almost identical distributions. Question 5 which deals with the preference of text over voice is slightly skewed in that the 2001 group seem to have a slightly stronger preference for text. Question 4 which deals with the preference for greater use of voice forums shows a slight tendency for the 2002 to want less future involvement with voice forums.

Our first concern was whether participants found the software difficult to use. We wanted to know whether the design of the software was a significant influence on the decision to post in text or voice. Question 1 (fig 2) shows that most participants found the software easy to use with no participant claiming the software was difficult to use.

We found the response to question 5 quite surprising, after all these students had never tried a text posting to the Wimba Voice Forums, yet the majority wanted to post in text. It seems that regular experience with voice-posting does not change the preference for text -posting in this context.

Responses to the free response questions (table 1), which probe deeper into the reasons why participants prefer voice, text, or a combination of both, are very similar for 2001 and 2002.

For a great many of the participants it would seem that voice-posting presents a challenge in that it:

- is embarrassing to talk into a computer in public or private
- is difficult to make long responses without errors
- is difficult to speak fluently
- is difficult to correct errors
- requires additional equipment (headset)
- presents technical problems on some computer systems

Those participants who preferred voice-posting see the benefits of voice as:

- a more natural and therefore easier way to present ideas and respond to the ideas of others.
- it is a richer means of communication that includes verbal cues and an emotional context.

Conclusion and Implications

The similarity between the 2001 study (Marriott 2001) and the subsequent 2002 study tends to provide validation for the initial findings. A small number of participants preferred to post voice over text. What is not clear are the factors that influence this decision. Familiarity with voice, alone, does not a likely factor. What is it that makes these participants different? This surely provides the impetus for a more focussed study that looks closely at people who prefer to post voice and attempts to uncover the contributing factors.

It may be that the context for the postings inherently is better suited to text and the participants are only responding to this environmental pressure. Perhaps certain types of asynchronous discussion are best done with text and others with voice.

What is not considered in this study is the effectiveness in terms of learning, of conducting a voice versus text asynchronous discussion. Does, for example, text or voice-posting provide deeper learning (Ramsden 1992)? Is this dependent on the context (Brown 1989)?

References

Anderson, Gary and Nancy Arsenault. 1998. *Fundamentals of education research*. London: The Falmer Press.

Brooks, David W. 1997. *Web-teaching : A guide to designing interactive teaching for the world wide web*. Innovations in science education and technology. New York: Plenum Press.

Brown, John Seely, A. Collins, and P. Duguid. 1989. Situated cognition and the culture of learning. *Educational Researcher* 18: 32-42.

Forsyth, Ian. 1998. *Teaching and learning materials and the internet*. London: Kogan Page.

Kemmis, Stephen and Robin McTaggart, eds. 1988. *The action research planner*: Deakin University.

Kouki, Rafa and David Wright. 1999. *Telelearning via the internet*. Hershey, PA: Idea Group Pub.

Marriott, Philip. 2001. Asynchronous voice: Some design issues. *Journal of Information Technology Theory and Application* 3, no. 3: 33-43.

Ong, W. J. 1982. *Orality and literacy: The technologizing of the word*. New York: Methuen.

Palloff, Rena M. and Keith Pratt. 1999. *Building learning communities in cyberspace : Effective strategies for the online classroom.* The jossey-bass higher and adult education series. San Francisco: Jossey-Bass Publishers.

Pettit, Anthony. 1998. Teaching first, technology second: The possibilies for computer mediated communication. In *Ctldec monograph series*, ed. J. M. R. Cameron:92. Darwin: Northern Territory University Centre for Teaching and Learning in Diverse Educational Contexts.

Ramsden, P. 1992. *Learning to teach in higher education*. London: Routledge.

Schön, Donald A. 1991. *The reflective practitioner : How professionals think in action*. Aldershot, England: Arena.

Developing Componentware for Education: A Programming Approach Providing Teachers More Creative Control of Course Design

Ryoji Matsuno,
Prefectural University of Kumamoto, Japan
matsuno@pu-kumamoto.ac.jp

Yutaka Tsutsumi
Kumamoto Gakuen University, Japan
yutaka@kumagaku.ac.jp

Richard Gilbert
Kumamoto University, Japan
gilbert@let.kumamoto-u.ac.jp

Abstract: The aim of this project is to build software development environments for teachers, enabling them to produce their own educational applications for their classrooms as easily as they might produce educational materials using a word processor. As one of means of realization of this goal, we have proposed a componentware methodology, and have developed fifteen components and three application programs for English as a Foreign Language, and presented the result (at ED-MEDIA 2002). We have continued researching componentware methodologies, and have created a wide variety of new components, categorizing these components into two main groups: basic components and high-level components. Basic components allow teachers to develop complicated CALL applications with a few simple programming statements. High-level components are, for example, independent applications not requiring any additional coding tasks. In this paper, we will describe 1) the background of the project, 2) advantages of componentware methodology, 3) past results, 4) basic components and high-level components, 5) Example applications made using our components , 6)a discussion of related issues and, 7) concluding remarks.

Background

Although a large number of computer-based teaching materials currently exist in the marketplace, these materials are not prevalent in the classroom (MEXT, 2001). One important factor contributing to their lack of use may be that these materials are designed to suit the largest common-denominator of students, and thus are often unsuited to individual classroom requirements, as instructional methods (and student comprehension) are highly variable and specific to each unique educational and curricular environment.

If a teacher were able to develop teaching materials on a multimedia computer in a manner similar to the development of more conventional teaching materials, such multimedia teaching materials would be more easily and thus more frequently implemented. Most teachers are acquainted with their students' abilities, and would be able to develop multimedia teaching materials corresponding to their students' needs, if minimal-to-zero programming knowledge on the teacher's part were required. As a solution to the current dilemma, we are proposing a componentware methodology. In the following section, we will describe the advantage of componentware methodology in contrast to more traditional authoring tools many teachers are currently using in order to produce teaching materials.

Advantages of componentware methodology

In contemporary education, many teachers are using authoring tools such as HyperCard and Toolbox in order to produce teaching materials. These authoring tools provide users with software-routines encapsulating some features enabling users to handle graphics and text. By using these software-routines, teachers can produce their own teaching materials. However, such authoring tools have some severe limitations. Some of these limitations are: 1) they require some programming ability, 2) they cannot provide us with new software-routines and do not allow us to change features of their software-routines in order to fit a specific purpose, and thus, 3) it is difficult to implement in software the rapid changes in multimedia technology, and in addition 4) such programs sometimes force us to re-work teaching materials whenever upgraded or entirely new versions arrive.

Componentware methodology has a great potential to overcome the above-mentioned limitations. Componentware is an object-oriented software development method which uses and integrates components as essential building blocks (Aoyama, 1996; Jacobson et al., 1995; Udel, 1994). Componentware methodology allows us to develop software systems in both a top-down and a bottom-up fashion. This is an essential aspect of educational software systems development. The bottom-up approach can allow a teacher to easily develop a new educational software system by assembling pre-existing components. In the case where a teacher wants to develop a new type of teaching material, the top-down fashion can be adopted to break down a teacher's requirements into functionally modular components. Another advantage of the componentware methodology is in meeting requirements for computer usage in the real educational world: We can categorize teachers into three groups: an advanced group able to develop original program components, an intermediate group able to assemble pre-existing components into educational software, and a beginner group who can use pre-existing educational software systems in their classes. The advanced group develops components, making full use of their specialized knowledge and provides them to the intermediate group; the intermediate group is able to make educational software by using given components (i.e. they can produce specialized software systems without specialized knowledge); and the intermediate group is able to provide educational software to the beginner group—the beginner group is then able to make use of the educational software in their classes. If this flow from the advanced group to the beginner group is made to function smoothly, computer-based education can become more effectively and easily implemented.

Past Results

We have developed four component-based software applications and fifteen reusable software components for English as a Foreign Language (EFL) education (McCarthy, Matsuno and Swan, 1996; Matsuno, Tsutsumi, and Ushijima, 1999; Gilbert and Matsuno, 2000a and 2000b). In the EFL field, teachers have not only been using multimedia devices such as tape-recorders, CDs and videotapes, but also have been using computers since the advent of the institutional computer lab. In this field, therefore, multimedia computer systems and software offer a significant contribution to education

In a pilot study, three beginner-programmer students produced EFL applications using componentware components. They were all able to produce EFL applications with sound and movie clips as easily as producing EFL educational materials using, for instance, word-processor software, after they were given instruction on the usage and programming of each component. (Instruction occurred within one 90-minute class.) There were some common themes in the students' software products, exemplifying typical EFL materials—for example a "listen-and-repeat" practice-program, Japanese/English bilingual-switching dialogue program, etc. While these were useful products, additionally the students had wanted to produce evaluation tools documenting the learning-effect. But these types of components (e.g. quiz-type or questionnaire-type components) required more challenging programming structures. There are three typical program structures for combining statements in a program: sequencing, conditional(if statement), and repetition(loop). The students used only the sequencing-structure component-types, and had difficulty using conditional- and/or repetition-structures. In this situation we were faced with two possibilities. The first was to instruct the students on conditional- and repetition-structures. A second possibility was to create some mechanism that would enable students to produce evaluation components without the necessity to code with conditional/repetition structures. As we have mentioned, the aim of this project has been to build software development environments enabling teachers to produce applications as easily as producing educational materials using a word processor. With this in mind, we examined our existing components, and classified them into two categories: basic components and high-level components. Both component-levels now include encapsulated conditional/repetition structures (which no longer require extra coding of these structures by the student). The difference between the two levels is that the high-level components are actually a conglomerative integration of a number of basic components, thus are oriented towards the beginner programmer (they are close to being stand-alone applications). In the following section, we will describe both basic components and high-level components.

Basic components and High-level components

Basic components (Fig. 1) allow teachers to set or change the required properties and parameters of each component during the design-stage as well as at any time the program is used. As well, the program does not have to be "run" in order for the properties to be confirmed (usually any change in design is seen immediately and visually). This means that since teachers are able to set and confirm many properties (e.g. "font color", "caption title", "audio-file filename") without programming, they are able to produce complicated applications using only a few simple lines of programming code. As well, teachers can change or set properties dynamically.
The intermediate group is able to produce higher-level applications by joining a variety of components together, using their more advanced programming skills. High-level components (Fig. 2) are component frames, and include several individual components. Both the properties and the more complex linking routines of high-level components are set in advance by the component builders (our componentware research team, or similar advanced programming group). Therefore, the beginner group can produce an application program with no programming requirements, and the intermediate group can produce a great variety of applications with the addition of extra components/frames and/or by adding new application behaviors by using inherited features of object programming. This is similar to cooking a frozen pizza. Even though you have no idea how to make a "scratch" pizza, you can microwave a frozen pizza in a few minutes by following some simple instructions; this enables you to eat pizza quickly and easily. If you have even modest cooking skill you can add some toppings, etc., prior to the actual cooking process for a more delicious frozen pizza. It may be noted that on occasion, even a talented (perhaps hungry) chef may wish to save time and effort by cooking a frozen pizza.

Basic components

Multimedia Components

The "Multimedia Components Group" is a set of components allowing teachers to use multimedia files easily. We will introduce MMLabel (Fig. 3), one of the multimedia-group components, as an example. MMLabel is helpful when a teacher wants to produce, for instance, an English Learning program for students whose mother-tongue is Japanese. Since MMLabel has two captions and a multimedia filename property, the teacher can set the English dialog text to caption1, a parallel Japanese translation-text dialog to caption2, and designate an English sound/movie clip filename (for example showing the teacher speaking). This process requires very little design time to implement. Now, all that the teacher needs to do is just press the "Run"-button. Students are able to see the caption1 text of the MMLabel component with the English dialog on the screen, and when they click on the MMLabel, they will listen to the English dialog or will be able to watch the movie clip. The teacher can use as many as MMLabels, as they wish, and can thus produce a conversation-practice program without coding. In case the teacher wishes to show students the corresponding Japanese dialog, the teacher only needs to write one line

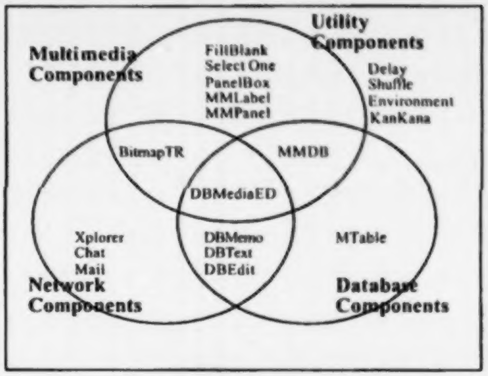

Utility Components
Multimedia Components
FillBlank
Select One
PanelBox
MMLabel
MMPanel
Delay
Shuffle
Environment
KanKana
BitmapTR
MMDB
DBMediaED
Xplorer
Chat
Mail
DBMemo
DBText
DBEdit
MTable
Network Components
Database Components

Fig 1. Basic Components

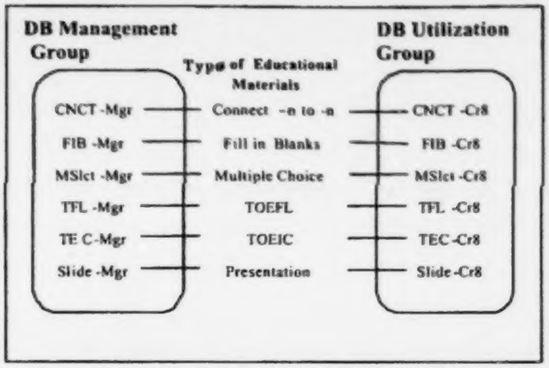
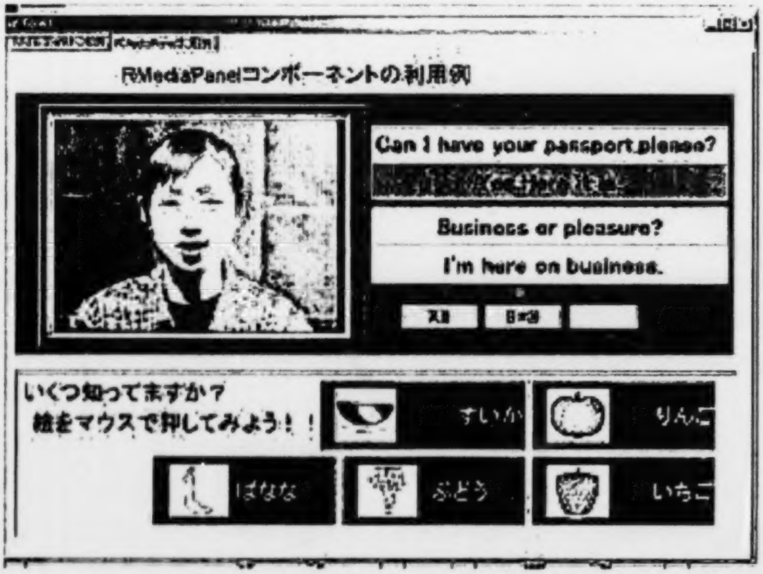

DB Management Group
Type of Educational Materials
DB Utilization Group
CNCT -Mgr
Connect -n to -n
CNCT -Cr8
FIB -Mgr
Fill in Blanks
FIB -Cr8
MSlct -Mgr
Multiple Choice
MSlct -Cr8
TFL -Mgr
TOEFL
TFL -Cr8
TE C-Mgr
TOEIC
TEC-Cr8
Slide -Mgr
Presentation
Slide-Cr8

Fig 2. High-Level Components



RMediaPanelコンポーネントの利用例

Can I have your passport please?

Yes, here it is.

Business or pleasure?

I'm here on business.

いくつ知ってますか？
絵をマウスで押してみよう！！

すいか
りんご
ばなな
ぶどう
いちご

Fig 3. An Example Application made using MMLabel

of simple code: "MMLabel.caption:= caption2". In the case of a teacher who has even modest programming ability, a variety of programs can be created in a like manner.

Communication Components

Communication components allow a teacher to make communicative programs such as their own browser and chat programs. The browser component is made using Microsoft's IE-engine. The Intermediate group can make their own browser by using the IE-Engine, but there are still difficulties for the beginner group. A similar

BEST COPY AVAILABLE

situation is faced when beginners try to make their own chat and mail programs. However, even the beginner group can make these types of programs very easily within the componentware environment. Additionally, since componentware browser components can show web pages in a specified order and at specified intervals, teachers can easily incorporate slide shows into their program materials.

Database components

The Database components group is a set of compound components handling multimedia and internet functions. We will introduce the MMTable component as an example. This component allows for the concurrent use of several different events, for instance: the display of a caption, display of an image, playing of a sound/movie. As well, this component can convert selected database elements into html form. The MMTable component has two important properties for easy database programming, a DatabaseName and a MultimediaField property. All a teacher has to do is set the database-name property to a DatabaseName parameter, and set the database field parameter of the MultimediaField property during the design phase. For example, set DatabaseName to "English Media" and set the multimedia field property to "Record I". The teacher can then use the specified database elements, and can additionally create new elements if necessary, without needing to re-design their program.

Utility Components

When making educational programs, we have observed that similar functions are often utilized (for example: shuffling/randomizing, delay-interval timer, kanji-to-kana converter). Utility components are sets of such small "gadget programs" for coding educational programs. Taking one of the utility components, a shuffle component, as an example, this component may be used when a teacher makes a quiz program. Students may memorize the location of the correct answer from a multiple-choice question if the same quizzes are repeatedly given to them in same order. With the shuffle component, the teacher can produce quizzes which randomize the correct answer within a larger set of wrong answers and show the correct answer out of a subset of multiple choices (say, one correct answer in four available choices), at random, with very little required coding.

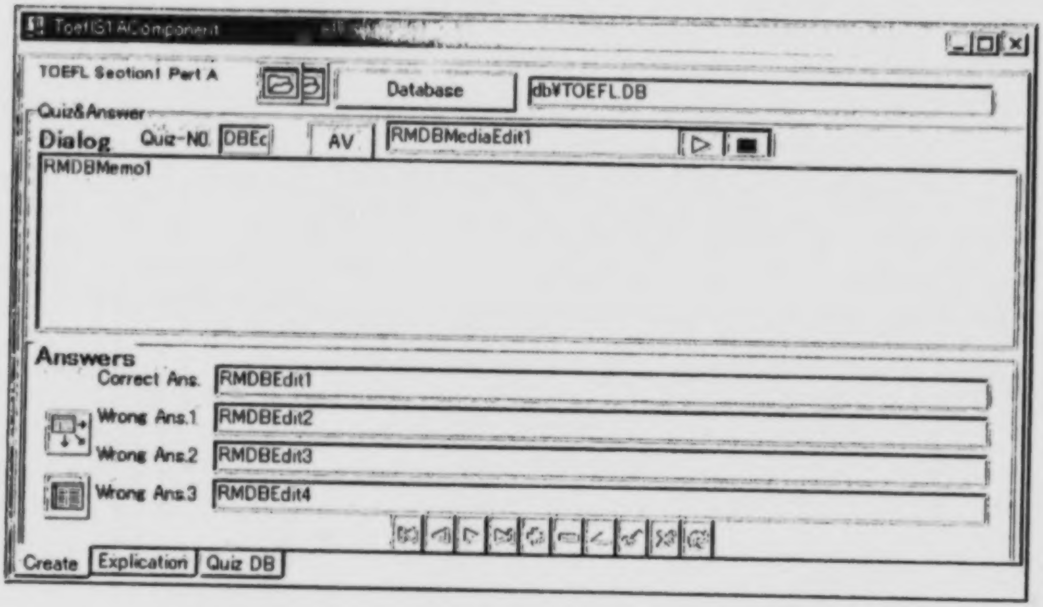
High-level components

High-level components are made by assembling basic components. The target group for the high-level components is the beginner group, and each higher-level component is additionally able to function as a standalone application when it is compiled. The advantages of providing such programs as component sets, rather than as finished applications is as follows:

1) To be able to modify layout and properties as an individual teacher prefers, which can thus provide teachers with fulfillment of their specific pedagogical goals.
2) To be able to add new features by integrating additional basic components.
3) To be able to modify the behavior of the components with inherited functions of object programming.
4) To be able to produce an application program of their own design by putting together one or more high-level components.

We would like to restate two important points, mentioned above: 1) high-level components are, virtually, standalone applications, and 2) in a componentware approach the overall process should be focused on a specific educational field. Therefore, we focused on EFL (English as a Foreign Language) education, which often utilizes computers for educational use.

We have six types of high-level components now. Three of them can be used for creating Web-based quizzes (these three components can be used not only in EFL fields, but in other fields as well). Two of these components can be used for creating TOEFL(Fig. 4) and TOEIC practice programs, and one of the components can be used for creating a presentation program (which allows for slides, sound/movies and simple animations).


ToeflS1AComponent
TOEFL Section1 Part A
Database
Quiz&Answer
Dialog
Quiz-NO.
AV
Answers
Create
Explication
Quiz DB

db¥TOEFL.DB

Quiz-NO. DBEc

RMDBMediaEdit1

RMDBMemo1

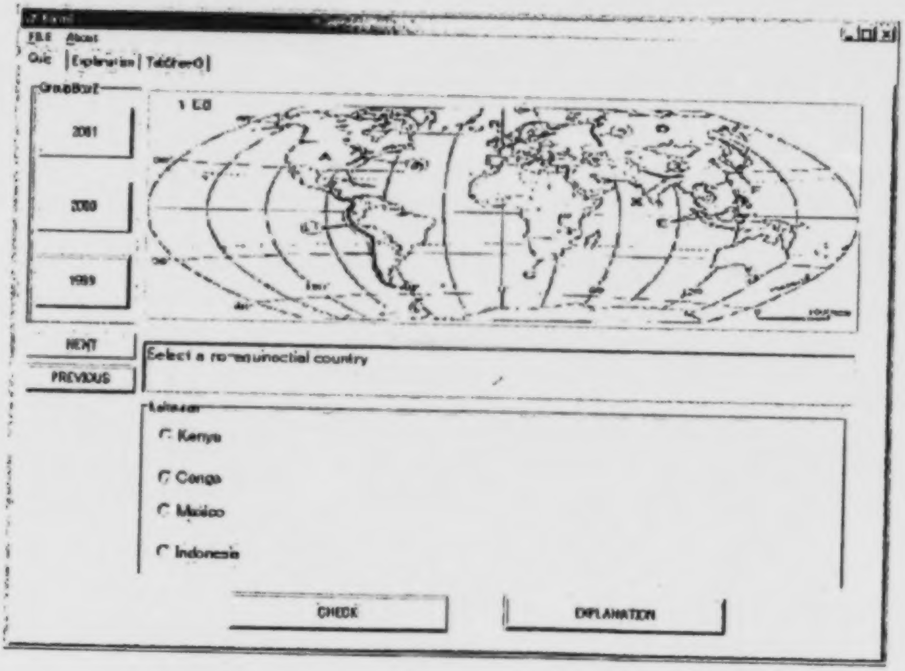
Correct Ans. RMDBEdit1

Wrong Ans.1 RMDBEdit2

Wrong Ans.2 RMDBEdit3

Wrong Ans.3 RMDBEdit4

Fig 4. TOEFL Component (an Example of High-level Components)


File
About
Quiz
Explanation
TabSheet3
GroupBox2
2001
2000
1999
NEXT
PREVIOUS
CHECK
EXPLANATION

Select a non-equinoctial country

○ Kenya

○ Congo

○ Mexico

○ Indonesia

Fig 5. An Example of Application Programs made by students

BEST COPY AVAILABLE

All of these components are assembled with database components, but teachers do not have to have any knowledge of database programming. High-level components are able to manage all of these database-programming routines.

Example applications using our components

We have had our students make several example-programs using our components(Fig. 5). All of these programs have been made with very little coding. If the students had attempted to produce similar programs without utilizing the componentware design system, it would have required a great deal of effort: they would have needed to write a several-hundred lines of code, including condition- and repetition-program structures, and also would have to study and gain experience in API (Application Program Interface) concepts. Pragmatically, this is an unlikely prospect for any beginner programming-group. Using componentware, they were able to produce their own programs in approximately one week, with most of the students' design time spent on educational content-design.

Discussion

We have developed more than 30 components focused on EFL education, and have made several sample applications using those components (Fig. 3). We have been able to reduce the large amount of development time typically required for producing such applications, as well as reduce the level of knowledge required to create such applications. We do not think however that 30 components are sufficient for producing a large variety of EFL applications. We will need to continue to survey teachers' requests, and develop more components. Additionally, we have to further research each component's "hidden programming-routine size" (the number and "depth" of internal structures determining available features in a component). We can incorporate a large number of features into one component, however it is sometimes hard, particularly for the beginner group, to become skilled in the use of a more complex component, as there tends to be a larger number of parameters to set in a feature-laden component. This fact has shown us that an "all-purpose" tool (with features for every contingency) may sometimes be functionally useless for its target users. On the other hand, if every individual component is too "simple", this creates a situation where a welter of components must be used in order to produce applications; as a result, it becomes difficult to decide which component to select and as well, more coding becomes necessary. Thus, there is a trade-off between the 'simple component' approach versus the 'multi-purpose component' approach, which must be balanced.

Conclusion

We have described a new approach to educational software development. Teachers should be able to accomplish the following goals utilizing a componentware approach:

For both Beginner and Intermediate Groups:

1) To make new applications for the classroom using high-level components.
2) To make new and sophisticated applications for their classrooms mixing high-level-components and basic-components

For Intermediate Groups:

3) To make new types of high-level components and/or applications using basic components, and to provide them to the beginner group.
4) To make new basic components using/improving our components, and to provide them to the beginner group.

As previously mentioned, we have been focusing on EFL education, however we believe our development concept is applicable to numerous educational fields. We have recently begun to develop basic components for mathematics and physics education. The Borland Delphi object-Pascal language is our chosen development environment. Nevertheless, the componentware approach can be executed in other object-oriented language environments.

References

Aoyama, M. (1966). Componentware: Building Applications with Software Components. *Information Processing Society of Japan*, 37(1), 71-79.

Jacobson, I., Christerson, M., Jonson, P., Overgaard G. (1995). Object-Oriented Software Engineering: A Use Case Driven Approach. Addison Wesley.

Jacobson, I., Booch, M., & Rumbaugh, J. (1999). *The Unified software development Process.* Addison Wesley.
McCarthy C., Matsuno, R., & Swan, K. (1997). Pronunciation Power: A Hypermedia Pronunciation Program For Learners Of English As A Second Language. *Proceedings of ED-MEDIA & ED-TELECOM 97*, 1312-1313.

Matsuno, R., Tsutsumi, Y., & Ushijima, K. (1999). A-MATE: A multimedia authoring system for teaching ESL, *Proceedings of ED-MEDIA & ED-TELECOM 99*, 237-238.

Gilbert, R. & Matsuno, R. (2000a). A Computer-Based Vocabulary Resource Database for JSL/EFL Education. *The Japan Association for Language Teaching 24* (9) 15-19.

Gilbert, R & Matsuno, R. (2000b). Complementing University EFL Science Courses: A CALL Multimedia Concordance Design for Vocabulary Comprehension. *Administration* 7 (1) 69-100.

Potter A., Kopp, G., Green, C. (1947): *Visible Speech.* Van Nostrand.

Udel, J. (1994). Componentware. *Byte*, 19(5), 46-56.

MEXT (Ministry of Education, Culture, Sports, Science, and Technology) (2001): Investigation into Actual Applied Computer-Use in K-12 Classroom Education [Japanese]. Available: http://www.mext.go.jp/b_menu/houdou/13/09/010911/main.pdf (Accessed March 4, 2002).

Developing an Organisational E-Learning Strategy

INTRODUCTION

During the past five years Blackboard and WebCT have become the world's leading learning platform vendors, having achieved spectacular market penetration in a small number of countries. Learning platforms offer enhanced student access to learning materials, straightforward integration of digital content and a range of student interaction and tracking services. Different systems have different emphases, but common features include content authoring tools, calendars, syllabi, discussion boards and assessment mechanisms.

Liverpool John Moores University (JMU) is one of the largest universities in the UK. It is a multi-faculty institution with in excess of 20,000 students. Its first learning strategy, in 1995, sought to identify and make explicit the University's commitment to learning development and to integrate this in the context of other University policies and strategies. The underpinning principles of the strategy were derived from the University's mission statement, with detailed targets for implementation, responsibilities for action and costings. In the years 1995 - 1999 institutional and local structures and processes were developed to support implementation, with a particular strength at the local level being the introduction of Learning and Teaching Coordinators (LTC's) in each of the University's Schools.

CONCISE CASE STUDY

The purpose of the case study is to examine institutional Learning and Teaching Strategy and decision-making which impacts on the promotion of ICT for learning, In Liverpool JMU These particular processes have been monitored by the Higher Education Funding Council for England (HEFCE).

Annual reviews of the JMU learning strategy, since 1995, demonstrated that significant progress was made across a number of fronts. It was observed that a number of real improvements in the learner support infrastructure were made, with substantial investment in development of the University network giving better access to ICT, induction in the use of ICT and in extending opening hours of JMU's three Learning Resource Centres. Increased emphasis was placed on front-loading support for students in the early stages of programmes, with a range of local subject-specific pilots focusing on the development of tutorial modules.

As a result of these initiatives there was evidence of increased use of ICT by both staff and students, particularly in the use of email for communication and there occurred a range of developments across the University in the area of web-based learning.

In 1999 a range of LTA themes, for the following three years, was developed. JMU took, as a primary focus, the need to provide a straightforward and limited set of initiatives that were meaningful to all groups of staff concerned with supporting learning within JMU and their franchised programmes. Five themes for Learning, Teaching and Assessment for the academic years 1999/2002 were developed. The five themes were positioned in two functional categories: three **Learning Themes** that encompassed various fundamental aspects of LTA; and two **Enabling Themes** that underpinned the Learning Themes, infusing and supporting them in a way thought to be fundamental to the success of the whole enterprise. For each of the five themes there was a deliberately planned short period at the outset for evaluating the effectiveness and impact of developments, in order to maximise the effectiveness of the new initiatives. Similarly as each new theme was undertaken, a robust processes for monitoring and evaluation was incorporated.

The five themes were:

- Effective and Efficient Assessment
- Curricular Enhancement for Employability
- Enhanced Learner Support
- Promotion of ICT for Learning
- Staff Development for Learning, Teaching and Assessment

The rationale of the fourth **enabling** theme, Promotion of ICT for Learning, was concerned with exploiting new learning technologies in relevant and appropriate ways in order to enhance learning, teaching and assessment. The theme recognised that the shift towards greater use of ICT in student learning brings with it a requirement for staff to have the requisite skills and understanding in order to exploit the huge potential of ICT in interactive learning. As part of this theme there was a particular focus on:

- Staff development;
- Opportunities for ICT supported Learning
- Learner Support Infrastructure

The stated goals of the theme were:

1. To identify and adopt good skills and practices for ICT-supported learning;

2. To incorporate interactive ICT usage in the learning process throughout JMU;

3. To identify the resource implications of promoting ICT-enhanced learning

A Learning Development Team was created at JMU to focus on the operationalisation of the LTA strategy. This core permanent team is small but LTA Theme Coordinators and part-time secondments for specific projects supplement it. There are five LTA Themes and each of these has a Coordinator working for 50% of their time on activities relating to the implementation of the LTA strategy. The Theme Coordinators function within the Learning Development Team but spend much of their time working across the University. They report their activities to a Learning Innovation Committee.

As mentioned previously there had occurred a range of developments across the University in the area of web-based learning. These began in 1997 with the introduction of a staff/student resource, a university supported Document Management System to support academic staff in placing materials on its campus wide information system (cwis). This web-based system supported small pockets of Learning and Teaching activity. In 1998 a number of staff, from several Schools within JMU, designed and developed complementary templates to serve the needs of students for modules of different programmes. The two separate web-based support mechanisms operated in parallel within JMU. In one case, Liverpool Business School academic designed templates formed the basis of the principal module web support provision for students. The latter initiative supported the stated goals of the fourth stated LTA theme for JMU and many research studies were undertaken concerning student perceptions and the impacts of the web-sites on learning and teaching development.

In 2001 a Web-Supported Learning Working Group was established at JMU to identify, evaluate and approve systems that support on-line learning. The group consisted of academics from a range of faculties, educational researchers, web-site developers, Learning and Information managers, Computer and Information Managers, Learning Development Team managers and it was chaired by the university's Director of Academic Innovation. As a consequence the group evaluated commercial Virtual Learning Environments (VLEs). Such as Blackboard and WebCT with some being tested by a number of different Schools and Service Teams. Other platforms were also investigated. The 'approved' system, Blackboard, was identified on the basis of comments and experiences from representatives of all stakeholders.

Scenario planning was undertaken, determining the functionality required to provide the ideal platform for JMU, including a JMU portal. Criteria included: capacity for all academic staff to have their own online space; training for academic staff; student allocation of modules and modular catalogue details; common service for on and off campus students; processes for faculty to manage and develop learning materials; and seamless integration with existing (and those in development) information technology systems.

The beginning of the 2001/2002 Academic Year saw the arrival of the **Blackboard Virtual Learning Environment** at JMU, replacing the JMU supported Document Management System as a web based system to support learning and teaching. The introduction of this VLE also provided a viable replacement for the academic designed templates. As well as allowing access to course materials via the web, Blackboard also offers a number of communications tools, including Announcements and the Virtual Classroom, all of which can be used to enhance the learning experience.

The Web-Supported Learning Working Group has now evolved into a Web-supported Learning Panel with representation from across the university, the panel is tasked with addressing issues concerned with Web-supported Learning; strategy, evaluation and projects. It is now the case that previous research and current research studies concerning student perceptions and the impacts of the web-sites on learning and teaching development will be focused on establishing 'best practice' in the internal use of VLE's.

In an effort to further enhance and develop initiatives for the five themes for Learning, Teaching and Assessment during the 2001/2 academic year over thirty-six awards were given out by the Learning Development Team to celebrate excellent practice in learning, teaching and assessment.

Awards were made using £63,000 of the HEFCE learning and teaching strategy money to make these awards in four categories. They involved staff from every School/Faculty and from Learning and Information Services and included teaching and learning, technical, administrative support staff and postgraduate students. Many of the awards were team awards. The aim of the awards was to raise the profile of teaching and learning at JMU and to recognise and reward effective practice."

The four award categories were: Curriculum Innovation: to recognise innovative curriculum development work that has already been undertaken Curriculum Development: to support new curriculum development work Teaching-related Research: to support staff researching their own learning, teaching and assessment practice Teaching Fellowship: to recognise individual excellence in teaching.

Many of the awards in Curriculum Innovation and Teaching-related Research support the Promotion of ICT for Learning theme and one of the three Teaching Fellowships is specifically focused on gauging and disseminating 'best practice' in the use of Blackboard.

Only one learning platform is now supported centrally at JMU. Academic staffs in Faculties are free to use other platforms but must fund and support them themselves. Whilst JMU has selected a single centrally supported learning platform, the University recognises that this is a rapidly evolving market and will regularly review its approach, and has put in place strategies to facilitate platform portability.

SOME RESEARCH FINDINGS CONCERNING BLACKBOARD USE

A series of surveys were undertaken on students using web templates for modules designed by academics in the academic year 2000/2001. The cohorts studied were both undergraduates and postgraduates. The surveys explored student attitudes and perceptions to the web-sites as well as providing insights into learning strategies adopted. Knowledge of student Learning Styles was incorporated into all assessments made. Results from these surveys have been reported (McClelland 2001a & 2001b). Follow up surveys of undergraduate and postgraduate students on modules using Blackboard (where the previous supports were web templates designed by academics) has also been undertaken (McClelland 2002 unpublished). .

A series of studies concerned with the sum-total of technology-based supports currently offered to students in JMU has been undertaken, representing a UK university that has a technological infrastructure (McClelland, 2001c). The research that supports this publication examines student perceptions of administrative support systems offered through a campus wide information system and range of supporting web-sites hosted at JMU. The research gives a systemic perspective and refers to Blackboard (now JMU's chosen format for web-site presentation to students).

In order to obtain vital feedback on the new Blackboard system, two JMU surveys were implemented in December 2001 to obtain user feedback of the system - one survey for staff, the second for students (Bird and Connor, 2002 unpublished).

A summary of the findings for the above surveys can be found in Table 1

It can be seen from conclusions in Table 1 that there is overwhelming support for E-Learning in Higher Education being an evolutionary change rather than revolutionary. Internal research (from JMU) indicates and supports incremental changes and this is mirrored by experiences in a comparable University to JMU, Edith Cowan University, Australia (The Observatory on borderless Higher Education, 2002).

Research Findings	Conclusions
Academic designed web-site supports enable flexibility for both students and tutors, avoiding restrictions such as time, place and accessibility of knowledge supports. Students at lower levels of a programme use sites more frequently. (McClelland, 2001a & 2001b).	Restrictions such as time, place and accessibility of knowledge supports support a continuous change model. Usage patterns indicate increasing usage of web-sites for less experienced learners.
Introduction of a commercial VLE, Blackboard, shows no major differences in student perceptions of quality, content, administration and learning experience than those experiences of academic designed web-sites. No differences in mean importance of all Blackboard site supports were observed when factored by the variable Student Learning Styles. Previous research on none Blackboard web-sites (McClelland, 2001b) had found one variance from this with External Links (exploring the web).	The no differences observation infers continuous change from a simple to a more complex form. The Learning Styles observation infers that Blackboard does not discriminate preferred learning styles of students and supports. This is a step improvement from observations on web-sites designed by academics. This can be viewed as continuous change.
At JMU the principles of clarity; attention; integrity and strategic use of informal information have been used in it's strategic transformational change processes due to a combination of consistent information flows; a series of targeted internal studies; a focus of all communications supporting organisational objectives and through the transparency of the transformation process, and wide involvement of staff, strategic use has been made of informal information. (McClelland, 2000 & 2001c)	Action and communication are developmental rather than major changes. The communication within JMU is to effect change and influence action in the direction of JMU's overall interest.
Almost 1000 students responded to a survey of Blackboard use (n = 900), 50% stated that all or most of their module leaders employed use of Blackboard. 71% indicated that they would like it used for more of their modules. There is evidence that Blackboard has a role to play in widening participation. Majority of staff and students view Blackboard as having great potential in enhancing and supporting learning but acknowledge that it needs to be exploited much more (Bird & Connor, 2002)	Uptake is gradual in the transition from JMU supported and academic designed web-provision, but greater than that previously experienced. There is a wider acceptance and greater perceived benefits. Awareness is widened and initiatives are developing. The changes are developmental and not fundamental complete changes.
In a case study on Edith Cowan University's introduction of Blackboard (Australia) the lessons that were taken on board were 'establishing a clear relationship between institutional strategy for online learning and the platform selection process; mapping the necessary links between the platform and existing in-house information technology and the value of active engagement and support for one learning platform, whilst other systems were allowed where local markets dictated.' The Observatory On borderless Higher Education, 2002).	Supports JMU experience of internal monitoring, evaluation and consultation processes, but focusing and supporting one platform whilst allowing flexibility. Supports incremental changes.

Table 1 Research Findings and Conclusions Concerning Blackboard Use to Date.

COMMERCIAL DEVELOPMENTS ASSOCIATED WITH BLACKBOARD

Liverpool JMU is currently developing a generic intellectual property policy for teaching and learning resources, including online materials available through the Blackboard sites, on-line articles and e-Book arrangements with publishers such as McGraw-Hill.

As a result of the experience gained through developments of web-sites and online delivery, JMU is part of a consortium producing and facilitating a Masters in Enterprise (M.Ent.) degree for Small to Medium size Enterprises in the UK. This is a distance programme utilising a Blackboard platform.

Liverpool Business School, in the JMU Faculty of Business and Law has developed a suite of Masters level modules on Blackboard which can constitute tailored Masters Programmes such as Masters in Business Studies (MBS), Masters in Business

Administration (MBA). These will allow more flexibility in differing delivery modes and a commercial product for international educational markets.

CONCLUSION

Research at JMU has demonstrated that web-sites enable a more consistent corporate image on-line, allow support services to focus and raises faculty and student skill levels and reduce confusion between the functionality of different systems. Use of the commercial VLE, Blackboard, offers to facilitate integration with in-house systems, such as Oracle.

The JMU experience holds a number of lessons, including establishing a clear relationship between institutional strategy for online learning and the learning platform selection process; mapping the necessary links between the platform and existing in-house information technology and the value of active engagement; support from senior managers; celebrate excellent practice in learning, teaching and assessment by motivating staff to develop sites by providing suitable reward structures; channelling best practice and supporting staff development in producing appropriate resources.

Although it may be too early to comment on to what extent, and in what ways, VLE's will have a long-term effect on teaching and learning a noteworthy development are the immediate commercial possibilities and educational markets for Programmes endorsed by universities and mediated through commercial VLE's.

REFERENCES

Bird, A., Connor, C. (2002) Blackboard User Evaluation Report, JMU

McClelland, R.J. (2000) Campus Wide Information Systems: An Integration Development for H.E. United Kingdom Academy of Information Systems UKAIS 2000 Conference, University of Wales Cardiff, 26 - 28 April 2000, McGraw-Hill, ISBN 0 07 709755 6

McClelland, R.J. (2001a), Digital Learning and Teaching: evaluation of developments for students in Higher Education, *European Journal Engineering Education* 26 No. 2 pp 107 - 115 ISSN 0304-3797 (print), ISSN 1469-5898 (on-line)

McClelland, R.J. (2001b) Web-based Delivery of a Generic Research Methods Module (for Social Sciences): The Graduate and Post-Graduate Experience. *Conference: Society for Information Technology & Teacher Education,* Orlando, USA 5 - 10 March 2001, Association for the Advancement of Computing Education (AACE) pp 2595 - 2600 ISBN 1-880094-41-X

McClelland, R.J. (2001c), Web-based administrative supports for university students, *International Journal Educational Management,* Vol.15 No.6 pp 292 – 302 ISSN 0951-354X

The Observatory On borderless Higher Education, Leading Learning Platforms: International Market presence 2 March 2002

Evidence of the Need to Support the Development of On-line Collaborative Skills: An Action Research Study

Laura April McEwen, Department of Education, Concordia University, Canada, laura@education.concordia.ca

Jennifer Sclater, Department of Education, Concordia University, Canada,
jennifer.sclater@education.concordia.ca

Abstract: This study examined the relationship between the quality of intra-group on-line collaboration among groups of undergraduate learners on the quality of products produced. The quality of on-line collaboration was assessed by the instructor and Teaching Assistant with the CSCL process assessment tool. The evolution of quality of intra-group on-line collaboration was examined over time, as was the quality of group products for the first and third on-line activity. Findings suggest that the quality of collaboration significantly impacted the quality of products produced by a group. The results of this study underline the need to provide support for the development of learners' on-line collaborative skills prior to the introduction of learning activities where grades are contingent upon effective collaboration. The strategy of self and peer assessment practices is introduced as a potential means of fostering the development of important collaborative skills essential to learners' successful negotiation of this novel learning arrangement.

Introduction

Educators are being encouraged to move away from directed instructional approaches and adopt a more interactive style of teaching. This fundamental shift in educator orientation involves dramatic adjustments in the flow of communication. Within such a context, learners are encouraged to interact among each other as well as with educators. One method of promoting interaction among students is to include collaborative projects in the instructional design of courses. In keeping with the current emphasis in academic institutions on social-constructivist theoretical orientations the incorporation of these learning strategies have been on the rise (Bagley & Hunter, 1992; Hansen & Perry, 1993; Morris & Hayes, 1997).

The emergence of technological tools such as computer mediated communication (CMC) software presents the potential to facilitate collaborative interaction at a distance (Keegan, 1993; Hiltz, 1994; Garrison, 1997). CMC is a specific type of human interaction that enables individuals to exchange knowledge, thoughts and feelings via technology. The culmination of this marriage of theory and technology is a powerful, dynamic learning environment unconstrained by time and space (Garrison, 1997; Hiltz, 1994; Keegan, 1993). Few would argue the compelling potential of such an active learning context, but along with this powerful pedagogical redirection come many challenges for learners.

Computer Supported Collaborative Learning

Computer supported collaborative learning (CSCL) environments are the product of constructivist approaches to learning supported by the technology of CMC software (Wenger, Holloway & Garton, 1999). CSCL can be defined as the educational use of computer technology to facilitate group learning. The CSCL process is best conceptualized as a dynamic interrelationship between several key elements which require learners to: (a) define learning goals, (b) make individual contributions to the group process, (c) negotiate roles and responsibilities, and (d) synthesize individual contribution into a cohesive group product. This interrelationship can provide learners the opportunity to build knowledge collectively (Brandon & Hollingshead, 1999; Dehler, 1998; DeSanctis & Monge, 1998; Garrison, 1997; Hiltz, 1994). However, an underlying assumption of such learning arrangements is that learners possess the skills to effectively collaborate within the on-line environment.

Central to the concept of collective knowledge building is the ability of learners to *communicate effectively* or make the implicit, explicit. Research findings suggest that the ability to clearly, concisely, and completely represent individual understanding to others is a skill associated with high ability learners (Linn, & Burbules, 1993). Therefore, we as educators cannot assume that all learners possess this capacity.

Along with learners' individual communication competencies, the characteristics of the medium must also be considered. Perhaps the most formidable task of communicating in this setting is the mastery of the distinct form of communication that this environment demands. In effect communication in the virtual realm requires the blending of skills of reading and interpretation, writing and speech to produce a new form of human interaction.

Most educators suggest building CMC skills gradually (Berge & Collins 1995; Harasim 1996; Hiltz 1994; Misancuk 1997). In this way participants are afforded the opportunity to familiarize themselves with the technology and acquire the skill set which will enable them to communicate effectively through the medium. However, many of the strategies commonly recommended, such as dyadic partnering of learners or the placement of learners in small groups for informal electronic exchange, do not promote the development of on-line collaborative skills.

When the collaborative process is considered, aspects of group dynamics figure prominently. Unfortunately, most learners' prior educational experience has been in the objectivist tradition of instruction, where competition among learners has been strongly promoted (Shepard, 2000; Wiggins, 1993; Wilbrinks, 1997). As learners are often inexperienced with collaborative learning arrangements, generally, their knowledge about critical aspects of productive group functioning may also be lacking.

Ultimately, CSCL arrangements demand that learners synthesize individual contributions to achieve a quality group product. Yet according to Bloom's Taxonomy (1956), synthesizing at the individual level is considered a complex cognitive task. The challenge of this type of task is compounded within a CSCL learning context, as group members struggle to synthesize individual expertise in such a way that all members of the group are richer for the interaction.

Considered in unison, the challenges associated with a collaborative learning arrangement situated in an on-line learning environment are substantial. If learners' grades are contingent upon the quality of a collaboratively produced product, then methods of promoting the development of learners' on-line collaborative skills need to be considered.

The Focus of Assessment

Educators communicate to learners what content and skills are important to learn through the focus of assessment (Boud, et al., 1999). In a social-constructivist learning context effective communication is a required skill, learners' success ultimately hinges upon their ability to communicate their ideas and comprehend those of their peers. Since the purpose of assessment is to promote student learning, assessment practices need to acknowledge the importance of the communication processes and provided incentives and guidance to improve these collaborative skills (Murray, 1999).

Assessment Practices as a Means of Promoting the Development of Collaborative Skills

Proponents of constructivist pedagogy emphasize the need for assessment to become an integrated component of the learning experience (Boud, et al., 1999; Duffy & Cunningham 1996a; Shepard, 2000; Sullivan & Hall, 1997; Wiggins, 1993). Within this framework, assessment is not an end in and of itself, but instead regarded as a tool for promoting individual growth through the development of important metacognitive, critical thinking and communication skills (Frederiksen & Collins, 1998; Linn & Burbules, 1993; Stefani 1998). From a constructivist perspective, successful learners need to effectively self-monitor, evaluate and interact. By including these processes in the focus of assessment, learners are provided with feedback they can use to inform their future performance.

The Study

The current study examined the relationship between the quality of intra-group collaboration and the quality of products produced. Learners were randomly assigned to four-member collaborative group at the beginning of the semester. They worked collaboratively on three group projects over a two-month period. Group membership was stable for the entire course.

Learners' collaborative process was assessed using a tool developed within the research context. Learners received a grade for their individual contribution to the group product based on the five CSCL process assessment criteria. Group products were assessed based on predetermined assessment rubrics.

Methods

Research Context

Technology for Educational Change (EDUC 305DE) is a one-semester undergraduate course offered at a distance by the Department of Education at Concordia University through FirstClass®, a client or web-based computer conferencing system. This course is intended for pre-service teachers, and other interested students from the Faculty of Arts and Science, as an introduction to the possibilities afforded them through the integration of technology into the classroom. Forty-five percent of learners' final grades were derived form three CSCL activities. Each CSCL activity was worth fifteen percent of learners' final grades. A description of the three CSCL activities follows:

Activity 1: Structured Debate

This activity was intended to familiarize learners with the strengths and weakness of CMC. Groups of learners were paired and each group within the pair group was designated an opposing position, presenting either the strengths or weakness of CMC. A reference to an on-line journal was provided in the FirstClass® course conference. Individual learners were asked to select and read an article. Groups were then given a week to collaboratively prepare a position paper supporting their argument with the literature they had reviewed and submit the paper to their partner group for rebuttal. Only the rebuttal paper was graded.

Activity 2: Experience to Practice

This activity was designed to introduce students to the constructivist theoretical perspective by requiring them to build on individual experiential knowledge of directed instructional approaches to learning and collectively convert one of the group's individual contributions to a constructivist learning activity. Learners had two weeks to complete this assignment.

Activity 3:Design

Learners were asked to debate the pros and cons of computer use in the classroom. They were then required to design a classroom activity that incorporated the use of computers. They were asked to define the role of the teacher, indicate the educational level of the students and describe the implementation as well as how it would be assessed.

Participants

Of the 56 learners enrolled in the *Technology for Educational Change* course in the Fall 2000 semester, 52 learners completed all course requirements, 21 learners were included in this analysis. This represented a 40% participation rate. Of the 21 participants in the study, nine were education or Art Education students, 3 were from the faculty of Commerce, three were Sociology majors, 4 were Psychology majors and two were independent students. Eleven females and ten males chose to participate in the study. According to responses to background questionnaires and information gathered over the course of the semester, participants had no prior experience in CSCL. However, students did appear to be familiar with collaborative learning in a face to face context, with 17 of the 21 participants reporting having encountered this form of instructional strategy more than three times over the course of their academic career. Half of those reported having engaged in collaborative learning activities more than ten times.

Instruments

The CSCL process assessment tool was developed in the first cycle of this action research study. It identified five assessment criteria associated with the characteristics of effective on-line collaboration and provided operational definition of each. Table 1: The CSCL Process Assessment Tool presented below was adapted from McEwen (2002). The CSCL Process Assessment criteria appear in the top row of the table. The operational definitions of each criterion are listed in the column beneath each.

Table 1: The CSCL Process Assessment Tool

Criteria	**Distributed Expertise**	**Leadership**	**Provides or asks for clarification/ feedback**	**Clarity and Accuracy of information Provided**	**Quality of individual contribution**
Operational definitions	shared prior knowledge or experience introduced new information, relating it to activity/discussion	initiate discussion of task/group meetings proposes deadlines defines roles posts early offers guidelines to support/ promote group interaction combines/edits group product	provides clarification on task instructions provides constructive feedback on teammate's contribution provides constructive feedback on combine group product provides information/instructions about functionality of software. requests feedback from group on combine group product asks for clarification about group member's contribution	clear concise instructions accurate information or directions	Individual component of task (article summary, personal learning experience) completeness, clarity, and utility of Introduction/ conclusion/section of assignment

Procedures

All FirstClass® messages posted by learners in their group sub-conferences, or Forums, as they became known, for each of the on-line activities were reviewed. The CSCL process assessment tool was used to evaluate the quality of intra-group collaboration. Each learner was assigned an *Instructor Assessed Individual Contribution* (IAIC*)* score out of five. The Instructor of the course assigned the IAIC scores for Activity 1: *Structured Debate*. The Teaching Assistant assigned the IAIC scores for Activity 2: *Experience to Practice* and Activity 3: *Design*. The instructor graded group products according to the pre-determined assessment rubrics.

Analysis

Two analyses were conducted. Given the similarity of task demand for Activity 1:*Structured Debate* and Activity 3: *Design*, a comparison of Group Product quality across these two on-line activities was made. A t-test was calculated on these two samples of scores. An analysis of variance was conducted to compare mean IAIC scores over time.

The Group Product scores for eleven groups for both on-line activities are presented in Table 2. The first column of the table indicates the name of the group. The second column provides the Group Product scores attained by each group for on-line Activities 1: Structured Debate. Group Product scores for Activity 3: Design appear in the third column of the table. The descriptives of Group Product scores are presented in the final rows of the table.

IAIC scores for Activity 1: Structured Debate, Activity 2: Experience to Practice, and Activity 3: *Design* are presented in Table 3. Learners are identified in the first column of the table. IAIC scores appear in the following three columns respectively. The final rows of the table indicate the means and standard deviations for each sample of scores.

Table 2: Group Product Scores for Activity 1: *Structured Debate* and Activity 3:*Design*

Group	**Group Product Scores Activity 1: *Structured Debate***	**Group Product Score Activity 3: *Design***
1	75	93
2	92	77
3	58	93
4	92	100
5	58	87
6	63	87
8	75	87
9	67	93
10	54	77
11	38	97
12	58	93
Mean	66.36	89.45
SD	16.26	7.39

Results

The quality of Group Products improved significantly from Activity 1: *Structured Debate* to Activity 3: *Design* ($M = 66.36$, $SD = 16.36$) to Activity 3: *Design* ($M = 89.45$, $SD = 7.39$). All but one group scored remarkably higher in the final group product. A *t*-test revealed that Group Products scores were statistically significantly higher for Activity 3: *Design*, $t\,(13) = 4.03, p < .01$. A possible explanation is the improved collaboration within groups as represented in improvement in IAIC scores across tasks.

According to mean IAIC scores learners' collaborative performance improved significantly over time. There was a steady rise of the means of the IAIC scores over time, $M = 2.81$, $SD = .98$; $M = 3.64$, $SD = .59$ and $M = 4.75$, $SD = .48$, respectively. The CSCL process assessment tool does appear to have captured improvements in learners' collaborative performance across tasks. An analysis of variance revealed statistically significant differences among the three means of the IAIC scores, $F(2,60) = 31.62$, $p < .01$. This finding suggests a degree of stability both in the improvement in learners' collaborative skills and in the CSCL process assessment tool.

Table 3: IAIC Scores for On-line Activities

Learner	**IAIC Scores for Activity 1: *Structured Debate***	**IAIC Scores for Activity 2: *Experience to Practice***	**IAIC Scores for Activity 3: *Design***
1	3.5	4.0	5.0
2	3.5	3.5	4.0
3	3.5	3.5	5.0
4	3.0	4.5	5.0
5	4.0	3.5	5.0
6	3.0	3.5	4.5
7	5.0	4.0	5.0
8	2.0	3.5	5.0
9	3.0	4.0	5.0
10	2.5	3.5	4.5
11	2.0	4.5	5.0
12	2.0	3.5	4.0
13	4.0	4.0	4.5
14	3.0	4.5	4.0
15	3.0	4.0	5.0
16	3.5	3.0	4.5
17	1.0	3.0	4.0
18	1.5	2.0	4.0
19	2.5	3.5	4.5
20	2.0	4.0	5.0
21	1.5	3.0	3.5
Means	2.81	3.64	4.57
SD	.98	.59	.48

Discussion

The Inter-relatedness of the Quality of Process and Product

There appears to be a definite positive relationship between the quality of process engaged in by groups and the quality of products produced. The stunning improvement in the quality of Group Products from Activity1: *Structured Debate* to Activity 3:*Design*, as shown by the increased grades on the final group products, coupled with the tremendous improvement in collaborative performance as represented in the rise of IAIC scores between activities supports this hypothesis.

This finding raises the important issue of the need to support the development of learners' collaborative skills early on. Apparently, a learning context characterized by a collaborative learning orientation within an on-line environment posed unfair challenges for learners. Upon reflection, we feel strongly that self and peer assessment practices offer educators a means of providing the support learners may require. We suggest that if these practices are appropriately orchestrated within a learner-centered context, learners can be successfully supported through this adaptation phase. These practices can draw learners' attention to the types of activities that promote effective collaboration. Furthermore, as the assessment process unfolds learners stand to further benefit through the development of evaluative and self-monitoring skills.

Conclusion

The findings of this study suggest it is unrealistic to expect learners to suddenly adopt a collaborative learning orientation without supporting the development of social skills necessary for their success. Learners need to understand what constitutes effective collaborative interaction within an unfamiliar learning environment. Self and peer assessment practices offer educators a means of supporting learners' emergent understanding of this learning orientation and the manner in which it is expressed on-line.

A central tenant of the self and peer assessment literature is learners' ownership of the assessment process. According to researchers exploring self and peer assessment practices in on-site learning contexts, feeling of ownership grow out of the act of learners having a hand in either the creation or definition of assessment criteria (Dochy et al, 1999;Topping, 1998). Activities such as these are also believed to foster deeper understanding for learners (Falchikov, 1993; Stefani, 1998). Therefore, truly supporting the development of collaborative skills would require that learners be included in the negotiation of the meaning of the characteristics of effective collaborative interaction. The impact of which could very well be the expression of this knowledge in learners' on-line practice. Consequently, the strength of the CSCL process assessment tool lies in the directing of learners' attention to important characteristics of effective collaborative interaction.

References

Bagley, C. and Hunter, B. (1992). Restructuring, Constructivism, and Technology: Forging a New Relationship.*Educational Technology*.22-27

Berge, Z. L. (1995). Facilitating Computer Conferencing: Recommendations From the Field. *Educational Technology*. 35(1), 22-30.

Bloom, B.S. (Ed.) (1956*) Taxonomy of educational objectives: The classification of educational goals: Handbook I, cognitive domain*. New York ; Toronto: Longmans, Green.

Boud, D., Cohen, R. and Sampson, J. (1999). Peer Learning Assessment. *Assessment and Evaluation in Higher Education*. 24(4), 413-426

Brandon, D. P. and Hollingshead, A. B. (1999) Collaborative learning and computer supported groups. *Communications Education*. 48(2), 109-126.

Dehler, C. (1998). Computer-mediated distributed cognitions: Cultivating collective knowledge and personal competencies. *SIGUE OUTLOOK*. 26(1), 15-19.

DeSanctis, G. and Monge, P. (1998). Communication Processes for Virtual Organizations. *Journal of Computer Mediated Communication*. 3(4).

Dochy, F., Segers, M. and Sluijsmans, D. (1999). The use of self, peer and co-assessment in higher education: A review. *Studies in Higher Education*. 24(3), 331-350.

Duffy T.M. and Cunningham D.J. (1996) in Jonassen,D.,H. (Ed). *Handbook of Research for Educational Communications and Technology: A project of the Association for Educational Communications and Technology*. 170-195. Macmillian Library Reference: New York, NY.

Falchikov, N. (1993). Group Process Analysis: Self and Peer Assessment of Working Together in a Group. *Educational & Training Technology International*. 30(3), 275-284.

Falchikov, N. and Goldfinch, J. (2000). Student Peer Assessment in Higher Education: A Meta-Analysis Comparing Peer and Teacher Marks. *Review of Educational Research*. 70(3), 287-322.

Frederiksen, J. and Collins, A. (1998). A Systems Approach to Educational Testing. *Educational Researcher*. 18(9), 27-32.

Garrison, D.R. (1997). Computer conferencing: the post-industrial age of distance education. *Open-Learning*. 12(2), 2-11.

Hansen, E. and Perry, D. (1993). Barriers to Collaborative Performance Support Systems in Higher Education. *Educational Technology*.46-52

Harasim, L. (1996). Effectively Using Electronic Conferencing. Retrieved: August, 15, 2000 from http://www.indiana.edu/~ecpots.html

Hiltz, R. (1994). *The Virtual Classroom*. New Jersey. Ablex Publishing Corporation.

Keegan, D. (1993). *Theoretical Principles of Distance Education*. London and New York: Routledge.

Linn,C. and Burbules, N.C. (1993). In Tobin, K. (Ed.). *The Practice of Constructivism in Science Education*. AAAS PRESS: Washington, DC.

McEwen, L.A. (2002). *Exploring Assessment of On-line Collaboration in Distance Education: An Action Research Study*. Unpublished master's thesis. Concordia University, Montreal, Quebec

Misanchuk, E.R.(1997). Exemplary Practices in CC. Retrieved: August , 20, 2000, from http://www.extension.usask.ca/papers/Misanchuk/AECT(&/

Morris, R. and Hayes, C. (1997). Small Group Work: Are group assignments a legitimate form of assessment? In Pospisil, R. and Willcoxson, L. (Eds), Learning Through Teaching, p229-233. Proceedings of the 6th Annual Teaching Learning Forum, Murdoch University, February 1997. Perth: Murdoch University. *http://cleo.murdoch.edu.au/asu/pubs/tlf/tlf97/morr229.html*

Murray, R. (1999). Peer Assessment in Practice. *Assessment and Evaluation in Higher Education*. 24(4), 443-444.

Shepard, L.A. (2000). The Role of Assessment in a Learning Culture. *Educational Researcher*. (29)7, 4-14.

Stefani, L.A.J., (1998). Assessment in partnership with learners. *Assessment and Evaluation in Higher Education*. 23(4), 339-350.

Sullivan, K. and Hall, C. (1997). Introducing students to self-assessment. *Assessment and Education in Higher Education*. 22(3), 289-305.

Topping, K. (1998). Peer assessment between students in colleges and universities. *Review of Educational Research*. 68(3), 249-276

Wenger, S.B., Holloway, K.C. and Garton, E.M. (1999). The effects of internet-based instruction on student learning. *Journal of Asynchronous Learning Networks*. 3(2).

Wiggins, G.,P. (1993). *Assessing Student Performance: Exploring the Purpose and Limits of Testing*. Jossey-Bass: San Francisco, CA.

Wilbrink, B. (1997). Assessment in Historical Perspective. *Studies in Educational Evaluation. (23)* 1, 31-48.

Acknowledgements

We would like to acknowledge Dr. Allyson F. Hadwin, Dr. Bob Bernard, and Dr. Richard F. Schmid of the Department of Education, at Concordia University for their guidance, support and critical perspective over the course of the design, implementation and analysis of the original thesis research from upon which this article is based. Furthermore, we would like to thank student participants, without whom this research would not have been possible.

Community Building: Facilitating Successful Online Courses

Mae McSporran
School of Information Systems & Computing,
UNITEC Institute of Technology,
Auckland, New Zealand
mmcsporran@unitec.ac.nz

Stuart Young
syoung@unitec.ac.nz

ABSTRACT

It is important to build a community of learners, so that co-operative learning takes place. This is more difficult to accomplish online, where the lecturer has to overcome the natural reticence of students to post in shared class spaces.

This paper suggests constructive methods of ensuring the success of an online course. These include reinforcing and recycling course content in a variety of integrated media, and encouraging students to become leaders and help their classmates.

We report results (from 1999-2001) from three undergraduate and two postgraduate computing courses that each have a significant proportion of the course taught online. These courses are studied by students with a wide range of ages, ethnic backgrounds, life and work experiences. We report widely ranging student participation rates in a variety of online discussions and course exercises, and discuss the contributing factors that cause some branches of the online learning tree to blossom and others to wither.

1. INTRODUCTION

Many researchers point out the importance of building a community of learners, (Campbell and Hawksworth, 1999, Foley and Schuck, 1998, Lehtinen, et al., 1999 , McSporran and King 2002), so that students can learn from each other. Felder and Brent, (1994) cite research that shows that "cooperatively taught students tend to exhibit higher academic achievement, ... better high-level reasoning and critical thinking skills, deeper understanding of learned material, more on-task and less disruptive behavior in class, ... ".

Online conferences, either synchronous or asynchronous, are generally recognised as a powerful tool for active learning. As Klemm (1998) points out, they require students to "comprehend what is being discussed by others, to create ideas in the context of the topic at hand, to organize thinking coherently, and to express that thinking with carefully constructed language (hopefully, clearly and concisely)". However it is also generally recognised that students are reticent about posting in shared class spaces – perhaps because they lack the confidence to assert themselves in public, or they are afraid of embarrassing themselves in front of their peers. Klemm (1998) recommends eight ways to increase quantity and quality of student participation in online conferences.

It is all too easy to invite student participation in an online course only to find that the contributions never happen. It is necessary to encourage and cajole students to participate using inclusive, enthusiastic and motivational language. However this is very time-consuming, and can result in the tutor feeling trapped in a "virtual prison" (Hart and Gilding, 1997). In this paper we share our tips and experiences for ensuring student participation, while reducing personal time overheads for tutors.

Some of the pedagogical strategies that we employ to ensure the cognitive engagement of the online community include:

- Encouraging student leaders
- Forming student groups

- Peer grading or comment and student exemplars
- Motivational, student-centered, socially inclusive, enthusiastic, positive, and conversational dialogue in a variety of media, such as email, discussion forum posts, time-specific course website announcements and co-ordinated tasks.

2. ABOUT THE COURSES

We discuss three courses in the Bachelor of Computing Systems degree (Internet and Web Development 1 and 2, and Help Desk) and two courses in the Masters of Computing degree (Internet Applications and Website Management). All our courses are taught in flexible task-orientated manner. We generally offer co-ordinated classroom sessions, paper and online lecture notes, practical exercises, and integrated usage of communication alternatives offered by the standard tools included in the course website building shells, Blackboard CourseInfo and WebCT. All of the courses involve some degree of assessment that is conducted online.

Internet and Web Development 1 is a popular introductory course, described in previous research (McSporran and Young 2001, Young, et al. 1999). In the first assignment (20% of total) the students research an aspect of the Internet in groups. Part of this assignment (20% of total) is attributed to online communication: how effectively the students communicate using email, web-based discussion forums and chat.

We first implemented a web-based discussion forum in IWD1 in the 1999-2000 Summer School, which was the first real remote class. The discussion forum was promoted, but we were disappointed with the low student usage, even though the remote students had few other ways of forming a community of learners, (Dewstow, et al. 2000).

In Semester 1, 2000 we assessed student usage of the group discussion forum for first time, forcing students to use it. To our surprise we noted that usage didn't improve, and with hindsight we noted that usage of the discussion forum in the first Summer School was actually quite good.

In 2000, the Master of Computing degree started at UNITEC. This is taught part-time one weekend a month, with online activities between the monthly class sessions. After experiencing the low usage of the IWD1 discussion forum, the decision was made to follow the advice of Klemm (1998) to increase quantity and quality of student participation. We designed structured and/or assessed exercises to encourage discussion forum usage, described in detail in a previous paper (Young, 2001).

In Semester 2, 2001, IWD2, a course focussing on real-world tasks and involving many class exercises, was offered for the first time. Very low participation rates in the class exercises were experienced. The decision was made to force participation in Semester 1, 2002, by allocating a proportion (20%) of the first assignment (25% of the course total) for participation in 20 class exercises. There was a dramatic positive effect on participation rates.

3. DESCRIPTIONS OF EXERCISES UTILISING DISCUSSION FORA

Examples of structured, assessed exercises that utilised a discussion forum include:

- **Website critique**
  An individual component of a postgraduate course group research project. Three member syndicates choose a topic and each student submits a critique of a single website within the top ic area. A week later the students are required to reply to their syndicate members' critiques. After a further week the writer of the critique submits a response that integrates all the posts. Thus in a three person group, each student writes two replies, and each student receives two replies.

- **Debate**
  A postgraduate course syndicate assessment that followed a typical debate format, again on a weekly basis, with the groups required to make opening and closing statements and to respond to the points made by the opposing syndicate.

BEST COPY AVAILABLE

- **URL Synopsis**
  An individual assessment, designed to encourage the postgraduate course students to continue their reading around the subject and develop their communication skills. They were required to write one sentence reviews of a useful web resource. These were marked on quality and applicability of the resource and accuracy of the review.

Some examples of structured, yet non-assessed exercises that utilised the discussion forum include:

- **Website changes**
  The students in this postgraduate course were given a case study for a complex e-commerce website, which included many screenshots of the different pages of the website. The students were asked to read the case study, to visit the website, and to identify the many changes that had been made since the case study was written. They were asked to list changes, giving reasons why they thought the changes were made, in a post to the discussion forum. After one week there were no posts to the discussion forum. The lecturer then posted a list of 5 changes and asked the students to reply with reasons, which only solicited 2 reply posts.

- **Server monitoring**
  Undergraduate and postgraduate students were asked to repeatedly test the response time of various websites, to calculate the average response time and to post their results to the discussion forum for collation. In classes where this exercise was not assessed there was poor participation. In IWD2, Semester 1, 2002 where participation was assessed, rates of close to 100% were experienced.

4. STUDY METHODOLOGY

Data was collected from course website usage statistics. WebCT supplies data on the number of discussion forum postings read and posted by each student, although there is no way to identify assignment group posts or general posts. Blackboard offers no data for each student, necessitating a manual count of student postings. It is impossible to detect how many posts each student read.

In this and our other studies we have decide to include a student's records if those students have recorded at least one assessment mark. Some of the students who drop out without submitting an assessment utilise the course website fully, while some students who submit one or more assignments never visit the website.

5. STUDENT DISCUSSION FORUM PARTICIPATION RESULTS

[Table 5.1: Average student discussion forum participation, IWD1.]

Semester	Average Posts Read	Average Posts Made
Summer School, 99-00	75.0	4.0
Semester 1, 2000	21.5	3.0
Semester 2, 2000	23.1	3.1
Summer School, 00-01	16.9	3.5
Semester 1, 2001	32.0	3.3
Semester 2, 2001	30.6	5.3

Table 5.1 reports participation in the IWD1 discussion forum, 1999-2001. The average number of posts read, and posts made by each student are reported - generally participation rates are low. The 99-00 Summer School has a high Average Posts Read result proving that this cohort of students developed an online community of learners - they really were interested in what the other students had to say.

In contrast, the figures for the 00-01 Summer School are very low. Two reasons for this may be:

- This cohort was mainly composed of Asian students who preferred to form their learning teams offline. Felder and Brent (1994) note that co-operative learning can occur in or out of class.
- The lecturer teaching this online course was disadvantaged by personal injury and made far less posts than normal.

Having experienced low participation rates in 2000, we increased our efforts to promote the discussion forum and there was improvement in 2001.

Table 5.2 and 5.3 describe different categories of forum activities, based on the work of Klemm (1998).

[Table 5.2: Average discussion forum participation, IWD2, Semester 2, 2001. Numbers in parenthesis are the number of posts that each student **should** have made.]

Forum activity type	Posts Made
non-Structured, non-Assessed	0.6
Structured, non-Assessed	1.6 (4)
Structured, Assessed	3.8 (4)
Total	5.0

[Table 5.3: Average discussion forum participation, postgraduate courses, 2000-2001. Numbers in parenthes is are the number of posts that each student **should** have made.]

	Posts Made			
Forum activity type	S1, 00	S2, 00	S1, 01	S2, 01
non-Structured, non-Assessed	2.6	0.2	1.2	0.1
Structured, non-Assessed	-	0.4 (1)	0.6 (1)	1.2 (2)
Structured, Assessed	7.4 (8)	6.0 (5)	7.7 (8)	6.3 (7)
Total	9.9	6.6	9.5	7.6

Postgraduates would be expected to be more motivated to take part in class discussions than undergraduates. However levels of participation in non-structured, non-assessed discussions were equally poor at both levels. Levels of participation in the General forum (non-structured, non-assessed discussions) in the postgraduate course, 818, were particularly poor, because there was no attempt by the lecturer to promote discussions. Levels of participation in structured, non-assessed exercises were disappointing. Only when the exercises were assessed was there near 100% participation. These results may be because of the non-English speaking background of a large percentage of the postgraduate students.

[Table 5.4: Average discussion forum participation, Help Desk, Semester 2, 2001. Numbers in parenthesis are the number of posts that each student **should** have made.]

Forum	Posts Made
General	0.9
Assignment 1	2.3
Industry Contacts	1.8 (1)
Personal Diary	26.6 (14)
Training Day	2.6

Table 5.4. shows that participation in the Help Desk discussion fora, in Semester 2, 2001 was considerably greater than required, and greater than the other courses. Some reasons for this success may include:

- An important outcome of the course is to improve communication skills.
- Students only receive departmental help with their industry placement if they display the level of communication skills required.
- Students develop personal relationships in class during the first six weeks of the course, which helps foster later online communication. Campbell (1999) found that quality of online contributions on a distance education course improved after the mid-semester class get-together.
- Several of the fora were related to real world tasks and involved peer grading. Klemm (1998) recommends that discussions should be interesting, require a deliverable, and involve peer grading.

6. DISCUSSION

6.1 Discussion Fora

We have noticed a trend for discussion fora to wither and die. There is often an initial flurry of posts as students excitedly discover the system and look for group members; then the numbers of posts falls off through lack of encouragement. It is important for the lecturers to respond quickly to queries posted in the forum, so that students are not discouraged. This sets a precedent and students thereafter except a quick response. On several occasions we have noted that if a question on the discussion forum has not been answered within a few hours, the student will then email us.

To keep the level of activity on a discussion forum ticking over it is necessary to continually post new material. This can be very time-consuming. Campbell (personal communication, 2002) found that student demands for attention became overwhelming and she therefore introduced two non-academics to her course to help respond to basic student enquiries.

We have a two-fold strategy for ensuring that contributing to a discussion forum does not overwhelm us. Firstly we recycle posts from previous semesters. Having built up an electronic resource of discussion forum posts, we can quickly copy and paste into a "new" posting, giving the illusion of a thoughtful posting. In addition, if an important news story occurs we can copy and paste it into the discussion forums for multiple online courses.

Our second strategy is to encourage students to take on a leadership role and respond to other students discussion forum posts. This is discussed in Section 6.3.

6.2 Announcements

We deliver administrative, motivational and content-specific announcements to our students in more than one media: emails, and course website announcements and tasks, believing that strong integration of a variety of learning materials has a beneficial outcome.

We send out weekly newsletter emails to the students on the IWD1 and Help Desk courses. These contain content such as class administration issues, relevant news items, motivational material and notification of changes to the course website. A major component of the emails is content related to the assignments, such as upcoming deadlines, milestones (what should have been accomplished each week) etc. We re-use weekly emails from previous semesters, but with some editing so it is possible to add new material, for example answers to questions that may have been asked in class. The weekly emails are sent out every Friday, which allows the students to revise what they should have accomplished each week, and to prepare for the forthcoming week. They are in a standard format that the students become comfortable with; student comments refer to them as being "well organised".

We utilise standard weekly announcements that are reused every semester and one-off announcements that may come up, for example relevant news stories and questions asked by students.

An example of a weekly announcement from the IWD1 course: "In Week 3 the theory session is on search engines and effective searching while the practical session covers HTML Tables". The same text is re-used in the calendar tool, as a time-limited announcement on the front page of the website, in the weekly email, and in relevant discussion forum posts. An example of a relevant discussion forum post would be: "This week we covered search engines and effective searching in the theory session. You may find it helpful to share your experiences of using search engines with your group."

Blackboard also offers a Tasks tool, which allows students to see what tasks are currently due. Students can order these by priority or due date, and can change priority and toggle their Tasks from "Not Started" to "In Progress" to "Completed". Believing that this is a powerful tool for students to manage their own learning, both authors began to use the Tasks tool in our Blackboard hosted courses in Semester 1, 2002.

6.3 Community Leaders

Kim (2000) discusses the importance of encouraging online community members to become leaders and help other members. The benefits for the leaders are:

- Rewards of being an "insider",
- Satisfaction at helping others,
- Reinforcing their learning by teaching others
- Gaining new skills,
- Receiving feedback about their performance.

Leaders can either be in some official capacity, or simply enthusiastic members of the normal community. Oliver et al., (1997) suggest that "ways to encourage capable students in the class to spend the time to view postings and submit solutions, and tips and tricks" should be integrated into the online environment.

There are a number of ways of encouraging leadership (Kim, 2000). Firstly it is important that the lecturer leads by example, by maintaining a friendly, responsive, collegiate voice on the discussion forum. Next it is important to offer leaders some sort of status or reward, ranging from a simple acronym in their website username to awarding stars for helpful discussion forum posts. Finally, a document explaining the leadership process is created. This document contains information on:

- The process involved in being a leader,
- The personal skills that make a good leader,
- The benefits of becoming a leader,
- Good practice for leaders.

Such a document could be describing an official leadership role, or simply a page on the course website that encourages capable students to help others.

We encourage a leadership process within the IWD1 Assignment 1 groups, by asking the students to designate a group leader to represent the team. This individual receives private emails from the lecturers and is encouraged to help their fellow team members.

In Help Desk the students undertake a project to plan a Training Day. This is a group project, with each group assigned a different part. Each group chose a group leader, and all contact with the lecturer was through the group leaders.

Kim (2000) advocates creating a "backstage" area for leaders to gather, relax, prepare and discuss topics relevant to leadership roles. This private gathering space could be a mailing list, private discussion forum or chat room. In Help Desk a private discussion forum was created for the Training Day group leaders. Independently of the lecturer the group leaders organised a face-to-face meeting of all group leaders, when they discussed whether each group was on track. At the training day debriefing, the leaders commented that the face-to-face meeting was very useful, one student commented that it would have been helpful to appoint a leader of leaders since there was no-one to chair the meeting and act as an overall project manager.

Kim (2000) promotes the use of feedback loops to keep track of leader performance and, if necessary, to intervene. In Help Desk this was accomplished by entries in the student's personal diary, which could be monitored by the lecturer. At the end of the course group leaders commented on the performance of their group, while group members commented on the leaders' group management skills. An additional benefit for the leaders was that the lecturer offered to allow the students to include her name as a referee on their CV.

We also acknowledge student excellence by highlighting the best student work. The best student assignment websites are displayed in an annual gallery, and examples of good work in class exercises are highlighted and acknowledged. This is a driver for encouraging quality student work, and indeed we have noticed a general positive trend in the quality of student websites.

7. CONCLUSIONS

To build a successful community of learners online requires the same teaching skills as building a community in a classroom. Motivating and responding to students online is very time-consuming. In addition the lecturer must practice many different ICT skills. If employing teaching assistants is not an option, then to avoid lecturer burnout it is necessary to save time by recycling content, encouraging student leaders and good time-management.

Content can be redistributed and reinforced in a variety of integrated media such as emails, discussion fora, course notes (both hard and soft copy), exemplars, and in the various tools provided by the course shell such as calendar, announcements and tasks.

Strategies for encouraging student leaders are essential to motivate students to help others online.

We also need strategies to encourage students to ask questions in public fora, such as allowing students to edit or delete their posts, to post anonymously, or to build in opportunities for private communication, such as private group forums.

We hope that other online educators will learn from our experiences, as we learn from others.

8. ACKNOWLEDGMENTS

Our thanks to all the students on our all courses, 1999 to 2002.

9. REFERENCES

Campbell, N. and L. Hawksworth (1999). The Nuts and Bolts of Learning with the Internet in Indigenous Contexts. LearnIT World conference: Indigenous Perspectives of Learning Online, Campbell.

Dewstow, R., McSporran, M., and Young, S. (2000). Remote Remedies: Challenges when Teaching Online. Proceedings of the National Advisory Committee on Computing Qualifications Conference, Wellington, NACCQ, p85.

Felder, R. and R. Brent (1994). Cooperative Learning in Technical Courses. (available URL, accessed 15 March 2002: http://www2.ncsu.edu/unity/lockers/users/f/felder/public/Papers/Coopreport.html)

Foley, G. and S. Schuck (1998). "Web-based conferencing: Pedagogical asset or constraint?" Australian Journal of Educational Technology 14 (2): 122 - 140.

Hart, G. and A. Gilding (1997). Virtual Tutorials, Virtual Lectures, Virtual Prisons? ASCILITE'97: What works and why?, Perth, Curtin University.

Kim, A. J. (2000). Community Building on the Web. Berkley, CA, Peachpit Press.

Klemm, W. R. (1998). Eight ways to get students More engaged in Online Conferences. T.H.E Journal, T.H.E. institute. (available URL, accessed 14 March 2002, http://www.thejournal.com/magazine/vault/A1997.cfm)

Laurillard (1993). Rethinking university teaching. A framework for the effective use of educational technology. London, Routledge.

Lehtinen, E., K. Hakkarainen, et al. (1999). Computer Supported Collaborative Learning: A Review, CL-Net.

McSporran, M. and C. King (2002). Online Teaching demands online Commitment. NZACE, Wellington, Waikato University.

McSporran, M. and Young, S. (2001). "Does Gender matter in online learning?" Association for Learning Technology Journal (Alt-J) 9 (2): 3-15.

Oliver, R., Omari, A. and Knibb, K. (1997) Creating Collaborative Computer-Based Learning Environments With The World Wide Web. Proceedings of ASCILITE, Perth, p444-449

Young, S., Dewstow, R., and McSporran, M. (1999). Who Wants to Learn Online? What Types of Students Benefit from the New Learning Environment? Proceedings of the National Advisory Committee on Computing Qualifications Conference, Dunedin, New Zealand, 293-300.

Young, S. (2001). Innovative Use of Bulletin Boards in Undergraduate and Masters Level Online Courses. Proceedings of EdMedia: World Conference on Educational Multimedia, Hypermedia and Telecommunications. Tampere.

Enhancing Web-Based Materials with Video Clips

Susan Mehringer
Cornell Theory Center
Cornell University
Ithaca, NY USA
susan@tc.cornell.edu

Abstract: The Virtual Workshop is a Web-based set of modules used to provide distance education in high-performance computing. One technique we are currently incorporating is the use of video clips. We are working with two types of clips. The first type is screen and audio capture for tool demonstration. The second is using a film clip of a speaker in conjunction with other Web-based materials. This paper describes the video clips, why they are used, how they are incorporated into existing online materials, design issues, and evaluation plans.

Background: CTC and the Virtual Workshop

The Cornell Theory Center (CTC) began offering asynchronous distance learning over the Web in 1995, with its first offering of the Virtual Workshop. To date, we have conducted fifteen Virtual Workshops for over 1000 participants. Participants typically are undergraduate through Principal Investigator in academia, or a researcher or scientist in a corporate or government office. These workshops cover various topics in High-Performance Computing. Each workshop is comprised of about ten modules, delivered over the course of four to eight weeks. Our courses are taken by those seeking professional development in high-performance topics, and those who more specifically want to learn how to use CTC resources. Those who complete a course are awarded a certificate. We initially offered web-based workshops to reach people who could not travel to Ithaca for training, but we now find that many people prefer the medium, progressing at their own speed, and being able to take portions of the course at any hour.

A goal in the Virtual Workshop evolution is experimentation with techniques intended to provide more interaction, as well as options for participants with different learning styles. Features we have added include

- Glossary, written in JavaScript. The definition appears by either hovering the mouse over or clicking on a glossary term.
- Interactive quizzes, written in VBScript. The quizzes are multiple choice forms. Submitting the quiz form automatically grades the quiz and returns a list of questions that were answered incorrectly, with optional explanations. The results are also written to a database, enabling us to review results for problem concepts.
- Personalized detail level with JavaScript. Easily moving between an outline version and a detailed version of the materials allow workshop participants to move through a topic in a way that best suits their learning style and needs.
- Animations using flash, QuickTime. Animations enhance the text description of a concept and break up pure reading material.
- MOO/Chat/ - Discussion Forums. We have experimented with various forums to provide consulting, as well as to promote discussion among the participants.
- Virtual Workshop Companion, utilizing Java programs and Perl scripts. Provides the ability to edit, compile, set run-time parameters such as number of processors, and submit a program, all without leaving the Web browser, via secure authentication.

One of the features we have used for about five years is the addition of video clips. Video clips are most often used to enhance a portion of a topic rather than provide a full presentation, e.g. the majority of a module is text, with a video included to introduce the topic or explain an important or difficult concept. The clips most often contain a speaker, screen capture, or motion graphics.

Unfortunately, using video clips has had a number of drawbacks: a few years ago, even short clips were very large, and could rarely be downloaded over most participants' network connections, and players were not available across all platforms. In development, it was time consuming and difficult to pair video clips with supporting materials, such as Web pages or slides. Network and desktop improvements have largely solved the first two problems, and we began to investigate solving the third.

Finding the Right Tool: Develop or Purchase?

The features we most wanted when playing the clip were:

- The ability to present audio, video, and a Web page or slide together on the Web page
- Synchronization of Web pages with video and/or audio
- The ability to focus attention on different parts of the Web page or slide at specified points during the clip. This would be used sparingly to focus attention, not to the point of annoyance.
- The ability to easily use the controls to stop, start, pause, resume, forward, and rewind the clip. At the same time, total length and current progression through the clip should always be visible. With these features, there is no need for slow motion. If the viewer doesn't understand or misses something, they can simply rewind and replay.
- The inclusion of a table of contents or index, which will allow the viewer to either jump into the desired section directly, or to view the whole segment in one piece.

We began the task of writing scripts to create such a presentation scheme. However, this past November, a new tool became available that meets all of our requirements for video clip creation and display: Microsoft® Producer for PowerPoint® 2002. In addition, this tool allows us to easily add audio, video, and screen capture paired with PowerPoint or HTML pages.. These capabilities were feasible to develop, but using this tool makes it much more cost-effective. Therefore we are now able to add video clips to Web pages where it makes most sense.

Description of the Video Clips

We are designing and producing a variety of video clips. The video clips will be used to enhance existing online materials, and will occasionally provide full lectures. The video clips are intended to improve our online educational materials by making the content more engaging and easier to understand. Two types of video enhancement we've been working with for several years now are speaker video or audio only, and screen capture.

Some web design sources, such as (Horton 2000) recommend video be used only as a last resort, for several well-founded reasons, including bandwidth requirements and production expense. This source and feedback received to date firm our preference for including short clips, only where most needed.

Screen Capture Video Clip

Capturing a computer screen session is a common feature in tools such as SnagIt from TechSmith®. Most file types created using these tools can be incorporated into Microsoft Producer projects, or Microsoft Producer itself can be used to capture the screen session.

Using screen capture with narration, we can record the technical expert "showing" how to use a tool or program, and hear him/her explain the process. In other words, this is a screen recording, with a speaker voice-over. Ideally, it has the effect of looking over the expert's shoulder while a tool or procedure is demonstrated and explained. Previously, our online materials covering use of graphical tools would use text and screen stills followed by a tutorial that walked the reader through the steps of a simple use of the tool. This is very tedious, error-prone, and frustrating. We feel that screen capture is a faster, more effective introduction.

Currently, our display for screen capture video clips consists of

- A video area, which should be as large as needed to see the detail of the tool being demonstrated
- An audio recording

- A table of contents, which can be omitted if the clip is very short, or the procedure cannot be broken into distinct sections
- A small HTML section which contains typical Web page information, such as date, copyright, and a link to return to the home page

Additional design possibilities we are experimenting with include:

- Offering the option to try to use the tool while viewing the demonstration.
- Using annotation such as a red circle or arrow to bring attention to portions of the screen.
- Including a set of several clips to cover different scenarios and programming languages.
- Making available supporting material, such as relevant hyperlinks.

Speaker Video Clip

Using speaker video paired with a Web page, the speaker video can assist in explaining a difficult point or be utilized to give a full talk. A speaker video can be helpful in giving the materials a human look and feel. Most of the people who use our materials never see the developers and consultants; many have never seen Ithaca. Adding a "Welcome to the Virtual Workshop" clip or a clip that introduces Virtual Workshop participants to the consultants serves to put a face on the materials, and hopefully, make them more comfortable interacting with us by email or chat room. As we all know, individuals do not all process information the same way; some learn better by reading, some by watching, some by experimenting, and of course sometimes a difficult concept only becomes clear when looking at it in a variety of ways. Our materials consist of text, pictures, animations, etc. Supplementing words and pictures with an expert speaker might provide additional help for difficult points. In the same vein, a non-gratuitous video clip can break up the monotony. Although the materials are fairly interactive, with reading, animations, simulation programs, diagrams, quizzes, and lab exercises, they can still benefit from an interlude of this type. And finally, though we intend to primarily use this tool to provide clips and not full topic lectures, some lectures will never be transformed into Web materials unless they are captured as live lectures and put online simply and easily. It is faster to videotape a live lecture and pair it with the speaker's slides than to develop web pages from the materials.

Currently, our display for speaker video clips (see Figure 1) consists of

- A video area, which can be fairly small. A head and shoulders video of a speaker can be very effective even in a small size, and many speakers are relieved to hear his/her face will not fill the screen.
- A table of contents, which we include even when the clip is very short, since it makes more sense to be able to pick and choose from a lecture. The table of contents is always placed on the left to promote the comfort level gained by displaying this piece where most people are accustomed to finding it.
- The supporting materials, either a set of Web pages or PowerPoint slides. Before we began using Microsoft Producer, we made the assumption that we would have to use HTML pages to avoid porting and converting issues. The addition of PowerPoint slides is a welcome change for some content developers, and sometimes the only way we can capture material from outside speakers. In addition, it's easier to add timed annotations to PowerPoint slides.
- A small HTML section which contains typical Web page information, such as date, copyright, and a link to return to the home page

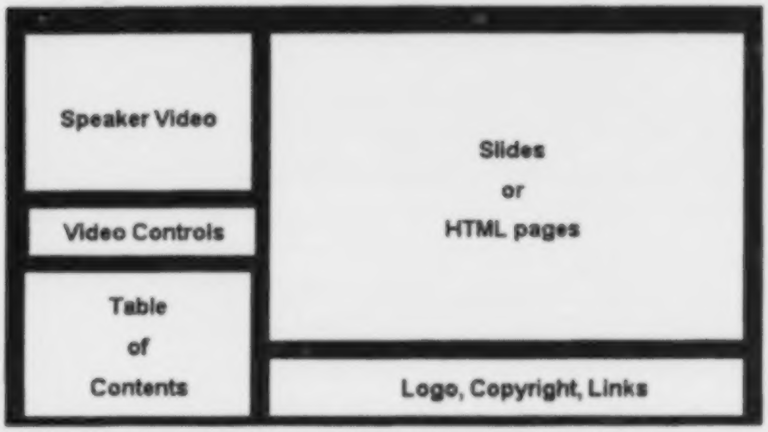


Figure 1: Diagram of display for speaker video clips

Additional design possibilities we are experimenting with are primarily in how we capture the speaker video. Methods we have, and plan to try include:

- A staged video shoot, where the speaker lectures to the camera in a quiet room. This method gives the opportunity to control the set and lighting, redo lines or whole sections, and edit the resulting video.
- Live lecture, where the speaker is talking to a live audience, and the camera is moved to the location as needed.
- Live lecture, where the room is always video-capture ready, with recording equipment always in place.

We have found that lighting is an important consideration. It is easier to adjust lighting levels in a staged video shoot than in a lecture room, where the lighting on the lecture screen often overpowers the lighting on the speaker. In delivery, the speaker in a staged shoot speaks to the person viewing the Web page, while in a live lecture the Web video often suffers. On the other hand, in a live lecture the speaker is often more animated; our speakers tend to be more wooden when speaking to a camera. Finally, in a staged shoot, the director can place the speaker in a chair; in a live shoot, the camera operator must be either very alert and skilled in tracking a moving speaker, or settle for a wide shot, resulting in a very small speaker image on the web page. However, the decision usually is not based on these issues, but rather what time, resources, and the speaker will allow.

Costs, Problems, Solutions

We began working with a browser tool and writing scripts to create the layout and presentation we were seeking. However, generalizing the scripts was time consuming, and the indexing table of contents we developed was too complicated and error-prone. In contrast, Microsoft Producer met our design goals, and is a free download for Microsoft PowerPoint 2002. To run the tool requires only Microsoft PowerPoint 2002.

To run the resulting web page requires

- Windows 98 or Windows NT 4.0 or higher
- Windows Media Player 6.4 or higher
- MSIE 5.0 or higher

This may seem like a strict set of requirements, but we felt that it would be too cost-prohibitive to develop our own tool that would reach a wider audience. Regardless of the solution, some percentage of Web page viewers would not be able to view the video clips. For clips containing content critical to the topic, we will continue to provide the materials in an alternate format, usually a series of still graphics and text.

BEST COPY AVAILABLE

We have seen by entries on our registration forms that the playback restrictions still allow us to reach the majority of our users; however, we will continue to track this number, as well as results from larger online surveys. In our case, the target is the equipment in homes and offices, for both our users and our potential users. Increasingly, this type of material is being put on CD, as well, for distribution at trade shows.

Research Plans

At this point most of the major questions have been answered. We have chosen a tool to produce the video clips, decided on two basic designs, and have begun to create production pieces. However, there are further issues to investigate:

1. The types of information which benefit most, e.g. complex concepts or procedural examples
2. Most instructive video clip components, e.g. speakers, or screen capture, or audio enhancement
3. Best layout and sizing for the various components
4. Most effective clip length

We expect additional issues will arise during research.

One area discussed that has not been investigated is finding a good way to encourage and allow the viewer to try a procedure while it is being explained. This will be the next new area being investigated.

Future Work

We are currently both creating production pieces and continuing to research issues such as those described next, with the goal of continuing to improve and refine our use of video clips. Valuable suggestions for evaluating online multimedia are included in (Kennedy 1999) and (Weston 2001).

Is the layout both clear and aesthetically pleasing? Are the major elements sized appropriately? Have we chosen the most readable font type and size? Is it clear how to navigate the page? Do the controls work as expected? The first three questions can be explored by showing the test group several possible layout schemes. Navigation and video controls can be tested by first watching each tester experiment, then tracking steps taken to navigate to a particular place in the clip; did the person choose the easiest method? These evaluation methods are described as direct observation and think-aloud interviews (Weston et al. 2001). We expect that for most of these issues we have already found the best solution, because we chose the conventional layout to increase comfort from the outset; e.g. the table of contents is at the left as expected, the footer on the bottom, and the video controls have the standard look and placement.

Which playback speed gives best quality without exceeding the bandwidth limits? Is it better to have one speed that is best for the majority, to auto select a speed based on connection type, or to let the viewer choose a speed? What is the ideal length of a clip? The best overall speed is difficult to define, because there is a wide range of target hardware and software, and it keeps changing; otherwise this would be the ideal since it is the simplest, least error-prone solution. One way to learn the preferred choice is to present all of these possibilities, and track web hits for what is chosen most often. It is expected that the auto-selected speed will be most popular, because I have learned through working with small test groups that even technically-savvy people are not sure which speed is best for them; they prefer to have this choice made for them. The ideal length of a clip can be tested by both watching and testing participants. The best length is expected to be less than five minutes; anecdotal feedback confirms that if a web clip is longer, attention will stray to email and other distractions. A study on using technology for language study (Ng 2000) found that PowerPoint presentations longer than twenty minutes were found to be very boring; ten minutes or less was advised. And although the broadband connections are continually improving, it is recommended that video file sizes be no larger than 320 x 240 for higher speed connections (Williams 2002).

And most important, does the use of video clips enhance understanding? Do "friendly faces" lead to improved or increased interactions in other parts of the course? Do clips interspersed in other web materials help keep the reader engaged in the module? What types of information are best presented this way, introduction, concepts, or topics with graphic elements? Testing will consist of checking whether modules with clips are completed more often than those without, reviewing the number of questions and tone for modules with and without a person associated, and comparing test results for modules that have video clips versus those with images and text. It is expected that this set of questions will be the most difficult to answer definitively, but that some level of improvement will be seen in all areas. A study on remote lecture presentations (Willie et al. 1999) found that presentations that include slides with sound and video have a higher hit rate than any other presentation type.

Author Biography

Susan Mehringer is a Senior Technical Consultant at the Cornell Theory Center, where she has been since 1987. Her current projects include work on the Virtual Workshop, including developing modules, consulting, and assessing WWW statistics; testing new systems and software; consulting; and developing and delivering training materials.

All brand names and product names referred to in this paper are trademarks or registered trademarks of their respective holders.

References

Horton, W. (2000). *Designing Web-Based Training.* New York, NY: John Wiley & Sons, Inc.

Kennedy, G. (1999). Defining the Dimensions of a Formative Evaluation Program: A Multi-Method, Multi-Perspective Approach to the Evaluation of Multimedia. *Proceedings of ED-MEDIA 99 World Conference on Educational Multimedia, Hypermedia & Telecommunications, 1999.* Association for the Advancement of Computing in Education, Charlottesville, VA. 640-645.

Ng, R. (2000). The Effectiveness of Using Technology to Teach English as a Second Language. *Vocational Education and Training for Life Long Learning in the Information Era, 2000*, IVETA Conference Proceedings, Hong Kong, China, 69-74.

Weston, T. & Barker, L. (2001). Designing, Implementing, and Evaluating Web-Based Learning Modules for University Students. *Edcuational Technology*; v41 n4, 15-22.

Williams, R. (2002). *Web Design Workshop.* Berkeley, CA: Peachpit Press.

Willie, S., Pui, C., & Palmer, A. (1999). Remote Lecture Presentation Preferences for Internet Delivered Continuing Medical Education. *Proceedings of ED-MEDIA 99 World Conference on Educational Multimedia, Hypermedia & Telecommunications, 1999,* Association for the Advancement of Computing in Education, Charlottesville, VA. 190-195.

Self and Peer Assessment in an Online Collaborative Learning Environment

Marylu Menchaca	Paul Resta	Carolyn Awalt
University of Texas	University of Texas	University of Texas
venus-v@mail.utexas.edu	resta@mail.utexas.edu	cawalt@mail.utexas.edu

Abstract

A challenge in online collaborative learning teams is assuring that all members of the virtual learning team are actively engaged and contributing to the work of the team. One strategy to hold individual members of a learning team accountable for their contributions is through the use of peer and self evaluations. This paper provides a summary of an analysis of peer and self evaluations as part of an ongoing study of the use of peer and self assessment in online collaborative learning environments. The subjects of the study were on-campus and off-campus students who were enrolled in a web-based graduate course in collaborative learning. Based on a factor analysis of repeated self and peer evaluations, two factors were identified. The present study focuses on developing a deeper understanding of the two factors. The nesting of the self and peer evaluations and the dependency of the repeated measures data guided the use of a hierarchical mixed effects linear model with the two factor scores as the dependent variable and self or peer, team, assessment time, gender and campus presence as the predictors. Among the findings are that students change their evaluations of themselves and peers over time, showing more differences as time goes on. Gender differences are also noted in their scores. Off campus men decrease their task performance and their contribution to the positive social interaction with time.

Introduction

There is growing interest in the use of collaborative learning in web-based courses. Among the challenges posed by the use of virtual learning teams is assuring that members of the learning team actively participate and contribute to the team's learning projects. As part of ongoing research on the use of self and peer assessment in online collaborative learning environments, this study is focused on an analysis of factors related to self and peer assessment in a web-based graduate level course on computer-supported collaborative learning. Factor 1 relates to the active process of engagement in actions that result in the successful completion of collaborative tasks in the online course and Factor 2 relates to the social dimension of human interaction required for the positive and successful interaction in groups. Factor 1 appears to be the online reflection of the personal characteristics of Instrumentality and Factor 2 of Expressiveness.

The subjects in the study included: 1) on-campus students who were enrolled in degree programs in a large urban Southwestern research university; and 2) off-campus students who were enrolled in a web-based degree program in instructional technology offered through the university system. The virtual learning teams formed in the course were balanced with both on and off-campus students as well as other factors such as gender, technology expertise, and cultural background. 75% of the students were women and 25% men.

There has been growing interest in the use of peer and self assessment as a tool to hold individual members of a collaborative learning team accountable for their contributions to the team's learning projects.

Assessment may serve three purposes. Assessment may be used as the basis for allocating a grade (a form of summative assessment), to provide feedback to guide or improve practice (formative assessment), or to compare the effectiveness of curriculum elements (comparative assessment). (Wolz et al., 1997, p. 62). In this study, the peer and self assessments were used in part to determine their grade and, more importantly, as a means of providing group members with feedback related to their efforts and work on online team projects.

Van Merriënboer (1997) conceives of self-assessment and peer-assessment as complex skills or as a skills hierarchy. He suggests that self assessment can be defined as the students taking responsibility for monitoring and making judgments about characteristics of their own learning. Students are required to think critically about what they are learning and to identify performance standards, and to apply them in the assessment of their own work. Van Merriënboer defined peer-assessment as an assessment in which the student takes responsibility for making critical judgments about the learning of peers and applying the agreed on standards to the work of their peers. (Van Merriënboer, 1997).

Sluijsmans & Moerkerke (1999) report that students become more involved in the learning and in the assessment process. They find that self-assessment promotes more reflection on one's own work and products of higher quality. Boud (1990) stresses that higher education assessment practices need to be compatible with the curricular goals. Sluijsmans_& Moerkerke (1999) state that one of these goals should be that students take responsibility for their own learning and at the same time evaluate their own learning at different phases in the instruction process.

Current Instructional technology perspectives of learning (e.g. Brown, Collins & Duguid, 1989; Duffy & Jonassen, 1992; Brooks & Brooks, 1993; Duffy & Cunningham, 1996; Jonassen, 1996; Maddux et al, 1997) leads us to view knowledge as constructed uniquely by the individual, in multiple ways, through a variety of authentic tools, resources, experiences, and contexts. Social interaction introduces multiple perspectives through reflection, collaboration, negotiation, and shared meaning. If we consider that learning is both an active and reflective process, and that the reflection in the personal learning process is a key component and together with the process in which the peers engaged can be used.

The impact of individual characteristics on learners' success in hypermedia environments has been documented in Dillon and Gabbard (1998) review of the hypermedia research literature. Hartley and Bendixen (2002) state that there is a need for better conceptualization of the impact of learner attributes like self-regulation and epistemological beliefs in new hypermedia learning environments, and also there is a need to examine how different learners can benefit or not benefit from their use. They argue that it is essential to better comprehend how learners' characteristics impact their ability to succeed in environments that are very different from traditional learning situations and they stress the importance of looking at characteristics that research demonstrated to be important in learning.

The online medium seems to influence collaboration along several dimensions. Verdejo (1996) emphasizes the verbal exchanges among learners, centering collaborative learning on a "conversation or dialogue paradigm". Following his view, if we consider learning as a process that occurs in a reflexive dialogue, then the conversation precedes the action. Some of the time we engage in conversation with our own selves and we prompt ourselves to action. Other times the conversation or exchange of words -the social interaction- becomes like the glue that bonds a community. At the same time, the social interaction is the building block that keeps together the learning community and through which learning occurs and products are developed.

Recently, Menchaca and Resta (2002), borrowing from earlier gender research that described the personal characteristics of masculinity and femininity (Spence & Helmrich, 1978), lately named "Instrumentality" and "Expressiveness", reported two similar factors found in a study of the peer and self Online Teamwork Assessment Scale (OTAS). In their initial exploratory study, two personal characteristics "Instrumentality" and "Expressiveness" appear as the OTAS factors and seem to be determining the online interactions of students in online collaborative learning groups.
The self and peer assessment data seem to be measuring two constructs underling the process of online collaborative learning work: Instrumentality and Expressiveness. The high presence of both personal characteristics "Instrumentality" Factor 1 and "Expressiveness" Factor 2 expressed in action and interaction is important for team success in online learning environments.

The successful attainment of tasks and positive social interaction in online learning communities requires the presence two dimensions: One, a self management personal dimension or "Instrumentality", similar to the personal characteristics called masculinity by Spence & Helmrich (1978). Instrumentality leads learners to be involved and accomplish tasks that promote the team goals. Two, a social interaction skills dimension or "Expressiveness" previously called femininity, necessary to maintain the positive social climate. The electronic world of work shared by modern men and women, requires the exercise of instrumentality for successful professional activities. It is also important to maintain satisfying personal relationships in a promotive social climate. Effective team work is enhanced through positive expressiveness and empathy that promotes constructive interaction and the well being of others. Both characteristics represent the sine qua non ingredients of successful interaction and attainment of the group common goals (Menchaca & Resta, 2002).

Materials and Methods

When faced with the task of self assessment (SA) or peer assessment (PA), students from diverse backgrounds experience a significant degree of difficulty with the task. Self or Peer Assessment requires a learning process for the student to become comfortable with the assessment task. Gender of the peer evaluator may also be a factor. The following questions are important in developing a better understanding of the use of peer and self assessment.

- Does peer and self-assessment carried on in an online collaborative community of practice reflect the team interaction process?

- What does the repeated peer and self-assessment process reveal of the teamwork process? Is there a training effect on the student ratings over time?
- Do self assessment (SA) or peer assessments (PA) provide significantly different results?
- How do peer and self-assessment vary across time for different teams, campus presence and gender?

The course used in the study was entirely web-based with all course materials made available and all communication taking place online. There were 22 students in the course and they worked together in completing four projects. Three fourths were women. Roughly half were students who were on-campus students and the other half were distance education students from areas across the state and country. Web-based forms of the Peer and Self Online Teamwork Assessment Scale and rubrics were used at the end of each project by students in performing the peer and self assessment. Peers also conducted assessments of the other teams products as well as their own at the end of each project. Student's grades were composed of both individual and collaborative scores. The assessments were anonymous and only the student and the instructor could view the peer assessment scores which were based on the average of the ratings of the self and peer assessment.

The data analysis focused on understanding how the factors changed throughout the repeated measures of the course, between self and peer assessment, gender, campus presence and teams. A hierarchical mixed effects linear model was used as indicated by nature of the nesting and repeated measures of the peer and self assessment data. Because evaluations of the same person are similar, evaluations of peers coming from the same student are similar and the self evaluations are also similar, we selected a data analysis model that takes into account the nesting and dependencies of the data. The rating a student makes of peers reflects personal attitudes, beliefs and interpersonal style. In the same manner, a student views their own performance and contributions through a uniquely personal perspective.

Table 1. Covariance Parameter Estimates

Variation due to	Estimate	Standard Error	Z Value	Probability of Z
Student	0.02724	0.01196	2.28	0.0114
Evaluator	0.01100	0.004957	2.22	0.0133
Residual	0.1100	0.006079	18.10	<.0001

The mixed effect hierarchical model had the two factors of collaborative teamwork, instrumentality and expressiveness as the dependent variable. In the model the predictors were: self or peer evaluation, assessment time, team, gender, campus presence, and the interaction between self/peer by time and gender by time interaction. In order to be able to simultaneously explore the two factors a dummy variable was created, Whichfact that stands for which factor. Which Factor was significant in this model (Whichfact $F_{1,655}$ =

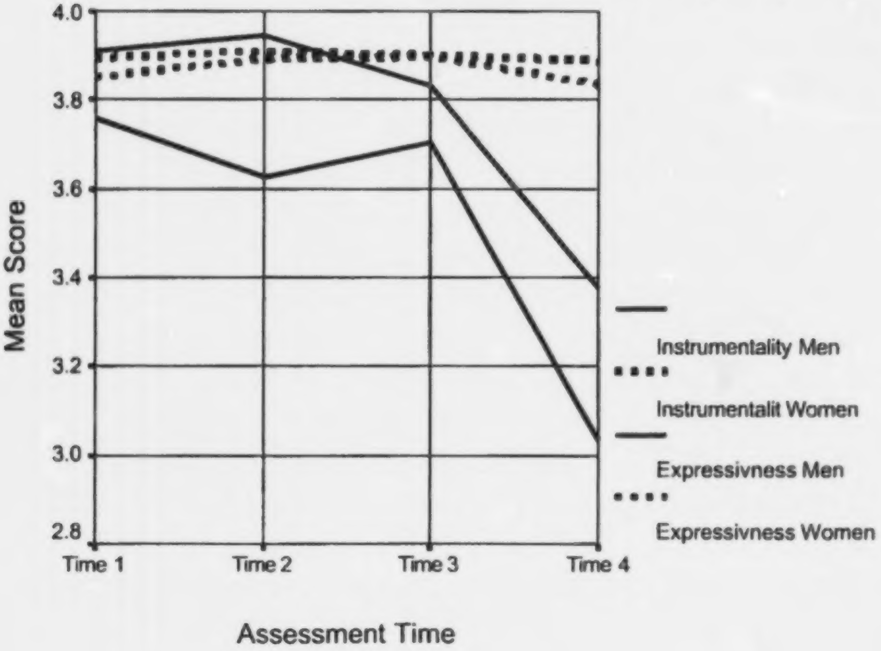
12.39 p = 0.0005 Table 2). More variance (variance for Student = 0.027 Table 1) is explained by the student then by the evaluator (variance for Evaluator = 0.011 Table 1).

Table 2. Type 3 Tests of Fixed Effects

Effect	Num DF	Den DF	F Value	Pr > F
SELF	1	655	0.53	0.4689
TIME	3	655	22.93	<.0001
GENDER	1	655	8.80	0.0031
TEAM	5	655	0.85	0.5160
INCAMPUS	1	655	1.41	0.2359
SELF*TIME	3	655	3.40	0.0174
TIME*GENDER	3	655	32.03	<.0001
WHICHFAC	1	655	12.39	0.0005

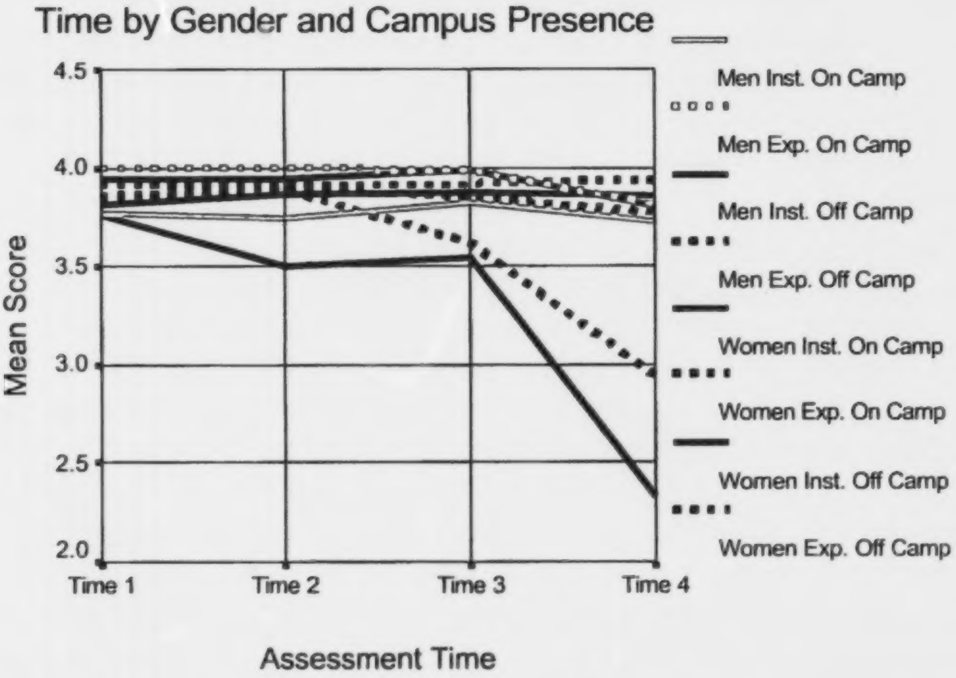
Through repeated practice on peer and self assessment over time, students learned to perform the evaluation process to reflect their assessment of the differential performance of others (Self by time $F_{3,655}$ = 3.40 p =.0174, Table 2). The main effect of Self versus Peer was not significant (Self by time $F_{1,655}$ = 0.53 p =.0.4689, Table 2).

Figure 1.Mean Factor Scores Change by Time



However, it is interesting to note that in some instances of missing data, when a student gives evidence online of not sharing their teamwork load rather than completing a self assessment in which they would have difficulty in rating themselves high on very specific indicators of active contribution to the team, they would choose to not complete the self evaluation.

Figure 2 Mean Factor Scores Change



The data also suggests the possibility of cross-cultural differences in the assessment experienced by students. There are some indications of reluctance to rate peers other than at a high level by some students. Further research needs to be conducted across students with different cultures to determine the extent to which culture may represent an important factor in peer evaluation.Students varied in the way they performed the evaluations over time (Time $F_{3,655}$=22.93 p <.0001Table 2 and Figure 1). At the end of the course students assigned lower scores to themselves and to classmates they viewed as not performing according based on criteria presented in rubrics for a high score. Men and women also differed in the way they were evaluated by their classmates (Gender $F_{1,655}$ = 8.80 p = 0.0031, Table 2 and Figure 1). Gender differences interacted with evaluation time (Time by Gender $F_{1,655}$ = 8.80 p = 0.003, Table 2 and Figure 1). Women's scores tended to stay high while men's scores tended to decrease over time although all peer and self assessment tasks were performed with the rubric for the quality of their collaboration.

The analysis indicated that students change the way they evaluate themselves and peers over time. In the process of self and peer assessment, students reflected on the performance of team members toward their goals (Instrumentality). The quality of team social interaction (Expressiveness) is also reflected in their observations of performance of their peers. Factor 1 relates to the active process of engagement in actions that result in the successful completion of tasks and Factor 2 relates to the social dimension of human interaction required for the positive and successful interaction in groups. In the mixed effect hierarchical model used no significant differences were found between teams (Teams $F_{5,655} = 0.85$ $p= 0.5160$) and campus presence (Campus $F_{1,655}=1.41$ $p = 0.2359$, Table 2).

In summary, the analysis of the self and peer assessments within a web-based course indicates that there is increased differences in peer and self evaluations over time that may reflect a training effect of students becoming more comfortable and competent in performing peer and self evaluations. It is also interesting to note consistent gender differences in peer evaluation. Also of interest is the observation that off-campus male students tend to decrease their task performance and contributions to positive social interaction of the team over time. The questions raised by these findings will be examined in further studies of the peer and self assessment process in online collaborative learning teams.

Bibliography

Boud, D. (1990). Assessment and the Promotion of Academic Values. *Studies in Higher Education*, 15(1), 101-111.

Brooks, J. G., & Brooks, M. G. (1993). *In search of understanding: The case for constructivist classrooms.* Washington, DC: Association of Supervision and Curriculum Development.

Brown, J. S., Collins, A., & DeGuid, P. (1989). Situated cognition and the culture of learning. Educational Researcher, 18.

Dillon, A.Gabbard, R. (1998). Hypermedia as an Educational Tool: A Review of the Quantitative Research Literature on Learner Comprehension, Control, and Style. *Review of Educational Research* v68 n3 p322-49 Fall

Duffy, T. M., & Jonassen, D. H. (1992). Constructivism: New implications for instructional technology. In T. M. Duffy & D. H. Jonassen (Eds.), *Constructivism and the technology of instruction: A conversation* (pp. 1–16). Hillsdale, NJ: Lawrence Erlbaum.

Duffy, T. M., & Cunningham, D. J. (1996). Constructivism: Implications for the design and delivery instruction. In D. H. Jonassen (Ed.), *Handbook for Research for Educational Communications and Technology* (pp.170-198). New York: Simon & Schuster Macmillan.

Engeström, Y and Cole, M. (1993) "A cultural-historical approach to distributed cognition", in Soloman, G (ed) *Distributed Cognition*, Cambridge, Cambridge University Press.

Hartley, K Bendixen. L. D. (2002) Educational Research in the Internet Age: Examining the Role of Individual Characteristics. *Educational Researcher,* 31, (1) pp. 22-26.

Jonassen, D. H. (1996). *Computers in the classroom: Mindtools for critical thinking.* Englewood Cliffs, New Jersey: Prentice-Hall.

Kaptelinin V,. Nardi , B.A., "Activity Theory: Basic Concepts and Applications", Workshop CHI '97, http://www.acm.org/turing/sigs/sigchi/chi97/proceedings/tutorial/bn.htm

Lave, Jean and Wenger E., (1991), *Situated Learning: Legitimate peripheral participation*. New York: Cambridge University Press.

Lejk, Mark & Wyvill, Michael. (2001). Peer Assessment of contributions to a group project: a comparison of holistic and category-based approaches.Assessment & Evaluation in Higher Education. Vol .26 (1), pp.61-72

Lin, S.S.J., Liu, E.Z.F., & Yuan, S.M. (2001). Web-based peer assessment: feedback for students with various thinking-styles. Journal of computer assisted Learning (2001) 17, p. 420-432 P. 423

Maddux, C. D., Johnson, D. L., & Willis, J. (1997). *Educational computing: Learning with tomorrow's technologies,* Second Edition. Boston: Allyn and Bacon.

Magin, D. (2001) A novel technique for comparing the reliability of Multiple peer assessments with that of single teacher assessments of group process work. Assessment and evaluation in higher education. Vol 26(2) pp. 139-152.

Menchaca, M. , Resta, P. (2002). A Factor Analysis of Peer and Self Assessments of Members of Online Collaborative Learning Teams. Paper proposal sent to AERA 2003.

Morris, J.'(2001). Peer assessment: a missing link between teaching and learning? A review of the literature. Nurse Education Today. Vol. 21 pp. 507-515.

Pond, K., Ul-Haq, R. & Wade, W. (1995). Peer review: a precursor to peer assessment. *Innovations in Education and Training International*, 32, 314–323.

Schön, D.A. (1983). The reflective practitioner: How professionals Think in Action. London; Temple Smith.

Schön, D.A. (1987). Educating the reflective practitioner: towards a new design for teaching and learning in the professions. San Francisco, CA: Jossey-Bass.

Sluijsmans, D. & Moerkerke, G. (1999). Open University of the Netherlands Student involvement in performance assessment: A research project. European Journal of Open and Distance Learning.

Spence, J., & Helmrich, R. (1978). Psychological dimensions of masculinity and femininity: Correlates and Antecedents. Austin: University of Texas Press.

Van Merriënboer, J. (1997). *Training complex cognitive skills*. Englewood Cliffs, NJ: Educational Technology Publications.

Verdejo, M. F. (1996) "Interaction and Collaboration in Distance Learning through Computer mediated Technologies". In *Advanced Educational Technology : Research Issues and Future Potential* Computer and Systems Sciences, 145 . Pages 77-88. ISBN 3-540-59090-0. Springer-Verlag.

Wolz, U., Palme, J., Anderson, P., Chen, Z., Dunne, J., Karisson, G., Laribi, A., Sirkku, M., Spielvogel, R., & Walker, H. (1997). Computer-mediated communication in collaborative educational settings, Report of the ITICSE'97 Working Group on CMC in Collaborative Educational Settings.

ELearn: A collaborative educational virtual environment

Anna Michailidou & Anastasios A. Economides
{michan,economid}@uom.gr
Information Systems
University of Macedonia
Thessaloniki 54006, Greece

Abstract: *Virtual Learning Environments (VLEs) that support collaboration is one of the new technologies that show great interest, concerning the innovative methods that gain ground in every aspect of educational procedure. In this paper, we present ELearn, a collaborative virtual learning environment for teaching e-commerce that has been developed using Active Worlds. We have constructed a virtual school using an environment that integrates the appearance of the virtual world, the web pages that are connected with specific objects in the world and the capability of synchronous chat among the users. Collaboration and interaction were two of the most significant matters taken under consideration, due to their important role in educational procedure. An evaluation of the environment is also included, with regards to specific criteria that we have developed for evaluating VLEs.*

KEYWORDS: COLLABORATIVE VIRTUAL ENVIRONMENTS, EDUCATIONAL PROCEDURE, VIRTUAL REALITY.

1. Introduction

The evolving growth that occurs in network and communication technologies leads to their enhanced usage in many and different aspects of human activity. One of the technologies that show great interest is Collaborative Virtual Learning Environments, which is used in various aspects, such as tele-education. Virtual Learning Environments (VLEs) [1], are learning management software systems composed of computer-mediated communication software and on-line methods of delivering course material. The implementation of innovative pedagogical practices is a response to the social needs for educational change [2]. Participants are experiencing new ways of learning and communicating with teachers by organizing the learning environment in a different way, based on several technological innovations.

2. A short description of the tools that were used for the lessons development.

ELearn was the name of the virtual world that has been developed at the University of Macedonia (Thessaloniki, Greece), with the purpose of teaching some of the basic aspects of electronic commerce.

Active Worlds [3]-[5] environment has been used for the development of the lessons, using virtual reality. This environment integrates at the same window, the appearance of the virtual world, the web pages[1] that are connected with particular incidents regarding the virtual environment and even the prospect of synchronous chat among the users (Picture 1).

The ASP language was used in order to achieve the lessons administration [6]. In cases, where an application is used by a group of users, it is necessary to develop a strong administration tool. In the first page of such a tool, the opportunity of choosing any of the offered functions must be given. In such a case the following functions must be considered: the opportunity of adding - removing users (students, teachers) and even changing some of their elements, such as their address or phone number. Only the lessons' administrator is entitled of using the above. On the other hand, a user should have the ability of searching and finding information concerning the teachers or the students.

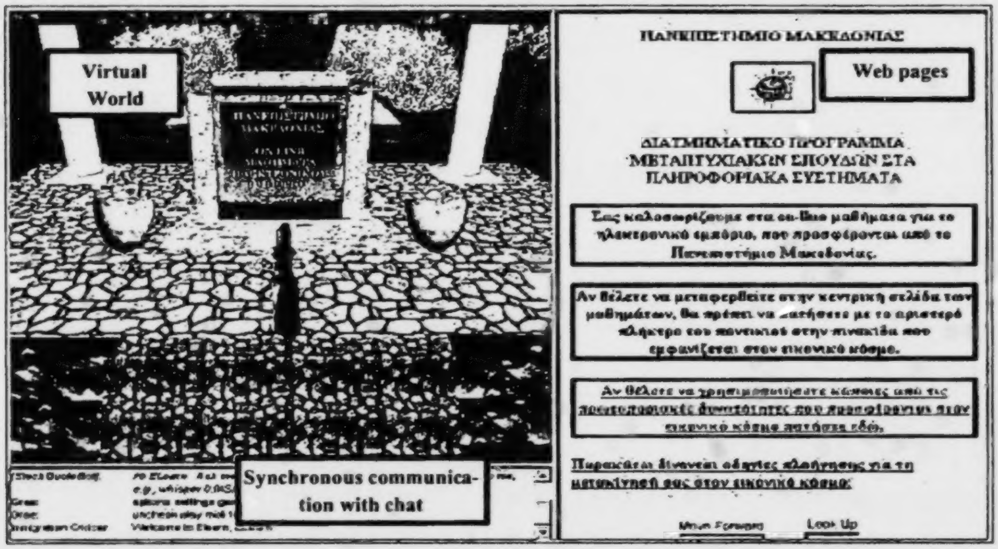
The web pages that are integrated in the Active Worlds environment have been created with the use of Microsoft Front Page 2000. The first page, having the role of a starter page, includes the following: Lesson map, Search, Information, On line enrollment, Administration, Communication and On line lessons of Electronic Commerce, which is the main page, concerning the lessons' development.

---

[1] Internet Explorer has been used for the development of the web pages.

BEST COPY AVAILABLE

- The **Lesson Map choice** consists of the contents of the two chapters that have been created regarding electronic commerce.
- The **Search choice** concerns the searching for information lying in the lesson pages.
- The **Information choice** includes elements of general interest, concerning the lessons.
- The **On line enrollment choice**, gives to a future student the opportunity to enroll for the lessons and also to a future teacher the opportunity of joining the teachers' team, with the objective of helping in the lessons construction.


ΠΑΝΕΠΙΣΤΗΜΙΟ ΜΑΚΕΔΟΝΙΑΣ

ΔΙΑΤΜΗΜΑΤΙΚΟ ΠΡΟΓΡΑΜΜΑ
ΜΕΤΑΠΤΥΧΙΑΚΩΝ ΣΠΟΥΔΩΝ ΣΤΑ
ΠΛΗΡΟΦΟΡΙΑΚΑ ΣΥΣΤΗΜΑΤΑ

Σας καλωσορίζουμε στα on-line μαθήματα για το ηλεκτρονικό εμπόριο, που προσφέρονται από το Πανεπιστήμιο Μακεδονίας.

Αν θέλετε να μεταφερθείτε στην κεντρική σελίδα των μαθημάτων, θα πρέπει να πατήσετε με το αριστερό πλήκτρο του ποντικιού στην πινακίδα που εμφανίζεται στον εικονικό κόσμο.

Picture 1.: The integrated environment, which was used for the lessons development.

- The **Administration choice** gives the opportunity of administrating the lessons (adding, deleting and changing information concerning students and teachers by the administrator - a password is necessary - and searching student - teacher - information - something accessible by any user-).
- The **Communication choice**, offers to any user the opportunity to communicate with the administrator by sending email and ask specific questions or make certain remarks.
- The **On line lessons of Electronic Commerce choice** leads to the central page concerning the lessons development. From this page, someone can choose any of the following choices:
  - ⇒ **Introduction:** it includes general information about electronic commerce.
  - ⇒ **Contents:** it includes the content of the lessons.
  - ⇒ **Chapter 1:** this chapter consists of four paragraphs with text, images and navigation links. The contents include information about the World Wide Web, definitions of electronic commerce, the necessity and the advantages and disadvantages of its usage.
  - ⇒ **Chapter 2:** as in the first chapter, there are also four paragraphs and consist of text, images, tables and navigation links. Specifically, the paragraphs refer to the market research that should be done before the construction of an e-store, the strategic planning which proceeds, the right presentation in the world wide web and the final stage of actual making the on line store. Additionally, in the fourth paragraph, two videos are included, as examples of two on line electronic stores.
  - ⇒ **Glossary:** it consists of some basic terms in alphabetical order, concerning the electronic commerce lessons.
  - ⇒ **Help:** it includes information on how the user can get help, through email to either the administrator or any of the teachers or students.
  - ⇒ **Exercises:** in order to make the application more educational, two tests are included, corresponding to the first and second chapter of the lessons. These tests consist of exercises, where the student can type the answer to the appropriate orthogonal frame and also of multiple-choice questions, where the student must choose the right answer from a group of choices.

BEST COPY AVAILABLE

⇒ **Library:** it includes sites concerning electronic commerce in a structured way so the users can find information regarding their interests.

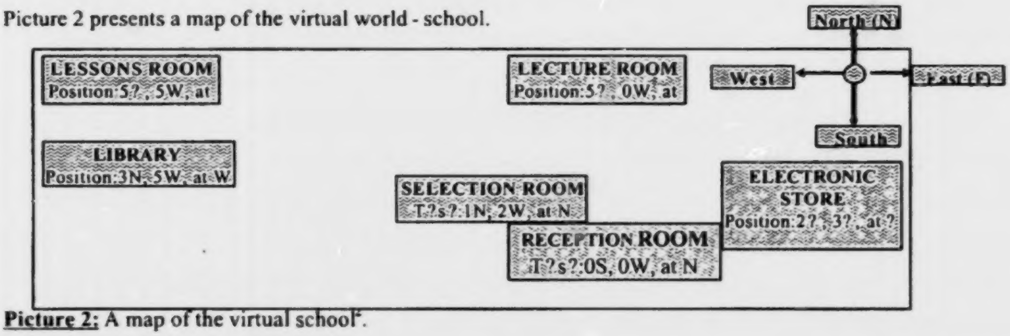
⇒ **Discussion Board:** it is a tool that can enhance collaborative learning. It can be used for creating discussions among interested users.

⇒ **Virtual Chat:** it also enhances collaborative learning. It can be used for synchronous chat between the participants.

For the conjunction of all the tools that concern the development of the lessons, the Active Worlds environment has been used [3]-[5], [7], [8]. The Active Worlds environment helps the user to create a virtual world and visit a number of other worlds available.

3. ELearn: A Virtual World of Electronic Commerce. Description.

Picture 2 presents a map of the virtual world - school.



Picture 2: A map of the virtual school[2].

There are six spaces to the virtual world: the reception room, the selection room, the lessons room, the library, the lecture room and the electronic store.

- **The reception room:** it contains an ancient temple with a sign placed at the center, which is welcoming the user. Additionally, at the chat window, the following massage appears: «WELCOME TO THE WORLD OF ECOMMERCE!» and a corresponding sound is listened.
- **The selection room:** it is connected with a web page that is also the main page of the lessons and includes the following choices: Lessons Map, Search, Information, On line Enrollment, Lessons Administration, Communication and On line lessons of Electronic Commerce, which is the central page that refers to the development of the lessons. Each of the previous choices corresponds to an object at the selection room. If someone presses with the left mouse button on an object, a corresponding web page will appear.
- **Lessons room:** it includes objects with signs, that each one of them is connected to a web page that contains information according to the specific topic of interest. The topics that are included are the following: Introduction, Contents, Chapter 1, Chapter 2, Glossary, Help, Exercises, Library, Discussion Board and Virtual Chat.
- **Library:** it includes sections filled with books. Each object that contains books is divided in three sections. In the first section, a sign is placed that informs the user for the contents of the next two sections. If the user left clicks on a section, he will be able to inspect the information that corresponds to that particular choice, at the web page window.
- **Lecture room:** the basic objects of the lecture room are the signs, the computer desks and the projection board. Every sign contains a paragraph title, from the first or the second chapter, concerning electronic commerce. If the user presses with the left mouse button to a sign, a web page concerning the correspondent paragraph will appear. If the user's avatar collides to a sign, a narration, concerning the subject will begin. Apart from the signs that are relevant to the paragraphs, there is one additional sign that refers to an example of an electronic store and two more signs, one for the use of the Discussion Board and the other for the Virtual Chat.

At the left side of the lecture room, there are **desks with computers**. If the user approaches a computer with the mouse pointer, an explanatory sign will appear that gives information on what will happen if a computer is pressed. The **projec-**

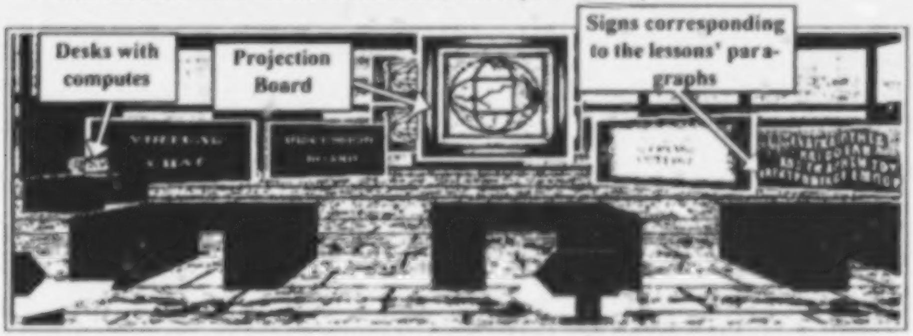
---

[2] This map refers to the position of each room at the virtual school, according to the north, south, east and west coordinates and to the direction of the avatar, the first time he/she visits the particular room.

BEST COPY AVAILABLE

tion board is located on the center of the room in front of the desks (picture 3). In the lecture room, two lectures are attended, concerning electronic commerce. The projection board is used for the slides change that concerns the lectures.

- **The electronic store:** it is an example of an electronic store that is located to the virtual world with the purpose of giving to the students the opportunity to understand how an electronic store is constructed in the «real» world. The store that is described offers cars, motorcycles and bicycles.

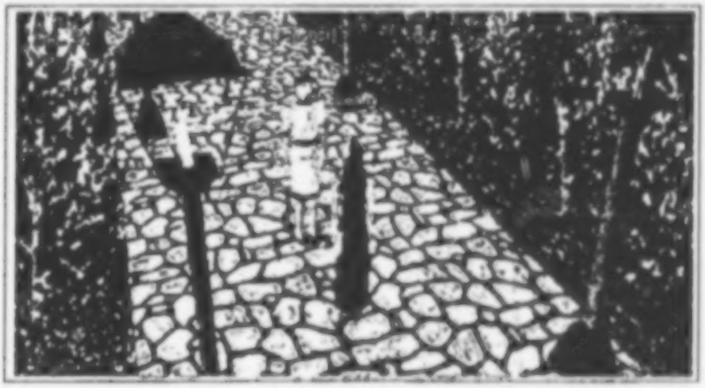


Picture 3: An aspect of the lecture room, where the basic objects are being viewed.

The Active Worlds environment offers the opportunity of using a Software Development Kit (SDK) [9]-[12], that allows the programmers to develop applications that can interact with the virtual world's environment. The most common type of application for the SDK is a bot.[3] Three (3) bots exist at the virtual world.

The first bot is named **Teacher** (Picture 4) and it is built for the purpose of helping the students during their navigation to the virtual world. The user can ask the teacher various questions concerning electronic commerce. The subjects that the teacher could be asked for, appear at the chat box, once the user types Help. A real teacher may manipulate the Teacher bot and therefore a discussion could be build between the teacher and some other users, based on any subject concerning the lessons. The teacher can also examine the students by asking them questions unknown to them. Additionally, a student can «whisper»[4] to the teacher and become recognized only by him.

The second bot is named **Salesman** and it appears whenever another user (avatar) enters the e-store. The salesman can give information concerning the products that are offered in the electronic store and advise the user of how he/she might fill an order form. The salesman can be used with the same way as the teacher.



---

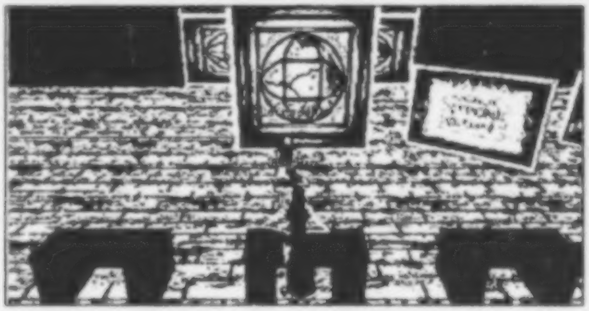
[3] A bot is typically an avatar that inhabits a virtual world and interacts with users. It is driven by a computer program, instead of a human being (citizen or tourist).

[4] A whisper is a chat massage sent directly to another user. When one whispers, the recipient is the only person who can hear what he says.

BEST COPY AVAILABLE

Picture 4: The teacher and the student coexist in the virtual world.

The third bot is named **Lecturer** and has the capability to give lectures, in the Lecture room (picture 5). The Lecturer can synchronize text spoken by the bot with changes in objects or .jpg images. Therefore, a virtual «slide show» can be created. The Lecturer's bot communicates by normal chat, but its more powerful feature is the ability to whisper to the avatars that are located in the lecture room. As a result, any other avatar that exists in another room of the virtual store, for example the electronic store, will not identify the Lecturer.



Picture 5: A lecture, as it develops in the lecture room.

4. Discussion

The evaluation of collaborative VLEs is not a simple task [13]. Without a descriptive model of the ideal collaborative learning process, we cannot easily find indicators (either qualitative or quantitative) that will tell us whether effective learning is taking place. Additionally, on the level of evaluation criteria, the criteria themselves need to be changed and adapted according to new findings and new constrains that result from system development. Therefore, formative evaluation needs to be performed on four levels simultaneously: **the pedagogical - psychological level, the technical - functional level, the organizational - economical level and the social - cultural level.** [14].

The **pedagogical - psychological level** includes all the criteria, referring to the learning process itself. For example, criteria such as support of different didactic methodologies, how to represent and modify knowledge, tools to define learning goals, or support for different roles (learners, trainers, tutors) need to be assessed at this level. The **technical - functional level** includes criteria that refer to the proper functioning of a concrete system, e.g., criteria such as stability, required bandwidth, interface design, e.t.c. The **organizational - economical level** deals with aspects of organizational context and constraints, e.g. how efficient and cost effective are computer supported learning processes compared to traditional ways of training. Finally, the **social - cultural level** evaluates how a system fits into the overall learning culture and how its users from a motivational and emotional point of view accept it. A model of evaluating collaborative virtual learning environments has been developed [15] - [18], based on the previous factors. Table 1 includes the evaluation criteria at the first column and some comments concerning the ELearn environment at the second.

5. Future work

The development of software, that is build on collaborative virtual environments could be proven extremely useful in the educational procedure. The current research and commercial interest in developing CVEs that support rich social interaction in densely populated virtual worlds is an ambitious goal, one that requires addressing a variety of technical challenges [19].

Based on future growth, the conjunction of virtual environments with databases that are continuously enriched with new elements in order to be synchronous is an interest aspect [20]. Another capability that is of great interest is teleimmersion that integrates the technology concerning collaborative virtual environments with audio and videoconference and other computer power demanding, technical capacities. Also, the addition of smart behavior to the system with the usage of intelligent agents is something worth of studying. Pedagogical agents are of great importance and can be used in collaborative virtual environments, as they are represented with a character (avatar), or a specific object (for example, a book).

The ongoing research involving VLEs is worthwhile, considering that the networking of multi - participant, collaborative virtual environments appears to represent a significant trend for future applications [17].

Evaluation parameters	ELearn environment
a. Pedagogical - Psychological parameters	
a.1. Teaching theories (collaborative learning, adaptive, constractivistic or conceptual model of teaching).	Collaborative learning is supported with the inhabitancy of many avatars at the same virtual world and the use of synchronous chat. There is also the capability of using the discussion board and the virtual chat.
a.2. Organization of the teaching material (it refers to the purpose of teaching, the age of the students and the aims of learning).	The lessons were developed with the purpose of teaching the basic elements concerning electronic commerce to pre-graduate students. A further development of the content is necessary in order to expand the field of analysis.
a.2.1. Teacher tools (can teacher take part in the development of the lessons, is there any directions concerning teaching, can the students be graded on line, can the teacher make exercises, quizzes, e.t.c.).	The teacher can participate at the development of the lessons and give exercises or grade to the students on line. It is essential for the teacher to have some basic knowledge of the tools that must be used in order to use the environment, to make a new test, to communicate with another teacher or student, e.t.c..
a.2.2. Student tools (can the students use on line help, possess their own email, use discussion boards or virtual chat, use asynchronous or synchronous ways of communicating, have access to their grades, e.t.c.).	The environment supports collaborative learning and therefore the students can use both synchronous and asynchronous ways of communication. They also can get help (the bots are essential) concerning the lessons (a glossary and the contents of the lessons are available). Searching is also included in order for someone to find information concerning the theme of interest. More attention should be given at the monitoring of the students progress.
a.3. Evaluating of learning(can the student use the environment soon enough without the teacher's help, interact freely with the environment, use interactive tests, e.t.c.)	The usage and navigation at the environment is easy and pleasant, through the user's interface. The students can interact with the environment under certain constraints - for example, they cannot change the objects properties or build anywhere at the virtual world -. There are no interactive tests included at the time being.
b. Technical - Functional parameters	
b.1. Development characteristics (are there any multimedia elements supported - pictures, sound, video, e.t.c. -, can the software being used at different platforms - Unix, Windows NT -, can the software communicate with a database, e.t.c.).	Various multimedia elements are supported and the software can be used in different platforms as well. The capability of using the connectivity with a database was not examined.
b.2. Designing the interface (is the environment designed in a clear and interesting way, how cautious where the designers concerning the text, pictures and other multimedia elements that where used, is it possible to personalize the user with an avatar, do the environment support facial and body gestures, is immersion supported - with the use of special equipment (the stereoscopic helmet, the gloves) -, e.t.c..	There has been an effort of designing the interface with an interesting way, using common ways of interactivity with the environment (e.g. signs) but also provoking the student to explore and learn. The user can be personalized with an avatar, facial and body gestures are supported but immersion is not.
b.3. Support procedures (can the students and teachers be informed on the software usage, is there any technical support offered by the company, is the software and the sites being often updated, is there a satisfactory security, concerning the files transaction, are there any mirror sites, e.t.c.)	The students and the teacher can use help concerning the software usage and the technical requirements. The procedure of updating the contents and the security problem need more work. There are no any mirror sites.
b.4. Administration tools (are backup files supported, are there any tools that prevent unauthorized access to the server, is on line enrolling possible, is there a way of administrating the lessons - add, delete, update records -, e.t.c.)	It is possible for the lessons administrator to retain backup files of the virtual world, on line enrolling is possible and an administration tool is being developed. The security matter needs to be more analyzed and developed. Furthermore, the ability of adding, changing and deleting students and teachers is entitled only to the administrator.
c. Organizational - Economical parameters (is it possible for the organization to support server hosting, advertisement of the lessons, is there any pricing policy and on what terms the users are going to be charged, e.t.c.).	The lessons were developed at the University of Macedonia and therefore server hosting was supported. There wasn't any study made on advertisement and pricing policy.
d. Social - Cultural parameters (are the differences on religion, cultural development, language, age taken under consideration, e.t.c.)	The lessons are not related with religion but the development on the basis on different culture and language may be crucial for on line teaching. The language used was Greek because the lessons where addresses to Greek students, but the development on a different language might widen the prospects of the software usage.

Table 1: An evaluation of the ELearn environment.

BEST COPY AVAILABLE

Bibliography - References

1. Sandy Britain, Oleg Liber *A Framework for Pedagogical Evaluation of Virtual Learning Environments*, University of Wales – Bangor, (1999), http://www.jtap.ac.uk/reports/htm/jtap-041.html .

2. International Forum of Educational Technology & Society. Formal Discussion Initiation, *'Implementing Virtual Learning Environments: Looking for Holistic Approach'*, Kessler, G. Drew, Doug A. Bowman, and Larry F. Hodges, (2000) *The Simple Virtual Environment Library, an Extensible Framework for Building VE Applications*, PRESENCE, 9 (2), Apr. 2000. pp 187-208.

3. http://www.activeworlds.com

4. http://www.activeworlds.com/tour.asp#build

5. http://www.activeworlds.com/3dhomepage/

6. John Kauffman, Kevin Spencer Thearon Willis, *Beginning ASP Databaes*, (1999), Wrox Press ISBN 1-861002-7-26

7. http://www.activeworlds.com/tech/

8. http://www.activeworlds.com/help/index.html

9. http://www.activeworlds.com/tech/sdk.asp

10. http://www.activeworlds.com/sdk/

11. http://www.activeworlds.com/tech/links.asp

12. http://www.activeworlds.com/tech/content.asp

13. Shirley Holst, *Evaluation of Collaborative Virtual Learning Environments: The State of the Art*, (2000) In: Friedrich Scheuermann (Ed.): Campus 2000: Lernen in neuen Organisationsformen. Proceedings of GMW 2000. Fachtagung der Gesellschaft für Medien in der Wissenschaft. Innsbruck, 19.-21. September, 2000, pp. 199-212, Medien in der Wissenschaft, Bd. 10, Münster, New York, München, Berlin, Waxman, 2000, ISBN 3-89325-925-2.

14. Hans-R?diger Pfister, Martin Wessner, Torsten Holmer, Ralf Steinmetz, *Evaluating Distributed Computer-Supported Cooperative Learning (D-CSCL): A Framework and Some Data.* To appear in: Proceedings of the 2nd international conference on New Learning Technologies (NLT99). August 30-31 1999, University of Berne, Switzerland, (1999), pp. 234-241, Bern, Universität Bern.

15. ? ??a???d?? ???a, ??????µ?d?? ? ?ast?s???, Ge?????d?? ???s?ßet, *S??e??at??? ???????? ?e??β?????ta ?a? ???s? t??? st?? e?pa?de?t??? d?ad??as?a. ??de??t???? a?a??se?? ?a? s?????se??*, ??a?t??? ?a?e??????? S??ed???? µe d?e??? s?µµet???, ??e? ?e???????e? st?? ??pa?de?s? ?a? st? ??pa?de?s? ap? ? p?stas?, ??????? 2001, ????µ??.

16. Georgiadou Elisavet and Anastasios A. Economides, *Evaluation Factors of Educational Software*, Proceedings IEEE,International Workshop on Advanced Learning Technologies, pp. 113-116, IEEE 2000.

17. Randolph L. Jackson, Eileen Fagan. *Collaboration and learning within immersive virtual reality*, Proceedings of the third international conference on Collaborative Virtual Environments, pp 83-92, (2000), ISBN 1-58113-303-0, ACM Press.

18. Georgiadou Elissavet, Anastasios A. Economides, Michailidou Anna, Mosha Anna, *Evaluation of Online Educational Software Designed for the Purpose of Teaching Programming*, Proceedings of the WebNet 2001 Conference on the www and Internet, pp. 339-404, AACE 2001.

19. Steve Benford, Chris Greenhelgh, Tom Rodden, James Pycock, *Collaborative virtual environments*, Communications of the ACM, Volume 44, Issue 7, pp 79-85 (2001), ISSN: 001-0782.

20. Robert Davison, Gert-Jan De Vreede, *Global Applications of Collaborative Technology: Introduction*, Communications of the ACM, (2001) Vol. 44, Issue 12, pp. 68-70, ISSN: 0001-0782.

BEST COPY AVAILABLE

Computer Support for Vicarious Learning

Rachada Monthienvichienchai
M. Angela Sasse
Department of Computer Science, University College London, Gower Street, London, WC1E, UK
+44 (0) 20 7679 3039
P.Monthien@cs.ucl.ac.uk and A.Sasse@cs.ucl.ac.uk

Abstract: This paper investigates how computer support for vicarious learning can be implemented by taking a principled approach to selecting and combining different media to capture educational dialogues. The main goal is to create vicarious learning materials of appropriate pedagogic content and production quality, and at the same time minimise the financial cost and effort to produce such materials. We propose that multimedia and television production principles can be harnessed for this purpose. We report the results of 2 case studies on collaborative learning of television production in communication arts and diagram construction in computer science and analyse the problems encountered in the production and use of the vicarious learning materials created. We conclude that, if vicarious learning is to be implemented, the problems that educationalists face in creating appropriate materials needs urgent attention.

Keywords: courseware authoring, vicarious learning, collaborative learning, digital video, higher education.

Introduction

What is Vicarious Learning?

Vicarious learning (VL) is learning that takes place when one learner observes an educational dialogue between a tutor/lecturer and another learner (Mayes & Fowler 1999). In previous studies of vicarious learning, the evaluation criteria were entirely pedagogical, such as assessing the effectiveness of VL materials (Lee et al. 1999; McKendree et al. 1998; Stenning et al. 1999) and whether VL promotes learning (Lee et al. 1998). The research reported in this paper builds on these studies, and extends them to consider how best to implement computer support for vicarious learning (CSVL). The main goal of our research is to create tool support for VL materials that contain the appropriate pedagogic and production quality, and can be delivered with the skills, resources and equipment available to most educators.

What makes CSVL different from a video?

The main advantages of supporting the production and access of vicarious learning material via computes as digital video (DV) over conventional video are:

1. the ability to integrate this resource with other online learning materials – DV can contain URLs to online lecture notes or relevant online formative/summative assessment modules and
2. the possibility of personalising the learning material.
3. DV can be divided into chapters that are much easier to navigate through than conventional analogue video.

As real life interactions will be recorded, students will be able to relate directly to problems that they and their colleagues are having during that academic year. In the simplest form, CSVL allows students to revisit their collaborative attempts at tackling a problem. Such revisits strengthen their understanding of the topic by promoting the use of *episodic memory* (Tulving 1983). Episodic memory is a person's personal memory encoded with respect to specific time and place, i.e., remembering the lecturer explaining what episodic memory is on a hot summer afternoon in his/her office. Such memory is more resistant to forgetting. Additionally, students will also be able to view other groups' attempts at tackling the same or similar problems by either accessing materials from the current or previous academic years.

Producing VL Materials

The main aim of our research is to produce a design specification for a cost-effective CSVL system that can be easily implemented by individual or small groups of educators and is flexible enough to accommodate the specific needs of their teaching topics and student cohorts. The system also needs to be flexible enough to support installation in small rooms (individual tutorial) and medium-size rooms (group tutorials).

Why focus on these implementations of CSVL? VL has been shown to be effective in professional productions, e.g., Open University education programs containing brainstorming and debates between lecturers and students and public debates often discussing issues concerning current affairs. However, a lecturer who wants to use such programs can face several obstacles. Firstly, the content of the program may not suit the need of the students/courses that the lecturer is teaching. Secondly, the materials are not grounded in the students' own experience and therefore do benefit from the effects of episodic memory. Professional productions are also costly and require large amount of time and effort from a lecturer who wants to produce similar material. For this reason, our research is asking whether computer support can bring the benefits of VL to individual lecturers. If so, how can it be done? If not, what are the main obstacles?

Pedagogic Design

VL can form parts of various pedagogic designs. Since the main aim of our research is to investigate the various aspects of technology used for implementing VL, the Laurillard's model of learning (Laurillard 2002) was adopted and maintained through out for consistency. In this case, VL forms part of the on going negotiation of meaning between the lecturer and the students. A simplified diagram of this model is given below.

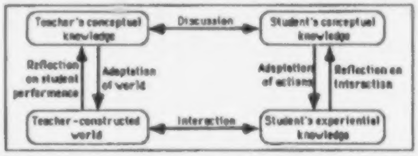

Teacher's conceptual knowledge
Discussion
Student's conceptual knowledge
Reflection on student performance
Adaptation of world
Adaptation of actions
Reflection on interaction
Teacher-constructed world
Interaction
Student's experiential knowledge

Figure 1: Simplified diagram of Laurillard's Model of Learning (Pennel 1996)

Another model of learning which may also be applicable is Wenger's Learning Architecture Model (Wenger & Snyder 2000), where students are working towards being part of a community of practice, in this particular case, the community of systems analysts and IT developers.

Perceived quality of production matters – a pilot study

Most video-based VL systems consist of video recordings of the interactions between lecturers and students, accompanied by notes on the topic under discussions, and perhaps the page of the lecture notes on the topic. Two such examples are The Dissemination System[1] used at Heriot-Watt University and a similar one at University of Edinburgh[2]. Both systems are used for teaching Human-Computer Interaction (HCI) courses. On the other end of the spectrum, the Classroom2000 project[3] at Georgia Institute of Technology demonstrates what high-quality recording and dissemination technology can deliver. By combining video/audio recording with time-stamped slides and annotation, the Classroom2000 project has managed to put the essence of a lecture online. However, this emphasis of putting lectures online means that Classroom2000 does not focus on student actions and feedback, which is essential for VL. Additionally, the system, requiring expensive equipment, is not cost-effective to implement in individual lecturer's or small tutorial rooms.

A pilot study was conducted to see how a simple production of a single-camera recording a tutorial session be perceived. Computer science students were shown some samples of videos containing vicarious learning resources and were asked to make general comments about them. In each video, a lecturer and a student have a staged dialogue on general HCI topics while seated around a table. At various points, either the lecturer or the student would refer to materials on pieces of paper or the whiteboard. The video was produced using a single static-angle video camera and, after encoding into RealMedia streaming format, shown on a 1-inch in diagonal window supported by mono sound. Some of the most prominent comments from the students concerning such a production were:

1. Poor sound quality made it very difficult to understand what each person was saying.
2. The video was so small and blurry that there was "little point in it being there".
3. It was impossible to see what was written on the whiteboard or the pieces of paper on the tabletop.

---

[1] http://www.hcrc.ed.ac.uk/Vicar/TT/

[2] http://www.cogsci.ed.ac.uk/school/study/ug/hc1h/

[3] http://www.cc.gatech.edu/fce/eclass/index.html

BEST COPY AVAILABLE

4. The content was perceived as "deadly dull."
5. It was hard work going through each video and picking out what the main message was.
6. Students said they would be reluctant to refer to such material, they would prefer to use lecture notes and books.

The pilot study revealed that the perceived quality of the material not only affects comprehension of the content being offered, but also its perceived practicality, i.e., whether such resource will be used or not. A previous study of real-time multimedia in a distance education context (Watson & Sasse 2000) found that perceived quality of materials can be affected by unsatisfactory audio quality resulting from incorrect setup of end-system audio hardware and equipment setup, rather than by network effects such as packet loss and jitter. Comments from students in this pilot study showed that perceived quality of recorded material can be similarly affected by insufficient end-system video hardware and incorrect equipment setup.

How to make a difference?

So what affects the perceived quality of video-based vicarious learning materials? This case study looks at the student's perception of the quality of materials in comparison with other materials such as lecture handouts, books and self-made notes. Audio/visual production variables play a crucial role in the perceived quality of the final material, We wanted to determine which variables affect students' perception of the quality of recorded instructional material, and to what extent.

Multimedia Production Principles

Reeves and Nass (1996) identified a number of factors that can influence the perception of multimedia material. In our view, the following are particularly relevant to authoring video-based multimedia:

1. **Image size:** larger images are evaluated more positively than smaller ones and better capture the viewer's attention. Additionally, content on larger images are better remembered than those on smaller ones.
2. **Fidelity:** sound quality was found to have more impact on the viewer's perception of the quality of the material being shown. More importantly, audio fidelity was found to affect attention to media and the viewer's memory for audio information.
3. **Synchrony:** viewers of videos containing audio-video asynchrony commented that people in the video were "less interesting, less pleasant, less influential, more agitated, and less successful in their delivery" than those in synchronized video. This is very significant, as educational materials should not have any of the attributes that have just been mentioned.
4. **Scene Changes:** scene changes can be used to provide structural cues to direct the viewer's attention as well as serving as markers in the viewer's memory. In order to create appropriate cuts and scene changes without using cameramen, it will be necessary to use more than one camera to capture the discussion.

Television Production Principles

Guidelines from the area of communication arts (or media studies) suggest that the number of camera angles also affect the viewer's perception of the quality of the production. The two main factors that have not already been mentioned are:

1. **Shot Selection:** Multimedia principles already point out that, if the production will be viewed in small windows, the camera should close in on the speakers to create the sensation of larger size. Television production principles add to this several points concerning the placement of cameras and how speakers should appear on screen (shot selection). These ranges from wide-angle shots used for orientation of the viewer to over-shoulder shots for suggesting relationship between speakers. Overall there are around seven main shots that can be used during an interview each with specific purpose (Armer 1990). Specifically in the context of this case study, it is also important to make sure that the camera shots that are used allow a clear view of any artifacts – such as models or drawings.
2. **Number of Cameras:** As well as shot selection, the number of cameras also influences the quality and style of production (Watts 1997). Single camera productions require a camera operator that can skillfully move around the set in order to film each speaker as he/she speaks without any obvious interruptions. In a two-camera production, camera movements are greatly reduced by "cross-shooting" (the field of vision of each camera appear to cross). Additionally, the camera operator can zoom in or out to get extra "over-the-shoulder" shots. However, if a third camera is introduced, the job of the camera operator becomes minimal or nonexistent. That is, it is possible to create all the necessary shots

with three cameras for an interview situation. If no camera operators are required, materials can be created without the camera crew associated with traditional video productions

Post-production Issues

In addition to multimedia and television production variables, there are some post-production design issues that may also affect the student's perception of quality. Compared with text, video and audio are slow media for transmitting information – reading a book yourself is much quicker than having it read to you. It is therefore necessary to provide navigational support to allow students to quickly access certain part of the material, without having to go through the entire content of the material.

Too Many Cameras?

Case Study 1 – TV Production Course, St. John's University, Bangkok, Thailand

According to television production principles, increasing the number of cameras will increase quality of production. *But is there a point of diminishing return?* In terms of return on investment, is the amount of information captured that much better when using three cameras than one?

An experiment was conducted to investigate how increasing the number of camera angles in video productions affects the students' perception of the quality of the production. Three cameras were used to capture 3rd year undergraduate communication arts students producing their first television program. Lecturers in this discipline usually introduce students to the theories of producing a "show" in the classroom, but it is difficult to teach students how things actually work or relate to each other in the studio. The aim of the video was to show fellow students the dynamics and the dialogues that go on within the control room – problems that other students encounter, how they solved them and how they make decisions within the group to accept certain takes. The point of the video is to minimize the amount of time students spend inside the studio learning how to produce a show rather than actually producing one. As studio time is rare and expensive, this will allow students to make better use of their studio time.

Experimental Setup

The production session takes place in two adjacent rooms – the control room and the studio. The producer, director, soundman, switcher and computer graphics supervisor work in the control room while actors, cameramen and stage manager work in the studio. It is the action in the control room that are of direct pedagogic relevance for this production, but the actions in the studio are also relevant in the wider pedagogic context. Three cameras were setup to capture the student's production session. The aim is to create for the experiment *three productions that differ only in the number of camera angles that are used.* Consequently, it was necessary to produce the three productions from just a single take to ensure that the content of the productions are identical. Each camera was positioned as follows:

Camera 1: Wide angle shot inside the control room with each person and control equipments visible. Each person has his/her back towards the camera as they are working on the equipments within the room. Additionally, a small portion of the studio room was also visible.

Camera 2: Wide angle shot inside the studio itself. This camera captures the actors, cameramen and stage manager.

Camera 3: Close up shot of each person inside the control room. Each person face, in contrast to camera 1's angle, is now visible.

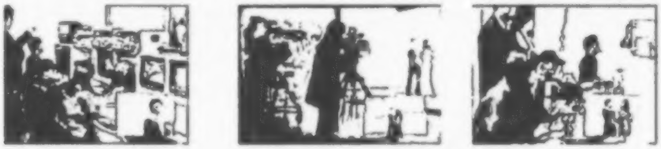


Figure 2: Screenshots showing the three camera angles used in the experiment (including PIP insert)

In addition to these three camera angles, it was possible to add another angle, which was drawn from the actual production that the students were creating – i.e., the show that they were making – this was presented as a picture-in-picture (PIP) insert. This is similar to being able to see what people are writing while they have a discussion around a whiteboard. From these three cameras and the PIP insert from the student's production, the following productions were created:

Production	Camera 1	Camera 2	Camera 3	PIP
1	X			
2	X			X
3	X	X		X
4	X	X	X	X

The productions are ordered according to the amount of effort it would take a lecturer to edit each production, where production 1 requires the least amount of effort. Once all the necessary productions have been created, twenty-one students were grouped into three focus groups. Each group viewed the following productions:

Focus Group	Prod.1	Prod.2	Prod.3	Prod.4
1	X	X		
2		X	X	
3			X	X

Students were not directly prompted to comment about the quality of the video but instead were first asked whether there were any differences between the two video productions.

Summary of Results

The transcripts of each focus group were analysed in terms of comments that the students made specifically about the quality of each production. There were significant differences in terms of perceived quality between production 1 and production 2, and between production 2 and 3. In both cases, increasing the number of camera angles resulted in the students thinking that the quality of the production had been improved. However, there were no perceived improvements in quality when moving from production 3 to production 4. As a matter of fact, focus group 3 actually said that production 4 was 'more boring than production 3'. This indicates that *while increasing the number of cameras does not always increase the perceived quality of the production, the number of cameras used does affect the viewer's perception of production quality.* The result suggests that the optimum setup for this particular case would be to use two cameras to capture the dialogue and one PIP insert to keep track of what the students are doing with props.

Analysis of Results

Why did the addition of another camera in production 4 not increase the perceived quality of the production? When breaking down the content of the video in terms of the Laurillard's model of learning, a pattern has emerged. If the content of each production is categorised in terms of the stages of interactions in the model, each additional camera angle in successive productions adds another stage of interaction of the model to the production – all except in the case of production 4. Production 2 adds the result of the student action, production 3 adds the actual action of the students in the studio, but production 4, while adding another camera angle, does not add a stage of interaction that has not already been covered by previous productions.

Consequently, in order to determine how many cameras will be needed to effectively capture a situation for use as vicarious learning material, it is necessary to *first identify what actions correspond to which part of Laurillard's model, and then implement the necessary technology to capture those actions.* For example, a 1-camera setup will be as pedagogically effective as a 2-camera setup when capturing a student and a lecturer talking about a concept, but a 2-camera setup will be more pedagogically effective should any written materials be introduced into the discussion.

Capturing Dialogues in the Real World

Vicarious Learning and Computer Science Education

Diagram construction is a major part in the syllabus of computer science and information technology students. Each year, students find it difficult to learn how to construct system models such as entity-relationship or UML diagrams. To help the students, many lecturers show common mistakes in diagrams constructed by students in previous years. But since the process of constructing such a diagram involves more than the finished product can communicate, most students acquire the ability to construct such diagrams only after several attempts of their own, with feedback from the lecturer. This type of feedback – delivered 1-to-1 or in small groups – is very demanding on lecturers' time. To get more learning revenue from this time-consuming process, the tutorial sessions were captured as digital videos, and integrated into course notes and online computer-aided assessment (CAA) system. In effect, students who are not present in the tutorial can vicariously learn the same material and more through this setup. Students can also acquire necessary skills by observing one of their colleagues constructing a diagram or, more often, by collaboratively constructing the diagram as a group. Additionally, if dialogues between the student(s) and the tutor/lecturer can be captured during an attempt at constructing a diagram, students who were not present will not only see the resulting mistakes but also how and why the mistake came about in the first place and of course, the reasoning behind constructing the final correct diagram as well! Hence, this particular case study looks at how best to produce Digital Video-*based (DV-based) vicarious learning materials* for teaching diagram construction in the field of computer science and what kind of problems lecturers face when producing video-based for such a course.

Case Study 2 – Systems Analysis and Design Course, University College London, UK

What kind of problems do lecturers really encounter when creating their own video-based materials? In order to investigate this issue, a case study was conducted. Rather than start from scratch, the system used was based on current knowledge of what is required to produce good quality video-based materials. A lecturer's room has been setup with the following equipments so that tutorials can be captured:

1. 3 digital video cameras
2. 1 MIMIO (see reference) electronic whiteboard
3. 1 Intel-based and 1 PowerPC-based PCs configured for DV-editing and whiteboard content capture
4. 1 Intel-based PC configured as a streaming video server
5. 1 high quality omni-directional microphone
6. 1 document scanner.

So far, the total cost of the system is under $10,000. While it has less functionality than Classroom2000, it is only one tenth of the cost.

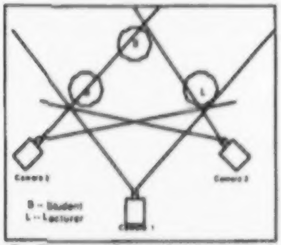


Figure 3: Camera Setup for Lecturer's Room

Problems with Capturing Real Educational Dialogues

Capturing real (as opposed to scripted) educational dialogues presents significant problems in terms of the pedagogic content of the captured material and the task of video-editing.

Pedagogic content

In a small-group discussion (1 lecturer and 2 students), the written materials referred to are often on paper, not on whiteboard as in the materials in the Dissemination System (see reference). Students bring their work on paper, and discussions and amendments centre around the pieces of paper on the desktop. Desktop and surrounding cameras did not get a good angle on the content of paper – even at close range both physically and through zooming. It was very difficult or impossible to make out what is being written on the pieces of paper in sufficient detail. Why is the whiteboard not used in this instance? The ReLaTe project (see reference) found that the use of the whiteboard is in the "tutor's domain". Students are reluctant to "expose" their work on the whiteboard and prefer the familiarity of their own paper (Hughes & Sasse 1997). For students, writing on the whiteboard means publishing their work, which they must be prepared to defend. Additionally, unscripted real world dialogues take time to get going – there are often periods of silence when discussion materials or off-topic chats.

Video editing

In order to produce good quality material, captured tutorial sessions need to be edited. Off-line editing of captured dialogue is the most time consuming task in the process of creating CSVL. It was necessary to first listen to a 5 or 6 second segment of a clip to determine which camera angle to use, then repeat this process until the end of the clip is reached. This "stop-go" approach is very time-consuming and not practical for a lecturer to do. TV studios do real time (live) editing where the producer or director makes the decision to "switch" cameras while the production continues to roll. This "studio" style of creating the final production would be much easier and less time-consuming for the lecturer. However, an individual educator cannot afford dedicated staff to support each captured session.

Implication for Design

This section presents the conclusions derived from the pilot study and the two case studies in terms of what educational users need and what tools are required to provide sufficient support for producing video-based educational materials.

So, what constitute the "ideal" video-based vicarious learning material? Together with the previous findings from the literature and the case studies conducted, the following attributes have be derived:

1. The size of the video should be at least 360x288 pixels (1/2 DV) in a 1024x768 screen resolution.
2. The audio should be captured at 16-bits stereo audio ,sampled at 48kHz.
3. Maintain audio-video synchrony.

However, these attributes are often dictated by the bandwidth that is available while viewing the material online and therefore will be more of a design constraint rather than a design feature. In contrast, the following features can be incorporated irrespective of bandwidth size:

4. Cuts and scene changes can be controlled and incorporated by design into productions.
5. Cuts or scene changes should be used to create structure within the production as well as keeping the viewer's attention at the appropriate level – more than one camera will be required and each camera will need to be placed in the appropriate position to obtain the best possible angle
6. The video must incorporate camera angles that give the viewer sufficient access to props.
7. Allow the viewer to navigate through the video with respect to a clear pedagogic framework.

Derived system requirements

A system that efficiently supports production of video-based educational multimedia must enable the author to create materials with the greatest degree of quality while minimizing the amount of time and effort required to create those materials, i.e., it must be pactical to use.

A survey of the current range of video-editing suites reveals that there are no packages that efficiently support, in terms of time and effort required, the task of authoring in-house video-based educational multimedia. Apple's iMovie is very easy to use but does not support the ability to have more than one synchronized camera angle to choose from at any one moment.

While Adobe Premiere and Apple's Final Cut Pro support multiple camera angles, they do not allow the author to choose camera angles "studio" style in post-production. Both packages force the user to use the "stop-go" approach to video editing. A system is required that can:

1. simultaneously capture DV footage from more than one camera
2. play each captured camera angle (video file) at the same time (once they've all been downloaded and synchronized) so that the author can see exactly what each camera has captured
3. allow the author to choose which camera to use in real-time without having to stop the videos being played (as if the production is being made live in a studio). This task should be as simple as clicking on the camera angle that is wanted at that time to switch to that camera in the final production.

This will critically improve the usability of video-editing systems in three major ways:

1. The pre-editing time will be cut substantially if footages from different cameras can be downloaded in parallel.
2. The editing time will be cut substantially compared with the "stop-go" approach.
3. The editing task and user-interface will be simplified to just picking which camera is "live" or active at certain time.

Conclusions

It is possible to bring the benefits of vicarious learning to individual educators but there are some significant problems and issues that still need to be addressed in order to implement the most effective support for such method of learning and teaching. Producing video-based educational multimedia is more than just pointing a video camera and shooting. Empirical works reported in this paper support the notion that perceived quality of production is significantly affected by the number of camera angles that are used in the production. While the current range of video-editing software packages have the features to produce video-based educational multimedia material of sufficient quality, the tasks in which they demand the user to go through in order to produce such materials are not compatible with the way the lecturer actually needs to work. To make video-editing packages usable in the educational context, the editing task needs to be both quicker and easier. As the number of camera angles in production affects the perceived quality of that production, packages need to support the use of multiple camera angles in productions without forcing the user into a "stop-go" style of interaction to edit videos – this is currently a significant usability bottleneck for users of these packages.

There is currently no large-scale empirical data on how students interact with vicarious learning materials. More importantly, there are no data on how the interaction pattern is affected when there are pedagogic shortfalls resulting from production problems, e.g., missing out vital contents through using insufficient camera angles. These variables are independent from the usual variables investigated in video technology, such as bandwidth, resolution and synchronization. This needs to be thoroughly investigated as pedagogic effectiveness is at stake.

References

Armer A. (1990), *Directing Television and Film*. 2nd Edition. Wadsworth Publishing Company, California

Hughes J. and Sasse M.A. (1997) Internet Multimedia Conferencing - Results from the ReLaTe Project. *Proceedings of ICDE World Conference*, Pennsylvania, 1997

Laurillard, D. (2002). *Rethinking University Teaching: A Framework for the Effective Use of Learning Technology*. London, RoutledgeFalmer

Lee, J., F. Dineen, et al. (1998). "Supporting Student Discussions: It Isn't Just Talk." *Education and Information Technology* **3**: 217-229.

Lee, J., F. Dineen, et al. (1999). Vicarious Learning cognitive and linguistic effects of observing peer dialogues. *American Educational Research Association (AERA '99) Annual Meeting*.

Mayes, J. T. and C. J. H. Fowler (1999). Learning technology and usability: a framework for understanding courseware. *Interacting with Computers* **11**: 485-97.

McKendree, J., K. Stenning, et al. (1998). Why Observing A Dialogue May Benefit Learning: The Vicarious Learner. *Journal of Computer Assisted Learning* **14**(2): 110-119.

Pennel, R. (1996). Essential Aspects of the Teaching-Learning Process.
http://edtech.nepean.uws.edu.au/mmn8/laurillard.html. , Educational Technology Centre, UWS Nepean. Accessed on 24/06/2000

Reeves, B. and Nass, C. (1996). *The Media Equation: how people treat computers, television, and new media like real people and places.* New York: CSLI Publications.

Stenning, K., J. McKendree, et al. (1999) Vicarious Learning from Educational Dialogue. *Proceedings of CSCL1999* (Palo Alto, California, December 1999), Lawrence Erlbaum Associates, Mahwah, NJ.

Tulving, E. (1983). *The Elements of Episodic Memory* NewYork: Oxford University Press.

Watson, A. and Sasse M.A. (2000) The Good, the Bad, and the Muffled: the Impact of Different Degradations on Internet Speech in *Proceedings of ACM Multimedia 2000*, Los Angeles, California, October 30 – November 4 2000, 269-276

Watts, H., (1997) *On Camera: Essential Know-how for programme-makers*. Lontec, Borehamwood, Herts.

Wenger E and Snyder. WM. (2000). *Communities of Practice: The Organizational Frontier*. Harvard Business Review, Jan-Feb, pp 139-145

Classroom2000 Project at http://www.cc.gatech.edu/fce/eclass/index.html Georgia Institute of Technology

The Dissemination System at http://www.hcrc.ed.ac.uk/Vicar/TT/ at Heriot-Watt University, UK

The Computers in Teaching and Learning course was a module of an MSc in Human Computer Interaction

Human Communications 1h: at http://www.cogsci.ed.ac.uk/school/study/ug/hc1h/

A first year undergraduate course taught at HCRC (University of Edinburgh).

MIMIO Whiteboard at http://www.mimio.com/

ReLaTe at http://www.ex.ac.uk/pallas/relate/
ReLaTe is developing and testing video conferencing software for use in language teaching. It is a joint project between the University of Exeter and University College London (UCL).

A Model Driven Process for Web-based Instructional Content Development

S. P. Mudur
Concordia Unversity,
1455, d Maisonneuve West. LB 903-3,
Montreal, Quebec, H3G 1M8, Canada
mudur@cs.concordia.ca

Prachi Gharpure
Mumabi University,
S. P. Jain College of Engineering, Andheri(W),
Mumba 400 058, India
Prachikonark.ncst.ernet.in

Parvati Rajan
SNDT University, Juhu Road,
Mumbai 400 049, India
prajan@ncst.ernet.in

Abstract: It is well established that WWW-based courseware must not restrict itself to the mere delivery of instructional material, but must be grounded in some sound model of instruction and learning. This paper discusses one such model, based on the best of instructional design principles and tries to overcome two of the most serious problems that are being faced in the process of introducing interactive web-based learning, namely disorientation and cognitive overload. Whereas the emphasis in a lot of recent work has been on digital technology reuse, our emphasis is on core aspects of the content development process. Our principal contribution is an intuitively clear iconic notation that can be used to templatize and thus simplify the task of educational content development. We briefly describe the evolution of this model, the experimental effort to evaluate this model and the courseware development process that was adopted.

Present Web-based Learning Scenario

Traditional learning is premised on linear learning, while current brain research finds that learning is nonlinear and relates to interrelations of feedback loops in a holonistic total[Muhammad, 2000]. The World Wide Web can make nonlinear learning much easier than textbook/traditional curricula. Thus web-based learning is widely acclaimed to bring in student-centric, self-paced instruction. However, many of the courses offered on-line and much of the course material that is on-line do not cater to these adjectives. Typically, courseware development is done by translating an existing lecture format course into an HTML document. The traditional learning model, which is predominantly instructor centric, is followed, albeit with far too many inter-linkages (hyperlinks) in the content. There is no real structuring or freedom for the students to choose their path meaningfully. One serious problem in learning that arises due to such ad-hoc non-linearity in content is that of disorientation. It refers to users not knowing where they are, where they have been, or how to get to where they want to go in hypermedia space. This results in a learner picking up disjointed knowledge with many gaps and often wasted energy in duplicate learning [Murray *et al*, 2000].

Another serious problem is that of cognitive overload [Murray *et al*, 2000]. This refers to learners being overwhelmed or confused by the options available to them in multi-path, multi-tool environments such as those provided by hypermedia courseware. This is primarily due to discontinuous narrative caused by breaks in didactic or dialogical flow of the matter itself and improper conceptual flow of ideas or concepts.

Learning object, a digital resource that supports learning, is the current instructional technology leader designed to address the above problems [Wiley, 2000, Longmire, 2000]. However it seems unfortunate that commercial considerations have forced premature focus on maximizing reusability, adaptability, rapid-prototyping, scalability and other such mass production aspects, peripheral to the core goal of learning itself [Greenberg, 2000].

Requirements of a Web Learning Environment

Ausubel maintained and subsequent researchers [French, 1999] have strongly supported that the most important factor in what one learns is often what one knows. Interactive web-based learning, one in which the learner is treated as a co-discoverer of knowledge and asked to work collaboratively, has the potential to capitalize on an adult learner's prior knowledge and experience in a way that traditional approaches have often failed to do.

Thus any web based learning environment must promote:

1. Integrative knowledge building, in a sense that recognizes the learner's existing knowledge base and links to it the new knowledge components as the learning progresses.
2. Customization, which, at the least, offers to a learner choices of meaningful learning paths, styles and pace of learning. A technologically advanced model can also include learner profile (or even build learner profile as learner progresses in her learning) and offer appropriate options, most suited to the profile.
3. Interactive content delivery that engages students continuously. A good environment should also have the facility to establish a contact with peer learners and the facilitator / teacher.

Instructional Design (ID) Principles - as applicable to web based instructions

Given the two serious problems described above, we propose a six-step approach for instructional content development adopting the best of instruction design principles:

1. Define a semantically meaningful unit of instruction – we will call it Concept.
2. Design an appropriate structure of concepts, which connect them in a logical way to ensure that the body of knowledge evolves as the learner progresses with the learning. We can adopt a tool like a Concept Graph for this purpose.
3. Design the right level of granularity of concepts.
4. Define a classification for the concepts.
5. Determine learning levels.
6. Select the right learning primitives to provide the desired learning experiences.

We shall discuss these in some more detail below.

Smaller and semantically meaningful unit of instruction: It is well established that the unit of a typical lecture/chapter, covering a fairly large chunk of content, cannot be easily related to concepts. It suffers from the disadvantages of long durations, unacceptably long attention spans for self-paced learning, and also from the fact that testing for understanding can be done only at unit boundaries [Joyce and Weil, 1996]. Hence educationists and early work in ITS have proposed a smaller unit of instruction. We will denote this by the term concept, a notion we largely base on Bloom's model for Mastery Learning. "A concept is a semantically meaningful unit of instruction with a specific intent type and a matching instruction and evaluation type." [Bloom, 1956]

Concept Graph: This is a simple structure representing prerequisite relationships amongst concepts [Cauano *et al*, 2000].

Granularity of Concept: A concept must have a simple, short and clearly stated learning objective. Enforcing this during review and evaluation will help ensure the right granularity for a subject. Finer granularity provides greater opportunities for learner control. [Quinn, 2000]

Classification of Concepts: Apart from specific intent type, the notion of concept has the other aspect of matching instruction and evaluation type. Content defined for learning a concept should match its intent. The idea is that, a learner, having decided upon the learning goals, can choose a matching type of instruction unit. This leads to concept classification-based on Merrill's work [Merrill, 1999].

1. Facts / Part-Of: Concepts in this category match the instructional objective concerned with the "WHAT?" aspect. Concepts consist of arbitrary pieces of information. Examples are facts about a particular event like a sports match, a particular object like a modem, a mouse, etc.
    i. Kind-Of: Here we are concerned with the classification aspect of the knowledge to be learned, identifying relevant examples and non-examples. Examples are categorizing various animals into different species, categorizing natural phenomenon, etc.
2. Rule-Using/Procedural: In these, the instructional objective is concerned with "HOW" to do some thing. A procedure is an ordered sequence of steps for accomplishing some goal. Examples of such concepts are adding fractions, operating a machine, sending e-mail, etc.
3. Principle/Problem solving: This category is concerned with prediction and explanation of "WHY" things happen in the world. They are cause-and-effect, correctional, or constraint relationships. A principle is a relation between two or more changes. Such concepts will have the problem-solving aspect as their main objective. Examples of such concepts will be "an increase in price causes decrease in demand", "plants grow from a seed to a seedling to a plant", etc.

Since this classification basically focuses on the intended objective of learning units, one significant outcome is that the environment can be designed to adopt pedagogically correct behavior appropriate to a learner's choice of learning unit type. For example 'Part-of ' type learning can occur if information is communicated in a form that remains accessible to the learner, say, a list of directions, throughout an act of learning [Gagne *et al*, 1992]

Learning levels: The issue of depth of learning or performance level leads to identification of learning levels as follows:

1. Memorize: Performance at this level merely requires the learner to search memory in order to reproduce or recognize information presented.
2. Understand: This level requires the learner to identify the examples and non-examples and their attributes in order to categorize and classify the data presented. Performance at this level promotes comprehension.
3. Apply/Use: This requires that the learner be able to apply the knowledge within a context, where it is clear that the piece of knowledge is applicable.
4. Problem-Solve: This requires the deepest level of assimilation. This level requires that the learners recognize if and when a piece of knowledge is applicable, and then apply it correctly.

Theoretically any concept type can be learned at any learning level.

Learning primitives: Learning a concept is a collection of several types of learning experiences such as reading/listening to instructions, exploring the subject matter, solving problems and many more. In a teacher centric environment a well designed and delivered lesson takes care of all these aspects. But in a learner centric environment the system has to provide these experiences explicitly by the means of various learning resources. We visualize these resources as building blocks enabling a learner to build her knowledge for a concept and term them as learning primitives, somewhat similar to Cisco's RIOs [Cisco, 1999]. Each learning primitive gives the learner a suitable learning experience (at required time, of suitable knowledge type, at required learning level and in desirable media type). Various learning primitives [Gharpure & Mudur, 2000] have been identified and these can be assembled into a concept. These include statement of objective, entry test, instruction, demonstration, simulation etc. More can be thought of. A primitive's contents are developed as a combination of interactive media elements and presented depending upon domain, environmental capabilities and learner preference.

Thus a model can now be evolved based on the ID principles as discussed above.

Learning Unit Class Model

A Learning Unit Class (LUC)[1] is the collection of learning primitives required to deliver learning of a particular concept for a combination of learning level and knowledge type. Content for any subject is a directed graph of LUC nodes, where arcs denote pre-requisite knowledge. The arcs could move across different subject matters. We have designed an intuitively simple iconic notation for different LUCs, which are shown in Table 1.

---

[1] In order to avoid any possible confusion/patent/copyright infringement, we have intentionally moved away from using already in-use terms like reusable learning object, knowledge object, educational object etc. for this or reusable information object for learning primitives. It also helps us emphasize the fact that our focus is on the creation of the content. Further

As an example, for teaching a procedural concept at the level of application, a demonstration will be very useful, while for teaching the same at the level of problem solving, an interactive simulation might work much better. Thus for each of learning unit class a template[2] (as a set of primitives) can be generated (*cf* Fig. 1 for an example). The real challenge before an instructional designer now becomes that of identifying suitable concepts, their learning levels, specification/design of various learning primitives for communicating the concept and finally the concepts into seamless and logical flow content.

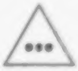
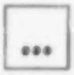
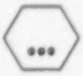
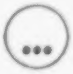
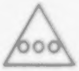
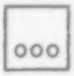
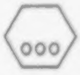
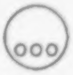
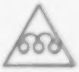
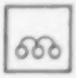
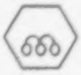
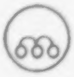
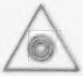
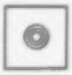
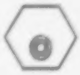
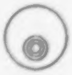
CONCEPT LEVEL — TYPE	MEMORIZE	UNDERSTAND	APPLY	PROBLEM SOLVE
PART-OF /FACT OBJECTIVE—	 Recall or state fact	 Recognize/Identify fact	 Use/apply fact in carrying out task	 Identify required fact and use/apply in task
KIND-OF CLASSIFICATION OBJECTIVE—	 Recall examples / non-examples	 Recognize example / non-example;	 Use correct example.	 Identify example in current context and use
PROCEDURE OBJECTIVE—	 Recall rule / procedure	 Select / identify the appropriate procedure	 Use/apply a procedure/skill	 Trouble shoot, adapt variant to solve problem
PRINCIPLE OBJECTIVE—	 Recall principle	 Identify scenario in which principle is applicable	 Apply the principle in a known scenario	 Identify and Apply the principle in an unknown scenario

Table 1: Iconic Notation for LUCs

---

these could be suitably wrapped into standard reusable learning components, whenever such technological packaging is demanded.

[2] Because of support for definition of such templates, this model has the scope to be developed as an integrated environment for content creator, offering a matching toolset for each template to create course content based on ID principles.

LUC TYPE	OBJECTIVE	ENTRY TEST	INSTRUCTION	ILLUSTRATION	DEMONSTRATION	EXPLAINATION	EXPLORATION	SIMULATION	EXAMPLE	NONEXAMPLE	REMINDER	REFERENCE	EXERCISE	HINT	EVALUATION	WORKPLACE	ADDRESS BOOK	ASK QUESTION	FEEDBACK
666	R	R	R	R	R	R	O	O	O	O	R	R	R	R	R	R	R	R	R

Legend: R: REQUIRED; O: OPTIONAL

Figure 1: A template for a Learning Unit Class (type: procedure, level: apply)

The Experiment and the Process Adopted

This experiment, conducted by one of the authors, Professor Prachi Gharpure involved developing the web-based content for a course titled 'Introduction To Internet ', paper IV for MECTA (Master of Education with Computer Application), a post graduate degree program at SNDT University, Mumbai. The content covered the entire syllabus for the course, as defined by the SNDT University. The course is being taken by MECTA students as we write this paper and the results of an on-going evaluation of the content will be available for further study by June 2002. For review purposes, part of this course is temporarily uploaded on http://www.sndt.netfirms.com/Faculties/Education/DET/Online%20Learn.html. The model-based process adopted is briefly presented in Table 2.

Phase	To be Executed By	Tasks
I May alternate with phase 2 in the process.	- Content Expert - Instructional Designer	1. Identify concepts covering syllabus 2. Map concepts into graph with pre-requisite links[Tellis, 2001]. Fig. 2 shows a first level graph whose nodes get exploded as the learning progresses. 3. Define LUC consisting of learning primitives (guided by template) most suited to meet the learning objectives of the concept. Fig. 3 shows the screen shot for one such LUC
		Example Tools: concept graph editors such as http://www.inspiration.com/ http://users.edte.utwente.nl/lanzing/cm_home.htm
II May alternate with phase 2 in the process.	- Instructional Designer - Software Developer - Visual Designer	Development of templates for different LUCs.
		Example Tools: Spreadsheet, Presentation, Word Processor, etc. (This step in the process adds value to the creation process in terms of consistent layout and look and feel throughout the learning experience. This is very important because the learner can navigate smoothly as she develops a certain amount of familiarity and comfort level in navigation, interaction and knowledge assimilation processes.)
III	- Instructional Designer - Visual Designer - Software Developer	Creation of interactive content
		Example Tools: Web content authoring/publishing tools that enable creation and integration of various components. (This step in the process is the actual content creation process .The process should consider issues like Learner control, Media selection, Interface Consistency, Internet issues etc.)
IV	- Software Developer	Integration into courseware and web based education delivery environment
		Example Tools: E-Learning Management Systems, for an overview of such systems http://www.ncst.ernet.in/~vidyakash/portal/tools.shtml
V	- Content Expert - Instructional Designer - Learners from a representative community	Courseware review Specification of Evaluation criterion
		Example Tools: Web-based feedback forms, statistical analysis tools etc.

Table 2: Model based process for courseware development

Conclusion

A model driven content development process, rooted in instructional design, offers excellent scope for developing an integrated system that guides courseware developers through templates to create potentially high quality content for individualized learning. The principal contribution of this paper is one such model, with an intuitively simple iconic notation. The model has been tested by actually creating content for a postgraduate course which is presently live. The content evaluation phase is currently on for evaluating the results for this model driven process both from instructional design and from learner perspectives.

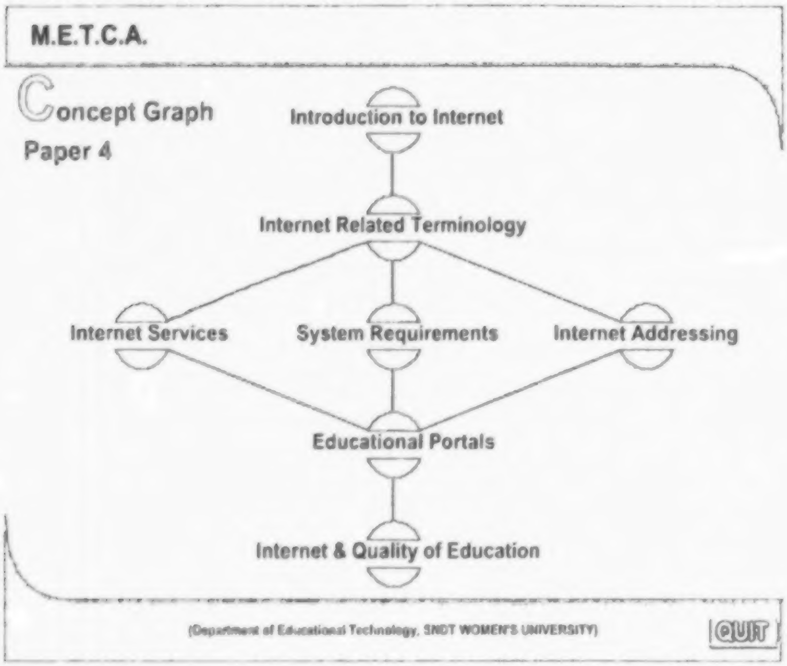

M.E.T.C.A.
Concept Graph
Paper 4
Introduction to Internet
Internet Related Terminology
Internet Services
System Requirements
Internet Addressing
Educational Portals
Internet & Quality of Education
(Department of Educational Technology, SNDT WOMEN'S UNIVERSITY)
QUIT

Figure 2: Concept Graph

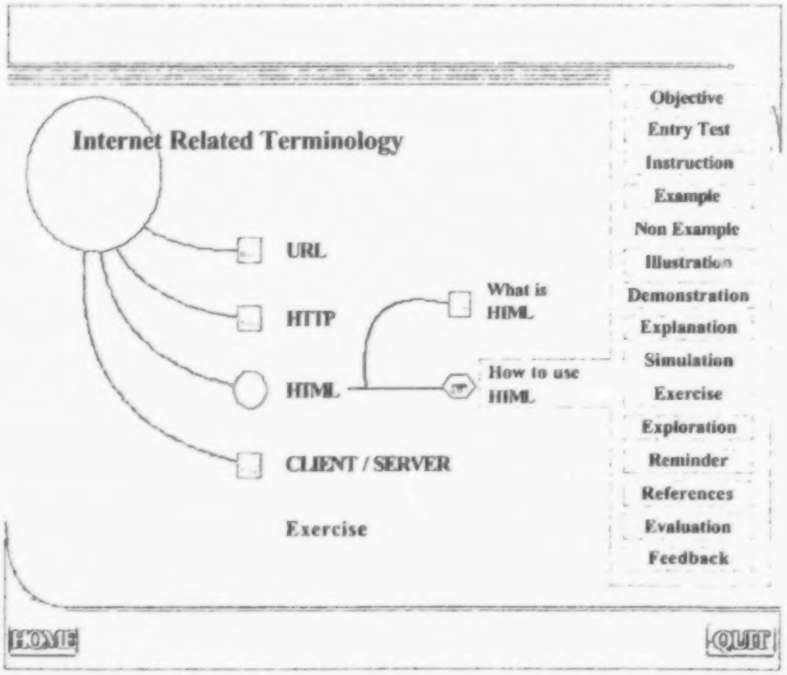

Internet Related Terminology
URL
HTTP
HTML
CLIENT / SERVER
Exercise
What is HTML
How to use HTML
Objective
Entry Test
Instruction
Example
Non Example
Illustration
Demonstration
Explanation
Simulation
Exercise
Exploration
Reminder
References
Evaluation
Feedback
HOME
QUIT

Figure 3: LUC Example

BEST COPY AVAILABLE

References

Bloom, B.S. ed. (1956), Taxonomy of educational objectives: The classification of educational goals: Handbook I, The cognitive domain, 1956, David McKay, New York.

N. Capuano, M. Marsella, S. Salerno (2000), ABITS: An Agent Based Intelligent Tutoring System for Distance Learning, *Proceedings of ITS 2000*, Montreal,Canada, June 19-23 2000, Springer-Verlag.

Cisco Systems (1999), *Reusable Information Object Strategy*, http://www.cisco.com/warp/public/779/ibs/solutions/learning/whitepapers/el_cisco_rio.pdf

Deanie French et.el (Editors) (1999), Internet [based] learning , KOGAN PAGE Ltd.UK ,1999 pp 106
Joyce B and Weil M. (1996), Models of Teaching, (5th Ed.), 1996, Prentice Hall Inc

Gagne, Briggs and Wager (1992), *Principles of Instructional Design*, Wadsworth/Thomson Learning, 4th ed. 1992.

Gharpure P., Mudur S.P.(2000), On Knowledge Representation In Individualized Learning, in G. Davies and C. Owen (eds.) *Proceedings of WebNet'2000 World Conference,* San Antonio, TX, Oct. 2000, AACE, pp 876-877

Longmire W (2000), *A Primer on Learning Objects* , http://www.learningcircuits.org/mar2000/primer.html
Jane Greenberg, ed. (2000), Metadata and Organizing Educational Resources on the Internet, Binghamton, NY: Haworth Information Press.

Merrill.M.D. (1999), Instructional Design Based on Knowledge Objects, *Chapter 17* in C.M. Reigeluth (Ed.), *Instructional-Design Theories and Models: A new Paradigm of Instructional Theory.* Mahwah, NJ: Lawrence Erlbaum Associates.

Muhammad Betz (2000), Curriculum, Instruction, and the Internet, *Educational Technology & Society* 3(2) 2000, ISSN 1436-4522.

Murray, T., Shen, T., Piemonte, J., Condit, C. , Thibedeau, J. (2000), Adaptivity for Conceptual and Narrative Flow in Hyperbooks: the MetaLinks System, *Proc. of Adaptive Hypermedia 2000.* Trento Italy, August 2000.

Quinn C. (2000), Learning Objects and Instruction Components, *Educational Technology & Society* 3(2) 2000, ISSN 1436-4522

Tellis Philip S, Prem Sreenivasan Narayan, Suresh Dhamapurkar, Sasikumar M, SP Mudur (2001), Vasistha - An Instruction Delivery Framework for Online Learning, *Proc. ELELTECH INDIA 2001*, Hyderabad, India.

David Wiley ed. (2000), *The Instructional Use of Learning Objects, Bloomington*, IN: AECT. http://reusability.org/read/

Digital Lecture Halls Keep Teachers in the Mood and Learners in the Loop

Max Mühlhäuser
Telecooperation, Department of Computer Science
Darmstadt University of Technology
Germany
max@informatik.tu-darmstadt.de

Christoph Trompler
Computer Operations Group, Department of Computer Science
Darmstadt University of Technology
Germany
trompler@informatik.tu-darmstadt.de

Abstract: In the transition from traditional teaching and learning to eLearning, we advocate avoiding disruptive approaches. We claim that many virtual university and corporate university efforts worldwide try to showcase big leaps forward yet lack sustainability, suffer from in-vitro conditions, and leave behind the big mass of teachers. Our Digital Lecture Halls (DLH) project accommodates traditional teaching and learning styles, making them *digitally* available for computer assistance. It also reaches out to a large variety of computer-assisted methods and to accompanying new organizational and business models. Apart from this non-disruptive approach, DLH also focuses on large venues. In contrast to known *electronic classroom* efforts that are limited to about 25 local participants, audiences without size limits are supported in DLH. The first implementations support 150 and 1000 participants. The paper describes the general DLH approach and architecture as well as details of the learners-in-the-loop components.

Rationale

Despite great achievements demonstrated at AACE conferences and in *in-vitro* showcases, computer-assistance is not common in lecture halls and classrooms, except maybe for the replacement of overhead transparencies by beamers. In cases where computer-assistance has become a commodity, like at *Hi-Tech* companies, sophistication is rather low: Computer Based Training (CBT) and Web Based Training (WBT) resemble behaviorist computer assisted instructions of the mid sixties, tele-teaching lessons present only a peep show like view for remote spectators, and *virtual universities*, behind a shiny *welcome screen* facade, offer mostly on-line versions of lecture notes originally conceived as paper documents.

One might argue that continuous and tertiary education worldwide is currently faced with a race towards corporate and virtual universities. Politicians and managers seem to be delighted with the budget-relieving vision of virtual teachers that can be replicated by way of keystrokes. However, looking at the continuation of many virtual university start-ups founded out of traditional university structures reveals some basic problems. The development efforts for suitable course material are tremendous for the virtual university set-up. Further, educators accustomed to on-site lecturing and contact to their students must realize that in distance education they face a different relationship with their students, requiring a different teaching and tutoring style to achieve success. As a consequence, we propose to avoid leapfrogging from real to virtual universities. Rather, we suggest a smooth transition that starts with the current and well-understood real universities. By augmenting current teaching venues with new technology, these teaching venues become digital (*electronic*) classrooms, Digital Lecture Halls (DLH), and virtual laboratories. Among these three, the present paper concentrates on Digital Lecture Halls since both electronic classrooms and virtual laboratories on the Internet are investigated in other projects. To the knowledge of the authors, no project concerning Digital Lecture Halls and e-classrooms, has addressed venues of large size, i.e. lecture halls for hundreds of learners.

Apart from addressing a new level of venue size, our approach is also novel as it is non-disruptive. The move from *analog* to *digital* teaching imposes as little as possible an adaptation for both teacher and learner in terms of teaching and learning methods and styles. Hence, the digital lecture halls proposed here remain physical venues -- distribution and virtuality is not an immediate goal. They even accommodate teachers who want to continue scribbling proofs or discourses by chalk and who are used to filling an entire handful of subsequent blackboards with a single proof or discourse. Finally, they offer *after hours* availability of such traditional lectures as a first noticeable improvement over traditional teaching and learning models. We will show that making this 'hardly noticeable' analog-to-digital move requires considerable yet feasible investment. The return on investment is unprecedented: instead of addressing only small elites of teachers, we emphasize changes for the masses.

One may ask whether a 'hardly noticeable' change is worth the effort in the first place. The answer is twofold: it is only the border of a continuous spectrum and being so simple, it can reach the masses instead of the elite. The remainder of this paper will show that the DLH concept accommodates all types of teaching methods: synchronous and asynchronous, local and distributed, strongly guided up to open explorative teaching methods. The difference is that by setting the entry threshold low for ordinary teachers, we intend to motivate nearly all teachers to enter the digital era. Also, the variety of computer-assisted teaching methods can be introduced at an individual pace and based on the experiences gained along the road – a policy which we claim to be indispensable, if the fast-moving computer and networking technology and the slower-moving *teaching culture* (pedagogy, didactics, and instructional sciences) are to be synchronized. By gradually adapting pedagogic and didactic concepts to the improved possibilities, the evolution process can keep pace with urgently needed feedback and evaluation. Such a smooth transition may include the following intermediate steps, each of which represents a computer-aided teaching set-up in its own rights:

1. DigiMax: Computer-augmented frontal teaching is immediately available in the digital venues (same-time / same-place), providing a *digital audimax* (DigiMax) setting in the DLH.

2. LearnerLoop: Cooperative learning can be introduced by offering mobile computing solutions for the learners in the audience owning portable devices.

3. AfterHours: Asynchronous rehearsal is the first immediate gain if streaming servers are added and lectures are kept on-line for a reasonable time.

4. NetExL: by hooking the digital venue onto the Internet in synchronous live mode, both remote humans (for example guest expert teachers) and remote bits (data such as Web sites, code such as simulations, virtual Internet labs, etc.) become available. Distributed DLHs can be created by mirroring the digital venue, allowing distributed classes to take courses. As streaming and multicast support are added, individual distance learners may join in.

5. CourseLine: Taking different kinds of recordings (see below) as raw material, the AfterHours level of different-time/different-place learning can be extended: Raw material can be post-authored into valuable course material for rehearsal and/or self-paced learning.

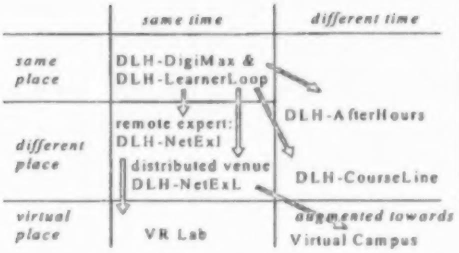
These steps are realized as different yet integrated components of the DLH hardware/software, each in turn consisting of several subcomponents. The detailed description of the steps will form the rest of the paper.

The Digital Lecture Hall

This section describes the design and implementation of the Darmstadt Digital Lecture Halls. The description follows the possible evolutionary steps, and hence, the above-mentioned components, that lead smoothly from *traditional teaching going digital* to different kinds of Internet/computer-assisted teaching. In Figure 1, these steps are related to a taxonomy of computer-supported cooperative learning (CSCL), showing that DLH covers all relevant areas of CSCL.

A coarse architectural description of DLH is depicted in Figure 2. It shows three basic layers of DLH, namely, hardware, components, and content (course material). The description will be extended only in the context of corresponding software functions. Among these, DigiMax is not only the first step of DLH's use, it is also the glue for further components. In particular, most LearnerLoop functions are directly related to DigiMax subcomponents, and AfterHours is an extension of DigiMax for recording. NetExL extends the reach of DigiMax over the network and CourseLine accesses all other components. Figure 2 also depicts a learner management system (LMS) (Hornung & Hornung 1999). Core LMS functions like network access and group support during a lecture are realized as part of the project. Additional LMS functions are external to the DLH project. DLH is prepared for integration with an external LMS.

The next four sections follow the stepwise approach of DLH components and provide more details about the respective subcomponents and functionality.



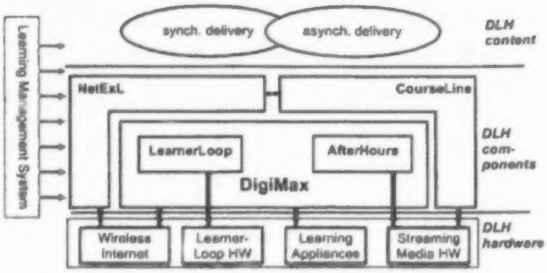


Figure 1. (left) DLH components related to CSCL taxonomy
Figure 2. (right) Coarse DLH architecture

DigiMax: Traditional Teaching Goes Digital

DigiMax realizes those computer-assisted features of a large-size auditorium that are related to the tasks of the lecturer. Therefore, minimal task change and minimal cognitive overhead are the key requirements for lecturers making the *analog-to-digital move*. Lecturers already accustomed to computer-based teaching, on the other hand, should find maximum support for their advanced needs. DigiMax consists of several software modules and supports flexible orchestration of numerous electronic lecture appliances and general-purpose hardware local to a lecture hall.

Virtual Multi Board: From the instructors' point of view, the main software module is the Virtual Multi Board (VMB). It is the only visible interface to other subcomponents like ScreenRecorder, RoomControl or LocalLectureLoop Applications.

Yet the VMB is not only a control interface. Major features are inspired from traditional *analog* use of lecture halls – following the major DLH goal to assimilate analog forms as much as possible. In traditionally large audiences, lecturers will not use a single blackboard. For instance, university lecturers teaching mathematics consume a handful of blackboards for a single proof. These multiple blackboards are usually visible to the audience at the same time. Even for a more loose related series of blackboards, it is a key feature of the *teaching technology* that several blackboards *in the history* remain visible: both to quickly review this history (to considerably improve retention rates) or as a buffer mechanism when learners lag behind with their note taking or re-reading. In order to support this *teaching technology* on the digital side, the VMB can be configured to hold threads of blackboards from *history*, manage multiple threads in parallel and display them with a customizable layout on a seamless multi screen display provided by the DigiMax hardware (Figure 3). Part of the VMB display space may also be configured to hold the output of any other software such as the NetExL component which might project a remote expert, lab, or peer DLH or results from quizzes deployed with the LearnerLoop Assignment module.

VMB offers simultaneous use of multiple input stations. Our initial DigiMax hardware provides two stations: a whiteboard and a tablet. The 72" whiteboard is rear-projected and mounted in such a way that the auditory has maximum visibility and the lecturer has easy access. The pen-based inductive tablet with rear display is positioned like an *analog* overhead projector. Using the tablet, the lecturer can more easily keep eye contact with the audience – a feature considered crucial by many teachers today and a main reason for many to move from blackboards to overhead projectors. Both stations can show the same or different presentation threads or show a composite view of threads and controls and other applications not meant for presentation to the auditorium, like online feedback captured with our local loop tools, presentation control and notes or room control.

ScreenRecorder: Many tele-teaching settings feature *electronic whiteboard software* that integrates recording functionality. Annotations made by the lecturer are recorded and can be played back during (asynchronous) rehearsal. Advanced settings also support slide presentations but require the presentations to be converted to an intermediate format, losing features of the native presentation system, for example animations in PowerPoint (see Lecturnity [www.lecturnity.de]). In our approach, recording is supported for arbitrary software. We can create snapshots as well as stream screen recordings at high frame rates. We can capture the live application, arbitrary animations, dynamically created output as well as output from remote software. Audio output is also captured. The snapshots are used by the VMB history functionality. The stream recordings are targeted for AfterHours and for ToGather, a tool part of the LearnerLoop.

BEST COPY AVAILABLE

Our annotation library supports ink as well as higher-level objects such as pointers, text and simple geometrics. We provide necessary bindings to make VMB and ScreenRecorder aware of underlying features of the attached appliances and the running presentation software. Different whiteboard input tools switch between annotation modes. Slide changes or animation steps in applications like PowerPoint signal events in ScreenRecorder to create dynamic index frames and snapshots. The slides text is exported on the fly and used for further indexing. We provide a COM and Java Library for integrators to make their applications aware to our system.

The DigiMax Software layer is flexible regarding the underlying hardware. Although the complete software can be installed on a laptop, we recommend using a stationary installation in a lecture hall, consisting of at least a dual-screen projection, rear-display tablet and a server holding core services and the presentation system.

Our initial DLH prototype in a Lecture Hall fitting 150 students has the two input stations described before and uses a 9x2.25m multi-screen projection with three projectors totaling a resolution of 3840x768 pixels. A Windows 2000 Server with an AGP- and an additional Quad-PCI-Graphics Card is used as the central server that drives all attached displays at once.

Currently, we are preparing a mobile DigiMax extension unit to be used for DigiMax enhanced lectures in a legacy lecture hall fitting 1000 students. We will augment the existing XGA projection with a digital sideboard of two stacked projectors and use a rear-display tablet as input station. The mobile unit will also hold hardware in use by other DLH Components.

Lecturers who need or want to use their own equipment (for example a laptop with a computer-specific license of software to be shown) can use a stand-alone version of ScreenRecorder on their computer to generate processable content for a stationary DigiMax and may use a web based interface to remotely access VMB functionalities.

LearnerLoop: integrating local learners

A major goal in DLH is the tight integration of learners into the digital teaching/learning process. This has been a goal in other projects as well, be it tele-teaching setups or electronic classrooms. DLH again emphasizes a smooth evolution and large venues in this context.

Tele-teaching setups usually support audio connections to learners for question-and-answer phases of the lecture. In this respect, the multiple pen-tilt-zoom (PTZ) cameras installed in DLH as well as the microphone / speaker installation – all described in the context of AfterHours and NetExL below – already provide a level of sophistication that goes beyond common approaches.

Ambitious electronic classroom projects have equipped learner workplaces with computers carefully designed for integration in the computer-assisted teaching process. Computer-equipped learner workplaces are central to DLH, but with three major differences:

Computer-equipped learner workplaces are supported and recommended, but not mandatory. Use of video/audio communication is offered as an alternative.

Our experience with the *Classroom-of-the-Future* in Linz (Mühlhäuser 1996) shows that computer-equipped learner workplaces may lead to learner distraction and social and cognitive disintegration of the class.

Quite often, the individual access and high degree of freedom provided by typical per-workplace user interfaces, together with the cognitive overhead and level of concentration required by that user interface, leads to a large number of individual *learning threads* among the students in class. For CSCW software and group meeting rooms, this observation (and other similar ones) has led to the recommendation to even avoid per-workplace computers. In our case, it has led to the *minimal distraction* requirement that materializes in the TVremote subcomponent of LearnerLoop described below.

In our vision of virtually every lecture hall of a university or organization being DLH-like, we imagine learners to come and go and to switch venues quite often. Given the high level of deployment of mobile computing equipment among today's and tomorrow's learners, it seems quite natural to support learner-owned equipment. This assumption has far-reaching consequences that set DLH apart from electronic classrooms. Four categories of learner devices are considered and reach from SmartPhones via PDAs and pen-based notebooks to laptops. Wireless connectivity is the only feasible connectivity approach (this approach scales up to an online campus vision where learners can access all kinds of resources on the move). The LearnerLoop has to accommodate with a broad performance range with respect to both the learner device and the communication bandwidth.

Regarding the hardware, the four device classes envisioned were mentioned above; the wireless networks currently supported are General Packet Radio Service (GPRS) and IEEE 802.11b wireless LAN (wLAN), to be complemented by a Personal Area Network (PAN) standard in the future. The LearnerLoop component comprises the four major subcomponents TVremote, Assignment, ToGather and UpLoad, which we will now describe in turn.

TVremote: As the name suggests, TVremote provides minimal functionality for the learner to *control* the digital lecture taking place. Following the minimal distraction requirement, the functions are usually mapped onto soft keys of the device, so that *pressing a single key* suffices for operation. The main function of TVremote is *tagging*: by pressing a tag key on the device, a learner expresses particular interest in the current phase of the lecture. She may either mark the beginning and end of a relevant section or indicate interest in *what the lecturer just said / presented*. In the latter case, the marker is set slightly back in time. Technically speaking, such tagging results in an entry in the learner's personal annotation file which points at the audio/video/presentation recording (see AfterHours) centrally stored. In a future version of DLH, tagging will influence the *aging* process of the recording, depending for example on whether or not a learner copied the marked parts to her private workspace.

Another important TVremote function is *RaiseHand*, a function that queues the learner for question. The lecturer may (immediately or later) call upon the learner using corresponding DigiMax functions. In the latter case, DigiMax calls VMB to display the slide that was visible at the time of *hand-raising*. While hand-raising is supposed to lead to immediate reaction by the lecturer for smaller audiences and local-only lectures, delayed calling-upon for questions is assumed to be common for very large audiences and distributed lectures.

We also use TVremote to implement a simple on the fly evaluation function, where the students can indicate if the instructor is doing a good job concerning understandability and presentation speed.

Assignment: The Assignment subcomponent offers a standardized means for lecture-initiated interaction, task assignment, and exams. Questionnaires, assignments etc. are modeled by the system as computer-based forms. Customizing this model, the lecturer can employ online questionnaires and examinations during the lecture. These questionnaires can be simple yes/no questions or more complicated multiple choice, gap text, or free text question / answer forms. The lecturer may perform the evaluation right on the spot, defer it to a later time or delegate the work to tutors. Questionnaire access can be anonymous to facilitate participation of learners who are scared of contradicting the lecturer. Exams, on the other hand, are of course authenticated. A tamper-proof authentication for official exams is still under development with our IT security research group.

ToGather: For a higher level of learner involvement and for group work during lectures, we relax the *minimal distraction* requirement in the context of the ToGather subcomponent. This subcomponent targets laptops, pen-based computers and hybrids used by learners in the DLH. Learners have the possibility to form closed discussion groups to perform group annotation. Their devices receive a live stream from the lecturer's input, presentation and annotations via ScreenRecorder. Learners can annotate this stream and see the annotations of other group members. Since local storage can be limited or is often not properly secure (in terms of backup), annotations are also stored on a central server. The learner can recall his notes offline from his computer, for example on his way home in public transport. She can exchange her notes between other students, ad hoc between devices. If willing, she may also expose her notes over the AfterHours system.

UpLoad: To prevent misuse of the network infrastructure, DLH is equipped with a firewall, which is part of the DLH specific LMS and allows access to be configured to the exact needs of different lectures. In this context, the Upload component provides learners with the possibility to access third-party virtual lab software during the lecture, based on access rights granted by the lecturer. This mode of operation is only possible if the wireless network infrastructure is not a shared installation, for example a shared campus-wide network.

TVremote and Assignment: the underlying OCLI platform

TVremote and Assignment use a common architecture, called Open Client Lecture Interaction (OCLI) (Trompler et al. 2002) and one generic model, called eQuestionnaire (eQ). OCLI supports instructor-based definition, control, and assessment of eQuestionnaires, and learner-based filling-in and submission. eQ embraces a broad spectrum from personal highlighting, over voting to assignments distributed during or after lectures.

OCLI uses a web-based XML processing framework and supports learners with any wireless networked terminal device capable of running some sort of web browser. Devices currently in use are WAP phones, PDAs like PocketPCs and notebooks. The OCLI system can be accessed by web applications, too. ToGather integrates OCLI access into its user interface. OCLI consists of five major modules: ADMIN, CTRL, DISPLAY, CORRECT and SCORE.

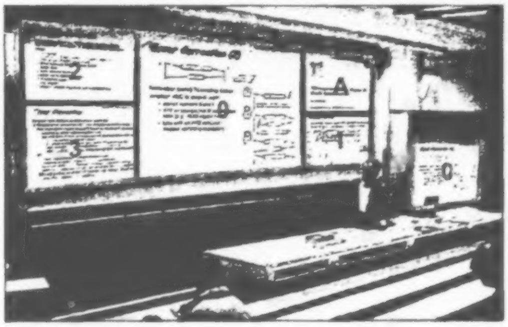
ADMIN, the administrative component, is intended for instructor use before the lecture. Featuring hierarchical curriculum/lecture/lesson structures, it lets the instructor define eQuestionnaires based on a set of pre-defined set of eQ-types (such as timestamp markers, Q&A, assignments, polls) and of answer types (such as multiple choice, free text, selection).

CTRL, the control component, is again mainly intended for instructor use. This component determines the dissemination and accessibility of eQs with respect to both the time period of availability and the authorized audience. For Q&A sessions, CTRL supports the instructor in queuing, displaying, calling-upon, and answering questions during the lecture.

DISPLAY is the display component. This module assures the translation of generic XML-based eQ definitions into terminal device specific formats (Figure 4). It provides the user interface to the learners. Learners may choose between an anonymous or authenticated mode, depending on the lecture's policy.

CORRECT takes over the assessment, evaluation, and correction of learner input to instructor-initiated eQs (such as assignments, polls, or exams). For self-assessment purposes, instructors can call upon the automatic correction features of CORRECT. For other cases, the module presents the learners' eQ replies to the instructor, supports their correction and optional annotations, and conveys the assessments back to the learners.

SCORE adds statistical and graphical evaluation for sets of filled-in eQs. These may be viewed by the instructor or the learners on their terminal device or viewed on the VMB.



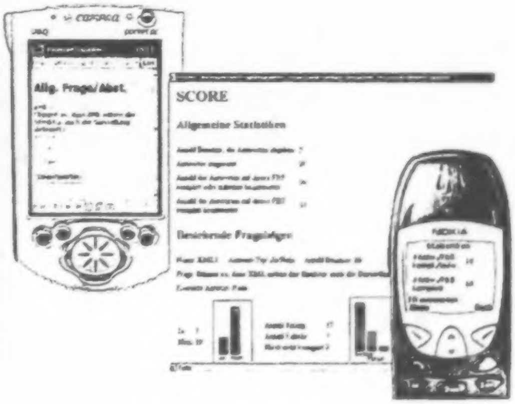


Figure 3. (left) Augmented photograph of DigiMax with VMB (0,1,2,3: thread with history, A: 2nd thread)
Figure 4. (right) OCLI: Assignment on different devices

AfterHours

AfterHours resembles the well-known lecture recording features for recalling the lecture after the sessions and before tests. This feature is found in many other distance learning and virtual university projects with a vast amount of tools available today. AfterHours approaches several issues we found especially important: Firstly, Multi Perspective Video, following observations first published by Jain and used in his MPIvideo products (Jain 1995). In contrast to common practice for tele-teaching, Jain advocates the use of multiple cameras. He refers to the cognitive process by which humans settle in an environment by subconsciously taking *snapshots* from different perspectives and view angles. Our current setups use two instructor and two audience cameras.

Secondly, automatic camera control and video composition, leveraging off an approach described in (Rui 2001). This eliminates the necessity of an assistant in charge of handling the multiple video streams and cameras.

Thirdly, we include student observations during and after recording to create a dynamic media repository. Students using TVremote to tag the lecture during the session can download compiled streams of the lecture containing only sections of interest. Tagging results can be shared in the same way as ToGather lecture notes. They are used for indexing and can be accessed together with the video and presentation recordings. A post-recording comment system is under development. Server access statistics and tagging results are used to garbage collect unused sections of the recordings.

BEST COPY AVAILABLE

NetExL and CourseLine

Since the NetExL and CourseLine components exist only in prototype versions, their description will be summarized here with a lesser degree of elaboration.

NetExL is currently realized as an outbound and an inbound subcomponent. The outbound subcomponent makes a live lecture recording available on the network. Corresponding to the available bandwidth of the remote site(s), several quality of service options exist. For high-bandwidth access on campus, the remote site receives all video streams and may interactively control the preferred camera stream. For lower bandwidth, either the main stream or no video stream at all may be selected. The inbound subcomponent places arbitrary inbound streams (camera input from remote experts, remote learners, or remote DLH sites) on a VMB sub-screen and optionally onto learner workplaces. Connections have to be manually set up requiring human intervention. This functionality must be augmented for further versions; for example as the lecturer calls upon learners for Q&A (either following a RaiseHand command or an Assignment based submitted question), she is to be auto-connected to the VMB remote-learner-sub-screen.

Within CourseLine, we explore two paths towards advanced teaching: starting from recorded lectures, furthering the above-mentioned authoring-on-the-fly approach and using the sophisticated DLH venue for a seamless introduction of advanced instructional strategies, like *Algorithm Animation* in computer science education (Rößling & Freisleben 2001).

Related approaches

Related work has been discussed in the course of this paper. A few general comparisons shall be added at this point, comparing DLH to electronic classrooms, virtual universities, and to tele-teaching efforts.

Of course, the project reported here is not the first digital teaching venue ever built. For comparable examples, see (Abowd et al. 1996) (Brown et al. 1998) (Ginsberg & Foster 1998) (Mühlhäuser 1996). However, other such venues were mostly built with only some of the above-mentioned milestones in mind. Even very advanced projects such as *Classroom 2000* at GeorgiaTech or the *Classroom-of-the-Future* project at the Ars Electronica Center in Linz, are restricted to classroom size around 25 participants.

However, some key goals and concepts of these electronic classroom projects are common with those of DLH. As a consequence, tools developed in the context of these projects partially resemble those presented in this paper. As discussed, major differences between electronic classroom tools and DLH tools for synchronous delivery are the interactive presentation support through the advanced possibilities of VMB and the learner integration via the Learner Loop Software.

Virtual universities have been mentioned several times in the present paper. DLH was positioned as an alternative approach in the sense that a smooth path from current to *digital* universities was proposed in contrast to the *leap* into virtual venues. At this point, it should be added that no commonly agreed definition of virtual universities exists and that other terms such as *corporate university* and *virtual campus* are used with overlapping meaning. Some of the corresponding projects concentrate on organizational and management issues, the technical aspects of these are largely addressed by learner management systems like WebCT (www.webct.com). Most virtual university projects offer on-line material for self-paced training - few of them go far beyond on-line versions of the lecture notes and/or classroom teaching material.

Lecture halls have been augmented with networking and computing equipment for tele-teaching. Among the many setups and projects worldwide, only a few are directly related to computer-assisted learning research and development activities like the activities at the Universities of Mannheim and Freiburg (Hilt et al. 2001). The work of these has brought forth a noticeable requirements document contrasting the status and vision of tele-teaching (Hilt & Kuhmünch 1999). This work also includes a description of the major scenarios to be supported, called *remote lecture room*, *remote interactive seminar*, *interactive home learning*, and *individual learning with CBT*. The overlap of these goals and concepts with the DLH project are obvious, yet these projects have different foci, mainly the support of large remote groups via sophisticated multicast and adaptive video, and the furthering of interactive whiteboard software. Such aspects at the core of computer-science related tele-teaching research, are of course relevant for DLH, but not considered the primary focus. Rather, DLH concentrates on issues such as large projection and intuitive (multiple input station based) input, minimal distraction and ease-of-use, and maximum tele-presence – as discussed in more detail above.

In summary, the research domains discussed in this chapter are complementary to DLH in their focus. Although they even have a different world view, all of them can be regarded as steps in the evolutionary process of digital lecturing proposed by DLH.

Lessons learned and summary

Despite the many virtual university and tele-teaching projects worldwide, many issues have yet to be resolved and many leapfrogging attempts may be questioned regarding their sustainability and effect on the *masses*. The Digital Lecture Hall project described takes a stepwise approach and offers an easy start for *the average teacher and learner* with virtually no need for behavioral change and with minimal cognitive overhead. The paper has introduced the major components that support stepwise sophistication, called DigiMax, LearnerLoop, AfterHours, NetExL, and CourseLine. We have shown how major known teaching and learning approaches can be accommodated by DLH.

Prototypes of DLH have been in use since summer 2001. There have been quite a number of concerns that the very low *entry threshold* for lecturers might be a temptation not to change the teaching process at all. These concerns did not turn out to be justified: average lecturers quickly learn to appreciate the additional possibilities offered by a digital environment. They will not switch to a different technology for technology's sake or by curiosity, such as the *elite* gathered in virtual university projects. This supports the basic assumption of DLH: virtual university projects are still too much *in vitro*, and teaching will only change on the large scale in the pace dictated by pedagogic and didactic improvements.

All in one, the first lessons learned strongly support the assumptions made at the outset of the DLH project.

References

Abowd, G., & Atkeson, C. G., & Feinstein A., & Hmelo C., & Kooper R., & Long S., Sawhney N., & Tani M. (1996). Teaching and learning as multimedia authoring: the classroom 2000 project. *International Multimedia Conference*. Association for Computing Machinery. pp. 187-198.

Brown, D., & Burg, J. J., & Dominick J. L. (1998). A strategic plan for ubiquitous laptop computing; *Comunications, Vol (41)1*. Association for Computing Machinery. pp. 26 – 35.

Ginsberg, R., & Foster, K. (1998). The Wired Classroom. *Spectrum, August 1998*. IEEE. pp. 44–51.

Jain, R., & Wakimoto. K. (1995). Multiple Perspective Interactive Video. *Intl. Conf. Multimedia Computing & Systems, 1995*. IEEE Computer Society. pp. 202-211.

Hilt, V., & Kuhmünch, C. (1999). New Tools for Synchronous and Asynchronous Teaching and Learning in the Internet. *ED-MEDIA and ED-TELECOM*, Seattle, USA. Association for the Advancement of Computing in Education.

Hilt, V., & Mauve M., & Vogel J., & Effelsberg W. (2001). Interactive Media on Demand: Generic Recording and Replay of Interactive Media Streams. *International Multimedia Conference*. Association for Computing Machinery. pp. 593-594.

Hornung, C., & Hornung, J. (1999). Knowledge Management in Learning Organizations, *19th World Conference on Open Learning and Distance Education*. Vienna.

Mühlhäuser, M. (1996). Interdisciplinary Development of an Electronic Class and Conference Room. *Journal of Universal Computer Science 2 (10)*, Springer Heidelberg. pp. 694-710.

Rui, Y., & He, L., & Gupta A., & Liu., Q. (2001) Building an intelligent camera management system. *International Multimedia Conference*. Association for Computing Machinery. pp. 2-11.

Rößling, G., & Freisleben, B. (2001). ANIMALSCRIPT: An Extensible Scripting Language for Algorithm Animation. *32nd Technical Symposium on Computer Science Education*, Association for Computing Machinery. pp. 70-74.

Trompler, C., & Mühlhäuser, M., & Wegner W. (2002). Open Client Lecture Interaction: An Approach to Wireless Learners-in-the-Loop. 4th International Conference on New Educational Environment. Section 3.1, pp. 43-46.

A Campus-wide Project of Web-based Academic Instruction: Research Framework and Preliminary Results

Rafi Nachmias, Judith Ram, Limor Segev & David Mioduser

School of Education
Tel-Aviv University
Tel-Aviv, Israel 69978

nachmias@post.tau.ac.il ; judithr@post.tau.ac.il; limo@post.tau.ac.il; miodu@post.tau.ac.il

Abstract: The use of the Internet as an instructional tool in higher education is rapidly increasing. However, alongside the enthusiasm and creativity that generally accompany this process, essential questions regarding the learning quality and effectiveness of online courses emerge too. In order to answer these questions a comprehensive research program is currently examining Virtual TAU – a campus-wide project aimed at integrating the Internet into the instruction of Tel-Aviv University's academic courses. In this paper we describe the research framework for the study of Virtual TAU, along with preliminary findings of the various studies at three levels: (a) the *macro level* taken the institutional perspective on the diffusion process of the Internet within instruction on the campus; (b) the *mezzo level* focuses on the character of teaching and learning processes emerging in web-supported courses; and (c) the *micro level* looks at the actual usage of the web in the teaching and learning of specific courses.

Introduction

The use of the Internet as an instructional tool in higher education is rapidly increasing. In the last decade, introduction of this new technology in higher education has generated a rich variety of teaching configurations (AFT, 2001; Bates, 2000; Bonk, Cummings, Hara, Fischler & Lee, 1999; Collis & Moonen, 2001; Harasim, Hiltz, Teles, & Turoff, 1995; Mason, 2000; Mioduser & Nachmias, 2002). These range from the incorporation of web technology into existing face-to-face courses as an additional information support tool, to the development of complete distance learning courses.

To look at the impact of these developments within the context of higher education implies, in fact, to examine the ways they challenge the 2,500 years old Socratic, face-to-face instruction modes characterizing most college and university teaching. However, alongside the enthusiasm and creativity characterizing this process, essential questions regarding the learning quality and effectiveness of online courses emerge (e.g, AFT, 2000; Guri-Rosenblit, 2001; Phipps & Merisotis, 1999). To answer these questions comprehensive research, is currently being conducted into Virtual TAU – a campus-wide project aimed at integrating the Internet into the instruction of Tel-Aviv University's academic courses. In this paper we describe the research framework along with preliminary findings.

The Virtual TAU Project

Tel-Aviv University (TAU) is one of the largest research universities in Israel. Located in the center of the country, it serves about 27,000 students annually. These students are enrolled in about 6,000 courses which are taught by about 4,000 instructors in almost every academic discipline.

The Virtual TAU project at Tel-Aviv University (http://virtual.tau.ac.il) was launched in the academic year 2000/01, in response to a government initiative to prompt advanced learning technologies in Israeli higher education. The project aimed to initiate and catalyze a process by which gradually more faculty members use the Internet to enrich learning processes and to make instruction more efficient and flexible.

The web-shell used by Virtual TAU is *Highlearn*, a novel Internet course management system. Similar to other web-supported course systems (e.g., *Blackboard, WebCT, Lotus Learning Space*), *Highlearn* allows easy creation of an information base for the course content and didactic activities, and supplies both synchronous and asynchronous communication tools for students and instructors. In addition, it provides tools that assist the instructor in administrating the course (e.g., course scheduler, address book).

One of the fundamental principles of the project is that the instructors, most of them TAU faculty, maintain full responsibility for the course's website. Their views regarding the objectives, syllabus, and instructional methods lead the development and the implementation of the course. No pre-designed pedagogical solution are imposed. Rather, each instructor acts according to his or her own pedagogical approach. Most of the projects' activities are aimed at empowering the instructors, helping them in the realization of their pedagogical vision.

The Study OfThe Virtual TAU Project

One major objective of the research design is to evaluate the potential of the web-supported courses and to examine the conditions needed to realize this potential. The research framework of Virtual TAU consists of three levels of analysis. First is the *macro level*, which focuses on the assimilation process of the Internet into the campus instruction from the institutional point of view. Second is the *mezzo level*, which focuses on the character of teaching and learning processes emerging in the web-supported courses. Finally is the *micro level* concerns the characteristics and consequences of the actual usage of the web features for teaching and learning purposes in specific courses. A detailed description of the research framework can be found in Nachmias, 2002.

Macro Level: The Assimilation And Diffusion Process

Questions asked at this level relate to the characteristics of the assimilation and diffusion process of the new technology, and to the factors affecting this processes. Rogers (1995), who contributed a widely accepted conceptual framework for the understanding of diffusion of innovation process, views organizations (e.g., universities) as social systems composed of individuals with varying degrees of openness to technological innovation. The rate at which an innovation is adopted within an organization is a function of certain characteristics of the organization's staff, the innovation itself, and the information disseminated about it. An innovation will be more easily adopted if the potential users are convinced that there is some advantage in using it, and if the innovation is compatible with their current needs and values.

The major research questions asked at the macro level are: Does the diffusion of the Internet in the TAU campus follow Rogers' model? What is the profile of the Tel-Aviv University staff members who have adopted the Internet in their academic instruction? What are the factors (e.g., central support, staff development) affecting successful integration of the Internet in instruction? What are the barriers diffusion (e.g., lack of incentive, instructor's reluctance due either to personal teaching style or to negative attitude towards ICT, limited infrastructure)?

Data collection at the macro level is being carried out every semester on each of the participating courses and their instructors. These instructors are asked to fill out a questionnaire regarding personal information (e.g., gender, position, ICT experience), their needs, and their perception of the contribution of the innovation to the students' learning. A sample of instructors and decision makers are interviewed as well.

Mezzo Level: Shifts in Instruction and Learning

The mezzo level deals with general learning and teaching patterns of students and instructors using Virtual TAU. These patterns are examined in five major domains:

Time/Space Configuration

Information and communication technologies (ICT) challenge the traditional definitions of rigid space and time slots (e.g., access anytime from anywhere). This domain refers to how, and to what extent, the Internet has made academic instruction more flexible in temporal and spatial terms. To answer this question a random sample of about 300 course websites (out of about 1000 courses in the year 2002) is being reviewed and analyzed using a *course website characterization scheme* developed for this purpose.

Information and Content

Content is the major ingredient of any course website (Bonk, 2001). While studying the course, students use various content resources included in the website (e.g., presentations, textbooks, papers, links to other websites, lecturer notes, readings). It is natural that instructors invest considerable effort in planning and developing their course website's contents. Given that a complete overlap between the developers' vision of the course website and the students' usage of it is impossible, it is important to assess the contents consumption patterns (e.g., Sason & Nachmias, 1999). The research objectives in this domain were to assess the extent to which (a) instructors upload contents on their websites, and (b) these contents are consumed by students. Using the data collected in this study, we aim to come up with possible statistical measures of courses' "content consumption". Data was directly collected from computer logs of about 5000 students in 117 courses using Virtual TAU in the academic year 2000/01. Page views for every content unit by every student were recorded and analyzed.

Communication and Interaction

In this domain we are interested in the extent and quality of students' and instructors' communication behavior supported by synchronous and asynchronous communication tools. A typical use of ICT tools in web-based learning is the asynchronous discussion forum. Such a tool provides students with the opportunity to communicate, share ideas and collaborate (e.g., Hara, Bonk & Angeli, 2000). The technical feature that enables storage and accumulation of all participants' contributions allows both students and instructors to review previous interactions and to reflect on different aspects of the learning process within the forum. The major research questions are: To what extent do instructors use forums in their course websites and for what purposes? What are the individual differences among students in forum usage? To answer to these questions, about two hundred courses in the academic year 2000/2001 were screened. Then, we analyzed the messages of all 994 students who studied in 34 courses who used forums extensively, and interviewed students and teachers as well.

Pedagogical and Didactic Solutions

From the pedagogical perspective, innovations are defined in terms of novel didactic solutions reflecting theoretical shifts (e.g., from a behaviorist to a constructivist perception of the learning process). The properties of ICT raise the need to examine fundamental questions regarding the desired features of pedagogical models using web technology (Mioduser, Nachmias, Oren & Ram, 2000), in hybrid face-to-face/virtual courses (Nachmias, Mioduser, Oren & Ram, 2000) or in online discussion groups (Oren, Mioduser & Nachmias, 2002). Research seeks to identify and classify the evolving web-pedagogies ("webagogies") and assess their usage and their effectiveness (e.g., Stephenson, 2001). The primary objective of this study is to identify, collect and classify exemplary pedagogical practices used by selected instructors participating in Virtual TAU (e.g., innovative educational activities, assignments, and didactic solutions). These all are being added to the "webagogies data-base" which will eventually be disseminated throughout the campus. Web-pedagogies are identified and classed through the analysis of the courses' websites, as well as via interviews with their developers and instructors.

Student And Teacher Roles

Increased delegation of responsibility and control over the learning process to the students is one result of the web-based pedagogical innovations. They might promote active and independent learning in which students take responsibility for their own learning, set their own learning goals, create their own learning activities, and/or assess their own progress and/or the progress of other students. ICT might engage students in collaborative, project-based learning in which they work with others on complex, real-world problems or projects. ICT also might provide students with individualized instruction, customized to their different entry levels, interests, or conceptual difficulties (Kozma, 2000). A major research question is whether all this potential is realized in the learning process. Another question is related to students' attitudes toward their use of the Internet for learning and their perceptions of the technology usage. To answer these questions about 3,000 students using Virtual TAU filled out a questionnaire designed for the study. Changes in teachers' role is also a substantial subject for research. Is the shift from "a sage on the stage" to "a guide on the side" a realistic one? Is such shift to be expected from all teachers given their various teaching styles and needs? These and similar questions are currently being answered by a sample of 50 lecturers participating in this study. Data are being collected by means of interviews in two phases: during the first year of usage by the lecturer and two years later.

Micro Level: Features of the Teaching/Learning Process in Specific Courses

At this level we are interested in the actual features and consequences of particular teaching/ learning processes and of explicit behaviors of instructors and students in specific courses. Several studies are being conducted The first study focused on the emergent collaboration activities in six graduate courses using Virtual TAU. Emergent collaboration is the process by which group configuration and transactional patterns evolve among participants in the course of learning. The major research questions were: What are the didactic modes that have been devised for supporting emergent collaboration learning processes, and to what extent do students and teachers participate in these processes? Data were collected by means of log files of students' page-views within Virtual TAU, transcripts of forums and collaborative activities, and unstructured observations. A description, results and conclusions of this study have already been published (Nachmias, Mioduser, Oren, & Ram, 2000).

A second study examined whether social climate evolves in different types of on-line courses.The study compared a hybrid course (involving a mixture of online and face to face interactions) and a distance learning course with reference of the emergence of a social climate This study focuses on the content analysis of messages posted by the students (a detailed description can be found in Oren et al., 2002).

IN ADDITION TEN COMPREHENSIVE COURSE CASE-STUDIES ARE BEING CONDUCTED WITH THE AIM TO PROVIDE MICRO-LEVEL INFORMATION REGARDING THE ACTUAL IMPLEMENTATION OF THE INTERNET IN THEINSTRUCTION (FIVEDURING THE ACADEMIC YEAR 2001/2002, AND FIVE MORE IN 2002/2003). Data collection is done a variety of instruments (e.g., instructor interview ; class observation; student interviews; analysis of the course's website, and learning products).

Preliminary Results

Since most of the studies are still at the data collection stage, we describe only some major results.

At the macro level we observed that the project expanded very rapidly beyond any expectation At the planning phase of the project we intended to implement the web shell in 100 courses over a two-year period, providing each one with a small budget and technical and pedagogical support. Actually, the number of courses in the project increased to 252 in the first year of the project, and in the current academic year (2001/2002) more than 400 instructors and more than 10,000 students from all faculties are using Virtual TAU in almost 1,000 courses. Only 100 courses are receiving financial support from the university. This suggests that the instructors realize the potential benefits of the novel technology for teaching, and are willing to invest their own time and resources in using it. Moreover, many instructors who previously developed course websites using various HTML editors, abandoned these tools and rebuilt their websites using the Virtual TAU shell. This implies that a uniform, easy-to-use, web-supported learning environment is the right tool in the right place for many instructors.

At the mezzo level, several phenomena were revealed. Flexibility in learning time and space was not really achieved so far. Less than 1% of the courses were implemented as complete distance education courses and very few instructors replaced face-to-face classes by web assignments. In the vast majority of the courses the web activities were additions to the ordinary classes . Most instructors view the Internet as content provider rather than a communication facilitator. While all instructors uploaded content to their websites (average of 28 items per website, sd 25), only in 16% of the courses asynchronous forums were included as a teaching mode. Content items include presentations, articles, academic papers, links to websites, simulations, assignments, tests, answer sheets, etc.

From the pedagogical point of view most instructors are using the websites in a basic fashion Only about five percent are developing and using novel pedagogies in which the web has clear added-value (e.g., web-supported collaborative work, replacing face-to-face instruction, web self-test, web peer review). Other instructors (an additional 5-10%) are experimenting and adding new features to their websites in successive runs of their courses (e.g., adding discussion group activities, developing self-tests for students).

As regards to students' usage of the course websites, which in most of the cases were complementary to face-to-face instruction and not obligatory, we found partial and limited usage of the digital medium. For example, out of 5,015 students enrolled in web-supported courses, 1,938 students (38%) did not view *any* content item on the courses' website. Out of 994 students enrolled in courses using asynchronous forums, 478 students (48%) did not participate *even once* in the discussions These figures are considerably large even taking into account that they include students who dropped the courses, and that many technical problems occurred in the first year of the implementation.

Of those students who did use the course website, many did not realize its full potential. For example, 70% of the students accessed less than half of the content items, and less than 5% accessed all content items in a course's website. Figure 1 shows the distribution of the percentage of content items viewed by students in 117 courses. A similar picture was obtained regarding the usage of asynchronous forums, where a few students dominated the discussions.

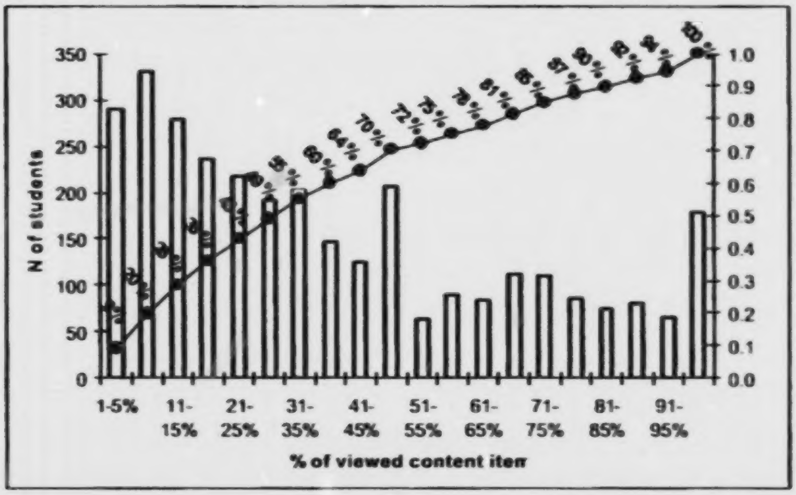
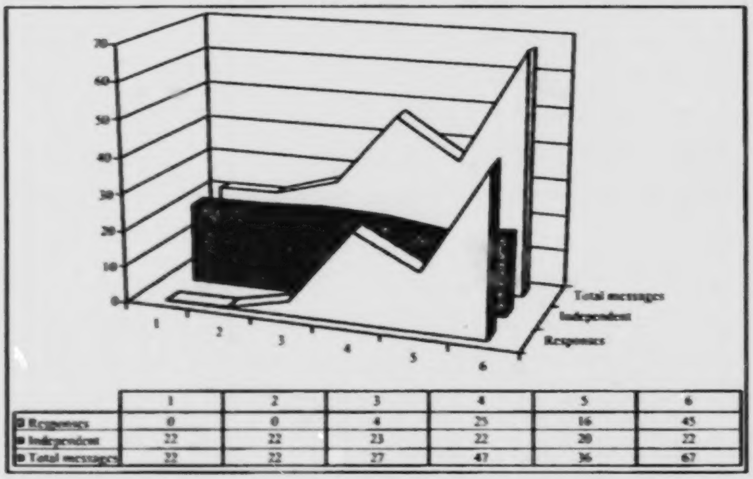


Figure 1: the distribution of the percentage of content items viewed by students(n= 117 courses)

At the micro level specific courses and particular educational transactions were investigated. For example, in one graduate course at the School of Education, critical reading activities were devised as Web-supported and collaborative tasks. Web-support took two main forms: most reading materials were located (as full text and in digital form), or could be reached, in Websites; and Web-shell tools (e.g., forums, mail) supported the students' work. Collaboration was implemented not in the form of pre-structured collaborative tasks, but as working milieu within which learning transactions and dynamic partnerships were expected to evolve in the course of the semester. Figure 2 shows the evolvement of the transactional volume in quantitative terms. The course (22 students) included six forums focusing on critical-reading tasks. For the first two forums, each student entered one message, according to the minimal requirements. By the fourth task participation had increased notably, up to a triplication of the initial values in the last task. The interesting aspect of these figures is that the number of independent contributions remained the same for all tasks, while the difference was made by the increasing amount of responses to other students' messages – from none at the beginning up to 45 in the last task (See Nachmias et al., 2000 for more details).



	1	2	3	4	5	6
▨ Responses	0	0	4	25	16	45
■ Independent	22	22	23	22	20	22
□ Total messages	22	22	27	47	36	67

Figure 2: Number of transactions in six forums of a graduate course using Virtual TAU

A similar observation was made in an undergraduate course in life sciences. This course, created specifically for distance learning, aimed to promote critical reading of scientific articles. The core content of the course comprised six scientific articles which the students were required to read, analyze, discuss and criticize using the asynchronous tools. Both instructor and students reported on an outstanding learning experience involving autonomous learning and collaborative work.

Final Remarks

This paper described the comprehensive research framework for a campus-wide implementation project aimed at integrating the Internet into the academic instruction. The data excerpts presented illustrate the complexity of the project and the many faces of its evaluation. On one hand, we saw enthusiasm and clear evidence of the educational potential of web-supported instruction. On the other hand it is obvious that most instructors and many students still have a long way to go in realizing this same potential. We view this comprehensive research effort as an essential part of the process of change in academic instruction. The research results (primarily at the micro and the mezzo levels) might assist instructors in their continuous efforts to improve their instruction. Updated data and just-in-time insights (primarily at the macro level) can support university leaders and decision makers in managing the technological change in the institution. And finally, research at all levels contributes to the growing body of knowledge about web-supported learning and teaching processes.

Bibliography

AFT, (2000). *Distance education: Guidelines for good practice*. American Federation of Teachers, May 2000. [On-line]. Available: http://www.aft.org

AFT, (2001). *A Virtual revolution: Trends in the expansion of distance education*. American Federation of Teachers, May 2001. [On-line]. Available: http://www.aft.org

Bates, A. W. (2000). *Managing technological change: Strategies for college and university Leaders*. San Francisco: Jossey-Bass.

Bonk, C., (2001). *Online teaching in an online world* [On-line].
Available: http://www.courseshare.com/report.php

Bonk, C., Cummings, J. A., Hara, N., Fischler, R. B., & Lee, S. M. (1999). A ten-level web integration continuum for higher education: New resources, partners, courses, and markets. [On-line]. Available: http://www.idea-group.com/Instructional_and_Cognitive_Impacts_of_Web_Based_Education.htm

Collis, B., & Moonen, J. (2001). *Flexible learning in a digital world: experiences and expectations*, London: Kogan Page.

Guri-Rosenblit, S. (2001). The tower of Babel syndrome in the discourse on information technologies in higher education. *Global E-Journal of Open, Flexible &Distance Education, 1*(1), 28-38.

Hara, N., Bonk, C. J., & Angeli, C. (2000). Content analysis of online discussion in an applied educational psychology course. *Instructional Science, 28*, 115-152. [On-line].
Available: http://www.wkap.nl/article.pdf?230642

Harasim, L., Hiltz, S. R., Teles, L., & Turoff, L. (1995). *Learning networks*. Cambridge, MA: The MIT Press.

Kozma, R. (2000). *Quantitave studies of innovative pedagogical practices using technology*. SITES-M2 unpublished design document, IEA.

Mason, R. (2000). From distance education to online education. *The Internet and Higher Education, 3*(1-2), 63-74

Mioduser, D., Nachmias, R., Oren, A., & Lahav, O. (2000). Web-based learning environments (WBLE) - current technological and pedagogical state. *Journal of Research on Computing in Education, 33*(1), 55-76.

Mioduser, D., & Nachmias, R. (2002). WWW in education. In H., Adelsberger, B., Collis, & M. Pawlowski, (Eds.), *Handbook on information technologies for education & training* Berlin: Springer, 23-43.

Nachmias, R. (2002). Research framework for the study of a campus-wide web-based academic instruction project. *The Internet and Higher Education, 5*(3).

Nachmias, R., Mioduser, D., Oren, A., & Ram, J. (2000). Web-supported emergent collaboration in higher education courses. *Educational Technology & Society, 3*(3), 94-104.

Oren, A., Mioduser, D., & Nachmias, R. (2002). The development of social climate in virtual learning discussion group. *The International Review of Research in Open and Distance Learning 3*(1), 1-19.

Phipps, R., & Merisotis, J. (1999). *What's the difference? A review of contemporary research on the effectiveness of distance learning in higher education*. Washington, DC: The Institute for Higher Education Policy. [On-line]. Available: www.ihep.com/PUB.htm#diff)

Rogers, E. (1995). *Diffusion of innovations* (4th ed.). New York: Free Press.

Sason, E., & Nachmias, R. (1999). *What makes them click?* Paper presented at the Ed-media. World Conference on Educational Multimedia, Hypermedia & Telecommunications, Seattle.

Stephenson, J. (Ed.) (2001). *Teaching and learning online: Pedagogies for new technologies*. London: Kogan Page.

Using Technology to Disseminate Classroom Teaching Practices

A. Background

In a recent address at Harvard University's Principals' Club, Richard Elmore pointed out the need to focus on changing teaching *practice*, not *structure*: "[Schools] know how to change…What schools do not know how to do is to improve, to engage in sustained and continuous progress toward a performance goal over time. So the task is to develop practice around the notion of improvement….Real improvement comes when you visit a classroom where somebody is doing the same thing you are - only better." (1)

The idea of improving teaching through enhanced communication among classroom teachers is certainly not new. The difficulty, however, has always been in knowing specifically how to do this, how to provide the time and opportunity for teachers to collaborate on a peer-to-peer basis much in the manner of other professionals. Accordingly, other than reading the occasional periodical, or attending a local conference or workshop, K-12 teachers largely are left to their own devices insofar as classroom teaching practices are concerned.

Today, the Internet has changed this situation. Andrew Lippman of the MIT Media Laboratory recently stated that, because of the Internet, "….we are at the cusp of real change both culturally and societally. This is not just a technology change; the Net is not just a telephone system that talks to computers, nor is it just something that works better than the phone system. We are using communication networks that are fundamentally different from any other communications systems that we have ever had before; they connect groups and social structures….That is what the next five years is all about: Bringing communications to the world." (2)

James Champy, in his recent book on *X-Engineering the Corporation*, makes the same point: "The power of the Internet as a technological development ranks with the advent of electricity, the internal-combustion engine, nuclear power, and the computer itself. It is the ubiquitous network that can link all organizations, and it is driving a fundamental shift in the way organizations operate. Over time, it will not only improve the performance of managers and employees- it will alter the very nature of their work." (3)

B. Current Availability of Best Classroom Practice Examples

Today, the Internet is filled with thousands of Lesson Plans and other descriptive examples of classroom teaching practice. For the most part, these materials are text-based documents and follow no geographic categorization format; that is, most often there is no effort to "regionalize" the Lesson Plans. Undoubtedly, Internet-posted Lesson Plans are excellent examples of particular classroom practices but, nevertheless, the question arises: How frequently are such Lesson Plans adopted by other classroom teachers? In the first place, just the sheer number of Lesson Plans available for review-coupled with the all-too-common lack of time on the part of practically every K-12 teacher, makes it doubtful if many such Internet Lesson Plans are adopted elsewhere. Media-based Lesson Plans are available to a lesser extent but also are seldom adopted since they must be distributed by CD/ROM and other cumbersome delivery methodologies.

C. A New Approach

In 2001, the University of Arkansas at Monticello School of Education obtained a small grant from the NEC Foundation of America to explore the possibility of creating a *National Teacher Education Technology Center*, centered upon the acquisition and web-based distribution of visually-oriented classroom technology practices found effective on a regional basis. The underlying concept behind this effort is that effective classroom technology teaching is already taking place in most K-12 schools; the problem is that, because of the virtually non-existent communications among K-12 teachers, very few people know of such excellent teaching practices. Our idea is that, by more effective use of the Internet, we can improve the communications between technology-using teachers, thereby raising the overall quality of K-12 teaching in the region.

A second key component of this effort is the use of Teacher Education Interns as "change agents." Specifically, we have altered our preservice curriculum so that each Intern is expected to design and to develop at least three technology-based projects each semester of the Internship year. One project will be centered on teaching, one project on student learning, and the final project dealing with some type of tool or utility software. The Intern then summarizes the results of the work in a formal mediated presentation to the faculty, and includes this electronic presentation in his or her Electronic Portfolio.

Since this instructional media production program is already in place, it is an easy step to ask the Intern to identify one or two other teachers at the Internship site that is utilizing classroom technology in some beneficial way and to then record this activity in an electronic format such as Microsoft *PowerPoint®* or other presentation software. This presentation is then vetted by School of Education faculty (Educational Technology Committee) and posted on a dedicated web site for access by other local teachers at that grade level and subject matter area. To date, twelve specific classroom technology applications have been identified, and it is planned to have these materials posted by the end of the current calendar year. We expect to add 20 to 30 additional examples each year thereafter. Also, it is noted that each posted example will include the following information: 1) Purpose, 2) Demonstration, 3) Student Feedback, 4) Resources Required, 5) State/District Standards, and 6) Further Information. Media formats include Text/Still Image, Text/Still Image/Audio, Text/Image/Video, and DVD, although the first examples will be limited to Text/Still Image only. Later, as Internet broadband capability expands, we will include streaming video and other more robust presentation formats.

D. Networking

An important part of this overall effort involves increased collaboration and communication with other area Schools, Colleges, and Departments of Education (SCDEs). Accordingly, and in connection with a U.S. Department of Education *Preparing Tomorrow's Teacher to Use Technology* (PT3), the University of Arkansas at Monticello School of Education hosted an Arkansas Teacher Education Technology Symposium on April 4, 2002 with the intention of forming a Technology Consortium among the eighteen Teacher Education institutions within the State. This proposal obtained good reception and, accordingly, we plan to extend this Classroom Technology Practice sharing idea on a State-wide basis within the next year. Later, as this approach proves successful on a local and regional basis, we can expand the scope of the project nationally through participation in the planned online Project CATALISE Teacher Education Resource Clearinghouse. (4) Again, all of this is possible only because of the ubiquitous availability and inherent communication effectiveness of the World Wide Web; that is, we are now able to do something that simply was not possible in the past.

E. Summary

In a recent article in the *New York Times Magazine*, the Scientific Director of Hewlett-Packard spoke of the "need to design novel mechanisms and institutions so that we can harvest the distributed knowledge that such a gigantic social mind is producing…research consistently finds informed communities making better decisions than any of their members, knowing more, and thinking better than experts. There is this notion of a collective mind, a social mind, and today the Internet allows us to tap that."(5) Elementary, Middle, and Secondary School teachers in every part of the country are making excellent use of classroom technology in their classrooms every day. To improve teaching practice in a most dramatic way, all we need to do to let other teachers learn more of what these other teachers are already doing. It is the purpose of this effort to do just that.

References

(1) Richard F. Elmore, The Limits of "Change," *Harvard Education Letter*, Jan/Feb 2002

(2) Andrew Lippman, MIT Media Laboratory, *Syllabus*, Feb 2002

(3) James Champy, *X-Engineering the Corporation*, AOL/Warner Pub., 2002

(4) Consortium for Application of Technology and Learning Innovations in Schools of Education (see CATALISE.org), 2002

(5) New York Times *Magazine*, April 22, 2001

Hybrid e-Learning System
for a Cooperative Linkage between University and Industry

Toshio Okamoto, Mizue Kayama, Hisayoshi Inoue, Tatsunori Matsui and Kazuya Seki
Graduate School of Information Systems, University of Electro-Communications
okamoto@ai.is.uec.ac.jp

Abstract

This paper presents a web-based distance education system that contains synchronous (live) video lectures, asynchronous learning materials with video-on-demand (VOD) archive data, and question & answer functions through digital reporting between a lecturer and students. It is intended to provide a collaborative workplace to encourage interactions among a lecturer/learners. As such, this environment enables learners to exchange their knowledge and their way of thinking, furthermore, to refine/build the knowledge acquired via lectures. One of the main purposes in our research is to build a flexible e-Learning environment by embedding self/collaborative support functions for the digitized live lectures in order to reinforce much more meaningful knowledge and skills. Moreover, we propose an innovative educational method of a cooperative link between a university and an industry for the higher education.

The Industry and University cooperation program is a project of the Japanese Ministry of Education (Mombusho). The target objective of this program is the harmonization of university level educational research, society practice and practical business. The University of Electro-Communications has been appointed by Mombusho to fulfill some specific parts of this program. In this paper we report about our experiences with the introducing of this program, about the framework, settings, actual implementation and first results. We analyze these results and the problems we encountered, as well as offer constructive solutions.

. Introduction

The Industry and University cooperation program is a project of the Japanese Ministry of Education (Mombusho[2]). The objective of this program is not only the completion of an environment where upstanding members of the society with business, industry or university background can learn, but also to the connection and harmonization of university educational research and society practice and practical business. Specifically, the program aims at offering the university student access to the practical, business point of view and practical knowledge on one hand, and the industry and company employee an opportunity to improve oneself and an access to higher knowledge and education[4]. In this way, we are promoting an educational collaboration program that binds university and industry[8].

The goal of the educational program we present is not the building of a large-scale novel curriculum, but the expanding and enrichment of the preexisting curriculum at the graduate school level, by adding company employees' and professional knowledge, and with the specific target of enabling practical, efficient re-training and re-education.

The Japanese Ministry of Education appointed the University of Electro-Communications (UEC) with the enacting of this cooperation program between Industry and University. The target learners are industry students as well as regular students of the university graduate courses, who wish to learn about the new Information Technology (IT) issues. The emphasis lies especially on advanced IT topics. The actual putting into practice involves the extension of the existing curriculum towards more flexibility, in contents as well as in form, in order to allow learning conditions for industry persons as well[5,6]. The implementation method is via long-distance Internet courses, which allow business and industry people to take courses from far sites, without leaving their working places. Moreover, the Internet method allows for flexible hours. Other three universities were appointed to start parallel projects in complementary fields.

In this paper we report about our experiences with the introducing of this program, about the framework, settings, actual implementation and first results. We analyze these results and the problems we encountered, as well as offer constructive solutions.

2. The Program

The subject of career development involving acquiring of high experience and knowledge in the field of information communication technology is an important subject for the future information communication society. The starting courses of the program involve this discipline. The lectures were focused on high information technology, large-scale information system planning and application, and network technology.

For the first year period, the courses involved the following topics:

- Multimedia Communication Technology
- Information Security

Moreover, the appointed lecturers for the industry and university cooperation program are not only researchers and professors from our graduate school, but also company researchers and implementers as well. This is due to the fact that it is important for students to acquire knowledge about not only the theoretical side related to information systems, but also about the practical side.

The lectures are held as collaborative lectures of the type called "*omnibus*" (each lecturer presents only one lecture). Although this new curriculum is of a flexible nature, with many evening hours (to ensure easy participation from far sites) and a relatively concentrated information contents given over a short time period (again, to ensure that company workers loose not too many hours with this program), the UEC graduate school has established a regular credit system for certification purposes. The level of certification is Master level.

3. Experimental situation

Here we report an example situation of a lecture entitled "multimedia communication science/ technology and application". The syllabus of this lecture includes: multimedia and distributed cooperation, CSCL (collaborative system collaborative learning) and collaborative memory, multimedia communication technology, ATM networks, new Internet technology, media representation form and application, data mining, multimedia and distributed cooperation learning support systems, knowledge management, standardization and new business models. The total number of learners attending the lecture was 63, among who only 13 were curriculum students. This time, the distance company sites that cooperated were located near Tokyo, in Kanagawa prefecture. The distance companies were linked via Internet and ISDN circuit, therefore establishing a real time bi-directional information transmitting & receiving environment (details in the next section). Figure 1 displays the geographical distribution of the distance company sites.

From the distance company sites to the University of Electro-Communications, the needed round trip time of the closest site is of 2 hours by public transportation, and for the furthermost the round trip is of about 6 hours. Therefore, considering the hours of time saved and the convenience of the distance education method, the system presents evident merit for both learners from far company sites as well as company managers.

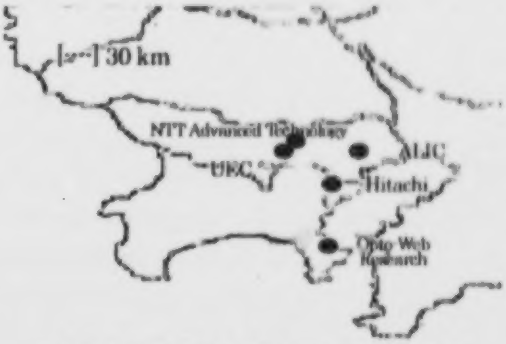


Figure 1. Distribution of distant company sites

4. Distance education system configuration

It is necessary to provide a lecture environment that guarantees the lecture movie, sound and lecture materials presentation distribution for attending students, as well as a dialogue function supporting the communication between lecturer and students. We

BEST COPY AVAILABLE

have implemented these functions by using a VOD (Video On Demand)[3,7] server and a WWW (World Wide Web) server. Figure 2 shows the system configuration of the distance learning system.

Each site has to configure the transmission server and the viewer. Each distance lecture site establishes two dedicated channels: one for receiving only and one for sending only. By connecting respectively the lecture classroom transmission with the distance site reception and the distance site transmission with the lecture classroom reception, bi-directional communication is implemented. Below, each function is outlined.

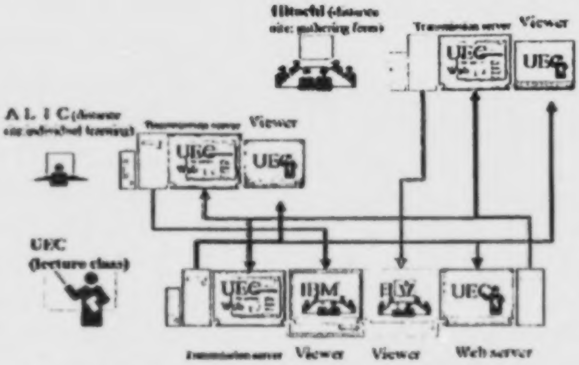


Figure 2. Distance learning system configuration

1) ***Transmission function of lecture's movie and sound*** : the movie and sound of the lecture is distributed to the attending sites with the help of the VOD server real time transmission function[10]. Moreover, in the case of some companies, their Internet access and therefore, the transmission/ reception of lecture movie and sound is not free. To cope with such a network environment, we had to ensure a dedicated Proxy server that relays the distribution of lecture movie and sound between Internet sites, to ensure the data reception. Students at far sites attend lectures by viewing the lecture movie and sound data distributed by the VOD server.

2) ***Lecture material presentation function*** : the lecture materials are formatted as HTML (Hyper Text Markup Language) sources and offered to students via the WWW server. Students use the WWW browser to access the lecture materials and to follow the lecture progress by referring the appropriate page.

3) ***Dialogue (chat) function*** : the communication tool between lecturer and student: Is ensured by a CGI (Common Gateway Interface) program written in Perl (Practical Extraction and Report Language). Lecturer and students access the CGI program via the WWW browser and perform a questions and answers session via the chat terminal screen.

One problem appearing is that the lecture movie and sound data sending and reception conditions depend on the network traffic conditions. Namely, if the reception data has a delay, far site students have difficulty in viewing the lecture, therefore failing to understand the lecture contents. Therefore we have setup a bi-directional communication channel between lecture site and far sites. In this way the communication channel between lecturer and students is guaranteed, independent of the Internet network conditions. Figure 3 shows the distance lecture environment structure (lecture site -> far sites) as well as the interface of both lecturer and students. As can be seen in the Figure, the lecture manager transforms the lecture materials into HTML form and performs the registration into the lecture materials database.

Figure 4 displays the main menu lecture site and attending sites registration window. Concretely, data recorded are machine name (organization name), VOD server IP address and port number and VOD contents stream identifier. Students attend lectures (Figure 4) via our distance lecture environment interface. Firstly, they select the lecture movie "reception" button from the main menu. The system than enquires for the movie to display.

4.1 The Environment for distributed e-Learning Contents

We have developed Web-based learning materials "Multimedia Communication Technology" by HTML, PERL, CGI, Java and VOD materials by Stream Authorware tool. The VOD materials consist of the archive data of movies / sounds from the live lectures in remote areas. According to the stream of movies, PowerPoint manuscript for each lecture is inserted with a synchronous signal in an appropriate position. This environment has three pull-down menus (i.e., a learning objective, a learning mode, and a contents-catalog) to enable learners to select and retrieve whatever they need. This distributing function has been implemented in our original Learning

BEST COPY AVAILABLE

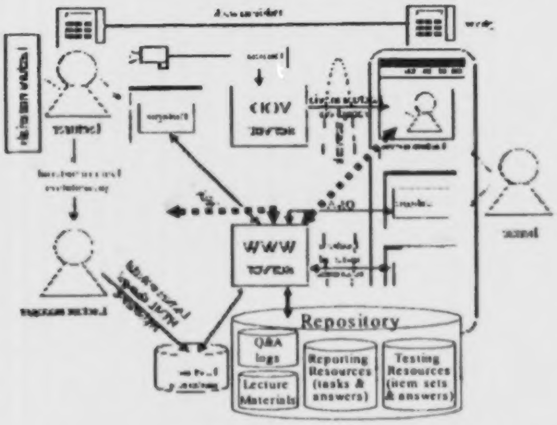

VOD
WWW
Repository
Q&A logs
Lecture Materials
Reporting Resources (tasks & answers)
Testing Resources (item sets & answers)

Figure 3. Hybrid e-Learning environment system

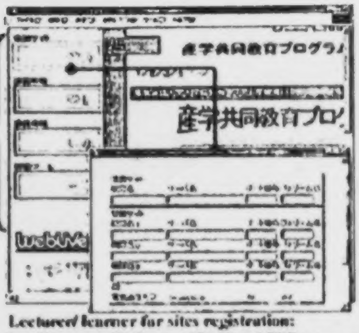

Main Menu
①lecture site/ distance learning site registration
②Lecture movie receiving
③Lecture materials indications
④dialogue tool startup
産学共同教育プログラ
産学共同教育プロ
Lecturer/ learner far sites registration:
[machine name | VOD server IP address] VOD server port number | streaming identifier] input

Figure 4. Lecture / distance learner site registration

Management System (LMS) named RAPSODY [9].

4.2 The Collaborative Workplace for Question & Answer

We built a collaborative workplace to encourage interactions among a lecturer/learners. In such a case, learners can exchange their knowledge and their way of thinking, furthermore they can refine/build the knowledge acquired via lectures. By a collaborative workplace, we mean a kind of BBS, nevertheless, in addition to Chat function, this workplace enables data/information sharing transmitted from different sites. Figure 5 shows the configuration of relationships between the personal workplace and collaborative one.

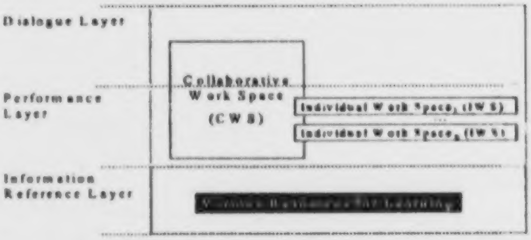

Dialogue Layer
Performance Layer
Information Reference Layer
Collaborative Work Space (CWS)
Individual Work Space$_1$ (IWS)
Individual Work Space$_n$ (IWS)

Figure 5. Configuration of relationships

4.3 The Assessment Module for Learners

After lecture/web-learning, a test or reporting for learners as a summative evaluation is needed. In this environment, we have provided the repository of a set of test items and reporting tasks according to subjects (course-unit) matched with each learning objective. Students can pick up certain amount of test items or reporting tasks designated by a lecturer, and then reply/send back their answers to *the digital pigeon box*. As such, a lecturer can score and evaluate their achievements online. The simultaneous test is carried out in order to avoid a student's copying behavior from others. Moreover, the *text analyzer* was implemented to check the similarity of the reporting contents from the students automatically. This analyzer was built on the statistical natural language processing method, performing the following functions: picking up important keywords, its occurrence frequency, and co-occurrence of the related word for a certain word.

After pressing the button "lecture site ->lecture movie", the system pops up the "lecture movie playback" window and starts the playback (Figure 6). Moreover, when clicking the main menu's "lecture materials presentation" button, the system presents the lecture materials, too. Students can browse the lecture material via the buttons "advance" and "return". To enable the questions and answers session, the lecturer has to select from the main menu the dialogue tool "startup", action that will generate a "chat" window.

Lecturers attend lectures via a similar procedure to the students. Firstly, they select the lecture movie "reception" button from the main menu (Figure 4). If the students' far sites are equipped with VOD server, video camera, microphone and movie encoder, it is possible for lecturers to receive the image (and sound) of the students attending the lectures. Similarly to the students, the lecturer can

BEST COPY AVAILABLE

view the movie and sound and use the playback function. Moreover, in the case of multiple far sites, the lecturer can switch between them. Questions and answers sessions are possible as full movie and sound exchange, as chat (in text format) or via the regular telephone line.

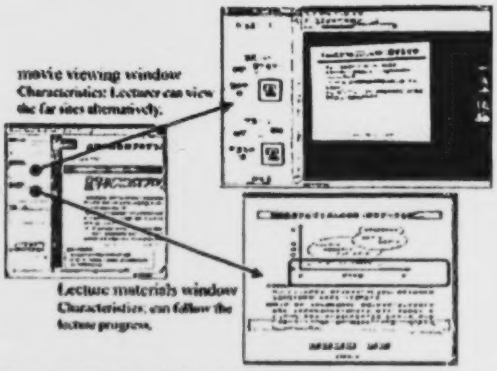

movie viewing window
Characteristics: Lecturer can view the far sites alternatively.
Lecture materials window
Characteristics: can follow the lecture progress.

Figure 6. Movie playback/ lecture material indication

5. Evaluation of the Industry and University Education Cooperation Program

The evaluation of the program focuses on how many of the objectives stated in the introduction were actually achieved, and was performed from the 3 points of view enumerated below:

1) *Science and technology aspect:* Here we analyze the operations, functions and the lecture movie and sound data transmission and reception.
2) *Educational aspect:* Here we examine the meaning and significance of the distance education lecture in the frame of the industry and university collaboration project, via questionnaires filled in by the students.
3) *Application and organizational aspect:* Here we collect information from administrators participating in the same program; the focus is on possible improvements of the distance education system, and the data collection is done via work sheets analysis and interviews.

The analysis of the lectures from the above-mentioned points of view is a continuous process. In this section we report the results of points (1) and (2) above.

(1a) Science and technology aspects; evaluation 1: movie and sound data transmission and reception aspect

We have measured the delays, time-lapses and evolution of the lecture movie and sound data transmission. For this purpose, we have analyzed a situation with 3 sites exchanging VOD data. Each site was respectively connected to the Internet via either a high speed -, low speed dedicated circuit (maximum rate 128 kbps), or via a business provider dial up IP link. For the analysis of the transmission, we have collected data from each site on the movie bit rate (Figure 6), movie frame rate (Figure 7) and sound bit rate (Figure 8). As can be seen in the Figures, the maximum real

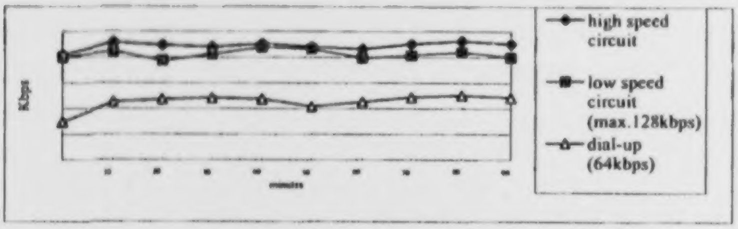


Figure 6. Movie bit rate time series

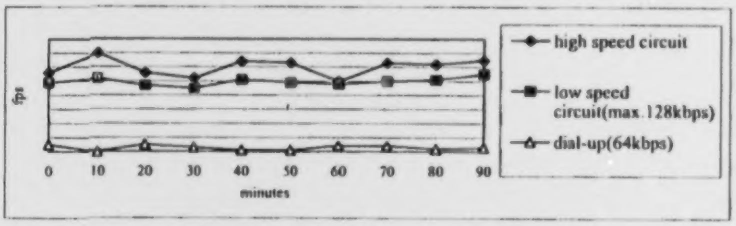


Figure 7. Movie frame rate time series

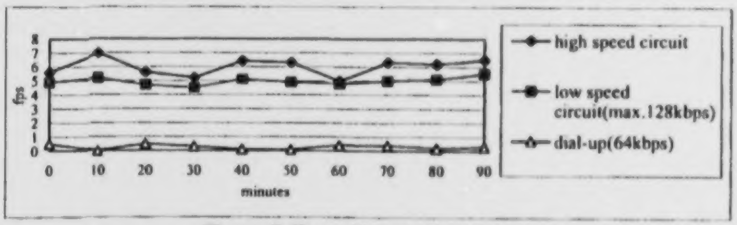


Figure 8. Sound bit rate time series

BEST COPY AVAILABLE

transmission values are, respectively, 48 kbps for the maximum real movie bit rate, 10 fps for the greatest real movie frame rate and 13.2 kbps for the highest real sound bit rate.

We will firstly discuss the movie transmission. For movie bit rates of 40 kbps and above, the lecture transmission is stable, with little interruptions, and the frame transmission is of about 5 frames per second. However, we have experienced that for the dial up connections, reception at the students' far sites is of about 1 frame per 10 to 20 seconds. At this rate, the lecture movie playback window often freezes into a still image for several seconds. Students attending lectures from such sites complained therefore that movie and sound reception is often asynchronous. Compared with the movie data reception, the sound reception was relatively stable for all participating sites. The above experimental result shows clearly that for such distance lectures the limitation is given by the movie reception, and that it is recommended to implement distance lecture environments on network circuits allowing maximum transmission capacity of 128 kbps or above. If a provider IP connection cannot be avoided, the distance lecture environment can be improved with a number of adjustments, as follows.

The first adjustment is related to the lecturer's actions. The VOD system used in our distance lecture environment complies with the H.261 standard, which bases the movie distribution on information compression via a frame prediction mechanism. Namely, the transmitted/ received information weight changes according to the movie data, movie complexity and details, movement intensity, etc. If the lecturer's actions are various, the transmission data weight grows. However, if the lecturer's actions during the lecture are moderate, the movie changes are reduced and therefore the lecture movie distribution can become a little more stable.

As another adjustment, the creation of a dedicated low speed circuit for the VOD server is necessary.

If these adjustments are made, all sites can reach similar bit rate, and the distribution occurs according to the different frame rates. I.e., according to the network bandwidth of the access points, the distribution to high speed circuit students' far sites should be high rate, whereas the low speed circuit far sites should receive low rate movie and sound data.

(1b) Science and technology aspects; evaluation 2: distance education system operatively and functions

We have identified a few possible improvement points concerning lecturing via a distance education system, with focus on application result, operatively and function. Table 1 shows the recommended improvements for the distance lecture environment. Some items in the table point to proposed solutions, others to counter- measures, and again others just present situational examinations.

Table 1: Problems and solutions of the distance learning environment implementation

Encountered problems	Solutions/ Results
Web lecture materials are not synchronous with the lecturer indications. If the lecturer is browsing quickly through the material (as often in the second half of the lecture), the distance learners cannot keep up with the current page.	By using applications with share function, the synchronous display in both lecture room and far sites is possible. One drawback is that the lecturer's personal browsing through the material is not possible anymore.
The circuit speeds of the distance lecture sites differ. Reception is therefore difficult for some sites.	Multiple preparations are necessary for correct movie & sound transmission. The server setup should follow the various requirements of the distance sites.
During the Q&A session, the communication quality is reduced by the existent delay between lecture room and far sites.	There is no fundamental replacement scheme at present. New infrastructure and communication hardware is necessary. Rehearsal prior to the actual Q&A session is useful (or guidance of session by a chair person).
The phone line Q&A sound problems: 1) Noise, hauling; 2) Speaker volume & receiver volume differ.	1) Noise, hauling are caused by the using of a large combination of equipment 2) The volume difference can be cancelled by the circuit resistance value.

(2) Educational aspects evaluation: questionnaire survey

After each industry and university cooperation program lecture we have asked the learners to fill in a questionnaire. The questionnaire contains 21 questions that are a combination of both free description form questions and questions with a 5 steps assessment scale. For the latter, the students should choose the most appropriate of the 5 steps (5: I strongly think so, 4:I incline to think so, 3: Neither Nor, 2: I incline not to think so, 1: I definitely don't think so).

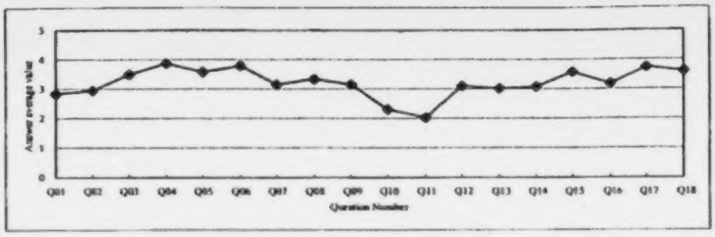


Figure 9. Curriculum questionnaire result average (first lecture in series)

As the industry and university cooperation program lectures cycle is not yet finished, we couldn't aggregate all the questionnaire results yet, and therefore cannot establish conclusive results yet. However, as at present we have finished the first round of lectures, it is possible to derive some suggestions and hints. Figure 9 shows the average answers of the first lecture. Questionnaires were anonymous and 38 questionnaires were returned from the 63 distributed. As the questionnaire (table 2) average is in general around 3-4, the result can be called satisfactory. Especially, questions Q4-6 (about students interest in the subject, the motivating effect of the lecture and about the knowledge they acquired) showed a high score.

Students had an average of 2.8 preliminary knowledge on the subject (Question Q1). This result possibly points to the fact that learners with no prior knowledge, up to learners with some prior specialty knowledge all were interested in the lecture. As the acquisition of high-level specialty knowledge is the main object of the industry and university cooperation program, this is an extremely important pointer. A low result was noticeable especially for questions Q10 and Q11 (regarding the far site transmission situation). Therefore, an important sub-goal and improvement point for the next lectures is the harmonization of the transmission with the far sites. As these were the results of the first lesson in the series, such problems were perhaps unavoidable, and the management and synchronization of lecturer, lecture manager, technical supporters, and teaching assistants was difficult to establish. Some of these problems have already been solved in the following lectures of the same cycle, but as the results were not yet analyzed, we present here our first experiences only, to be of use and serve to guide other educators worldwide.

Table 2: Industry-University Collaboration Program Questionnaire

Q1. Did you have previous knowledge on the contents of this lecture?
Q2. Is there an important connection between today's lecture and your research/ study field?
Q3. Do you think you will be able to use today's lecture contents in your future research/ job?
Q4. Are you interested in the topics presented by today's lecture?
Q5. Do you feel that today's lecture has opened new perspectives?
Q6. Did today's lecture deepen your knowledge?
Q7. Was today's lecture according to your expectations?
Q8. Was today's lecture level appropriate?
Q9. Was today's presented subject of expertise of importance?
Q10. Was the cooperation with the far sites smooth?
Q11. Could you consider the far sites part integrated in the lecture environment?
Q12. Did the lecture materials offered with the lecture help you in understanding the lecture?
Q13. Did lecturing and lecture material presentation run smoothly?
Q14. Was question asking made easy by the offered environment?
Q15. Were today's sound and movie transmission clear?
Q16. Was today's lecture complete and sufficient for you, although designed as a distance education lecture?
Q17. Was the time distribution appropriate for today's lecture?
Q18. Was the time distribution appropriate for far sites, with regard to the Q&A session?

BEST COPY AVAILABLE

6. Conclusion

In this paper we have presented our experience with the introducing of the industry and university education cooperation project at our graduate school to promote the future high level information communication society based on life-long education. Especially, we have highlighted the following points.

1) The implementation method as well as possible problems of the distance lecture environment offering synchronous study possibility at the lecture site as well as far sites, based on bi-directional communication. In this sense we have concretely presented the lecture form, the representation and presentation technique, as well as the implementation of the questions and answers session.
2) The issue of curriculum integration and certification/ recognition of both on-site and far-site learners. Students in the graduate school as well as far site learners achieve credits according to the Master course credit system. Credits can be obtained course-based or program-based. We have also pointed to the merits of continuous learning and self-improvement for company employees, within our program.
3) Moreover, we have discussed and presented our efforts in the direction of building the infra-structure necessary to support the lecturing within the industry and university education cooperation program. Specifically, we referred to the prior collecting of information, which is to be sent together with the lecture movie and sound transmission. This service packet contains advice and assistance information concerning the lecture contents, the collection and classification of lecture materials, text forwarding, etc.

In this way we hope to support and respond to the forecasted growing future learning demand, especially on advanced IT topics, and to create the chance and environment for a wide area high-level education.

Acknowledgements

Special thanks to Mr. Akihiko Koga from HITACHI, Mr. Yuji Tokiwa from IBM and Mr. Kenji Ito from ALIC for their cooperation during this program.

References

[1] B. Collis, : Design, Development and Implementation of a WWW-Based Course-Support System, In Proc. of *7th International Conference on Computer and Education*, pp.11-18, 1999.

[2] Japanese Minatory of Education, Culture Sports Science and Technology : http://www.mext.go.jp

[3] J. Peltoniemi, "Video-on-Demand Overview", http:// www.cs.tut.fi/tlt/stuff/vod/ VoDOverview/vod1.html ,1995

[4] L.G Salvador, : Continuing Education Through Distance Training, In Proc. of *7th International Conference on Computer and Education*, pp.512-515, 1999.

[5] M.J.Rosenberg, : E-Learning –strategies for delivering knowledge in the digital age-, McGraw-Hill Companies, Inc., USA, 2001.

[6] M. Slomen, : The e-learning revolution – from propositions to action-, Chartered Institute of Personnel and Development, London, 2001.

[7] S. Hui, "Video-On-Demand in Education", http://www. cityu.edu.hk/~ccncom/net14/ vod2.htm

[8] T. Okamoto, (research representative/delegate) : Advanced Information Society; synthetic research on the contents, system and form of teachers' education - final report, 3 year research grant of the Ministry of Education, (A)(1)09308004 stage report. 2000.

[9] T. Okamoto, A.I.Cristea and M. Kayama, Towards Intelligent Media-Oriented Distance learning and Education Environments, Proceedings of *8th International Conference on Computer in Education*, pp.61-72, 2000.

[10] T. Okamoto, T. Matsui, H. Inoue and A. Cristea, A Distance-Education Self-Learning Support System based on a VOD Server, Proceedings of *International Workshop on Advanced Learning Technologies*, pp.71-78, 2000.

An Evaluation of Scaffolding for Virtual Interactive Tutorials

Claus Pahl
Dublin City University
School of Computer Applications
Dublin 9, Ireland
cpahl@computing.dcu.ie

Abstract: Scaffolding refers to a temporary support framework used during construction. Applied to teaching and learning it describes measures to support a learner to become confident and self-reliant in a subject. In a Web environment scaffolding features need to replace the instructor. We discuss our approach to Web-based scaffolding based on the cognitive apprenticeship and activity theories. We suggest a set of four scaffold types that have made our scaffolding-supported virtual interactive tutorial successful. We present a novel evaluation approach for virtual tutorials that is embedded into an iterative, evolutionary instructional design.

Scaffolding

In increasingly knowledge-based societies, flexible and self-reliant learning becomes more and more important. Internet technologies make learning environments available without restrictions in time and location. However, the reduced direct contact between the instructor and the learner requires additional support. The term scaffolding refers to a temporary support framework that is used in the construction of buildings. Scaffolding is needed in the construction process, but will be removed once the building process is advanced and the building supports itself. Scaffolding has been suggested – the idea can be traced back to (Vygotsky 1978) – as an approach to support learners in their learning effort. The essential objectives are self-reliant learning and the achievement of competency in a domain. Scaffolding is in particular suitable to support active learning approaches. Classically, scaffolding refers to the support learners get from interaction with experts, teachers, and peers, see (Guzdial & Kehoe 1998) or (Suthers 1998). It should enable the learner to accomplish a task in a self-reliant way. The forms of support that can be provided include learning material, feedback, assessment, and demonstration. Three characteristics are essential for scaffolding:

- Modelling: the desired learning behaviour is modelled by providing an adequate learning (infra)structure.
- Support: Targeted support is given to the learner so that the learner can perform a task independently.
- Fading: Over time the support is reduced to let a learner become self-reliant.

The presentation by the instructor needs to be contextualised for the learner. The progress of the learner through the material needs to be coached. Fading of support is an integral part of scaffolding. We can distinguish two dimensions: fading provision of support and fading usage of support. Reflection and, if possible, the articulation of reflection should be encouraged.

Scaffolding is often considered as a part of the cognitive apprenticeship theory, see (Shabo, Guzdial & Stasko 1997) or (McLoughlin, Winnips & Oliver 2000). This theory addresses the problem of coaching a student to perform a specific task. A student learns through active participation in a task in an authentic setting in a close collaboration with a master. The master provides the scaffolding. The process of apprenticeship-oriented learning is characterised by increasing control and ownership by the learner. The cognitive apprenticeship theory puts an emphasis on reflection. A first phase of learning is typically coached, followed by reflection. In the final phase, free and self-reliant learning is supposed to take over. An authentic setting is another key element of a successful apprenticeship model. Its allows a learner to train with or within the subject of concern itself.

In the presence of computer-supported teaching and learning, the notion of scaffolding needs to be adjusted. In particular the World-Wide Web offers new ways for the learner to interact with the environment. The instructor's role in providing the scaffolding support can be taken over by an intelligent software agent. This new context allows innovative forms of support, but there is also the difficulty is to capture the usually verbal communication process between an instructor and a learner in a virtual setting. Elements of the coaching process have to be represented using Web technology. The student progress has to be measured against an expert model. However, the establishment of a successful expert model in the Web context is a problem, since often no topic-specific expertise for learning with the Web exists. The integration of the evaluation of learning and instructional design is therefore imperative. An evolutionary approach to the design of Web courseware in general and scaffolding in particular is needed.

Scaffolding is suitable for active learning. The instructor can be replaced by an intelligent agent that also controls the learner activity. Activity theory is a framework that can help us to redefine scaffolding in the context of the Web. Activity theory is a conceptual framework that can describe the structure, development, and context of computer-supported activities, (Nardi 1997). Its emphasis on the interaction between agents and their environments explains the principle of tool mediation. Tools shape the way humans interact with reality. Tools reflect experiences other people – such as the master in the apprenticeship approach – have made in trying to address similar problems. This experience is accumulated in structural and behavioural properties of the tool. A teaching and learning environment is the tool that provides a student with access to a part of the reality – the course subject – guided by structural and behavioural rules defined by the instructor. Approaches such as problem-based learning, constructivism, or exploratory learning can be derived from constructivist theory, (Dede 1995). Constructivism says that knowledge is constructed by a student, rather than taught to the student. The process of knowledge construction is viewed as deeper than the traditional approach. The student is engaged in solving meaningful problems – we call this active learning. This lends itself to be supported by scaffolding. Interactive educational systems can enable active, apprenticeship-based learning in a constructivist style.

Our objective here is to evaluate the impact of scaffolding on student learning in a virtual interactive tutorial environment that supports the autonomous learner. We will address aspects relating to the acceptance of scaffolding measures, the student behaviour in the presence of scaffolding, and the student performance in an evaluation of our own virtual tutorial. The questions of acceptance and effectiveness of scaffolding shall be answered in this paper. This evaluation is formative in nature. Since learning with Web technologies is not fully understood, an evolutionary approach feeding evaluation results back into the instructional design process is necessary.

A Virtual Tutorial

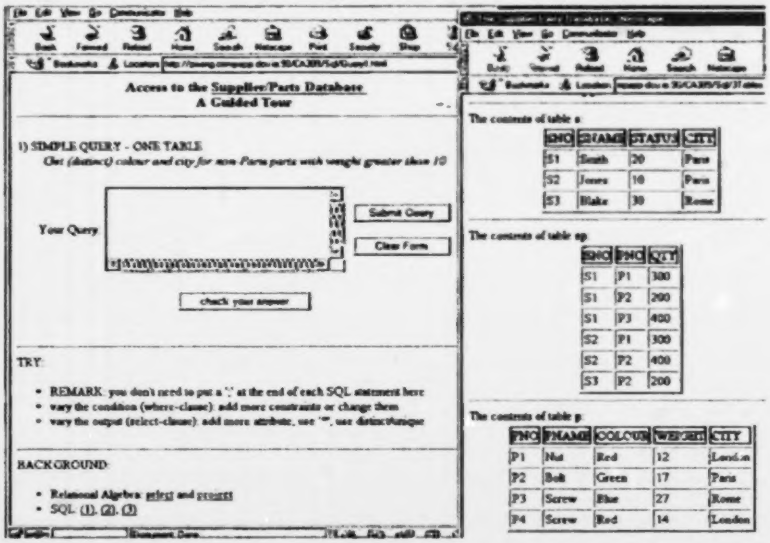
The School of Computer Applications at Dublin City University delivers its undergraduate Database course as a virtual course using Web technologies, (Pahl 2001). A central element is a virtual *tutorial service* that adds a dynamic, interactive dimension to the system, see Fig. 1. The tutorial service facilitates programming in the database language SQL. The service also facilitates learning about the activity of programming. It guides the student through a series of problems with increasing complexity. The central learning focus is on skills, but background knowledge is also required. The learning style can be both structured and unstructured.

The tutorial service offers the student to practice programming skills. A student can type in his/her attempt to formulate a query in the database language SQL and submit the query for execution to remote database server. The server reply will update the current page. In addition to the tutorial, a separate programming interface provides practical material beyond the examples used in the tutorial. This system also allows students to create and query their own databases. The idea behind this service is to support a more unstructured style of learning.

The tutorial is implemented based on a guided tour approach. It starts with a simple example and substantial scaffolding and increases the complexity of the problem and reduces the scaffolding features towards the end of the tutorial. The objective is to implement the apprenticeship model in an authentic setting. The three key aspects of scaffolding are addressed in the design of the tutorial:

- Modelling: The provided structure models the most suitable form of learning and guides the learning process.
- Support: Support in form of context pointers to background material and additional textual advice is provided. This form of coaching is necessary until the students can perform the tasks on their own.
- Fading: The support given through the tutorial is gradually reduced towards the end.

We have used several software-based scaffold types that substitute the interaction with the instructor in our virtual tutorial. Firstly, a guided learning process allows the learner to progress in a structured fashion based on an expert model towards self-reliance. Secondly, assessment and correction features provide necessary feedback and criticism. The system offers individual feedback in form of a check-function. These features are essential to reduce the scope for failure and allow the learner to assess his/her current level of competence. Thirdly, context pointers to background resources contextualise the active elements. Key background resources are audio-visual lecture notes. Finally, comments that resemble advice given by an instructor in a face-to-face coaching process enable the learners to accomplish tasks that they would not be able to achieve on their own. We consider these four scaffolds types as essential in Web environments with little direct contact between instructor and learner. The combination of these types of scaffolds can ensure that the learner is provided with an environment that he/she can interact with in order to accomplish the learning objective. These features provide support for the autonomous learner in the process of becoming self-reliant.



Access to the Supplier/Parts Database
A Guided Tour

1) SIMPLE QUERY - ONE TABLE
Get (distinct) colour and city for non-Paris parts with weight greater than 10

Your Query

TRY:

- REMARK: you don't need to put a ';' at the end of each SQL statement here
- vary the condition (where-clause): add more constraints or change them
- vary the output (select-clause): add more attribute, use '*', use distinct/unique

BACKGROUND:

- Relational Algebra: select and project
- SQL: (1), (2), (3)

The contents of table s:

SNO	SNAME	STATUS	CITY
S1	Smith	20	Paris
S2	Jones	10	Paris
S3	Blake	30	Rome

The contents of table sp:

SNO	PNO	QTY
S1	P1	300
S1	P2	200
S1	P3	400
S2	P1	300
S2	P2	400
S3	P2	200

The contents of table p:

PNO	PNAME	COLOUR	WEIGHT	CITY
P1	Nut	Red	12	London
P2	Bolt	Green	17	Paris
P3	Screw	Blue	27	Rome
P4	Screw	Red	14	London

Figure 1: A Virtual Tutorial

The current implementation of the scaffolds is, however, the result of several years of evolution. Initially based on hypotheses about student learning and student behaviour, feedback from students and interactions with them have substantially influenced the design and implementation of the current scaffolding. Input that has been given to students face-to-face in a traditional delivery of the course is now reflected by features of the tutorial system. In particular the most appropriate learning path has been determined incrementally.

Articulation and reflection are often considered as critical elements in the learning process. Our system is based on two forms of usage. Firstly, a structured approach to learning during term in which students follow the guided tour and work on exercises. Secondly, an unstructured approach where students revise for their exams, re-address aspects that remained unclear before, etc. In-between these two forms of using the system, an implicit reflection phase is present. The students need to assess their current knowledge and skills before starting their exam preparation. A usage evaluation shows a clear distinction between the two forms of usage. In the first usage phase, a clear structure and a prescribed learning process is of advantage for most of the students. Once their skills and knowledge increases, students can determine their own individual needs and most suitable learning processes.

Evaluation Techniques

Acceptance and effectiveness are two key criteria for this formative evaluation of scaffolding. Our data is based on student surveys addressing the student perception, exam results addressing student performance, and Web mining addressing the student learning behaviour. A requirement is that the behaviour evaluation technique captures the essential student activities in relation to the scaffolding types discussed in the previous section. Background resources are linked to the tutorial material, i.e. context is constructed. Links to assessment and correction functions are implemented. The guided tour is implemented as a hypermedia system with suitable navigation support. The navigation behaviour of students within the Web system is the central element of behaviour evaluation.

Web mining is our central evaluation technique. Web mining is the application of data mining to the Web environment. We will use Web mining to evaluate the student behaviour in our virtual tutorial. This will be based on standard Web and data mining techniques (Agrawal & Srikant 1995). However, educational systems differ from commercial systems and students differ from visitors of a commercial Web site (Zaiane & Luo 2001). The student's goal – learning – is a long-termed one. Students usually spent a relatively long time in the system, and they will repeatedly visit the site. Adequate mechanisms need to be in place to support the teacher in developing and evaluating these complex behavioural patterns. The process of learning has to be described and analysed. For this purpose we have developed our own analysis software, which goes beyond standard Web mining technology.

Data mining is defined as the discovery and extraction of information from a database. Web mining is data mining for the Web, i.e. data available in Web-based systems is analysed. The database is here the access log generated by a Web server. Each entry usually contains the user (requester), the date/time of the request and the requested document. In our case of dynamically created pages, the classical problem with Web logs – pages are cached and therefore repeated accesses are not logged – does not apply. The following techniques can contribute to the evaluation of educational systems:

- Session statistics. The Web log is partitioned into sessions for each user. For each session, overall length in terms of time and number of pages visited are available. The average lengths of sessions help us to assess the investment of time for learning activities.
- Session patterns. Session patterns describe the behaviour of students in a session. This includes the sequence of pages that has been visited, whether elements have been repeated, etc. Important is the intertwined use of content and support elements. Their co-occurrence is an indicator of the acceptance of scaffolding.
- Time series of session data. The development of session statistics and also session patterns over time is particularly important. The change of any behaviour in relation to scaffolding features is central since fading use of support indicates the increasing self-reliance of the student. The variance in use over time is central to the determination of the effectiveness of scaffolding.

The increasing self-reliance, which in turn shows the effectiveness of the scaffolding approach, and the success and the learner's competency in the subject measured by exam results and exam/usage correlations have to be shown. A high usage at the beginning shows the acceptance and a considerable usage over time indicates the usability of the scaffolding features.

Evaluation Results

The methods of evaluation address the aspects learning behaviour, student opinion, and student performance. Learning behaviour analysis is based on automatically generated Web server statistics. The Web server statistics are based on data about Web page requests. Database and scaffolding requests for the tutorial have been analysed using this mechanism. Student opinion analysis is based on student questionnaires that survey the student perception. Student performance analysis is based on exam, project and continuous assessment results.

Two observations result from the statistical Web log analysis. Firstly, the data shows that the interactive tutorial is mainly (about 2/3) used during the semester to support students in their coursework and to a lesser extent (about 1/3) for the final exam preparation. Secondly, the programming interface of the tutorial is used in combination with the scaffolding features. This fact is confirmed by the session pattern analysis. This technique shows that a significant number of students use scaffolding features and follow scaffolding links from the tutorial. Web mining can give us a clear picture about the purpose of use. It allows us to identify individual learning sessions and determine the purpose of the sessions. A pattern analysis identifies sequential request patterns and associates them based on structure and content to a purpose.

The survey shows that the students recognise the potential of virtual courses to use different forms of learning at the same time. The interactive tutorial is used in combination with other resources provided by scaffolding. Web mining confirms that in 77% of all tutorial sessions students have also used online course notes at the same time. The students have looked up background material to solve specific problems interactively using the provided navigation support. While nearly all students avail of this feature in their first tutorial sessions, we observed a decrease of scaffold usage during tutorials over time, indicating the increased knowledge and skills of students. The process of becoming self-reliant usually starts with a phase of structured, coached learning, followed by reflection and then more unstructured, self-determined learning. We found strong evidence for this behaviour.

In order to understand how students learn and how they use the support features offered, we need to look at the concrete behaviour. We need to look at how students navigate, whether they repeat units, whether they combine tutorial elements with scaffolds. A pattern analysis can answer these questions.

Tut1; [ExecQuery|Scaffold]; Tut2; [ExecQuery|Scaffold]*; ... ; Tut12; [ExecQuery|Scaffold]**

This is a behavioural pattern describing the intended learning path in our interactive tutorial service. This service consists of twelve tutorial units (*Tut1*, ... , *Tut12*) to be worked on sequentially. Within each unit students can iteratively (*) either execute an SQL query (*ExecQuery*) or use any of the scaffolding features (*Scaffold*). Web mining shows that 84% of all sessions actually follow this pattern of mixing interactive and scaffolding material – most of those that do not are either very short or use a different order.

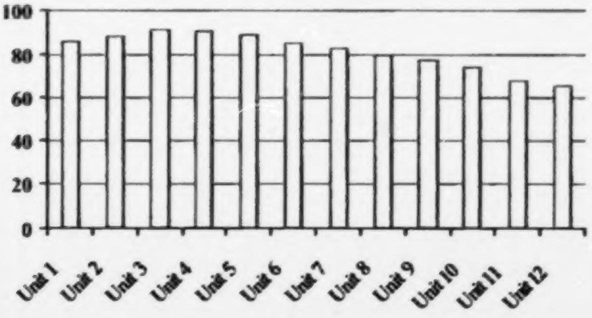


Figure 2: Support of Scaffolding Usage in percent

Fading – the reducing provision and usage of scaffolding features over time – is central in scaffolding. We have analysed time series of Web statistics and behavioural patterns to determine the success in this aspect. Fig. 2 shows the support of scaffolding usage, i.e. the fraction of students that use any scaffolding features in a session, in the twelve tutorial units. It shows that scaffolding features are used extensively by a large part of the student population in all tutorial units. In combination with Fig. 3 – which shows the decreasing length of sessions for the tutorials – and the fact that less scaffolding is provided in later units, it shows that effectively less time and less support is needed for the advanced tutorial units than for the earlier ones. The absolute numbers of scaffold requests have been reduced to around 35% in the later units compared to the first four units.

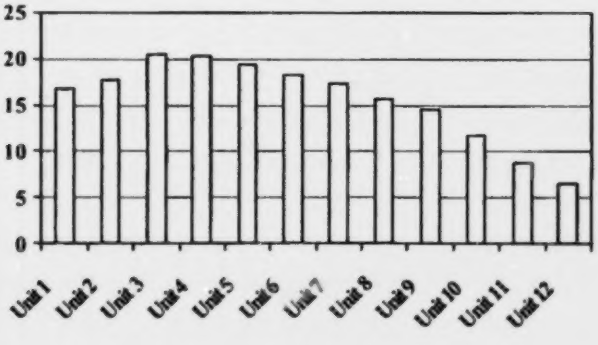


Figure 3: Average Length of Sessions in Number of Requests

BEST COPY AVAILABLE

We have surveyed the student opinion with respect to the usability of the system and the adequacy of the scaffolding approach. The students have pointed out that guidance and in particular the feedback features are central for a successful learning experience, i.e. scaffolding is considered necessary.

Performance is a key indicator for the effectiveness. Over the past couple of years we have constantly improved the scaffolding features of our interactive tutorial. Over the same period we have observed a steady improvement of exam and continuous assessment results.

Discussion and Conclusions

Virtual course technology offers the opportunity of using a course for lifelong learning approaches or distance access to courses. Distance education will play a major role in future education. In order to make an undergraduate course suitable for distance delivery, major functions of a teacher or coach have to be replaced by virtual system functions if direct contact is not possible. Scaffolding is an approach to provide features that can provide the learner with the necessary support. We have implemented a virtual tutorial with scaffolding for the database language SQL – a subject with a reasonable level and complexity of skills and knowledge. The tutorial is anchored in an authentic setting – which has been easy to realise for learning of programming skills. An important feature is that not only knowledge retention is the objective, but also the transfer of knowledge and skills to new application areas.

Our experience suggests that virtual tutorials can substitute the classical instructor-student interaction if sufficient guidance and integration is offered by the system. The interactive services have been accepted by students as a suitable tool in their preparation for continuous assessments, projects and exams. Our main result is that scaffolding can be successfully implemented for a Web-based course if the four scaffold types – guided learning process, assessment and correction, context pointers, advice – are provided. We have shown the success of the approach through the use of a novel evaluation technique – essentially Web mining – to determine the acceptance and the effectiveness of the approach. Guidance of the learning process is the key issue. Contextualised assistance of the learner is necessary to accomplish independence and self-reliance. A key concern is always the cost-effectiveness of a new technology. In our system, the investment into scaffolding features has been reasonable – the key problem was to get it right. This has required an incremental, evolutionary approach to the design and implementation of scaffolding. Our result is different from (Winnips, Collis & Moonen 2000), who have concluded with a more sceptical view on scaffolding. Our context and objective is to make virtual course delivery work. An improvement of classical delivery by Web-based features – as in their case – is not an option for us.

The Web as an open and flexible platform enhances the applicability of scaffolding features. The Web typically encourages students to explore a topic beyond the boundaries of given material. This supports the pro-active and exploratory nature of learning and allows the student to become self-reliant. Ultimately, to make scaffolding most effective, personalised and adaptive systems are the best solution. The needs and behaviour of individual students need to be considered in the provision of scaffolding. A user model needs to be built and student tracking is another prerequisite for adaptive personalised scaffolding. In most approaches to scaffolding, peer-communication and collaboration are central. Computer-supported systems usually offer shared workspaces. We have not considered this aspect since our course is set up to support autonomous learners.

References

Guzdial, M., & Kehoe, C. (1998). Apprenticeship-based learning environments: A principled approach to providing software-realized scaffolding through hypermedia. *Journal of Interactive Learning Research, 9*(3/4), 289-336.

Shabo, A., Guzdial, M., & Stasko, J. (1997). An Apprenticeship-Based Multimedia Courseware for Computer Graphics Studies Provided on the World Wide Web. *Computers & Education*. 29(2/3), 103-116.

Suthers, D. (1998). Representations for scaffolding collaborative inquiry on ill-structured problems. AERA Conference, San Diego.

Vygotsky, L. (1978). *Mind in society: the development of higher psychological processes*. Cambridge MA: Harvard University Press. (Original material published in 1930, 1933 and 1935).

Dede, C. (1995). The evolution of constructivist learning environments: Immersion in distributed, virtual worlds. *Educational Technology*. 35(5), 46-52.

Nardi, B. (Eds) (1997). *Educational Context and Consciousness: Activity Theory and Human-Computer Interaction*. MIT Press.

Pahl, C. (2001). Interactivity and Integration in Virtual Courses. *Proc. International Conference on Advanced Learning Technologies ICALT 2001*, 395-396. IEEE Computer Society.

Zaiane, O.R., & Luo, J. (2001). Towards Evaluating Learners' Behaviour in a Web-Based Distance Learning Environment *Proc. IEEE International Conference on Advanced Learning Technologies ICALT'01*. 357-360. IEEE Computer Society.

Agrawal, R., & Srikant, R. (1995). Mining Sequential Patterns. *Proc. 11th International Conference on Data Engineering ICD*E, Taipei, Taiwan.

Winnips, J.C., Collis, B., & Moonen, J. (2000). Implementing a 'scaffolding by design' model in a WWW-based course considering cost and benefits. *Proc. ED-MEDIA Conference.*

McLoughlin, C., Winnips, J.C., & Oliver, R. (2000). Supporting Constructivist Learning through Learner Support On-line. *Proc. Ed-MEDIA Conference*.

Data Mining Technology for the Evaluation of Web-based Teaching and Learning Systems

Claus Pahl, Dave Donnellan
Dublin City University
School of Computer Applications
Dublin 9, Ireland
[cpahl|ddonnell]@computing.dcu.ie

Abstract: Instructional design for Web-based teaching and learning environments causes problems for two reasons. Firstly, virtual forms of teaching and learning result in little or no direct contact between instructor and learner, making the evaluation of course effectiveness difficult. Secondly, the Web as a relatively new teaching and learning medium still requires more research into learning processes with this technology. We propose data mining – techniques to discover and extract knowledge from a database – as a tool to support the analysis of student learning processes and the evaluation of the effectiveness and usability of Web-based courses. We present and illustrate different data mining techniques for the evaluation of Web-based teaching and learning systems.

Motivation

Web technologies allow us to create Web-based teaching and learning systems that support a variety of different educational features in an integrated form, including audio-based lectures, video-conferencing, interactive tutorials, and various forms of animations and simulations. This opportunity to create novel and innovative course material is currently the focus of an area of active research. Instructional design for Web-based courses is a relatively young discipline. Important quality criteria are the effectiveness of the approach and the usability of the system. Two central difficulties can be identified in this context. Firstly, there is a lack of direct contact between instructor and learner, which makes it more difficult for the instructor to assess and evaluate the quality of teaching and learning. Secondly, new forms of teaching and learning are implemented for which methods of best practice do not exist. Therefore, an evaluation needs to create a broader picture of the process of student learning. Furthermore, an evaluation needs to be incorporated into an incremental, evolutionary instructional design approach.

Data mining technologies can provide essential support for this evaluation of learning processes based on Web technologies (Agrawal & Srikant 1995), (Zaiane & Luo 2001). Data mining is the discovery and extraction of knowledge from a database. Web mining is the application of data mining to the Web. Web logs, created by Web servers that record document requests on the Web, form the database. The classical application domain of data and Web mining are business systems. Some of the classical data and Web mining technologies can be used in the context of Web-based teaching and learning systems. However, teaching and learning systems differ from commerce and business systems substantially. The goal is a different, more long-termed one, which obviously effects the usage of a Web-based system. Frequency, regularity, number and purpose of visits and behaviour are different. As a consequence, some new technologies are needed to address in particular the process of learning. Techniques are required that for example identify and extract the students' learning processes from Web logs.

The objective of this paper is to introduce Web mining as an evaluation technique for educational systems. We will present data mining techniques, including some novel ones, that are suitable for the evaluation of Web-based teaching and learning systems. We will illustrate their use using a virtual course system taught by the first author since several years as a case study, (Pahl 2001a).

Data and Web Mining for Educational Systems

Data mining is concerned with the discovery and extraction of knowledge from a database. Typically, this knowledge can be classified into rules and patterns that help users in analysis and decision making processes. Web mining is the analysis of data in Web-based systems. Usually, the database is the access log created by a Web server. Each request of any text document or other type of resource – a URL – is recorded in the access log. Each entry in this log consists of the requester, the requested URL and time/date of the request. The typical format of an entry is described in Tab. 1.

Field	Description
Client	IP address
Ident	requestor ID (rarely used)
User	(authenticated) user name
Date	date of request
Method	HTTP GET or POST
Request	URL of requested document
Protocol	HTTP version
Status	success indicator (200 is success)
Bytes	bytes requested/transferred

Table 1: Web Log Format

An example of a few requests is the following:

```
136.206.18.130 - rkyne   [08/Nov/2001:11:38:15 +0000] "GET /CA309/ch5ov.html HTTP/1.0"  200 43
136.206.18.14  - lgavin  [08/Nov/2001:11:38:18 +0000] "GET /CA309/ch32c.html HTTP/1.1"  200 2048
136.206.18.16  - bahern [08/Nov/2001:11:38:25 +0000] "GET /CA309/Asgn.html HTTP/1.1"   200 2018
```

Besides HTML-documents, as in this example, any other file type including executables, images and other media can be requested.

Technically, Web mining based on access logs is a server-side evaluation technique that is in contrast to client-side evaluation of Web-based teaching and learning systems. Client-side evaluation can observe the students more directly and evaluates the student behaviour based on data that is acquired at the student's side, e.g. the Web browser. Usually, client-side techniques allow more precise observations. Server-side techniques can not capture all student activities. However, based on suitable implementations, the essential ones can be captured. Most dynamic Web pages result in log entries at the server side, or can generate these, e.g. in technologies like Java applets (Pahl 2001b). An advantage of the server-side technology is the possibility to monitor all students constantly without the need for any additional monitoring equipment to be installed. Data available from the Web logs can provide sufficient and adequate knowledge for the evaluation process.

Web mining for the educational context is based on a central concept, a basic unit of learning: a session. A session reflects a period of active learning of a particular student. The first step in actually applying educational Web mining to Web logs is to clean the logs and to partition the log into individual sessions. We define a session as a sequence $P = <P_1, \ldots , P_n>$ of requests P_i from one student for a period of time in which the student is active. A request P_i is in our case a page request, i.e. a URL. Inactivity for a period of about 20 minutes – a heuristically determined value – indicates the end of a session.

We propose the following techniques as central in a Web mining-based evaluation of teaching and learning systems:

- Session statistics: basic statistics about sessions such as average session length in time or in number of requests.
- Session patterns: the determination of student learning processes extracted from navigation and request behaviour.
- Time series of session data: the analysis of the development of session statistics and session patterns over a period of time.

Besides these three classes, other Web and data mining techniques exist that can provide useful information. Standard tools for Web mining, e.g. (Analog 2002), produce hit lists, i.e. rankings of URLs based on the number of requests for some time interval. This data might be used to analyse the visits of individual pages.

Session Statistics

A session is a sequence of Web log entries that reflects the navigation and request behaviour of a student in a period of active study. Some basic measures can help to answer for example questions about the investment of time per student for a given learning activity. The measurements that can be calculated from the Web log are for example:

- the session length in time,
- the session length in number of requests.

These measurements are simple numerical values derived from the session logs. Simple statistical analyses based on these values that provide some useful information including mean and standard deviations of length measures, or correlations between lengths in time and lengths in number of requests. The purpose of the statistical evaluation is for example to measure the investment of time of a student for the course or for a particular part of it. Any of the results can be compared against the expectations of the educator or instructional designer. Explicitly formulated expectations can form a master model.

There are other statistics that might result in useful insights – as we have briefly discussed in the previous section. The total number of requests by interval or total numbers ranked by resource provide relevant information for an evaluation. These measures give an idea about 'what' resources are used, but not 'how' they are used. The latter shall be addressed in the next section.

Session Patterns

The central knowledge for successful instructional design of Web-based courses is how students actually learn the best in a Web-based environment. Due to the lack of accepted standards of best practice, an evaluation of student learning can lead to useful insights. At the core of this form of evaluation is the extraction of the students' learning processes from the Web logs. Two forms of knowledge discovery are important:

- The extraction of purpose patterns from session data. The purpose pattern analysis is based on classification. The site resources are divided into different parts, e.g. lectures, tutorials, administrative/organisational material, etc. One or several main session purposes can be determined from the resource classification. Then, the overall association of sessions and purposes can be analysed. A somewhat surprising result of a purpose analysis for our virtual database course was that students very often log on to the system to look up organisational resources, such as timetables, exam related material, etc. More than 30% of all session included administrative/organisational elements.
- The extraction of behavioural patterns from session data. The behavioural pattern analysis has the determination of the student learning processes as the objective. The starting point is the Web log. The Web log provides only sequences of resource requests. However, behavioural concepts such as repetition need to be identified. The instructional design might work with concepts such as options and choice. As a consequence, the actual behaviour (as a sequence) has to be measured against an expert model that reflects the instructor's intended or expected learning process and learning path.

The purpose of both analyses is to determine how students learn. This is reflected in the Web logs through the way students navigate and which resources they request, and in which order. As we have explained earlier on, this approach can capture the essential learning activities.

The behavioural pattern analysis is an advanced and novel technology that we will illustrate here. The starting point is the extraction of sequential patterns based on sequences of log entries in sessions. Let $Q = <Q_1, \ldots, Q_m>$ be a sequence of log entries. A sequence $P = <P_1, \ldots, P_n>$ is contained in sequence Q if $P_1 = Q_{i1}, \ldots, P_n = Q_{in}$ such that $i1 < \ldots < in$. This means that each element of the P-sequence can be found in the Q-sequence, and additionally that the P-elements appear in the Q-sequence in the same order in which they appear in the P-sequence. The idea of containment is necessary to filter out activities not relevant for the learning process under investigation – for instance students might go back to previous pages, lookup other pages, even leave the system temporarily. The P-sequence is a candidate sequential pattern. Elements of Q that are not in P are the irrelevant requests. A sequence is called maximal if it is not contained in any other sequence. Maximality allows us to ignore shorter sequences that are contained in others. These would not provide any additional information.

In order to find out what patterns students follow, we need to look at the number of students that follow a particular sequence in a session. A student supports a sequence if the sequence can be found in any of that student's sessions. The support of a sequence is defined as the fraction of all students that support this sequence. A sequential pattern is a maximal sequence that has a certain minimum support. The choice of the minimum depends on the system and the objectives of the analysis. It needs to be determined heuristically. A high minimal support will only reveal patterns that are supported by a vast majority of students. A low minimum will show more patterns, which in extreme cases reflect more the behaviour of individual students than that of the whole group. The site structure, and in particular the degree of choice has an influence on the best choice of the threshold. For systems with a high degree of choice, the threshold should be low in order to detect common behaviour.

The sequential patterns describe the actual behaviour of students. The higher the support for a sequence is, the more often this path is followed by students. Typical sequences with very high support are sequences leading from the home page via a table of contents into some resource page:

HomePage ; TableOfContents ; Chapter1Overview ; ...

The main purpose of the sequential pattern extraction here is that they can be compared to expected behavioural patterns specified by the instructional designer or educator. Sequential pattern determination is a standard data mining technique, see e.g. (Agrawal & Srikant 1995), that we have adapted here to a Web environment. The behavioural pattern analysis, which we are going to present now in more detail, is a novel technique.

Behavioural pattern analysis is a design tool for instructional designers for the development of Web-based virtual courses. A model of the course topology – the navigation infrastructure and the interactive elements integrated into dynamic pages – underlies the specification of behavioural patterns. A behavioural pattern is a path expression on the course topology that describes an ideal learning path. The following is an example from a tutorial part of our virtual database course:

Tut1;[ExecQuery|Scaffold]+;Tut2; [ExecQuery|Scaffold]+; . . . ;Tut12;[ExecQuery|Scaffold]+

This is a behavioural pattern describing the intended learning path in our interactive tutorial service that teaches programming skills in the database language SQL. This service consists of twelve tutorial units *Tut1*, ... , *Tut12*. Within each unit students can iteratively (denoted by +) either execute an SQL query (*ExecQuery*) or use any of the scaffolding features (*Scaffold*) that are provided to support the learner. The semicolon denotes sequential composition, the brackets *[..]* enclose optional elements, and choices are separated by a bar /. The control flow combinators for this path expression language are summarised in Tab. 2.

Name	Notation	Description
iteration	P^+	the page P can be access any number of times, but at least once
option	$[P]$	the page P might or might not be accessed
choice	$P \mid Q$	either P or Q can be accessed
sequence	$P ; Q$	the page Q will be accessed after page P

Table 2: Path Expression Notation for Behavioural Patterns – Combinators

It is important to note that we can see sequential patterns as path expressions of behavioural patterns. We can compare a specification of expected behaviour in terms of path expressions and actual sequential patterns. An ordering relation indicates whether an actual sequential pattern satisfies a behavioural pattern. An ordering $S \leq T$ on path expressions compares actual and intended use and determines whether the actual use conforms with the intended use: $S \leq T$ means that pattern expression S satisfies T. Typically, S will be a sequential pattern and T will be a behavioural pattern. A set of rules – summarised in Tab. 3 – allows us to determine whether a sequential pattern (or a behavioural one) satisfies a given behavioural pattern. In the table, the letters S, T, U, X, and Y stand for path expressions. The expression ST means that S and T are concatenated, i.e. sequentially composed.

Rule	Description
$T^+ \leq T$	means that actual repetitions of T are allowed
$S \leq [S]$	means that the user can choose to access S or not
$SU \leq S[T]U$	means that optional pages T can be left out

Table 3: Pattern Satisfaction Rules

A mathematical property shall be noted: the relation $\leq$ is reflexive, antisymmetric, and transitive, i.e. forms a partial ordering. A weaker variant of $\leq$, denoted with $\subseteq$, can also be introduced: $STU \subseteq XY$ if $S \leq X$ and $U \leq Y$ which allows students to deviate for a while from the pattern path. Deviation, choice and repetition in actual navigation sequences are important concepts to express learning behaviour in a Web-based system.

The final step in the analysis is the determination of the support for a behavioural pattern. The support shall be defined as the fraction of sequential patterns that support the behavioural pattern. A high support for a behavioural pattern that is described by the instructor shows the effectiveness of the instructional design. For the aforementioned tutorial pattern, we have achieved 84% support, which shows that the instructional design has been accepted by the students.

The expressive power of the behavioural pattern notation can even be improved. The notation might be extended to include a parallel composition $P \parallel Q$ which says that pages P and Q can be accessed concurrently – e.g. using two Web browser windows. We shall ignore this possibility here. However, we would like to point out that logging and evaluating multi-window activity is important, and will help to obtain a more accurate analysis of student behaviour.

Time Series of Session Data

Time series are sequences of measurements over a period of time. These measurements can include session statistics and session patterns. The purpose is the detection of change in learning behaviour. This is important for two reasons. Firstly, change might be intended by the instructional designer and the actual occurrence of this change needs to be verified. Secondly, unexpected changes need to be detected.

An example for the first case is an evaluation of scaffolding features that we have carried out for our virtual course (Pahl 2002). Fading use of scaffolds – features that support students in becoming self-reliant and competent in a domain – is an essential characteristic that is expected to happen in an effective scaffolding implementation. An observation that leads to the second case is that, according to our experience, the more students work with computer-supported teaching and learning systems, the more they appreciate this new form of learning. More experience with these systems seems to lead to more effective forms of using the systems, and therefore more effective forms of learning. The evaluation of behavioural patterns can help us to extract the evolution of student learning towards the most effective form of learning from a Web log.

With respect to session statistics, for example the decrease in session lengths for a series of equally difficult tutorial units shows increasing self-reliance and competency of a student. With respect to session patterns we have observed that early patterns often show single purpose use, for example lectures only in a multi-service course system, but later patterns show multi-purpose usage, i.e. integrated usage of different educational services at the same time.

Conclusions

Essential knowledge for an instructional designer confronted with the development of courseware for the Web includes how students learn in a Web environment, i.e. whether students learn effectively and whether the instructional design is effective. In novel environments for teaching and learning, such as the Web, the determination of effective learning behaviour might need to be determined in an incremental and evolutionary way. The integration of instructional design and evaluation into a cyclical development approach is therefore essential. Only an iterative process of design and evaluation allows us determine and evaluate effective learning in a Web environment and to design the most effective courses for the Web. We have presented Web mining technologies for teaching and learning systems that can help us to answer essential questions about student learning in a Web environment. We have presented a set of mining techniques suitable for the educational context – some of them novel techniques developed for the educational context.

The usage evaluation of Web-based systems can be classified into two dimensions: time and space. Usage in time addresses the frequency and regularity of usage, number of accesses, etc. Usage in space is concerned with usage patterns based on the course topology. Our central evaluation techniques for educational systems are evaluations in space. The combination with an evaluation in time can provide additional valuable information. Various tools that provide statistics on numbers of accesses, frequencies, etc. are available – see e.g. (Analog 2002). Tool support is critical for this Web mining-based type of analysis. In our own virtual database course, we usually have between 250000 and 400000 log entries per term. We have implemented our own tool support in particular for the space dimension.

We have looked at using Web mining for the purpose of behavioural analysis. However, the technology can be used to obtain a wider range of information. This could include monitoring individuals or groups of students, or the identification of weak students. The technique presented here is limited to activities in one browser window. If several windows were used concurrently, then this behaviour would have to be recognised as a concurrent one. A corresponding operator for the path expression notation has been suggested. The extension of the analysis towards concurrent activities is planned for the future. In a first step, the notation for behavioural patterns should be extended to encompass parallel activities and corresponding rules to determine satisfaction. In a second step, the pattern analysis should be extended from sequential to parallel patterns.

References

Agrawal, R., & Srikant, R. (1995). Mining Sequential Patterns. *Proc. 11th International Conference on Data Engineering ICDE*, Taipei, Taiwan.

Analog (2002). *Analog Logfile Analyser*. Web site: http://www.analog.cx

Donnellan, D. (2002). *User Session Classification Tool For The Analysis of Web Server Logs*. M.Sc. Dissertation. Dublin City University. School of Computer Applications.

Pahl, C. (2001a). Interactivity and Integration in Virtual Courses. *Proc. International Conference on Advanced Learning Technologies ICALT 2001*, 395-396. IEEE Computer Society.

Pahl, C. (2001b). XML-technologies for the Support of Active Learning in Web-based Virtual Learning Environments. *Proceedings 6th WebNet Conference*, Orlando, Florida, US. AACE.

Pahl, C. (2002). An Evaluation of Scaffolding for Virtual Interactive Tutorials. *Proc. 7th E-Learn 2002 Conference*, Montreal, Canada. AACE.

Zaiane, O.R., & Luo J (2001). Towards Evaluating Learners' Behaviour in a Web-Based Distance Learning Environment *Proc. International Conference on Advanced Learning Technologies ICALT'01*. 357-360. IEEE Computer Society.

Acknowledgements

This work has been supported by the Dublin City University Teaching and Learning Fund (contract tlf/2000-2001/small-project-00/2).

Learner Relationship Management: Impacting the Top and Bottom Line

David B. Palumbo
Vice President, Learning Services
Sapient Corporation
Cambridge, MA
dpalumbo@sapient.com

Ted Killian
Manager, User Experience
Sapient Corporation
London, England
tkillian@sapient.com

Abstract: This paper provides a view of learner relationship management that looks to examine the potential for learning systems across an organizational value chain by addressing the potential for learning solutions beyond the Human Resources function in an organization. We identify a return on investment strategy to align the goals of the organization with the goals of the learners. We also look to leverage lessons learned from other technology-based initiatives, namely customer relationship management (CRM) systems and supply chain management systems, both of which also attempt to add value throughout the value chain.

The future rests on how we learn. While this has historically been the lexicon of institutions of higher education, and to some extent the K-12 education system, more and more decisive business leaders are looking toward learning programs and systems as strategic business opportunities. This has caused organizational learning to extend and move beyond the traditional Human Resources departments and squarely into the sights and purview of business unit owners.

To that end, there is a meaningful shift in the view of learning as a way to solve business problems, not just as a means to address training problems. This opens up the door to extend the infusion of instruction, knowledge management, and collaboration to the supply-side and the demand side of the organizational value chain as well as to more effectively and efficiently offer learning solutions intra-organizationally.

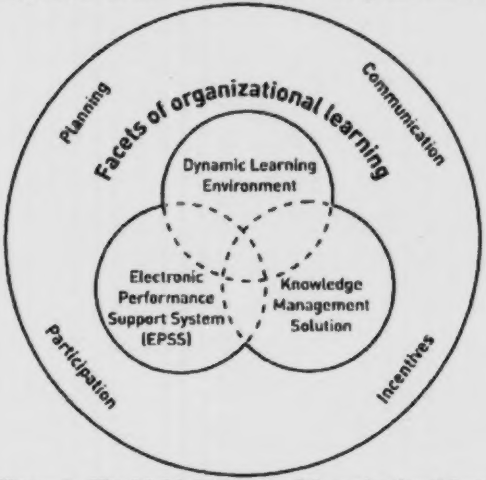

Planning
Facets of organizational learning
Communication
Dynamic Learning Environment
Electronic Performance Support System (EPSS)
Knowledge Management Solution
Participation
Incentives

Figure 1. The Multiple Facets of Organizational Learning

BEST COPY AVAILABLE

Learning in this context has rapidly evolved from traditional stand and deliver training courses and computer- based training environments sponsored, designed, operated, and delivered from the Human Resources department to a wide suite of communication, collaboration, and learning systems that permeate all aspects of the organizational structure. While much of the technological focus of corporate learning initiatives has been placed on Learning Management Systems (LMS), Learning Content Management Systems (LCMS), and reusable learning objects, another, and perhaps more important, advance has also been achieved. Organizations are beginning to see explicit business value from provide exactly the right information, at exactly the right time, in exactly the right format, through exactly the right media to a much larger group of individuals both within and beyond the organizations walls. Along with the additional scope associated with moving learning content and delivery system beyond the walls of the organization, come the additional owners associated with these problems and solutions. More and more we are seeing business unit owners developing and executing learning strategies and projects. Those of use in the learning services field need to realize that these individuals have a set of wants, needs, and desires that we can fill in order to deliver on the promise that we have made on the value of learning within and beyond an organization.

This changing view of organizational learning requires those of us that support such initiatives to look beyond instructional design and content authoring tools and techniques, to a more expansive set of offerings. To maximize the efficiency and effectiveness of any large scale initiative, we must look at a tool box that includes lessons learned from other large scale technological and organizational change initiatives. These include both the technologies to support the initiatives as well as the processes and project management skills required to assure an appropriate payback to the organization. These environments and projects also require us to work together to develop solid business plans and models to leverage all of the costs associated with these initiatives into acceptable return on investment metrics.

Learning from CRM and Supply Chain Initiatives

In the past decade significant hype as well as meaningful advances have been made using technology-based solutions to impact various aspects of an organization's value chain. From the significant growth of customer relationship management (CRM) processes and technologies to provide clients and customers with an more valuable experience with the organization both now and in the future, to the emergence of similar systems to support all aspects of supply chain management, from the acquisition of raw materials, to product creation, and eventually to their ultimate and timely distribution, organizations are looking to introduce both effectiveness and efficiency into all aspects of their operations.

One positive aspect of these initiatives includes the pervasive nature of them across the corporate landscape. Organizations have come to grips with the people, processes, and investment needed to implement large scale CRM and Supply Chain Management solutions. They are beginning to understand the ongoing.investment required to support and maintain these systems that once promised their patrons the vision of a "silver bullet" where business gains would magically appear. The harshest critics of these solutions state that they have been over sold, over hyped, and under delivered.

A key challenge to these environments is often the lack of alignment between the wants, needs, and desires of all relevant audiences that are required to use the system. This misalignment can cause systems to fail, or more typically, to atrophy from lack of consistent use. In either case, the business model and return on investment metrics do not live up to the promise that is associated with these projects at the start of the initiative. As we begin to see why spread interest in more holistic learning solutions within organizations, those of us in the learning services space need to make sure that the alignment of all the stakeholder and user needs are constantly monitored throughout all aspects of an initiative. This includes the project kick off, the design, delivery, and implementation as well as ongoing assessment and evaluation and program refinement.

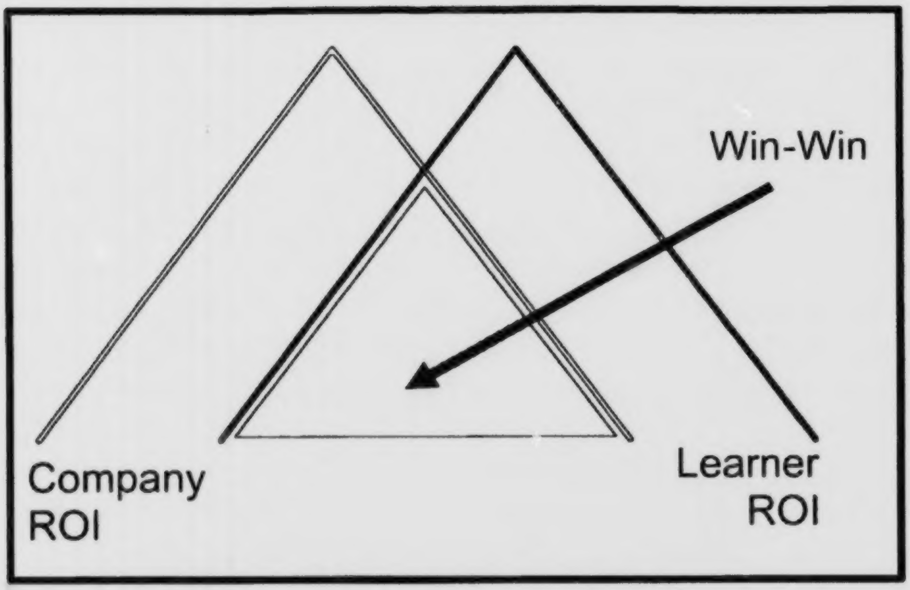


Figure 2. A Multifaceted View of Return of Investment for Learning Systems.

Technological solutions and services organizations

The notion of Learner Relationship Management looks to leverage learning systems, learning processes, and learning content across an organizational value chain. This is critical as organizations move their view of learning from a cost center to a revenue generating (or cost containment) side of their businesses.

Creating business value involves changing behavior, and effectively and efficiently changing behavior requires the design, development, implementation of appropriate learning tools and environments. Our approach to Learner Relationship Management is tailored to aligning the needs of the organization and the wants and needs of the individual at any point in the value chain. Solutions need to deliver timely, specific, relevant information to the learner to effect positive change in their behavior and help them make wise business decisions. We have found that by combining state of the practice learner research with deep industry knowledge we are able to examine and develop personal, meaningful and relevant learning contexts.

The following figure shows an example of how an organization can leverage its content distribution and learning management system to effectively and efficiently deliver learning experiences and assess the success of these systems to a variety of constituencies. Such a model looks to maximize the investment in both the technological infrastructure and the content development process to the largest number of potential audiences. Organizations that are successful in doing so not only increase their reach within their organization landscape but also successfully drop the cost per unit of learning for each audience member.

Such a system requires a systematic and systemic view of learning and a targeted view of the wants, needs, and desires of all potential audience members. This model needs to be addressed in the visioning process for any initiative and then carried through in the projects design, development, implementation, and assessment components of the project. Technologists, instructional designers, content strategists and developers, and user experience design experts need to be have a clear vision of all of the audiences which may user the system and a clear vision of their goals for system interaction. With these criteria clearly defined this team will be able to create an environment that can be successful in meeting the needs of multiple audiences, rather than have to develop disparate system to meet multiple goal states.

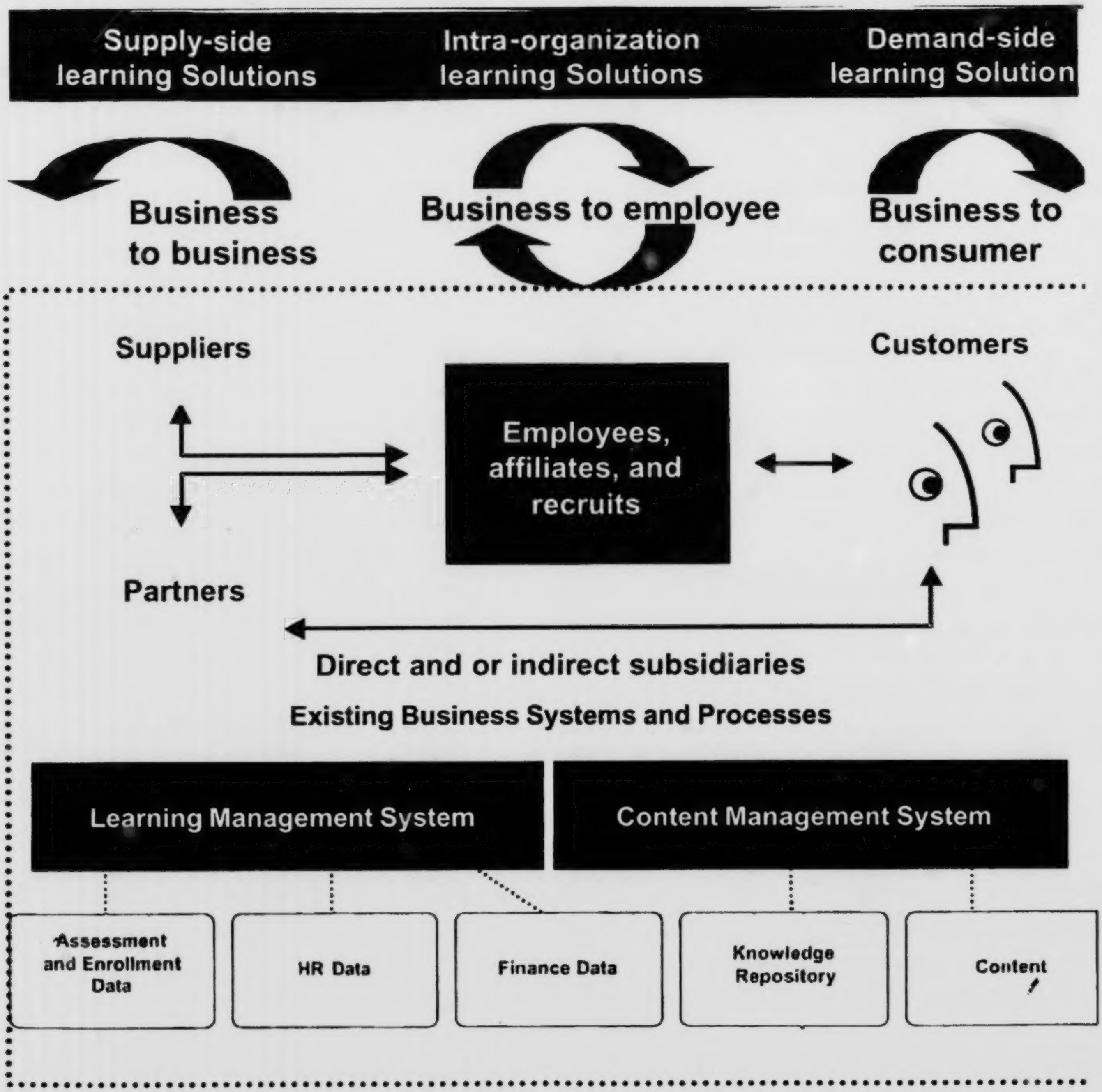

Supply-side learning Solutions
Intra-organization learning Solutions
Demand-side learning Solution
Business to business
Business to employee
Business to consumer
Suppliers
Customers
Employees, affiliates, and recruits
Partners
Direct and or indirect subsidiaries
Existing Business Systems and Processes
Learning Management System
Content Management System
Assessment and Enrollment Data
HR Data
Finance Data
Knowledge Repository
Content

Figure 3. Learner Relationship Management: Creating Value Across the Value Chain

BEST COPY AVAILABLE

Learning Offerings across the Value Chain

To identify the opportunity for learning based solutions across the value chain to be developed for such systems, one must first identify the potential business opportunities and challenges that exist both within and beyond the organization. Again, it is critical to view these challenges in terms of their explicit business needs and to establish success metrics that are based on readily quantifiable business results. The follows are a brief set of examples of how learning solutions can add value across the value chain.

Supply Side Learning Solutions

As organizations look to maximize the efficiency and minimize the churn among their suppliers and partners, learning solutions have the potential to add explicit by providing business process education for suppliers and partners to enhance the effective and efficiency of their workflow. These environments can also provide business process education and establish a community around distributed design and development activities. Likewise they can provide educational experiences around hot topics such as collaborative commerce solutions and plan and execute systems to reduce risk and enhance adoption of these types of solutions.

Intraorganizational Learning Solutions

Internally these types of learning solutions can be an agent for delivery of business process education for employee effectiveness. They can also be the integral system to support internal knowledge management. An organization can also use the learning and content management technologies to design and monitor employee proficiency.

Additional we are seeing an opportunity to create a sense of brand awareness within these systems to help employees feature and differentiation their products and services for enhanced performance. The system can also be pointed to support new employee orientation as well as recruitment experiences to ensure success and reduce turnover.

Demand Side Learning Solutions

As more business unit owners look to implement learning solutions, it is only natural for them to begin to see how they can leverage their learning content and infrastructure to support and enhance their relationship with their customers and clients. Learning solutions hold to potential to support business process education to customize the experience for high volume purchasers. These solutions also cam provide an extended type of marketing channel where an increased customer value can be derived from educationally oriented marketing materials. Organizations can also achieve a first mover advantage by providing their clients exactly the right information to before their job functions, this grabbing additional market share.

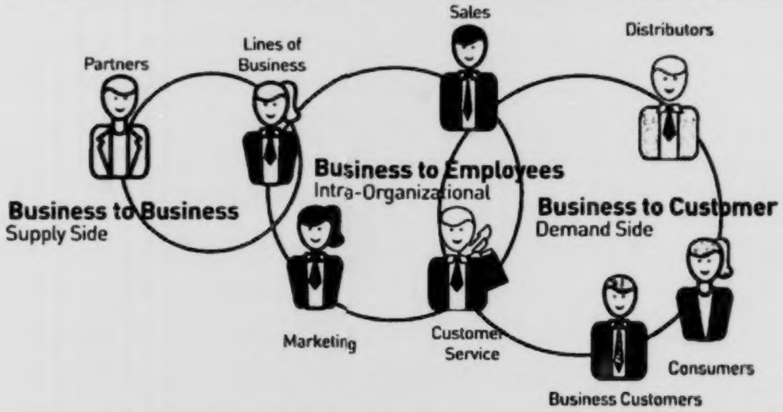


Figure 4: The Business of Learning across the Value Chain

BEST COPY AVAILABLE

Summary: Return on Investment as the Mantra for Organizational Learning

As stated previously, return on investment has become the current hot topic in the Learning Services industry. People are looking to build out realistic business cases and business models for all of their learning related initiatives. It is important to realize that these models and metrics need to take into consideration both the needs of the learner and the business needs of the organization.

The following is a typical model that looks to place the learning at the center of the learning landscape. Those of us in the learning field have long recognized that placing the learner and the learning context in the center and then developing the pedagogical, content development, community. Technological, and evaluation and assessment models provide the optimal experience for the individual learner.

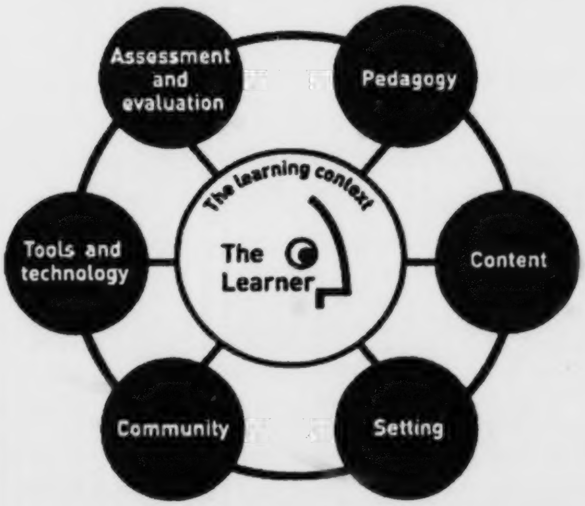


Figure 5: Placing the Learning at the Center of the Learning Universe

What we haven't been so successful in doing is realizing that we need to have similar approach to align the business needs and objectives of the organization in a similar model. By broadening the view of learning beyond their internal organization and structure, companies are able to leverage their investment in both their learning systems and content development costs. They can then rationalize both of these investments against measurable business results.

BEST COPY AVAILABLE

Combining Cognitive, Affective, Social and Metacognitive Learner Attributes for Assistance in Distributed Learning Environments

Gilbert Paquette, Anne Brisebois and Diane Ruelland

LICEF Research Centre, Télé-université
4750, avenue Henri-Julien, bureau 100, Montréal
gpaquett@licef.teluq.uquebec.ca
http://www.licef.teluq.uquebec.ca
Telephone: (514) 840-2747 ext 2292

Abstract. Adaptive assistance in distributed learning environments (DLE) provides new and exciting possibilities through the full exploitation of data captured from the interaction of the different actors with information processing, collaboration and self-management tools. We will present a process to build adaptive assistance in a DLE. A distributed learning environment is rich enough to anchor a diversified user model, including the user's competency achievements, his affective reactions to the activities and resources, his collaboration patterns within a group and his metacognitive activity. Together with a model of the group and of the environment, these three models contribute to a diagnosis and a selective display of information intended for human or computerized assistance agents.

Key words. Adaptive Assistance. Student modeling. Distributed learning environments. Intelligent distance learning. Web-based training systems

1. Adaptive Assistance in a DLE

The now ubiquitous availability of multimedia telecommunication opens up a realm of new opportunities for learning in networked environments through a Distributed Learning Environment (DLE). Our DLE model (Paquette, 2001, Paquette,1997) emphasises the concept of process-based learning scenario coupled with information

Individualized tutoring	*Network-based Assistance*
Individualized, learner- computer tutor relationship	Collaboration, multi-actor, multi-agent relationships
Computerized tutor is the main if not the only learning material	Multiple resources integrated into the on-line environment; external information
Assistance from the tutoring module of an ITS	Multiple human and computer assistance agents
Fixed and limited set of instructional strategies	Flexible learning scenarios and strategies
Close guidance to the learner	Learner self management
Specific knowledge, precise goals	More generic, flexible, adaptive goals
Observation data is continuous and closely linked to the target knowledge and skills	Observation data is partial and loosely related to a set of target competencies

Table 1 – Individualized vs network-based assistance or tutoring

BEST COPY AVAILABLE

processing, collaboration, self-management and assistance resources. Basically, the learner proceeds according to a scenario, a network of learning activities, using different kinds of resources to help her achieve the tasks and produce some type of outcome: a problem solution or new information that can be used in other activities. He/she interact with other actors such as trainers, content experts, designers and managers.

Adaptive assistance to these actors, based on knowledge of their activities and productions, is even more important than in the past because of the complexity and flexibility of network-based learning environments. But the problem is quite different than in individualised ITS research (Anderson, Corbett, Koedinger & Pelletier, 1995; Clancey, 1993; Wenger, 1987). It provides large areas of unexplored territories especially towards the full exploitation of the multiple data sources captured from the interaction of the different actors with the resources involved in a distributed learning event. Table 1 provides a brief comparison between individualized tutoring and network-based assistance.

2. Assistance in the Explor@ system

At delivery time, the learner and the other actors interact within a computerised learning environment. Figure 1 presents such an environment where the specialized content of a course is displayed in a browser (the host system) and the generic resources are distributed into five interaction spaces, self-management, information, production, collaboration and assistance, accessible in an Explor@ navigator, according to an actors' role and course specificity. The resources can be generic tools developed specifically for the Explor@ system, generic commercial tools or web resources (used in many courses) such as a technical FAQ, a virtual library, an agenda or a calendar.

2.1 Assistance in a Distributed Learning Environment

Whatever the agents, human or computer-based, the assistance must be « intelligent », that is, informed of the user, of the kind of tasks he is involved in, of the information he has consulted or produced, of the interactions and collaboration with others, and finally of his use of the assistance resources and self-management. In another words, the central question of ITS research, the user model, reappears in distributed learning systems, but in quite a different context [6]. We will give here priority to well informed assistance by human facilitators, without excluding direct intervention from computerized agents.

2. The learning environment model

Using instructional engineering methods and tools (Paquette, 2001, Merril, 1994) a designer can produce the specifications of the host learning environment. The user model will be built in relation to the model of host environment as opposed of the specific implementation of the "physical" system. The advantages of such an approach have been discussed in (Paquette, Pachet, Giroux, Girard, 1996; Paquette, Girard, 1996).

In the Explor@ system, we actually model the host environment into three kinds of hierarchical structures.

- The *instructional structure (IS)* groups the activities or operations that the learner can enact in the environment, from the program or course, down to the modules, the activities and finally the elementary steps where the learner consults, use or produces a resource (document, tool, service, etc.).
- The *knowledge and competency structure (KS)* decomposes a main knowledge object into related parts down to simple skills that apply to knowledge in the structure.

— The *resource structure (RS)* is composed of the list of resource spaces (information, production, collaboration, assistance, self-management) subdivided into individual resources.

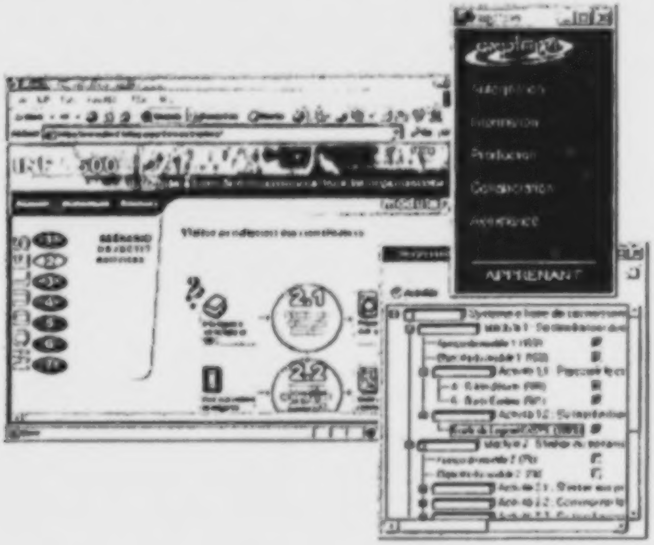


Figure 1 – A host web environment and an Explor@ resource navigator.

2.3 The "progress" part of the user model

To provide adaptive assistance to a learner, we need first to consider his position and progress into each structure of the learning environment model. The definition of adaptive assistance towards progress in the activities is actually done through an interface where the designer of the advisor first describes the IS and the KS, define simple templates to update the user model, and displays an advice or engages in a dialogue with the user (Lundgren-Cayrol, Paquette, Miara, Bergeron, Rivard, & Rosca, 2001). The advisor system also enables the designer to define tailor-made rules for the same purpose.

The learner model is updated essentially in three ways: by the designer's predefined templates or rules, by querying the user or by some action taken by the user can take to modify the model. The progress model is inspectable through a bar graph diagram (figure 1) that changes with the completion of the activities in the IS instructional tree structure.

3. Modeling users and groups

The user model described in section 2 is generic, that is applicable whatever the knowledge domain. But it is incomplete, limited to showing the learner her progress in the activities (in the IS) or in the knowledge and competency acquisition (in the KS). In this section, we will describe a process to build a more complete user model, that fully accounts for the knowledge and competency structure (KS), and also using data from the user's interaction with the collaboration and self-management resources.

3.1 The Modeling Process

BEST COPY AVAILABLE

The main objective of the modeling process presented in figure 2, is to build and combine attributes enabling assistance adapted to the needs of each learner.

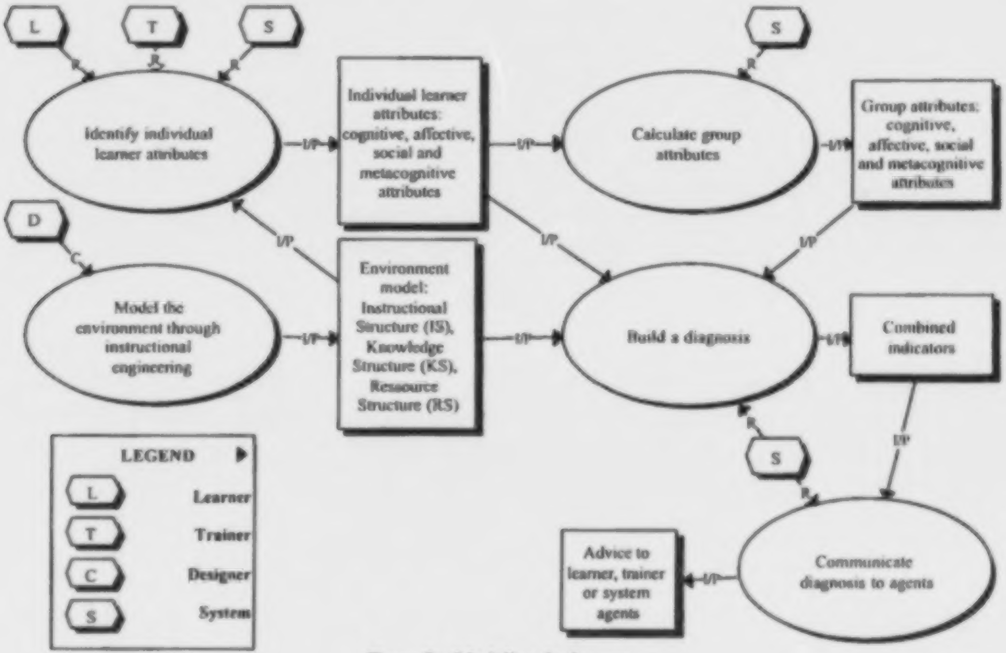

L
T
S
R
R
R
Identify individual learner attributes
I/P
Individual learner attributes: cognitive, affective, social and metacognitive attributes
I/P
S
R
Calculate group attributes
I/P
Group attributes: cognitive, affective, social and metacognitive attributes
D
C
I/P
I/P
I/P
Model the environment through instructional engineering
I/P
Environment model: Instructional Structure (IS), Knowledge Structure (KS), Resource Structure (RS)
I/P
Build a diagnosis
I/P
Combined indicators
R
S
R
I/P
LEGEND
L
Learner
T
Trainer
C
Designer
S
System
Advice to learner, trainer or system agents
I/P
Communicate diagnosis to agents

Figure 2 – Modeling the learner.

The learner (L), the trainer (T), the designer (D) and the assistance system (S) built by the designer participate to this display of the five sub-processes involved. The first process models the learning environment. It supplies information about the instructional structure, the cognitive structure and the resource structure, targeted towards the type of assistance that the designer intends to build. The second process tracks down the characteristics of the learner through her use of the environment. It embeds cognitive, affective, social and metacognitive attributes. The third process deduces, calculates and compiles group attributes from the individual learner's attributes. All this information is related and analyzed by the fourth process, the diagnostic one, opting to identify learning needs and learner's potential problems. Finally, the compiled attributes, needs and problems are communicated to an appropriate assistance generator, either for the learner, a trainer, a peer helper or a computer agent by the last process.

3.2 User model and the learning environment model

The modeling process draws a dynamic portrait of the user by tracking down a series of data based upon the interactions carried out in the learning environment. This portrait supplies a certain number of cognitive, affective, social and metacognitive attributes obtained by relating the learner's action with resources in the environment.

Cognitive attributes. The cognitive attributes derive from the knowledge and competency structures involved in the learning activities and productions achieved by the learner. We have developed a taxonomy of skills that helps define a scale of competency and performance levels corresponding to the acquisition of a certain knowledge unit (see [7]). The designer defines the entry level (DEC) and the target level (DTC) for each competency to be acquired in a learning activity. Then the learner is invited and encouraged to evaluate and compare, on a regular basis the state of her actual (LAC) and target (LTC) competency level. The trainer assesses the learner's productions or performances, yielding another value for the actual

BEST COPY AVAILABLE

competency (TAC) of a learner. Depending on the relations between these values, it is possible to identify some learner's needs or problems. For example, if TAC < DEC, then the learner does not have the entry level competency stipulated by the designer and a prerequisite course is activated. The distance between TAC and DTC is important especially if a large time interval has elapsed since the beginning of the learner's activities within the course. For each activity in the instructional structure (IS), the associated competencies are evaluated and integrated in the learner's model.

Social attributes. The needed information is obtained by tracing the learner in her use of the collaboration resources in the learning environment, for example emails, forum, chat, videoconference, production showcase and so on. For each of these collaboration tools, some functions will have to be selected and the corresponding data captured. For example, how many messages does a learner send, by email or in a forum, to whom and on what subject? Previous work on forum analysis can contribute to this goal (Ricciardi-Rigault, Henri, 1994).

Affective attributes. The affective attributes are very important in a learner model but hard to track down because of the limited capabilities of today's computers. Emotional states are initialized through the use of an attitude pre-test. A special annotation tool is under construction and will be used to capture changes in attitude and emotions of the learner towards activities in the IS and resources in the RS. This annotation tool can be used anywhere in the learning environment and the learner can use it to enter small written messages, validated through a set of emotional values (Aubé, 2000) ranging from positive emotions (pride, gratefulness, joy, hope), to neutral, or negative emotions (fear, sadness, guilt, anger).

Metacognitive attributes. The Explor@ learning environments put a strong emphasis on self-management tools to help learner plan her activities, evaluate her progress, compare her results with other learners, and decide on a new course of action at a any point in time (Ruelland, 2000). Metacognitive attributes are discovered by the way the learner uses the self-management and assistance tools provided in the learning environment: the frequency of use, the consistency between the planned actions and the progress as well as the kind of modification the learner makes to her training plan.

3.3 Group model and the individual learner models

The model of a group contains group attributes on cognitive, social, affective and metacognitive dimensions. Individual scores of all members of the group participate in the process. In certain cases, the result shows average, median, minimum or maximum scores. In other cases, the distribution of learners in different categories is computed. Still in other cases, it builds the graph of all exchanged messages between learners and analyze it for clusters, number of links at a certain point, transitivity attributes and so on. In the affective evaluation of an activity or a resource, the group model shows how students distribute between emotions.

4. Combining attributes for diagnosis and assistance

We conclude this paper by giving a few examples of the combined use of the three models discussed (environment, user and group) to build a set of diagnostic attributes used to provide adaptive assistance to the learner. We will emphasize the possibility to give advice taking into account, cognitive, social, affective and metacognitive features of the models.

4.1 Diagnostic process

The diagnostic process goes beyond the descriptive models that capture the learner's individual attributes or the group attributes. It participates in the identification of learner's problems and diagnosis. Learning problems uncovered by educational research, particularly in the distributed learning field, feed this process. A diagnosis consists of a problem, its sources of difficulty and the attributes either essential or contributory, describing the problem. During this process, the system watches the manifestations of these attributes in the learner model and establishes, in terms of percentage, the probability that a hypothetical problem is a true problem for a learner.

The problem. For example, persistence has been the subject of numerous researches in the field of distributed and distance learning. The risk of dropout is a problem highly relevant justifying its presence among hypothetical problems.

The attributes. The diagnostic attributes are collected from the attributes available in the three descriptive models of the environment, the learner and the group. They are also obtained through comparisons between these attributes. Table 2 presents a list of examples of such attributes, together with the DLE resources used by the learner, and the model into which they can be found.

Diagnosed attributes	*From resource*	*In model*
1. Distance between the learner actual competency and the entry level defined by the designer	Self diagnosis tool	Learner model, Environment model
2. Values of learner's actual competencies lower than those of the group	Self diagnosis tool	Learner model, Group model
3. Distance between values of learner's actual competencies and those estimated by the trainer.	Self diagnosis tool, Tutor assessment tool	Learner model
4. Delay in the delivery of learner's productions	Progression tool, work plan tool	Learner model
5. Delay in achievement of the activities according to the work plan	Work plan tool	Learner model
6. Slower progress in the activities compared to the group	Work plan tool	Learner model Group model
7. Negative feelings	Annotation tool	Learner model
8. Absence or important decrease of the use of the resources of information, collaboration, assistance and of metacognition.	Progression tool	Learner model
9. High risk of failure (90%)	Inference from the system	Learner model

Table 2 – Example of diagnostic attributes

Some of these data are considered essential while others have a contributory character in that they participate in the description of the problem without being essential to the confirmation of the problem.

The sources of difficulties. The sources of difficulties associated to a problem are going to steer the attention of the trainer or learner on the causes of that problem. They derive from an analysis of the attributes and from their relationship with the cognitive, emotional, social or metacognitive domains. Thus, the sources of difficulty of the learner who demonstrates the attributes 1,2 and 7 of the above list would be of cognitive and emotional nature.

The percentage of credibility. This value is expressed on a continuum for example, persistence / dropout in the above mentioned case and is calculated by a set of rules according to the presence of the essential and contributory attributes in the descriptive three models. The percentage of credibility has two functions. It gives an appreciation of the probability that the hypothesis is really a problem for the learner. It could also be used to establish a priority order among possible problems. This will allow steering the attention of the assistance agent towards some priorities.

All attributes are obtained from the descriptive learner model. The attributes 2, 6 result also from the group model and the attributes 1, 4, 5, from the model of the learning environment. So the three models contribute to supply a critical vision on the learner.

The method described above is an inductive approach to diagnosis (Self, 1990) linking diagnostic attributes to a problem. Other learner problems can be added to the list using an editor to be added to the DLE to allow the trainer to add a diagnosis based on the inspection of the descriptive models. The trainer can either select a problem within a list of hypotheses supplied by the designer or formulate a new problem based on his inspection of the attributes of the descriptive models. He then establishes a concrete relation between the proposed diagnosis and the descriptive model attributes to communicate his perception of the learner problems. This approach informs the designer of learner difficulties not yet listed in the learning environment thus participating to its improvement.

4.2 Communicating diagnostic results

Learners, trainers and designers have different roles and needs regarding the information contained in the models and the diagnostic attributes. It is then advisable to select and organize the information in order to respond to the special needs of each actor.

For example, a learner who wishes to compare his results with those of the group, consults a graphs displaying the group results if the DLE integrates this possibility. In other occasions, a learner has the chance to consult his results and attitudes related to instructional structure before choosing in a range of activities.

The trainer, on his part, receives an orderly list of possible learner's problems. The agent consults and evaluates the appropriateness as well as the type of intervention to establish. The trainer can consult the individual learner's models and the group model before adopting a strategy of assistance. He can also ask to be informed when certain diagnostic attributes have reached a threshold of critical credibility. In the above example, the trainer should be informed about the position of the learner on the persistency/dropout continuum. In accordance with Self's (Self, 1990), all of the attributes need not to be identified. A trainer, who suspects a learner problem, identifies the missing attributes in the learner model and establishes his strategy to obtain the missing information.

The designer as well, has specific needs. This actor will be interested mostly by the group model, the most significant of the three, to improve the learning environment. Inspecting the attributes and problems of the group will direct his attention towards weakness in the design. Learning that a whole group feels anger regarding an activity or experiences difficulty in meeting a target competency will probably help him to implement certain modifications in the cognitive, pedagogical or resource structures.

Conclusion

Proposing summaries tuned to the role of the actor who requested it, approaches the question of learner assistance in a broader way than direct assistance from the system. It is inspired by the "human-in-the loop" approach (Kumar, V., 2001), an approach that was built, right from the start, into the architecture of the Explor@ system and the DLE model we have referred to in this paper. The multi-agent view is focused on a continuous and recursive collaboration between human agents, the actors, and computerized agent, including those giving or helping actors to provide adaptive assistance to the learner.

The approach to adaptive assistance we have proposed here is wide and ambitious. Each dimension of the learner model and the group model has witnessed much research in the past, especially for the cognitive dimension and, more recently, for the social dimension. What we propose here is not to go in depth on any dimension but instead, to use previous research results, to add new elements for the affective and metacogntive models, and to integrate them in combination to detect important learning problems.

Even though we have focused on assistance to the learner, most of what we have described can be adapted to other actors in the environment. Some of our colleagues are presently working on similar schemes to provide assistance to designers.

Finally, we hope to progress in this research in a way to provide guidelines and tools to designers to enable then to integrate new resources in Explor@ DLEs, not only to contribute to learning scenarios, but also to provide ground for adaptive assistance to those scenarios.

References

Paquette, G. (2001). Designing Virtual Learning Centers. In H. Adelsberger, B., Collis, J. Pawlowski (Eds), *Handbook on Information Technologies for Education & Training* within the Springer-Verlag series "International Handbook on Information Systems", pp. 249-272,

Paquette, G. (1997) Virtual Learning Centers for XXIst Century Organizations. In F. Verdejo and G.. Davies (eds.), *The Virtual Campus.* pp. 18-34. Chapman & Hall, London,

Anderson, J. R., Corbett, A. T., Koedinger, K. R., & Pelletier, R. (1995). Cognitive tutors: Lessons learned. *The Journal of the Learning Sciences 4*, 167-207.

Clancey, W. (1993) The knowledge level reinterpreted; modelling socio technical systems. *International Journal of Intelligent Systems*, 8, 33-49,

Wenger, E. (1987) *Artificial Intelligence and Tutoring Systems- Computational and Cognitive Approaches to the Communication of Knowledge*. Morgan-Kaufmann Pub. Co.

Girard, J., Paquette, G., Miara, A. & Lundgren,-Cayrol, K. (1999) Intelligent Assistance for Web-based TeleLearning. *Proceedings of AI-Ed'99, in AI and Education, open learning environments,* S. Lajoie et M. Vivet (Eds), IOS Press,.

Paquette, G. (2001) TeleLearning Systems Engineering – Towards a new ISD model, *Journal of Structural Learning* 14, pp. 1-35.

Merrill, M.D. (1994) *Principles of Instructionnal Design. Educationnal* Technology Publications, Englewood Cliffs, New Jersey.

Paquette, G., Pachet, F., Giroux, S. & Girard, J. (1996) Generating Advisor Agents for Existing Information Systems. *Journal of Artificial Intelligence in Education*, (7) 3/4, pp. 349-379.

Paquette G. & Girard J. (1996) *AGD: a course engineering support system.* ITS-96, Montreal, June.

Lundgren-Cayrol, K., Paquette, G., Miara, A., Bergeron, F., Rivard, J. & Rosca, II. (2001) *Explor@ Advisory Agent: Tracing the Student's Trail*, WebNet'01 Conference, Orlando.

Ricciardi-Rigault, C. & Henri, F. (1994) *Developing Tools for Optimizing the Collaborative Learning Process*, Proceedings of the International Distance Education Conference, Penn State University, USA, June..

Aubé, M. (2000) *Les émotions comme opérateurs des engagements : Une métaphore pour les structures de contrôle dans les systèmes multi-agents.* Thèse de doctorat, Université de Montréal.

Ruelland D. (2000) *Un modèle des processus d'autogestion de l'apprentissage.* Thèse de doctorat, Université de Montréal,

Ragnemalm, E. L. (1996) Student Diagnosis in Practice; Bridging a Gap. *User Modeling and User-Adapted Interaction* 5:93-116.

Self, J. A. (1990) Bypassing the intractable problem of student modeling. In C. Frasson & G Gauthier (Eds.), *Intelligent Tutoring Systems.* New Jersey : Ablex Publishing Corporation. 124-139.

Kumar, V. (2001) *Helping the Peer Helper.* Ph.D Thesis, Department of Computer Science, University of Saskatchewan, Canada.

Minimizing the Gender Equity Gap in Science and Technology

Dr. María Victoria Pérez Cereijo
Department of Communication, University of Texas at Arlington. cereijo@uta.edu

Dr. Tandra Tyler-Wood
Department of Technology and Cognition, University of North Texas. wood@tac.coe.unt.edu

Dr. Jon Young
Department of Technology and Cognition, University of North Texas. young@tac.coe.unt.edu

Abstract:

The 21st century will require educational changes to meet the demands of industry. Workers in the 21st century must come equipped with a repertoire of both science and technology skills. Currently, many employers are concerned about where they will find highly trained and capable employees for the new century. Therefore, it has become increasingly important to provide female students an opportunity to explore careers in both science and technology. If we are to meet the demands of our technology driven society, all capable students and workers should be given an opportunity to maximize his/her potential. This article reviews the current state of gender equity in science and technology, and provides information on a program that addresses the gender equity issues.

In the Department of Technology and Cognition at the University of North Texas a demonstration project, *Bringing Up Girls in Science* (BUGS), funded by the National Science Foundation is now underway. The goal of this project is to provide: educational experiences in an outdoor learning lab and technology exposure for girls, in grades four and five that will increase girls' interest, participation, self-concept, knowledge, and achievement in the environmental sciences and in technology. The project is the result of an extensive review of the literature on "best practices" for providing effective programs for girls to increase the number of females who choose science and technology careers. The BUGS project is an attempt to bring theory into practice with the help of technology.

Methodology

Thirty-six 4th and 5th grade girls (BUGS participants) currently participate in an after school outdoors science lab at Sam Houston Elementary in the Denton Independent School District in Denton, TX. The contrast group is also participating in two science related over-night field trips; one to a zoo and another to Sea World. Participants for the project were recruited from across the district. As part of the study, BUGS participants are mentored by female high school students enrolled in the Texas Academy for Mathematics and Science (TAMS). TAMS provides an opportunity for talented students in mathematics and science to complete the first two years of college while earning a high school diploma. Each TAMS student will be matched with a BUGS participant. TAMS students will also serve as instructional aides for the outdoor lab. Each TAMS student assists a BUGS participant in developing a science fair project and a hands-on demonstration of a concept learned in the lab that will be presented to parents and future BUGS participants. A two-week summer experience at the University of North Texas' Environmental

Education Center, Elm Fork, will be provided for the academic year participants. TAMS students will serve as educational aides while graduate students in environmental science provide instruction. To increase technology skills for the BUGS participants a project WEB site, chat rooms, computer "pen-pals" and two-way audio-video technology have been established.

The Issues of Gender Equity in Science and Technology

According to Baker and Leary (1995) attracting females to science and technology careers has been, for many years, a well-documented problem. Subrahmanyan and Bozonie (1996) argue that crucial areas of science and technology education, particularly for girls, should occur prior to high school. Programs that address gender equity in science and technology at the high school level are often "too little, too late." Science and technology programs for young female students should address the very specific needs of bright and capable female students. Programs should not strive to be equal to programs for male students, but should be equitable, emphasizing hands-on, real-life laboratory experiences while incorporating verbal/language arts components where many females excel. Cooperative learning and mentoring programs are effective methods for incorporating a verbal/language arts component into such programs. It appears to be most important to encourage science and technology participation at an early age. Subrahmanyan and Bozonie document the need to match curriculum to learning styles. To facilitate gender equity in science and technology it is critical to identify programs that provide learner centered materials at an early age.

On the other hand, differences in the use of computers in our schools seem to be mounting in detriment to some of our student populations. Namely – minority, disadvantaged, inner-city, handicapped, rural and females. Neuman (1991) has suggested that these differences were promoted by inequitable access, distribution and use of computers within and across schools. In schools where limited access is further exacerbated by scheduling patterns favoring higher ability students, reasons for students' limited access were identified as being related to location of hardware within schools, unnecessarily difficult pre-requisites for computer courses, lack of handicapped oriented adaptations on the computer systems and stereotyping oriented software (Neuman, 1991; Rothchild, 2000).

Several other studies strongly suggest that differences in the use of computers in the schools exist more due to gender stereotyping than due to capabilities. Capabilities in the cognitive or affective areas have been found to be consistently the same for both genders (Forsyth, 1986; Elliot, 1993). On the other hand, our society's stereotyping through psychological and social processes may be the main contributor of the gender differences in computer skills and subsequent perceptions (Miura, 1986; Nickell, 1987; Eastman, 1984).

As early as 1986, Holligan (et al) point out that not only is the limited access of computer resources a factor, but goes further to say that these reasons coupled with a 4:1 ration of male to female teachers of computing in the high schools may further deter female students from showing any interest in technology. Boys, on the other hand, are in general favored by software themes, given more mastery opportunities, have more role models to emulate, have less fear of machines and seem to express overall a more positive attitude about the benefits of computers in society than do girls (Miura 1986). Nickell (1987) further concurs with Miura and adds that regular use of computers at school and at home positively affects computer attitudes and that society's stereotypes further encourage such usage only in direct relation to the subject's future sex role functional occupation and what expected computer skills will be necessary.

Rationale for Early Involvement in Science and Technology

Hamrick (1990) conducted a study on Women's Perceptions of Science, which indicated that women harbor stereotypical ideas about science and scientists. Most women believe science is a male dominated field with few opportunities for female participation. Weinburgh (1995) conducted a meta-analysis of the literature on gender differences in students' attitudes toward science. The correlation between students' attitudes towards science and student achievement was explored. Weinburgh concluded that boys display more positive attitudes towards science and that their attitude is highly correlated to their achievement in the subject. Oakes (1990) conducted a study that indicated that the number of students considering careers in the field of science and technology increases very little after ninth grade. Therefore, improving the elementary females' perception of science and technology at an early age would seem to be an essential goal if one is to increase science and technology achievement in female students and subsequently increase the number of females participating in science and technology careers.

Improving Female Involvement in Science and Technology

In a study conducted in 1997, Burkham emphasized the importance of active classroom involvement as a way of promoting gender equity. Methods to increase active involvement include: engage in real life scientific experiments that personify females' interest areas, increase hands-on experience through lab time, allow girls to share research findings through innovative methods that have a strong verbal component (ex. two-way audio visual interaction through the use of the computer), increase opportunities for cooperative learning (Tyler-Wood, 1993).

Technology as a Facilitator

In a recent report, Davis (2000) documented the role that technology can play in an elementary science class designed to increase under-represented female elementary students. Technology can serve as a door-opener or as a gate-keeper for female participation in science. If technology is used appropriately it can serve as a tool to increase an elementary school girl's use of science inquiry and discourse. Possible appropriate use of technology include: conducting science experiments at multiple sites through the use of two-way audio visual technology, the use of chat rooms for scientific discussion, and keeping an on-line journal for science experiments. Davis' research strongly encourages the appropriate use of technology for increasing female participation in science activities at the elementary level.

In 1998, Clements review of the literature finds that computers serve as catalysts for social interaction, with children spending nine times as much time talking with peers while working at computers than while doing puzzles. The review also suggests that the interaction is further influenced by the type of software used and the physical environment surrounding the computer. Beyond Wilson's assertion that the cultural environment has an effect on the content (Stokrocki, 2000), an international study of 303 undergraduate students found that attitude towards computers and computer experience were culture-free constructs. Although the study further confirms that males are more confident about computers than female students, it also found that increased computer experience, number of computer courses completed, and knowledge of computer languages as well as software application packages were enormous contributors to higher confidence levels and overall positive attitudes towards computers (Moon, 1994).

Early on, a similar study conducted, on 247 middle schoolers in the United States, by Eastman & Krendl (1984) had found that the computer task has greater influence on computer achievement than inherent verbal or spatial skills, and that experience using computers reduces sex-related stereotypes. Eastman & Kendl strongly suggest that new technologies foster educational equity.

Conclusions

The literature suggests certain components that should be included in a program designed to increase science and technology career opportunities for females:

1. Hands-on interaction

2. Female teachers as role models
3. Highly capable female mentors for BUGS participants
4. Emphasizing Verbal interaction
5. Working in Groups
6. Using technology to facilitate communication

The BUGS program attempts to move theory into practice by placing proposed promising practices into reality. Currently the program has been under way for a full academic year with all these components in place. Data is being collected on the effects of different components and program practices on the study's population. Analysis of the data will be conducted during the summer. Based on the results, modifications on the procedures and practices of the program will be considered, but the long term impact of BUGS is yet to be determined. Will this theory based program increase the number of females interested in science and technology, and the number of females who obtain high proficiency in skills associated with technology and the environmental sciences? Will BUGS participants enter science and technology careers? Will BUGS participants' achievement scores in science and technology increase?

References

Baker, D. & Leary, R. (1995). Letting girls speak out about science. *Journal of Research in Science Teaching, 32* (1), 3-27.

Burkham, D.T. (1997). Gender and science learning in high school: Subject matter and laboratory experiences. *American Educational Research Journal, 34*(2), 297-331.

Clements, D. (1998). *Young children and technology.* (ERIC ED416991)

Davis, A.M. (2000). Effects of gender, cognitive learning styles, and computer attitude on students' course satisfaction: A preliminary study II. (ERIC ED 442416).

Eastman, S. T. & Krendl, K. A. (1984). *Computers and gender: Differential effects of electronic search on students' achievement and attitudes.* (ERIC No. ED258827)

Elliot, A. (1993) Effects of gender on preschoolers' play and learning in Logo environments. *Journal of Computing in Childhood Education. 4*(2), 103-127.

Forsyth, A. S. Jr. (1986). *Applications of microcomputer search-type adventure games in research on spatial orientation, place location, and memory for places.* (ERIC No. ED273264)

Hamrick, F.A., and Carlisle, L. W. (1990). Gender diversity in student affairs: Administrative perceptions and recommendations. *NASPA Journal.* 27(4) 306-311.

Holligan, P. (et al) (1986). *Use of microcomputers in Leicestershire schools.* (ERIC No. ED277364)

Miura, I.T. (1986). *Understanding gender differences in middle school computer interest and use.* (ERIC No. ED273248)

Moon, S. (et. al) (1994). *The relationships among gender, computer experience, and attitudes toward computers.* (ERIC No. ED381142)

Neuman, D. (1991). *Technology and equity.* (ERIC No. ED339400)

Nickell, G. S. (et al.) (1987). *Gender and sex role differences in computer attitudes.* (ERIC No. ED284114)

Oakes, J. (1990). *The effects of race, social class, and tracking on opportunities to learn mathematics and science.* (ED 329615).

Rothschild, B. (2000). Computing gender bias. *Humanist. 60*(2), 36-38.

Stoking, V. (1993). Attitudes about school of academically talented seventh graders. *Paper presented at the Annual Meeting of the American Educational Research Association.* (ED 374034).

Stokrocki, M. & Buckpitt, M. (2000). *An exploratory study of Apachè middle school students' computer animation.* (ERIC ED 441734)

Subrahmanyan, L. and Bozonie, H. (1996). Gender equity in middle school science teaching: Being "equitable" should be the goal. *Middle school journal,* 27(5), 3-10.

Tyler-Wood, T. (1993). Troup Science Project Evaluation Report, State of Georgia Innovative Program Grant, Georgia Department of Education.

Weinburgh, M. (1995). Gender differences in student attitudes toward science: A meta-analysis of the literature from 1970 to 1991. *Journal of Research in Science Teaching, 32*(4), 387-398.

Student Perceptions of Online Synchronous Courses

Dr. María Victoria Pérez Cereijo
Dept. of Technology and Cognition, University of North Texas. cereijo@coe.unt.edu

Dr. Tandra Tyler-Wood
Dept. of Technology and Cognition, University of North Texas. wood@tac.coe.unt.edu

Dr. Jon Young
Dept. of Technology and Cognition, University of North Texas. young@tac.coe.unt.edu

Abstract:

This study identified student reasons for participating in synchronous web based learning environments. Students were interviewed after completing a series of surveys designed to elicit their perceptions of the strengths and weaknesses of the delivery methodology. Responses indicated that both convenience and learning enhancement were considered advantages, while disadvantages included isolation and technology quality.

Background

Our daily routines of having to juggle work, travel, family and for some, the desire to further their education, is being challenged by the increasingly mobile nature of our society (Sherritt & Basou, 1997). In order to accommodate the changing lifestyles of the student population, institutions of higher education are offering courses in many and varied formats beyond the traditional in-class setting. Students every semester are having to make a choice of not only what courses to take to fulfill their degree requirements, but once selected they are having to decide in which campus to attend and/or in which class format. Beyond the usual on-campus class offerings, courses are also being broadcasted either via Vtel/Tangem systems (Distributed Learning) or via the Internet, also known as Web based courses.

Online Class Formats

Web based courses maybe offered either asynchronously or synchronously. For some students, Web based courses are the best solution because of their space independent and sometimes time independent nature as in the case of the asynchronous class format. In the asynchronous setting, professors post all class resources such as handouts (syllabus, schedule and assignments), power point presentations, and even video lectures on a web site. Students can then, using the course schedule and/or other instructional design scheme provided by the instructor, study the materials and complete the requirements to successfully master the objectives.

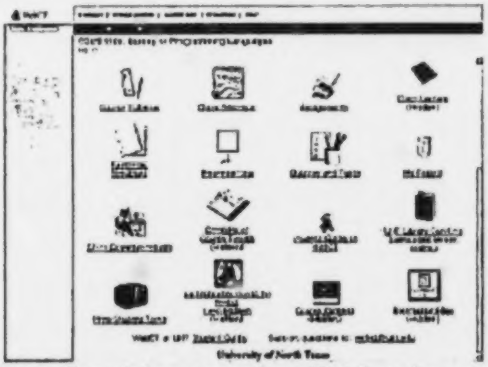


Fig 1 - Sample home page for a Web based course

BEST COPY AVAILABLE

The asynchronous format allows students to "attend" the class at any time from anywhere, thus accommodating not only the students' schedule but also many, sometimes insurmountable, obstacles such as distance from school, lifestyle commitments, and more.

Courses offered in the synchronous format posses all the same characteristics as their asynchronous counterparts except that students must "attend" the live lectures at the pre-arranged class times. Still, this setting offers the space independent feature that allows students to watch the class videos from wherever they choose (home, office, library, other), wherever a computer with an Internet browser and Real Player client software is available.

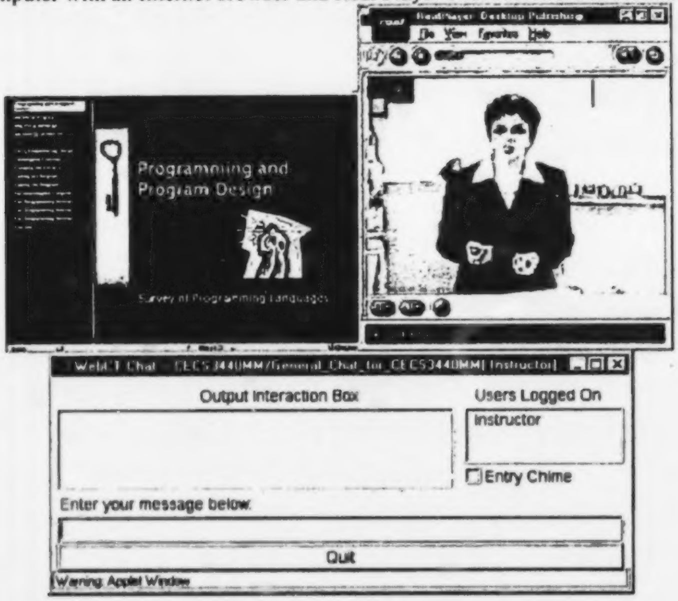

RealPlayer: Desktop Publishing
Programming and
Program Design
Survey of Programming Languages
WebCT Chat - CECS3440MM/General_Chat_for_CECS3440MM[Instructor]
Output Interaction Box
Users Logged On
Instructor
☐ Entry Chime
Enter your message below:
Quit
Warning: Applet Window

Fig 2 - Synchronous class format

In this setting students can follow the broadcasted lectures videos with the help of the teacher's power point, and use the chat room to ask questions in real time. So essentially, the difference between the synchronous and asynchronous settings is that students in the asynchronous setting are not able to ask questions in real time. Otherwise, the feel and accessibility to the resources is the same for both settings.

Methodology

A recent study was conducted with a group of graduate students attending an online web-based course taught at the university level. For purposes of this paper only the factors uncovered in the synchronous class-setting portion of the course will be discussed. Students, in this study, were observed, interviewed and asked to complete surveys to determine their perceptions, experience and overall "feelings" for the class format. Questions asked were intended to help find answers to the main research question of "What were the advantages and the disadvantages of the synchronous class format of the course?" A qualitative approach of data gathering and analysis was used to collect students' verbal and textual answers. The three qualitative methods of data gathering used in this study – interviews, observations and surveys – insured the validity of the findings through triangulation (Glaser & Strauss, 1967). As a result, factors were uncovered and grouped as either an advantage or a disadvantage. Further, using the grounded theory approach to data analysis introduced by Strauss and Corbin (1990) relationships between factors under these general groups were established and so related factors were clustered under these emergent categories.

Data Interpretation

Following the grounded theory approach, student statements were carefully read and compared multiple times with other student statements to find commonalities. These commonalities were then identified as the underlying themes, which in turn became the categories. Next, all statements were clustered under the category of "best-fit" following a similar process of analysis. Some students' comments were stored under more than one category because of their broadness. Finally, categories were grouped as advantages and disadvantages. Fig 3 & 4 show the advantages and

BEST COPY AVAILABLE

disadvantages of the synchronous class setting. Although tallies were kept for the number of student responses grouped under each factor, this quantification was not used to determine the true statistical relevance of each factor but to affirm its importance and give future investigators ample evidence by which to judge the appropriateness of the categories. These categories will be considered the variables of future studies.

On examination of the tallies, ***Convenience*** and ***Learning Enhancement*** were the most frequently cited advantages for the synchronous class format (57% of all positive statements). Under ***Convenience***, Economy of Travel, Comfort of Familiar Environment and Similarity of Traditional Environment ranked the highest with a 24% of the total number of statements made. Travel was the one sub-category most often mentioned by students, 53% of the students made a positive statement about the advantages of not having to travel to school. As (Cristina) stated, "I feel I'm making the most of my time. I'm not wasting my time driving when I don't have to." All other subcategories of ***Convenience*** were closely related to these three. Under ***Learning Enhancement***, Technology Factors and Comprehension/Understanding ranked the highest with 19% of all the statements made. Of the two factors, Technology Factors ranked the highest. In this sub-category, students expressed a liking and/or an increased understanding of the technology used, which became a benefit they did not set out to gain. (Leslie) best explained it, "That maybe one reason why I prefer to do something on the Web, rather than just go to class. Because, the challenge in and of itself, just to get on line, and make sure that everything works. That to me, it's really cool!"

The disadvantages of this synchronous online setting ranked highest were related to ***Technology*** and to ***Isolation***. Under Technology (45% of al negative statements), complaints ranged from apprehensions with using the technology, to the video's poor quality, to complaints with the transmission delay over the Internet. As for Isolation (35% of all negative statements), complaints were mostly related to lack of opportunities for informal socialization with the teacher and students. In general, with faster connections and proper technology training, students can be helped to overcome some of the apprehensions online courses present.

Conclusions

In this study, there were 91 negative statements made vs. 230 positive statements made about the synchronous online setting experienced. The figures and the comments appear to support the assumption that online synchronous courses present more advantages than disadvantages. Students found that this classroom setting supports their lifestyle while allowing them to "attend" classes. Students with a hectic life, full of commitments and who live at a distance from school seem to fully embrace Web based courses as an alternative to wasting hours in driving to and from school, and to be able to stay closer in touch with their family and in a more comfortable environment. Online synchronous courses offer students an alternative to coming to campus, and an opportunity to further their studies in an otherwise unlikely situation. Although no one class format has yet been proven ideal for everyone, from some student's perspective Web based courses are making education an accessible reality.

References

Glaser, B., & Strauss, A. (1967). *The discovery of grounded theory*. Chicago: Aldine.

Sherritt, C., & Basom, M. (1997). *Using the Internet for higher education*. (ERIC No. ED 407 546)

Strauss, A., & Corbin, J. (1990). *Basics of qualitative research: Grounded theory procedures and techniques*. Newbury Park, CA: Sage Publications.

BEST COPY AVAILABLE

Table 1 – SYNCHRONOUS CLASS FORMAT – *ADVANTAGE FACTORS*

CATEGORY/Subcategory	DEFINITION/responses related to:
CONVENIENCE	Advantages which "save work" in the students' course experience.
Family	the student's increased time to be with other members of his or her family.
Focus	improved concentration and focus on the class material.
Comfort of Familiar Environment	the convenience of viewing the lectures in one's own comfortable surroundings.
Economy	responses related to a savings of resources, including:
Money/Time	
Travel	no driving to and from school-work-home
Eco-System	contributing to saving the environment.
Similarity to Traditional Classroom	responses related to feeling as comfortable with the setting as when being in the classroom or feeling that one is not missing out on any of the interaction or visual cues.
FLEXIBILITY	advantages which allowed students to adjust the course experience to changes in their lifestyles and personal preferences.
Class Backup	having the lectures available in case class had to be missed.
Learning Self-Assessment	assertions made by students that, with this class format, they had acquired the same amount of knowledge that they would have attained in a traditional classroom setting.
Schedule Flexibility	establishing a lecture-viewing schedule around one's work and family schedule.
Viewing Flexibility	the ability to stop or pause viewing the lectures, for any amount of time, due to any type of interruption.
HUMAN INTERACTION	advantages related to the exchange of information among class participants that benefits all involved.
Community Maker	responses related to interacting with others in the classroom for reasons other than course content related, resulting in a sense of camaraderie, a feeling that one knows the classmates.
Communication	responses related to the exchange of information among class participants.
Interaction	being able to have immediate connectivity/interaction with teacher and students.
Socializing	interacting with professor or students for reasons other than course related material.
Immediate Questioning	Ability to ask the professor u other students questions about the class material as soon as need arises.
Body Language Cues	body gestures generated by the speaker that supports oral communication.
Class Discussions	being able to hear or see, oral, or textual communication of other class participants.

BEST COPY AVAILABLE

LEARNING ENHANCEMENT	all those advantages that represent new approaches to a classroom routine and that turned out to be beneficial to the student.
Better Note Taking	for which the video-pause feature was key.
Comprehension/Understanding	the ability to go over the class material more than once for improved understanding depending on need.
Reviewing Lectures	repeatedly viewing the lectures in full increments.
Content Accuracy	repeatedly viewing the lectures in short increments.
Discipline	increased personal **Discipline** – setting and following a viewing schedule.
Multi-Tasking	concurrently performing two or more activities while effectively dividing one's attention.
Technology Factors	while using the technology required to "attend" classes in this format, the student learned to use the new technologies, and, in the process, developed a liking for them.

PSYCHOLOGY	advantages that have, from the student's perspective, beneficially affected the personality or psyche of the participant.
Posing Questions	a) at the student's chosen time but not necessarily during class time, b) once the student had collected his/her thoughts, c) in a more private setting without a face-to-face encounter with the teacher and other students.
Teacher Support	obtaining **Teacher Support** due to a more frequent and structured connection between students and teacher in this setting than when attending classes in a traditional format.
Participation	decreased **Participation** or the choice of not listening to other student's questions, anecdotes, comments and other off-the-track distractions, by fast-forwarding or skipping over portions of the recorded lecture
Self-esteem	An increase in **Self-esteem** or improved self-confidence and self-image by attending class through this format, in a non-threatening environment. (For a student, previous traumatic classroom methodologies had made learning a detrimental experience).

BEST COPY AVAILABLE

Table 2 - SYNCHRONOUS CLASS FORMAT – *DISADVANTAGE FACTORS*

CATEGORY/Subcategory	DEFINITION/responses related to:
ISOLATION	a feeling of being alone and disconnected from the teacher and other students due to a perceived lack of interaction and/or communication.
Absence of Body Language Cues	from the speaker, which eliminated the ability to discern emphasis and other meaning attached to the oral communication.
Absence of Hearing Classroom Discussions	The absence of on-going class discussions and questions on the pre-recorded lectures contributed to students feeling left out and isolated.
Absence of Immediate Questioning	immediate clarification of points made by the teacher was not possible because the lectures were pre-recorded. Although email and phone calls were to be used as the alternate tools for submitting questions to the teacher, not all students felt these were adequate.
Lack of Interaction (no feedback, no socializing)	to communication between student and teacher, and between students, beyond class discussions and immediate questioning. Some students in the course perceived there were a) a lack of socializing opportunities – getting to know other students and the teacher on a personal level – and b) a lack of feedback on the student's progress in the course.
LEARNING ENVIRONMENT	involves all those situations where the student's progress in the course was negatively affected by the environment chosen by the student in which to view the videos.
Interruptions/Distractions	problems in the student's personal environment directly interfering with the smooth, continuous viewing of the lecture.
Lack of Focus	to inability to concentrate on the content of the videos being viewed.
Missed Material	technical problems or student perceptions that contributed to gaps in viewing the lecture.
Lack of Time Flexibility	responses related to having to adjust to the online class schedule in order to view the live broadcast.
Physical Problems	responses related to health related problems that seem to worsen with prolonged use of the computer.
TECHNOLOGY	factor included technology problems that were either perceived as a potential disadvantage or actually experienced as a disadvantage by the students.
Language	loss of **Language** understanding – difficulty understanding lectures over the Internet.
Net Congestion/Buffering	difficulty accessing the videos directly from the department's server over the Internet.
Poor Video Quality	difficulty with the small size, low resolution and jerkiness of the video image.
Other Hardware/Software Problems	difficulty getting comfortable with the technology and the need to make upgrades to permit viewing the lectures.
Typing	responses related to students having little keyboarding skills and experiencing difficulty typing questions in the chat room expediently enough to keep up with the lecture.
Delay	a 20 second delay between actual lecture broadcast and the time the computer would output the image and sound, becoming a nuance when students would ask a question and the teacher had already passed the topic.

AutoTutor Passes the Bystander Turing Test

Natalie Person[1], Mary Erkel[1], Arthur C. Graesser[2],
& the Tutoring Research Group[2]
[1] Rhodes College, Department of Psychology, Memphis, TN 38112
person@rhodes.edu
[2] University of Memphis, Department of Psychology, Memphis, TN 38152-3230
a-graesser@memphis.edu

Abstract: In this study, the Bystander Turing Test (BTT) paradigm is used to determine whether participants rate particular dialog moves in tutoring transcripts to be generated by a computer tutor, AutoTutor, or by a skilled human tutor. Results indicate that participants are unable to differentiate computer-generated moves from those generated by skilled human tutors. Participants did, however, view some dialog move categories to be more pedagogically effective than others regardless of whether the dialog move was generated by AutoTutor or by a skilled human tutor.

Introduction

The study presented in this paper is one of several studies that were recently conducted to determine whether AutoTutor can pass a variation of the Turing test. AutoTutor is a web-based computer tutor architecture that can be used for a variety of content domains (Graesser, Hu, Susarla, Harter, Person, Louwerse, Olde, & the TRG, 2001; Graesser, Person, Harter, & the TRG, 2000; Person, Graesser, Bautista, Mathews, & the TRG, 2001; Person, Graesser, Kreuz, Pomeroy, & the TRG, 2001). AutoTutor's architecture has been described extensively in previous publications, and therefore, will not be addressed here (Graesser, Wiemer-Hastings, Wiemer-Hastings, Harter, Person, & the TRG, 2000; Person, Graesser, & the TRG, 2000; Person, Graesser, Harter, Mathews, & the TRG, 2000; Person et al., 2001; Person, Klettke, Link, Kreuz, & the TRG, 1999; Wiemer-Hastings, Graesser, Harter, & the TRG, 1998; Wiemer-Hastings, Wiemer-Hastings, & Graesser, 1999). The Tutoring Research Group (TRG) has recently developed two versions of AutoTutor, one for computer literacy and one for conceptual physics. The computer literacy AutoTutor is designed to help students learn basic computer literacy topics covered in an introductory course (e.g., hardware, operating systems, and the Internet). The conceptual physics AutoTutor is designed to help students learn Newtonian physics.

Two of the primary design goals of AutoTutor's developers are to create a system that simulates the dialog moves of effective human tutors and to have the system deliver the dialog moves in conversationally appropriate ways. We know that effective teachers and tutors encourage students to take an active role in the learning process by structuring tasks and dialogs in ways that force students to engage in behaviors such as asking questions, recognizing misconceptions, generating explanations, and synthesizing information from multiple sources (Chi, 1996; Chi, Bassok, Lewis, Reimann, & Glaser, 1989; Graesser et al., 2001; Person et al., 2001). Currently AutoTutor initiates a conversation with the learner by posing a question or presenting a problem for the learner to solve. Students learn about computer literacy or physics by engaging in a conversation with an animated agent that remains on the monitor throughout the tutoring session. AutoTutor scaffolds the conversation with a series of dialog moves that are frequently used by effective human tutors (Graesser et al., 2001; Person & Graesser, 1999). The dialog moves included in AutoTutor are Pump, Prompt, Hint, Assertion, Correction, Summary, and three kinds of Short Feedback (positive, negative, and neutral). Although AutoTutor delivers these dialog moves (via the animated agent) in pedagogically and conversationally appropriate ways that enable learners to construct elaborate answers and solutions to questions and problems (Person et al., 2001), it is unclear whether AutoTutor is actually simulating the pedagogical and conversational behaviors of human tutors or whether AutoTutor is producing a set idiosyncratic behaviors that accomplish the same end. The present study is designed to elucidate whether participants view the teaching and conversational behaviors of AutoTutor differently from those of skilled human tutors. The subsequent sections of this paper include the following: (1) an overview of the Bystander Turing Test (BTT), (2) a description of the study being presented in this paper, (3) a summary of the findings and (4) the conclusions drawn from the BBT research.

The Bystander Turing Test

Turing (1950) argued that computers are not capable of thinking and provided several theological, psychological, and sociological arguments in support his position. To determine a computer program's intelligence, Turing proposed several benchmark methods. One such method requires humans to decide whether they are interacting with an actual computer program or another human via computer mediation. According to Turing, a computer could be described as intelligent if it could deceive a human into believing that it was human.

The original Turing test is based on the Imitation Game. In the Imitation Game, the participants are a man, a woman, and an interrogator. The interrogator is physically separated from the man and woman. The object of the game is for the interrogator to determine which participant is male and which is female by evaluating their responses to questions posed by the interrogator. Turing proposed replacing one of the humans (i.e., the man or woman) with a computer. If the interrogator cannot discern whether the responses are generated by the computer or by the human, the computer program is said to pass the Turing Test. Specifically, the computer program is emulating human thought and intelligence if it can process human language, utilize knowledge it has been given before and receives during the interactive session, and use stored knowledge to engage in an intellectual conversation with the learner (Turing, 1950).

The Bystander Turing Test (BTT) is a variation of the original Turing Test (Person, Graesser, & the TRG, 2002). In the BTT, participants rate whether particular dialog moves in tutoring transcripts are generated by AutoTutor or by skilled human tutors. We converged on this variation of the original Turing Test for two reasons that are based on our observations of human tutors attempting to tutor students in computer-mediated environments. First, human tutors have tremendous difficulty responding in conversational real-time to student input. Given that AutoTutor responds immediately to student contributions, noticeable time lags resulting from human tutors' need to think would potentially influence an interrogator's decisions. Second, human tutors frequently make errors when typing their responses. Hence, AutoTutor's text-to-speech generator would mispronounce a considerable number of words, and unquestionably, affect an interrogator's judgments.

Recently Person, Graesser, and the TRG (2002) used the BTT paradigm in a series of studies to determine the following: (1) whether participants could discriminate dialog moves that were generated by skilled human tutors from those generated by AutoTutor, (2) whether the pedagogical effectiveness of the dialog moves generated by AutoTutor differed from the those generated by human tutors, and (3) whether the participants perceived the dialog generated by AutoTutor to be more or less conversationally appropriate than those generated by humans. The results of these studies indicated that the participants could not discriminate whether particular dialog moves were generated by AutoTutor or by human tutors. Further, they reported no mean differences on measures of pedagogical effectiveness and conversational appropriateness for AutoTutor and human-generated dialog moves.

One explanation of why the speaker discrimination (computer or human) was so low involves the dialog move categories. Perhaps the college students used the dialog move category information to diagnostically decide whether a computer or human produced the dialog move. College students may have been penalized in their predictions if they were poor guessers for some categories, but accurate guessers for others. However, previous findings from a dialog move category analysis indicated that the likelihood that the participants believed that AutoTutor generated a dialog move was absolutely equivalent for all of the dialog move categories. That is, the proportion of four, five, and six ratings on the "Who Said It?" question for each dialog move category did not significantly differ (Person, Graesser, & the TRG, 2002).

One interpretation of the findings from the previous BBT studies is that participants were simply not able to discriminate anything (e.g., speaker, examples of effective teaching, conversational appropriateness, or dialog move categories), and therefore, were forced to guess on every rating dimension. The study presented in this paper addresses this very issue by including randomly inserted dialog moves in the conversations. It is predicted that the participants will be sensitive to randomly inserted tutor dialog moves in that they will perceive the random moves to be generated by the computer (i.e., AutoTutor). It is further predicted that the random moves will not be rated as favorably on the Effective Teaching and Conversational Appropriateness assessment questions.

The BTT Study with Random Dialog Moves

Participants. The participants were 64 undergraduates at a small liberal arts college located in Memphis, Tennessee. The students participated in the study to fulfill research requirements for introductory psychology classes.

Materials. The conversations included in this BTT study were constructed in the following way. Two hundred and eighty-two conversations were randomly selected from several thousand conversations that had taken place between college students and the computer literacy AutoTutor. In each of the 282 conversations, a particular AutoTutor dialog move was deleted along with all subsequent conversational turns. Six-skilled human computer literacy tutors were asked to read each conversation and then fill in the blank lines with what they would say to that student at that juncture in the conversation.

After the human tutor responses (i.e., dialog moves) were collected, packets containing 36 different tutoring conversations were assembled. Each packet of 36 contained four types of conversations: (1) conversations in which all tutor dialog moves were generated by AutoTutor in actual tutoring sessions with students (Authentic computer condition, 9 total), (2) conversations in which the last tutor turn was a randomly selected AutoTutor dialog move from another tutoring conversation on the same topic (Random Computer condition, 9 total), (3) conversations in which the last dialog move in the conversation was generated by a human tutor (Authentic Human condition, 9 total), and (4) conversations in which the last tutor turn was a randomly selected human dialog move from another tutoring conversation on the same topic (Random Human condition, 9 total). To the extent possible, the dialog move categories (e.g., Pump, Prompt, Assertion) for both AutoTutor and the humans were evenly distributed across the four conversation types.

Procedure. All participants read and signed an informed consent form before the experiment began. Testing packets were then given to the participants that included 36 conversations. After reading each conversation, participants provided three six-point scale ratings for the last tutor dialog move in each conversation (see Table 1). After providing ratings for all 36 conversations, participants were asked to describe any strategies they had developed for identifying which dialog moves were generated by the computer and which were generated by humans. The analysis of these open-ended responses will not be discussed in this paper.

Table 1. Dialog Move Assessment Questions Used in Study 1 and 2

1. The last tutor response/question is:

1	2	3	4	5	6
Definitely Human	Probably Human	Not sure, but guess Human	Not sure, but guess Human	Probably Computer	Definitely Computer

2. In terms of conversational appropriateness, the last tutor response/question is:

1	2	3	4	5	6
Definitely Inappropriate	Probably Inappropriate	Not sure, but guess Inappropriate	Not sure, but guess Appropriate	Probably Appropriate	Definitely Appropriate

3. In terms of effective teaching, the last tutor turn response/question is:

Definitely Ineffective	Probably Ineffective	Not sure, but guess Ineffective	Not sure, but guess Effective	Probably Effective	Definitely Effective

Results

Three 2 x 2 ANOVAs were performed to determine the effects of Speaker (Computer vs. Human) and Authenticity (Authentic vs. Random) on the participants' ratings of the three six-point scale assessment questions. The means for the three questions are reported in Table 2.

Table 2. Means and Standard Deviations for the Three Assessment Questions

Question	Computer	Human	Total
	Mean (n) SE	Mean (n) SE	Mean (n) SE
1. Who said it?			
Authentic	3.62 (36) 0.12	3.59 (36) 0.13	3.60 (72) 0.09
Random	3.91 (36) 0.12	3.88 (36) 0.12	3.90 (72) 0.09
Total	3.77 (72) 0.09	3.73 (72) 0.09	

2. Conversationally appropriate?			
Authentic	4.24 (36) 0.14	4.41 (36) 0.14	4.33 (72) 0.10
Random	3.45 (36) 0.14	3.25 (36) 0.14	3.35 (72) 0.10
Total	3.85 (72) 0.10	3.83 (72) 0.10	
3. Effective teaching?			
Authentic	4.00 (36) 0.13	4.09 (36) 0.14	4.04 (72) 0.10
Random	3.26 (36) 0.14	3.29 (36) 0.14	3.28 (72) 0.10
Total	3.63 (72) 0.10	3.69 (72) 0.10	

Who said it? (Question 1). The 2 x 2 ANOVA for the "Who said it?" question indicated no mean differences for the Speaker condition, $F(1,140) = 0.07$, $p > .05$. The participants could not distinguish the dialog moves that were generated by AutoTutor (Mean = 3.77) from those that were generated by skilled human tutors (Mean = 3.73). However, the means for the Authenticity condition did significantly differ, $F(1,140) = 5.63$, $p < .05$. Participants considered the Random dialog moves (Mean = 3.90) to be significantly more "computer-like" than the Authentic dialog moves (Mean = 3.60). The interaction between Speaker and Authenticity was not statistically significant, $F(1,140) = 0.00$, $p > .05$.

Conversationally Appropriate? (Question 2). The 2 x 2 ANOVA for the "Conversational Appropriate?" question indicated no mean differences for the Speaker condition, $F(1,140) = 0.02$, $p > .05$. The participants considered the dialog moves generated by AutoTutor (Mean = 3.85) to be as conversationally appropriate as those generated by the human tutors (Mean = 3.83). The means for the Authenticity condition, however, did significantly differ, $F(1,140) = 49.65$, $p < .05$. As predicted, the Authentic dialog moves (Mean = 4.33) were rated as more conversationally appropriate than the Random dialog moves (Mean = 3.35). The interaction between the two conditions was not statistically significant, $F(1,140) = 1.83$, $p > .05$.

Effective Teaching? (Question 3). The 2 x 2 ANOVA for the "Effective Teaching?" question indicated no mean differences for the Speaker condition, $F(1,140) = 0.18$, $p > .05$. The Effective Teaching ratings for the dialogs moves generated by AutoTutor (Mean = 3.63) were equal to those generated by the human tutors (Mean = 3.69). Once again, the means for the Authenticity condition did significantly differ, $F(1,140) = 31.56$, $p < .05$. The Authentic dialog moves (Mean = 4.04) received higher effective teaching ratings than the Random moves (Mean = 3.28). The interaction term for the two conditions was not statistically significant, $F(1,140) = 0.04$, $p > .05$.

Discussion

We can conclude from this study that AutoTutor is achieving many of the design goals of AutoTutor's developers by simulating the dialog moves of effective human tutors and delivering them in conversationally appropriate ways. The findings from this study bolster previously reported BBT results with the addition of the Authenticity conditions. Given that the participants rated random dialog moves less favorably than authentic ones, but could not discriminate the speaker (human or computer), we can be more confident that AutoTutor's dialog move selections are on par with those of human tutors.

The fact that the Conversationally Appropriate means did not differ for speakers and were higher for authentic dialog moves is a promising indicator that AutoTutor is a competent conversational partner. Additional evidence of AutoTutor's communicative competence lies in the fact the conversational ratings for the AutoTutor authentic moves were closer to the more favorable extreme of the six-point scale. Of course, it may be the case that the human tutors adopted the conversational style of AutoTutor rather than generating the dialog moves they would have produced in an actual human-to-human tutoring session. However, even if this was the case, the participants considered the dialog moves of both speakers to be conversationally appropriate. Hence, even if AutoTutor does not emulate the style of human tutors in human-to-human sessions, AutoTutor does deliver dialog moves that are perceived as acceptable and believable.

References

Chi, M.T.H. (1996). Constructing self explanations and scaffolded explanations in tutoring. *Applied Cognitive Psychology, 10*, S33-S49.

Chi, M.T.H., Bassok, M., Lewis, M. W., Reimann, P., & Glaser, R. (1989) Self-explanations: How students study and use examples in learning to solve problems. *Cognitive Science, 13*, 145-182.

Graesser, A.C., Hu, X., Susarla, S., Harter, D., Person, N.K., Louwerse, M., Olde, B., & the Tutoring Research Group (2001). AutoTutor: An intelligent tutor and conversational tutoring scaffold. *Proceedings for the 10th International Conference of Artificial Intelligence in Education* (pp. 47-49). San Antonio, TX.

Graesser, A.C., Person, N.K., & Magliano, J.P. (1995). Collaborative dialogue patterns in naturalistic one-to-one tutoring sessions. *Applied Cognitive Psychology, 9*, 1-28.

Graesser, A.C., Person, N.K., Harter, D., & the Tutoring Research Group (2000). Tactics in tutoring in AutoTutor. In the *ITS 2000 Proceedings of the Workshop on Modeling Human Teaching Tactics and Strategies* (pp. 49-57), Montreal, Canada.

Graesser, A.C., Wiemer-Hastings, K., Wiemer-Hastings, P., Kreuz, R., & TRG (1999). AutoTutor: A simulation of a human tutor. *Journal of Cognitive Systems Research,* 1, 35-51.

Graesser, A.C., Wiemer-Hastings, P., Wiemer-Hastings, K., Harter, D., Person, N., & the Tutoring Research Group (2000). Using latent semantic analysis to evaluate the contributions of students in AutoTutor. *Interactive Learning Environments, 8*, 129-148.

Person, N.K., & Graesser, A.C. (1999). Evolution of discourse in cross-age tutoring. In A. M.O'Donnell and A. King (Eds.), *Cognitive perspectives on peer learning* (pp. 69-86), Mahwah, NJ: Erlbaum.

Person, N. K., Graesser, A. C., & the Tutoring Research (2002). Group Human or computer: AutoTutor in a bystander Turing test. In the *Proceedings of ITS 2002*, Berlin: Springer-Verlag.

Person, N.K., Graesser, A.C., & the Tutoring Research Group (2000). Designing AutoTutor to be an effective conversational partner. In the *Proceedings for the 4th International Conference of the Learning Sciences* (pp. 246-253), Ann Arbor, MI.

Person, N.K., Graesser, A.C., Bautista, L., Mathews, E.C., & the Tutoring Research Group (2001). Evaluating Student Learning Gains in Two Versions of AutoTutor. In J.D. Moore, C.L. Redfield, & W.L. Johnson (Eds.) *Artificial intelligence in education: AI-ED in the wired and wireless future* (pp. 286-293), Amsterdam, IOS Press.

Person, N.K., Graesser, A.C., Harter, D., Mathews, E.C., & the Tutoring Research Group (2000). Dialog move generation and conversation management in AutoTutor. *Proceedings of the AAAI Fall Symposium: Building Dialogue Systems for Tutorial Applications* (pp. 45-51), Falmouth, MA: AAAI Press.

Person, N.K., Graesser, A.C., Kreuz, R.J., Pomeroy, V., & the Tutoring Research Group (2001). Simulating human tutor dialog moves in AutoTutor. *International Journal of Artificial Intelligence in Education, 12*, 23-29.

Person, N.K., Klettke, B., Link, K., Kreuz, R.J., & the Tutoring Research Group (1999). The integration of affective responses into AutoTutor. *Proceedings of the International Workshop on Affect in Interactions* (pp. 167-178), Siena, Italy.

Turing, A.M. (1950). Computing Machinery and Intelligence. In E.A. Feigenbaum & J. Feldman (Eds.) *Computers and thought*. New York: McGraw-Hill.

Wiemer-Hastings, P., Graesser, A.C., Harter, D., and the Tutoring Research Group (1998). The foundations and architecture of AutoTutor. *Proceedings of the 4th International Conference on Intelligent Tutoring Systems* (pp.334-343), Berlin, Germany: Springer-Verlag.

Wiemer-Hastings, P., Wiemer-Hastings, K., and Graesser, A. (1999). Improving an intelligent tutor's comprehension of students with Latent Semantic Analysis. *Artificial Intelligence in Education* Amsterdam (pp. 535-542), IOS Press.

Acknowledgements

This research was supported by grants from the Office of Naval Research (N00014-00-1-0600) and the National Science Foundation (SBR 9720314 and SBR 0106965). Any opinions, findings, conclusions, or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of ONR or NSF.

BEST COPY AVAILABLE

A Portrait of an E-Learning Teacher as an Art Educator

When I began my journey twenty years ago, my role as an art educator never seemed in question. But with advent of computer technology and the Internet this role needed to be re-addressed.

Today, proponents of education and technology advocate the importance of computer-generated courses in all levels of education. Computers and the Internet have become powerful tools that can enhance teaching and learning in innumerable ways. However, pundits often criticize Web-based Education for ignoring crucial considerations in the development of on-line education, i.e., issues of computer usages, pedagogy/instruction, and curriculum/content. Web-enhanced and online courses have become increasingly popular, but keeping the content interesting and interactivity can be difficult.

The value of the computer and the Internet, like that of any tools, depends upon what purposes they serve and how well they are used. Computer technology and on-line education can be used in positive ways, such as to help make learning more engaging, better address the needs of individual students, provides access to a wealth of information, and encourage students to explore and create—or in negative ways, such as to play mindless games, gain access to inappropriate materials, or isolate students with mundane course material. Many on-line courses in schools, even with up-to-date multimedia computers with high speed Internet access, are not being used in ways that significantly enhance teaching and learning. The reality according to educator Glenn M. Kleiman (2000) is that all this expensive technology will yield little educational return until schools and districts address the need for more professional development i.e., teacher training and in-services, technical support, classroom management, and curriculum integration. [1]

Innovative approaches to addressing these concerns by providing interactivity for online students are key elements in decreasing course attrition rates. The role of the on-line teacher in the success of his/her course, and student attention/retention and achievement is clearly based on combining available technology and resources to add interest and interactivity to online courses. Only by developing innovative curricula can these courses succeed.

One strategy might be by building a course by interconnecting Curriculum Web Design and Instructional Development within the context of delivering a "good story." As educators we need to approach on-line education as modern day storytellers or troubadours, using the computer as our flute, drawing our student

---

[1] Kleiman, Glenn. *Myths and Realities about Technology in K-12 Schools.* 'The Digital Classroom: How Technology is Changing the Way We Teach and Learn,' Leadership And The New Technologies. Issue 14 Harvard Education Letter. April-June 2000.

audience to the screen and keeping them engaged with a well-told and developed story. Storytelling had its origin in play activities, with gifted but ordinary folk entertaining their particular social group informally. Gradually these activities were included in religious rituals, historical recitations and educational functions. Ellin Greene defined storytelling as:

"...an art...taking the printed words in a book and giving them life. (World Book Encyclopaedia, 1976)"

In web-based learning, this role is even more critical, as an on-line instructor one has to overcome potential barriers caused by technology, time, and place in the hopes of creating an optimal environment for achieving educational goals.

Over the past two years, as an asynchronous online learning instructor and an artist, I have created and developed on-line learning at the high school and elementary levels of education for the Toronto Catholic District School Board. The following reflections come from educational research, as well as personal experience as an online learning student, instructor, and instructional designer.

The purpose of this paper is to examine the process, implications, and ethos of becoming an e-learning teacher with an art background. What is the role of a teacher in developing and teaching this new pedagogy? Does it matter what background you bring to e-teaching? Is the role of the on-line teacher; a critic, a guide, an initiator, a transmitter, a facilitator, or is the role of an on-line teacher like a scientist? What makes great web-based learning? Finally, this paper presents the researcher's broad definition of e-learning, and reflects on his present stage as an e-learning teacher.

Reliable Assessment With CyberTutor, A Web-Based Homework Tutor

David E. Pritchard and Elsa-Sofia Morote
Research Laboratory of Electronics
Massachusetts Institute of Technology
United States
dpritch@mit.edu , smorote@mit.edu

Abstract: Socratic electronic homework tutor, CyberTutor can integrate effectively instruction and assessment. CyberTutor assessment has about 62 times less variance due to random test error than a three-hour final examination, and 53 times less variance than twelve weekly tests. This improvement results from the combination of three factors. First, the typical student interacts with CyberTutor 16 times longer than the 3-hour final exam and 10 times more than 12 weekly tests together, diminishing the effect of lucky guesses and careless errors. Secondly, by considering requests for hints, solutions, and importantly the number of wrong answers and the time the student takes to complete each part of the problem, CyberTutor can make a better determination of the student's skill on a problem. Lastly if a problem is too difficult for the student as presented, CyberTutor's hints and responses to wrong answers systematically adapt the difficulty of the problem to the student's skill level.

Introduction

It is the end of semester and you have two students waiting to talk with you about their score in the final exam. You know what they want. Are you sure they deserve to fail? Are you wondering if that student who miraculously passed, deserved to pass? You are a fair teacher, and put all your effort into constructing a fair final exam but have you ever tested how reliable your final exam was? Do you really believe that a 3-hour final exam will accurately reflect the precise "skill" level of every student?

This paper demonstrates that an electronic tutoring program can collects data that enables a far more reliable assessment of students' skills than a standard examination. The following scenario illustrates the basic idea: Imagine that a rich ship-owner has hired Socrates to tutor his children. At the end of the month he desires to assess the amount they have learned. Would you advise him to:

a) Administer a standardized hour-long test to the children? or
b) Ask Socrates how much they have learned?

The answer is straightforward. Clearly Socrates' many hours of individual interaction enables him to form a far more accurate and nuanced assessment of each student than could be provided by a one-hour test. Moreover, this integrated assessment is continuously updated and is used by Socrates to adjust the pace and content of the session. Importantly, this continuous integrated assessment is available without the stress and time loss of traditional testing.

Tutoring with Assessment

The recent advances on the Internet and World Wide Web have brought attention to the world of Web-based education. There is an increasing demand for use of computerized educational aids by students and faculty (Cao & Bengu, 2000). Teachers are not only using electronic homework systems but recently there has been growing interest in using tutoring agents in education systems (Boy, 1995). The educational impact of real-time processing and reporting results of diagnostic electronic homework of results is recognized by Just in Time Teaching (Novak et al., 1999). It enables classroom instruction to be efficiently tuned to students' needs. The essential element is feedback between the web-based tutoring and classroom activities. The positive effects on learning of these web-based electronic homework tutors have been confirmed by several studies such as Mestre et

BEST COPY AVAILABLE

al. (2000); Ogilvie (2000); Thoennessen & Harrison (1996) and Pritchard & Morote (2002a). Some of these electronic systems also eliminate the task of grading; enabling teachers to shift efforts to instruction, but only few offer an integrated system of tutoring and assessment.

Researches at Massachusetts Institute of Technology have built "CyberTutor" a Socratic electronic homework tutor. CyberTutor has a fine-grained assessment algorithm which permits the identification of skill deficiencies in foundational skills as each student moved through the course. This would allow tutors (or perhaps additional CyberTutor problems) to remedy the deficiency before it causes irreparable harm to the student. Additionally, knowing the class' skill profile on each detailed topic could allow the teacher's next lecture to review topics that were not being well learned.

The CyberTutor analog of Socrates' assessment is a skill profile – that student's skill rating on each of a set of predetermined topics. A topic could be an item in the regular syllabus like momentum, but it could also be a foundational skill like vector components, a general skill like using dimensions and units, or a conceptual topic like Newton's concept of force.

Because it is continuously updated, skill profiling has the following potentially revolutionary benefits for the student and the teacher

1) It is vastly fairer to use as the basis of a grade because of its dramatically smaller random error
2) Students who have gaps in their foundational skills can be identified and helped early in the course
3) The skill level of the class on the current topics can guide the teacher's allotment of class time – a new form of Just in Time Teaching.
4) The assessment is sufficiently detailed to be used to predict the student's grade on a standard test, for example a midterm or the AP physics test.
5) Teachers can therefore dispense with some examinations and increase class time

Skill profiling can have a revolutionary impact if it is used as a grade (e.g. your grade on the momentum homework is your skill at momentum on Thursday night at 10PM). This could replace the students' current strategy of "avoid lost points" with the much improved one "learn the most."

Methodology

Using data of Introductory Newtonian Mechanics, course 8.01 teaching at spring 2001 at MIT we evaluated reliabilities of the final exam, weekly tests, and CyberTutor. Over 90% of the students taking 8.01 in the spring term have previously attempted this course without being able to learn the problem solving skills demanded by the 8.01 final examination. Besides course elements such as class participation, written homework, group problem solving, and a Socratic electronic homework tutor, the students were given 12 weekly tests during the semester and a final exam.

We note in passing that this particular final exam had three features that should give it less error than typical physics finals. A standard test (Mechanics Baseline test) was used for 1/3 of the Final. The remainder was divided into basic skill problems and complex problems which accentuate the performance of different students. The total test requested 47 specific responses from the students. In comparison, the 8.01 final in the preceding semester required only 28, and therefore probably had larger relative statistical fluctuations.

Testing Reliability

By definition, someone taking a test or other assessment measure achieves the "observed score." The observed score is thought to be composed of two different components: The true score, an exact measure of the amount of the trait or skill assessed, offset by a random error score (Observed score = True score + Error score). The error may result from individual student responses to particular questions (Manson & Bramle, 1997) or external conditions such as fatigue and noise.

The variance of the observed score is composed of the variance of true scores and the variance of error. Then, $\sigma^2_o = \sigma^2_t + \sigma^2_e$, where, σ^2_o = variance in observed scores, σ^2_t = variance in true scores, and σ^2_e= variance of error

The "reliability" of a test or assessment measures its repeatability or freedom from random testing errors. An assessment is considered reliable if it would give us the same result over and over again. By definition, the reliability is the ratio of variance of the true skill divided by the total variance of the measurement (observed variance), σ^2_t / σ^2_o. The reliability provides a direct guide to the reproducibility of the grade between two similarly prepared tests (odd or even numbered questions) on equivalent material. If reliability = 1, there is no error in the test.

A standard method of determining the reliability of an assessment is to divide the test questions into two subtests, for example the odd and even questions if they were equal in coverage of topics and difficulty. If the resulting subtests determine skill with perfect reliability, each student would receive the same score on both subtests, and a scatter plot of each student's scores on the "odd (a)" and "even (b)" subtests would lie on the diagonal. We compute the reliability of the various assessments considered here from the *uneven split reliability formula* (see Pritchard & Morote, 2002a for derivation). This method does not assume that the halves have equal standard deviations, an assumption of the Spearman-Brown formula[1].

$$\text{Reliability} = 1 - (1+\beta)^2 / 4\beta * \sigma^2_{(a-b)} / \sigma^2_{(a+b)} + (1-\beta)^2 / 4\beta \qquad (1)$$

where $\beta = \mu_a / \mu_b$, the ratios of the means of the two subsets. In this formula, the major factor that reduces the reliability below 1.0 is the mean variation of the difference between the scores on the even and odd collections of problems, $\sigma^2_{(a-b)}$.

Testing Validity

Validity relates to the meaning of the scores and the ways we use scores to make decisions (American Psychological Association, 1985). Validity addresses the issue of how well do these scores reflect the physics achievement. One way to empirically evaluate validity of the CyberTutor data is to study its "predictive validity", its ability to predict some subsequent performance. The correlation coefficient between prediction and subsequent performance now becomes the validity coefficient.

The Value of Electronic Homework Tutor as an Assessment Instrument

Reliability of CyberTutor

The reliability method was applied first to the MIT 8.01 final exam for 2001. Figure 1 (left panel) shows some lack of consistency between the performances on the two subtests in the Final exam. This reflects the error on the two subtests: they covered the same material, but random errors are considerable. Of course, adding the two halves together reduces the relative size of the error and results in reliability of 0.85 as computed from (1). In the same way, we computed the reliability of the 12 weekly tests resulting in a reliability of 0.87. The reliability of these tests, 0.85 and 0.87, is a moderate reliability in a test. Generally reliability above 0.90, typical of ETS[2] tests, is considered good for a test in education and behavioral sciences (Manson & Bramle, 1997). For example, in the case of the final exam, its reliability means that 85 percent of the variance in the observed scores is due to true score variance. The error causes 15 percent of the observed variance. This 15 percent error will offer, lead to a misdetermination of who should pass and fail as we discuss later.

If someone is highly skillful, he generally makes fewer errors and takes less time to successfully complete a task than a less skilful person. Moreover, any individual has the option to work more quickly at the expense of making more errors or vice versa. For the electronic tutor, we developed an assessment algorithm that depends on the number of right responses and hints, subparts, and number of solutions requested. We also included additional variables (time and wrong answers) as well as all other variables available from the log of each student's interactions with CyberTutor including among others, number of problems worked, etc. We call this assessment algorithm the "Enhanced CyberTutor Assessment"

The CyberTutor algorithm is computed from the even problems and the odd problems for each student (Figure 1, right panel). The curvature indicates a small excess of easier problems in the even group. The reliability from (1) of the combined assessment is 0.9976. This is a fantastic improvement over the final examination and weekly tests. That means that 99.8 percent of the observed variance in scores is due to true score variance. Overall, it has 62 times less error than final exam and 58 times less error than the all weekly tests together. It provides nearly error-free assessment.

---

[1] Spearman-Brown Reliability = 2 * [correlation (Odd, Even)] / [1 + correlation(Odd, Even)]

[2] Educational Testing Service, e.g. tests: GMAT, GRE, TOELF and PRAXIS.

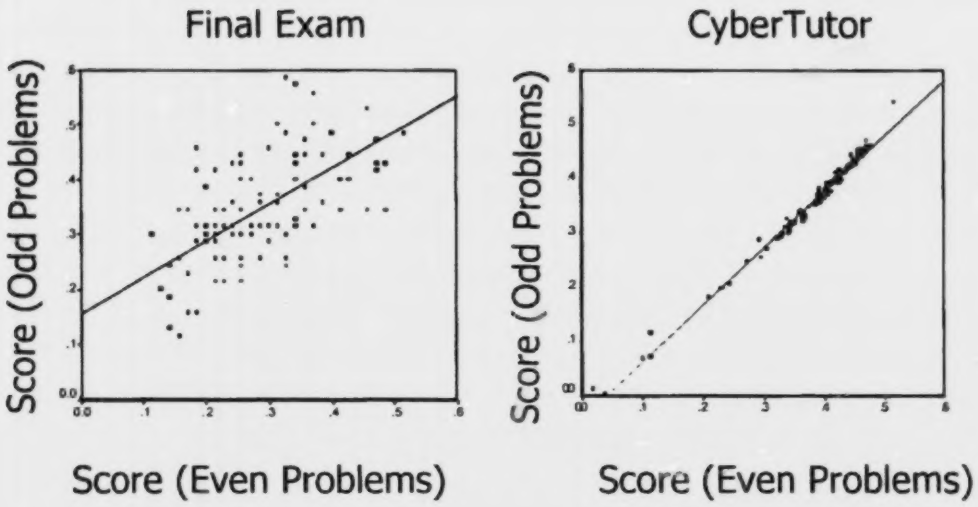


Figure 1: Grades of each individual student on the two subtests (odd -y axis - and even – x axis), comprising the CyberTutor and MIT 8.01 Final Exam in 2001.

Table 1 shows the differences among Final Exam, Weekly Tests and CyberTutor. The Enhanced CyberTutor algorithm shows higher reliability than the other tests. In addition, by eliminating marginally discriminating problems[3], we were able to increase the reliability to 99.92 percent. We called this "CyberTutor -" (the negative sign indicates that we took out all negative discriminating problems). "CyberTutor -" has 183 times less variance than the final exam. Table 1 also shows the difference of the variance per unit of assessment time The "CyberTutor -" assessment has over an order of magnitude less error variance per time than the final in this regard.

Table 1: Summary

	Reliabilities	s^2_e / s^2_t per unit time	s^2_e / s^2_t	s_e / s_t
Final exam	0.85	0.011	0.17	0.42
Weekly tests	0.873	0.014	0.144	0.380
E. CyberTutor	0.9976	0.0024	0.0024	0.049
CyberTutor -	0.9992	0.0008	0.0008	0.028

The final exam, which was carefully developed, contains so much error that 1/4 of the students assigned failing grades should has pass, and an equal number of students who should have failed are assigned a passing grade. Thus, for every two students who took the final exam one was misdiagnosed. A similar case occurs using weekly tests.

To see how this arises, look at Figure 2, where failure is set at one standard deviation below average, which fails 16 percent of the students, the typical failure rate for 8.01 course. The dashed line shows the true skill distribution inferred from the measured error and the observed skill distribution (heavy line), which is slightly broader. The number of students failed versus their true skill level, is indicated by the small curve centered on skill = 40. (The width of this curve is very nearly the width of the error.)

---

[3] By performing item analysis using item discrimination. It measures how well an item distinguishes between the students who understand the content universe if the test well and those who do not.

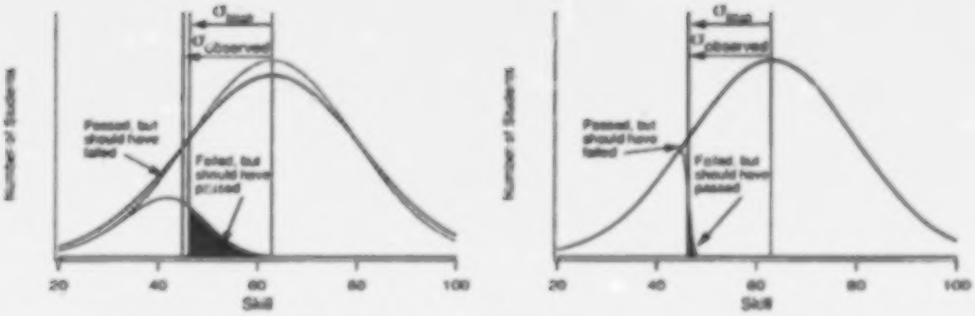


Figure 2: Fairness in the Final Exam versus CyberTutor

Below skill = 35 the failed students and the true skill distribution were coincident, indicating that all students whose skill is this low fail. Failed student curve drops well below the true skill distribution between 35 and 46 (the selected true skill for passing) indicating that some students (lighter shaded area) whose ability is below passing will pass. The distribution of failed students does not drop immediately to zero above true skill = 46, these (darker shaded area) whose true ability is passing, will fail the test.

If the much more accurate Enhanced CyberTutor Assessment were used to set pass-fail instead of the final exam, only 1 percent of the students failed would be misdiagnosed (Figure 2, right panel). In a class of 100, only one student would be misdiagnosed, and his true skill would almost certainly lies only 1 or 2 points away from the pass-fail line.

Validity of CyberTutor

The skill profile can be used to predict each student's grade on a standard test. As a first step in this direction, we developed an algorithm to predict students' grades on the "adjusted" MIT final exam. The adjustment reflected the findings from item analysis that both exam questions concerning angular dynamics were poor measures of overall skill. It is well known that many students "hit the wall" of misunderstanding here, and while we believe that an examination of CyberTutor data concerning angular dynamics would improve our predictive ability on these problems, it was cleaner to eliminate them for this study of validity.

The final prediction (Figure 3) yields a value for r, the predictive validity coefficient, of 0.71, which is highly statistically significant[4]. In fact this correlation coefficient would be higher were in not for the 15% unreliability of the final exam. This suggests that the "real" validity coefficient is around 0.77. This level suggests that a variant of the "Enhanced CyberTutor algorithm" would enable us to predict the students' skills with less error than a one-hour test such as a midterm could determine it.

We are optimistic that a prediction based on a detailed skill profile instead of the overall performance could do considerably better at predicting the final exam scores and conclude that CyberTutor as a measurement instrument is not only extremely reliable but also has significant validity. Indeed there is every reason to believe that it would give a better indication of students in trouble at midterm time than the midterm itself.

In this section, we have begged the question of the validity of adopting the final exam as a criterion of validity (e.g. only about 1/4 of the final exam involved conceptual questions). In the future we hope to use the performance in the subsequent required physics course as another measure of validity.

---

[4] The minimum value of r required to be statistically significant at the 0.05 levels a sample size between 100 and 1000 is 0.197 (Hopkins and Glass, 1978 p. 409).

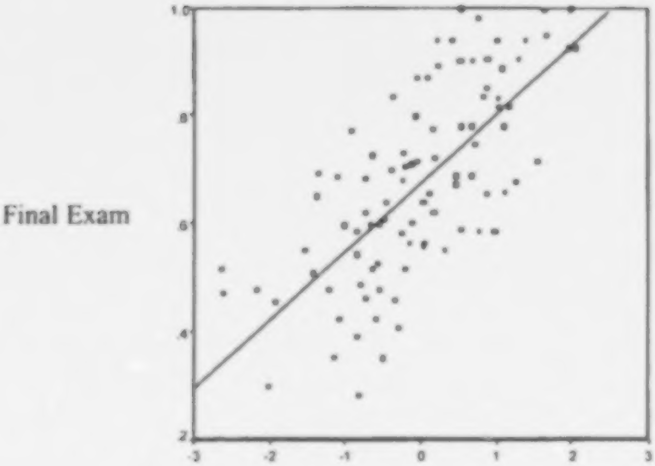


Figure 3: Prediction of scores on Adjusted Final Exam from CyberTutor data, r = 0.71. The horizontal axis is deviation from CyberTutor prediction in standard deviations

Discussion

We have shown that a web-based electronic homework tutor collects data that enables an assessment and tutoring and gives us a better way to deal fairly with students' capabilities. CyberTutor provides objective measurements on which educational decisions can be based. It can provide means for improving and enhancing feedback, motivation, and over learning.

The dramatic reduction in the variance of the error results from combination of three factors. First, the typical student interacts with CyberTutor for at least 48 hours per term, 16 times longer than the 3-hour final exam and 10 times more than 12 weekly tests together. This reduces the error variance due to the general statistical rule that the variance of error approximate 1/T, where T is the total time of the measurement.

Secondly, by considering requests for hints, solutions, and importantly the number of wrong answers and the time the student takes to complete each part of the problem, CyberTutor can make a more reproducible determination of the student's skill on a problem. Lastly if a problem is too difficult for the student as presented, CyberTutor's hints and spontaneous responses to wrong answers systematically adapt the difficulty of the problem to the student's skill level, and the CyberTutor assessment algorithm accurately determines that level. In contrast, too difficult written problems provide only an upper bound on the student's skills.

Tutor-based assessment has such low error that it is capable of providing accurate assessments on a number of pre-selected topics providing the detailed skill profile. If we took 20 topics – say the major topic of the 13 weeks of the course plus 7 foundational topics; the assessment on each topic would be twice times as reliable as the overall assessment of the current final. Even if we increased the skill resolution to include each of the major weekly topics (i.e. perhaps 180 topics) the variance on each would be small enough to identify those students requiring immediate assistance on a particular topic. By basing the assessment on a more careful analysis of wrong answers (many wrong answer reflect omission of a particular step or reflect use of a particular wrong assumption rather than just a careless error) we project that we can improve the CyberTutor assessment sufficiently to measure skill across this fine grid with the accuracy that the current final determines the overall skill of the students.

References

Boy, G. (1995). *Software agents for cooperative learning*, in J.M. Bradshaw (Ed.) AAAI Press/The MIT Press.

Cao, L., & Golden, B. (2000). *Web-based agents for reengineering engineering education*. J. Educational Computing Research, 23, 4, 421-430.

Ebel, R., & Frisbie, D. (1991). *Essentials of educational measurement*. New Jersey: Prentice Hall.

Manson, E., & Bramle, W. (1997). *Research in education*. Sydney: Brow & Benchmark Publishers.

Mestre, J., Dufrense, R., Hart, D., & Rath, K. (2000). The effect of web-based homework on test performance in large enrollment introductory physics courses. *Journal of Computers in Mathematics and Science Teaching*

Novak, G., Patterson, E., & Gavrin, A. (1999) *Just-in-Time Teaching : Blending active learning with web technology*. Prentice Hall Series in Educational Innovation.

Ogilvie, C. (2000). Effectiveness of different course components in driving gains in conceptual understanding. Cambridge, Internal report, Department of Physics at MIT. [on-line] URL: http://torrseal.mit.edu/effedtech/

Pritchard, D. & Morote, E. (2002a) *99.8% Reliable Assessment with CyberTutor. Physics Department, Report to Massachusetts Institute of Technology*. [on-line] URL: http://torrseal.mit.edu/effedtech/

Pritchard, D., & Morote, E. (2002b). *What course elements correlate with improvement on tests in introductory Newtonian mechanics?* NARST Annual Meeting New Orleans, Louisiana, April 7-10.

Thoennessen, M., & Harrison, M. (1996). Computer-assisted assignments in a large physics class. *Computers Educ.*, 27, 2 , 141-147.

Acknowledges

This work was supported by NSF grant PHY-9988732. We are grateful to Dr. David Kokorowski for his help on the Figures.

Communities, Communication and Cognitive Change: Social Processes and Designing Engaging e -learning Discourse

ANDREW RAVENSCROFT
Learning Technology Research Institute (LTRI)
London Metropolitan University
166-220 Holloway Road
London, UK, N7 8DB.
Tel: +44 (0)20 7314 4301
Fax: +44())20 7314 4302
Email: a.ravenscroft@unl.ac.uk

Abstract: A number of projects over the past decade, in a range of educational contexts, have sought to link forms and patterns of communicative interaction to improvements in knowledge, conceptual understanding and reasoning skills. These initiatives have produced dialogue models, methodologies for developing these in ways that lead to the design of dialogical elearning systems and empirical evaluations that have implicated the role of context in effective educational interaction. We don't, for example, "argue and discuss with anyone, about anything, at any time". Hence, the nature and characteristics of online communities have emerged as critical factors in designing educational discourse that exploits developed models and implemented systems. This paper will review a selection of work on dialogical approaches to learning, dialogue design, system design and learning communities before discussing the possibility of an integrated model for e-learning discourse, which accepts that learning is, ostensibly, a social process.

Keywords: Human-Computer Interaction, Instructional Design for eLearning, Learning Communities.

1 Vygotsky: linking dialogue processes to cognitive change

Vygotsky's (1978) theory of the development of higher mental processes can provide a foundation and inspiration for approaches to elearning that emphasise the necessity for collaborative, argumentative and reflective discourses. Although he conceived learning as an instructional process aimed at 'transforming the mind of the child into that of an adult', nowadays it is accepted that his ideas can equally apply to any relevant situation involving a learner and a more learned other[1]. This more learned other may be a teacher or a more capable student—which is often the case in higher education settings. Similarly, his theory is not bound to the 'traditional' concept of a school, but can be applied more generally, to online and other learning communities.

Vygotsky draws a clear distinction between lower level mental processes, such as elementary perception and attention, and higher level mental processes that include verbal thought, logical memory, selective attention and reasoning. He argues for a qualitative distinction between these two levels of mental performance, because unlike lower level activity, the higher level is: mediated through cultural symbols and tools; self-regulated rather than bound to a stimulus context; social in origin; and, the result of conscious awareness rather than an automatic response.

Critical in distinguishing higher and lower level activity is the qualitative developmental transition that occurs when language, or any other signification system, is internalised to operate as a mediating factor between environmental stimuli and an individual's response. This mediation *transforms* the lower level activity by *lifting it onto a higher plane* and can be achieved through the application of material or psychological tools. Further, in using such tools we become conscious and in control of our mental activities. However, Vygotsky considered language to be the most interesting and powerful of these semiotic mediators and the primary tool for thinking. He claims that these higher mental functions originate in the social, and development proceeds 'from action to thought' and therefore communication and social contact are essential. It is through the communicative process that external signification systems conveying interpersonal communication become internalised to operate as intrapersonal psychological tools that *transform* mental functioning. In other words, internal language and thought are transformed from the 'outside'. This idea is critical to Vygotsky's notions about conceptual development and the evolution of linguistic meaning as we develop our higher level mental processes.

---

[1] For brevity, henceforth, we will use the word 'tutor' in this paper to refer to the person that is considered 'the more learned other', who may be a teacher or a more capable student.

The primary theoretical construct introduced by Vygotsky for 'engineering' this conceptual change is the zone of proximal development (ZPD). According to Vygotsky (1978), the ZPD represents the place where the student's empirically rich but disorganised spontaneous, or contextual, concepts meet with the *systemacity* and logic of the tutor's reasoning. It is:

"...the distance between a child's actual developmental level as determined by independent problem solving and the higher level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers." (Vygotsky, 1978, p. 86)

Through tasks, exercises, discussions and dialogue within the ZPD, the weaknesses of the student's spontaneous concepts and reasoning are made explicit and compensated for by the strengths of the tutor's scientific conceptions and reasoning. Thus, in performing the task, the student 'appropriates' the more mature, scientific conceptualisations and becomes socialised into the expert practitioner's knowledge and approach to particular problems, subsequently operating as a more expert practitioner themselves.

The notion of the ZPD is also a positive and powerful paradigm for evaluating and improving the teaching-learning process in cooperative contexts. Failure to complete a task successfully can be evaluated in terms of what 'extra' should be introduced to improve the ZPD, instead of simply assessing a 'failure' in performance.

2 Activity theory: relations between the learner and their context

Activity theory is a development of Vygotsky's (1978) work that provides a framework for learning and development that accepts that meaning arises and evolves during interactions that are influenced by the social relations within a community of practice. Or, 'you are what you do' (Nardi, 1996, p.7) in a natural context that is influenced by history and culture. Hence, human practices are conceived as developmental processes 'with both individual and social levels interlinked at the same time.' (Knutti, 1996, p. 25).

An activity is considered the minimal meaningful context for individual actions, which means they are not rigid and static, but continuously changing and developing. These activities contain various artifacts, such as signs, methods, machines and computers, that serve as mediational tools to facilitate the operationalisation of conceptions in ways that lead to 'higher levels of thinking'. In achieving this, the mediational processes involving subjects and tools are directed towards objects, or objectives, and in transforming the objective into an outcome there is motivation for performing the activity. The addition of another 'level' that links the subject and the community and the objectives and the community is also included to complete the basic structure of an activity (Engestrom, 1987). Here, the relationship between subject and objective is mediated by tools, the relationship between subject and community is mediated by rules, and the relationship between objective and community is mediated by the division of labour. Therefore, this framework is essentially holistic. It emphasises relationships between interactions, processes and outcomes and the relevance of social conditions, such as a shared enterprise and the need for mutual engagement of conceptualisations. Therefore, the relevance of conceptual similarities and differences and changes and developments over time are taken into account in the design of mediated learning activities.

3 Discourse analysis and dialogue designs

Given that theories of learning have implicated dialogue as being central to shaping conceptual development, there is a need to further examine the features that make educational dialogue effective in ways that inform the development and use of systems that support e-learning. Work investigating natural educational dialogues that aim to change student conceptualisations in a variety of situations, have produced some consensus as to the roles, strategies and speech acts (sets of moves) which are likely to be important. For example, using the DISCOUNT Discourse Analysis scheme (Pilkington, 1999), which includes Exchange Structure, Move

(Speech-Act) and Rhetorical analyses, it is possible to determine which participants are active in dialogue and how. DISCOUNT has been used to give insights into collaboration in natural and CMC dialogue contexts (de Vincente, Bouwer & Pain, 1999; Pilkington, Treasure-Jones & Kneser, 1999). From these and similar studies there is evidence that 'successful' exchanges are more likely to include clarifying, challenging, hinting and justification moves.

A more direct approach to linking discourse analysis to system design has been proposed by Ravenscroft & Pilkington (2000), who developed the methodology of *investigation by design* (hereafter IBD). This combines discourse analysis and dialogue game techniques (e.g. MacKenzie, 1979; Walton, 1984; Ravenscroft, 2000) to specify formal dialogue models that can me implemented as intelligent and collaborative e-learning systems. A central tenet of this approach is to take some of the features of successful dialogue—as yet not fully proven to be effective—and actively design them into interaction scenarios aimed at supporting learning. Once these models have been developed, we can evaluate their effectiveness, and systematically vary the roles, strategies, tactics and moves adopted to further explore the utility of these features in guiding learners towards more systematic reasoning. Within this IBD scheme, we use the DISCOUNT (Pilkington, 1999) scheme to develop dialogue models specified as dialogue games. A major advantage of the dialogue game approach is that it allows us to incorporate rules and constraints into the design of communicative interactions that are consequently structured and managed along the lines we prescribe. Therefore, these systems can act as powerful cognitive and mediational tools that guide the dialogue and lines of reasoning in ways that lead to improvements in individual or shared knowledge and understanding.

Research investigating and examining the suitability of this approach, that has been ongoing for the past ten years (see Ravenscroft, 2001; for a review), has shown that dialogue game theory can be used as a software design paradigm for types of computer-mediated and computer-based argumentation dialogue in educational contexts. Here, the notion of a game is used to characterise and specify discourse in terms of the goals of the interlocutors (e.g. the elaboration of knowledge, the co-elaboration of knowledge, supporting or winning an argument), the relative roles of participants (e.g. inquirer, critiquer, explainer) and the types of dialogue tactics and moves that are performed (e.g. Assertion, Challenge, Withdraw). Also, rules govern the types of moves available to participants, the effect these have on commitment—to beliefs—and issues of initiative and turn-taking. Note that, in focusing on pragmatic level knowledge, these projects have not needed to directly address issues of semantic and syntactic level natural language processing and generation that have been examined by Pilkington (1992) and Pilkington & Grierson (1996). Other research has demonstrated how dialogue game theory can represent a range of dialectical discourse genres (Maudet & Evrard, 1998; Moore & Hobbs, 1996), include multimedia features (Moore, 2000) and be adapted to take account of multi-user polylogues (Maudet & Moore, 2000).

4 System designs: cognitive tools and intelligent dialogue

Projects adopting the approach above have produced a number of successful designs. They have shown that a model of collaborative argumentation—a *facilitating* dialogue game—supports and stimulates conceptual change and development in science (Ravenscroft, 2000; Ravenscroft & Matheson, 2002). And a model of fair and reasonable debate—a DC dialogue game—can be used to teach generic reasoning skills for debating controversial subjects (Pilkington, *et al*, 1992; Moore, 1993). The former dialogue game has been implemented in the 'intelligent' computer-based dialogue system called CoLLeGE and the latter model has been implemented in the DIALAB computer-mediated argumentation system, that structures fair and reasonable debate. Another project called CLARISSA has used dialogue games to implement a computer modelling 'laboratory' for investigating collaboration (Burton, Brna & Pilkington, 2000).

However, in evaluating and testing some of these dialogue games (Ravenscroft & Matheson, 2002; McAlister, 2001), the relevance of the broader, socio-cultural context is becoming increasingly apparent. So, to integrate these dialogue game approaches within e-learning contexts where they will function optimally, we will first need to understand and consider the appropriate 'conditions' for these discourses, as we cannot hold a serious and engaging educational dialogue 'with anyone, about anything, at any time'. One current project is integrating a dialogue game for critical discussion, realised through a structured interface—of sentence openers and preferred moves, within a broader framework for educational conferencing and moderating (Salmon, 2000). Thus linking a cognitive tool with a framework that defines the socio-cultural context in which it should be effective. However, preliminary findings from this project are further emphasising the need to better conceptualise and design for the community and contexts in which educational discourses operate. In brief, we need to investigate, examine and, where possible – design, appropriate learning communities if we want to support effective e-learning discourse.

5 Learning communities and cooperative learning

According to Preece (2000) 'The internet has given rise to a new community model of communication' (p xii). Currently, however, there is little agreement on what this model actually is, how we can conceptualise it, or how it can be operationalised and exploited for educational purposes. Preece (2000) herself argues for Community-Centred Development (CCD), that accepts the sociology and social psychology of community development and maintenance, putting the 'community' firmly at the centre of the design process in the same way that Norman (1986) conceived the 'user' as central. Within this scheme she points out that we need to support the evolution of communities, design for usability and plan for sociability. This approach seems to fully accept that learning is, essentially, a social process, but raises a crucial question about whether we can actually build online communities that truly satisfy the necessary social conditions for effective, and often dialectical, discourse interactions. Or, putting this another way, can we be sufficiently social online to have meaningful conversations, discussions and arguments that lead to conceptual change and development?

The recent work of Wenger (1998) on 'Communities of Practice' considers meaning, along with learning and identity, as important features in the educative process. This theory of learning, that is particularly aimed at the work-place, holds that:

'...engagement in social practice is the fundamental process by which we learn and so become who we are. The primary unit of analysis is neither the individual or social institutions but rather the informal "communities of practice" that people form as they pursue shared enterprises over time.'

Central to this notion, inspired by Lave and Wenger's (1991) work on 'situated cognition', is that these communities have knowledge about practice embedded within them, and therefore learning occurs through legitimate entry and participation within the community. Or, 'Learning is a process that takes place within a participation framework, not an individual mind' (Lave & Wenger, 1991, p 15). Wenger (1998) argues that effective communities of practice are characterised by mutual engagement, joint enterprise, shared repertoire and the negotiation of meaning in practice. Whilst this theory has been readily adopted by the business community, successful realisations in e-learning have been limited, with a few exceptions (e.g. McConnell, 2000). There can be difficulties in operationalising these key concepts within the design and operation of online communities and communication. For example, there is a problem mapping some of the features to desired discourse practices. Whilst we obviously want to promote features such mutual engagement, shared repertoire and negotiation of meaning, other aspects such as joint accountability, diversity and partiality are not necessarily appropriate in most educational contexts—except, perhaps, informal learning (for the latter two). In brief, it is not yet clear how to design, develop and maintain a community of practice supporting engaging e-learning discourse. Nevertheless, Wenger's work has provided a valuable 'conceptual resource' of socio-cultural features that should be considered when developing and designing communications in context.

McConnells (2000) work focussing on "Implementing Computer Supported Coopreative Learning" (hereafter CSCL) is one of the few practical approaches that considers Wenger's work, as he emphasises the role for socially oriented theories of learning (e.g. Vygotsky, 1978; Lave & Wenger, 1991). He proposes six design features for promoting and supporting cooperative learning: openness in the educational process (the learning community); self-determination in learning; having a real purpose in the cooperative process; a supportive learning environment; collaborative assessment of learning; and assessment and evaluation of the ongoing learning process. And he presents a specific design for a CSCL system that is successfully implemented in a UK higher education setting. The emphasis here is quite 'high level', being placed on learning management and organisation that supports CSCL, or the conditions and issues for cooperative learning in general. Whereas 'lower level' questions, such as whether the discourse processes that are fostered lead to genuine improvements in knowledge and understanding remain largely unanswered in any systematic way. Nevertheless, this work makes a useful start in considering social processes in the design and management of computer-mediated activities, and McConnell himself freely admits to the state of research and development in this field:

BEST COPY AVAILABLE

"CSCL is an idea that helps surface questions about the role of technology in learning, and about the nature and purpose of learning itself" (McConnell, 2000; p 2).

6 A synthesis: towards an integrated model for designing e-learning discourse

This paper has argued that effective e-learning requires high quality educational discourse, that leads to, at the least - improved knowledge, and at the best – conceptual development and improved understanding. We hold that this is possible if we adopt a sophisticated approach to e-learning design that accounts for necessary relationships between cognitive changes, dialogue processes and the communities, or contexts, for learning. Or, putting this another way, we need a socio-cultural framework for cognitive change, that includes motivational and affective factors. Thus far, work on developing dialogue models and system designs linked to cognitive change and development has been somewhat limited but successful, and necessitated at least ten years of research and development. But, at least, we now have a reasonable idea about what counts as patterns of good educational discourse, and how we can design systems that can effectively mediate the desired dialogue processes, in ways that, hopefully, lead to the internalisation of improved reasoning and dialectic processes. However, the key questions at the moment include: how can we design or develop the social conditions and communities that give rise to the dialogue models and discourse practices that are desired in e-learning contexts? What are the most optimal group characteristics, in terms of size and profile for example? Can we establish 'preconditions', in terms of learner characteristics and settings that will favour high quality educational dialogue?

So, the next step must be to investigate and examine e-learning communities to develop a better conceptualisation of how and why they operate successfully, paying particular attention to motivational and affective issues and factors. This should then provide the basis to either harmonise the operation of our dialogue models within existing community practice or, more prescriptively, to develop communities that are aimed at supporting high quality collaborative and dialectical e-learning discourse. Hence, we are currently developing methodologies for investigating learning communities in a number of projects that include traditional and informal e-learning contexts.

To conclude, we need to cultivate effective e-learning communities, emphasising shared interest and enterprise, and other motivational aspects. Within these communities, we can then stimulate, structure and manage high quality educational discourse that fosters collaboration, critical discussion and argumentation. We will then be able to investigate the link between these communicative practices and improvements in knowledge and understanding, because we will have to truly support the mutual engagement of conceptualisations to realise the co-elaboration of knowledge and understanding that corresponds to effective learning. Currently, we are making reasonable progress, given that work on how to develop, maintain and manage online communities is itself both new and complex. But we cannot avoid the challenge to make e-learning engaging and ostensibly social, because very few citizens want to or can learn alone.

References

BURTON, M., BRNA, P. & PILKINGTON, R. (2000) Clarissa: a laboratory for the modelling of collaboration, *International Journal of Artificial Intelligence in Education*, 11, pp. 79-105.

DE VINCENTE, A., BOUWER, A., & PAIN, H (1999) Initial impressions on using the DISCOUNT scheme, in: R. PILKINGTON, J. MCKENDREE, H. PAIN, & P. BRNA (Eds) *Proceedings of the Workshop on Analysing Educational Dialogue Interaction. Workshop at 9th International Conference on Artificial Intelligence in Education, 18th-19th July, 1999.* (87-94). Le Mans, France: University of Le Mans.

ENGSTROM, Y. (1987) *Learning by Expanding: an activity theory approach to developmental research* (Helsinki, Orienta-konsultit).

KNUTTI, K. (1996) Activity theory as a potential framework for human-computer interaction research, in: NARDI, B.(Ed). *Context and Consciousness: activity theory and human-computer interaction* (Cambridge, MIT Press).

LAVE, J & WENGER, E. (1991) Situated Learning: Legitimate Peripheral participation, Cambridge University Press.

MACKENZIE, J. D. (1979) Question-begging in non-cummulative systems, *Journal of Philosophical Logic*, 8, pp. 117-133.

MAUDET, N., & EVRARD, F. (1998) A generic framework for dialogue game implementation, in: HULSTIJN, J. & NIJHOLT, A. (Eds) *Second Workshop on Formal Semantic and Pragmatics of Dialogue* (TWLT13) May 13-15, 1998, University of Twente,

BEST COPY AVAILABLE

MAUDET, N & MOORE, D. J. (2000) Dialogue games as dialogue models for interacting with, and via, computers, submitted to *Informal Logic*.

MCALISTER, S. (2001). Argumentation and Design for Learning, Dialogue & Design Research Group Technical Report DDRG-01-2, Institute of Educational Technology, Open University, UK.

MCCONNEL, D. (2000) *Implementing Computer Supported Cooperative Learning*, Kogan Page.

MOORE, D. J. (2000) A framework for using multimedia within argumentation systems, *Journal of Educational Multimedia and Hypermedia*, 9, pp.83-98.

MOORE, D. J & HOBBS, D. J. (1996) Computational use of philosophical dialogue theories, *Informal Logic*, 18, pp.131-163.

MOORE, D. J. (1993). *Dialogue Game Theory for Intelligent Tutoring Systems* Unpublished Ph.D. thesis. Computer Based Learning Unit, University of Leeds, UK.

NARDI, B. (1996) *Context and consciousness: activity theory and human-computer interaction* (Cambridge, MIT Press).

NORMAN, D. A. (1986). Cognitive Engineering. In Norman, D & Draper, S. (1986) (Eds.) User-Centred Systems Design. Hillsdale, NJ: Lawrence Erlbaum.

PILKINGTON, R, M. (1992) *Intelligent Help: Communicating with Knowledge Based Systems* (London, Paul Chapman).

PILKINGTON, R.M. (1999) *Analysing'Educational Discourse: The DISCOUNT Scheme*. Version 3, January 1999. CBL Technical Report No. 99/2, ISBN: 1 901418 022.

PILKINGTON, R.M., HARTLEY, J.R., HINTZE, D. & MOORE, D. (1992) Learning to argue and arguing to learn: an interface for computer-based dialogue games, *International Journal of Artificial Intelligence in Education*, 3, pp. 275-85.

PILKINGTON, R. & GRIERSON, A. (1996) Generating explanations in a simulation-based learning environment, *International Journal of Human-Computer Studies*, 45, pp. 527-551.

PILKINGTON, R. M., TREASURE-JONES, T., & KNESER, C. (1999) Educational CHAT: using Exchange Structure Analysis to investigate communicative roles in CMC seminars, in: P. BRNA, M. BAKER, & K. STENNING (Eds) *Roles of Communicative Interaction in Learning to Model in Mathematics and Science: Proceedings of C-LEMMAS TMR Conference*. 15th-19th April, Ajaccio, Corsica (Computer Based Learning Unit, University of Leeds).

PREECE, J. (2000) *Online Communities: designing usability, supporting sociability*, John Wiley Ltd.

RAVENSCROFT, A. (2000). Designing Argumentation for Conceptual Development, *Computers & Education*, 34 (2000), pp. 241-255.

RAVENSCROFT, A. (2001) Designing e-learning interactions in 21C: Revisiting and re-thinking the role of theory, *European Journal of Education: Special edition on On-line Learning*, Vol. 36, No. 2, pp. 133-156.

RAVENSCROFT, A. & PILKINGTON, R.M. (2000) Investigation by design: developing dialogue models to support reasoning and conceptual change, *International Journal of Artificial Intelligence in Education*, 11, pp. 273 – 298.

RAVENSCROFT, A. & MATHESON, M.P. (2002). Developing and evaluating dialogue games for collaborative e-learning interaction, *Journal of Computer Assisted Learning: Special Issue: Context, collaboration, computers and learning*, Vol. 18, No. 1, pp. 93-102.

SALMON, G. (2000) *E-moderating: The Key to Teaching and Learning Online*, London: Kogan Page.

VYGOTSKY, L. (1962) *Thought and Language* (Cambridge, MA, Harvard University Press).

VYGOTSKY, L. (1978) *Mind in Society*(Cambridge, MA, Harvard University Press).

WALTON, D. (1984) *Logical Dialogue-Games and Fallacies* (published thesis) (Lanham, University Press America).

WENGER, E. (1998) *Communities of Practice*, Cambridge University Press.

Learning Objects – Instructional Metadata and Sequencing

Giselher Redeker
Deloitte Consulting
Haydnstrasse 5
D-33775 Versmold
Germany
giselher@ammma.de

Abstract: The main focus of current discussions within the standardization process of Learning Technology is on economical opportunities and technical aspects of so called learning objects. Surprisingly little discussion is about the instructional or didactical issues. The purpose of this paper is to conceptualize a Taxonomy of learning objects for the facilitation of reusable instructional navigation patterns.

Introduction

At the dawn of the 21st century the industrial society is being influenced by dramatic technological development which calls for continuous actualization and advancement of peoples' know-how and capabilities in order to keep companies and economies competitive. Slogans such as "Lifelong Learning" and "Learning on Demand" verify the tendency of changing forms of learning, media, and communication as well as the inherent transformation of an industrial society into an information society.

The classical résumé - school, apprenticeship, university, career, and retirement - has therefore been increasingly challenged. Whoever wishes to be successful on the job market must continue to educate themselves in a focused manner - further education has thus become more and more a basic human need.

This basic need is, however, still faced with many barriers: training is expensive and time consuming, it often only conveys overall views and relies upon a particular time and place. In addition, it cannot be optimally adapted to individual needs as the interests of all participants must be taken into account.

The Vision - a marketplace of knowledge and education

While considering the above, imagine it was possible to access a potentially endless amount of learning material - presentations, videos, learning programs by various suppliers - right from one's own working place, to participate in training courses and classes on the other side of world. A global market of further education without any access limitations whatsoever, available to anyone anywhere, combined with the opportunity of contacting other pupils or tutors. A marketplace in which public and private institutions both compete with and complement one another, the result being effective and personalized further education - moving away from predetermined career options to individual qualification profiles.

The current situation

Internet and the World Wide Web (WWW) respectively offer ideal conditions for such a vision: they are globally available, multimedia, accessible to everyone, and also open up new opportunities in communications and cooperation. They thus allow the combination of varied further education offers ranging from simple text documents to interactive virtual classroom training, making them available to any location on Earth.

In this sense, the WWW is becoming the technological basis of knowledge globalization, a universal library accessible worldwide. At the same time, however, major problems arise in conjunction with a flexible usage of this worldwide knowledge for educational and further educational processes. Some examples include the consistency of courses already in existence, the retrieval of relevant and significant information regarding the respective thematic and didactical context as well as usage rights and payment.

Metadata, data which supplements existing information in the web with information on resources (based on additional or metainformation), illustrates one way of dealing with these problems.

Metadata is thus information *about* the resources themselves and should characterize the knowledge modules in such a way so that they can be found more easily in a given context.

Standardization Initiatives

Against this backdrop numerous standardization syndicates have been founded during the last few years. Their goal has been to define open technical standards for computer supported learning environments and education products and their characteristic metadata. The most important initiatives are the Aviation Industry CBT Committee (AICC)[1], the Instructional Management Systems Project (IMS)[2], the Alliance of Remote Instructional Authoring and Distribution Networks for Europe (ARIADNE)[3], the World Wide Web Consortium (W3C)[4], and the Advanced Distributed Learning Initiative (ADL)[5].

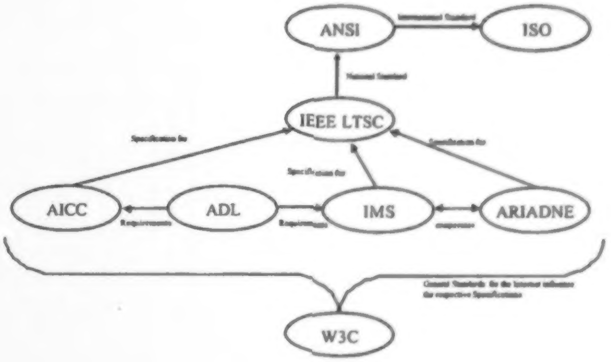

ANSI
International Standard
ISO
National Standard
IEEE LTSC
Specification for
Specification for
Specification for
AICC
Requirements
ADL
Requirements
IMS
cooperation
ARIADNE
General Standards for the Internet influence the respective Specifications
W3C

Figure 1: Network of the contributing partners to the standardization process

Following the initial independent running of these standardization endeavors, especially the IMS and ADL have now begun an attempt at harmonizing results and, within the framework of an IEEE Learning Technology Standards Committee (IEEE LTSC)[6] work group, are establishing an internationally recognized and

---

[1] http://www.aicc.org

[2] http://www.imsproject.org

[3] http://www.ariadne.unil.ch

[4] http://www.w3.org

[5] http://www.adlnet.org

[6] http://www.manta.ieee.org

BEST COPY AVAILABLE

expandable standard.

Within these groups the main focus is on the financial opportunities that may arise, but surprisingly there is scarcely a discussion about the didactical or instructional design implications of learning objects (cf. Wiley 2002).

Consecutively I will try to conceptualize an approach for didactical sequencing of learning objects based on a specific set of educational metadata and thereupon synthesized generic sequencing strategies.

The goal is to develop a domain specific ontology for the educational science field capable of typifying teaching and learning material.

Learning Objects

In order to guarantee an optimal maintenance and reusability of contents, object oriented approaches are applied to the maintenance of multi-media teaching and learning material. Reusability, adaptation, and composition mechanisms are therefore employed to structure knowledge contents and so-called **learning objects** (LO) are defined. A learning object reduces the knowledge of a specific theme to its most essential unit. LOs may be divided into even smaller LOs. At its most basic level, a learning object is made up of several knowledge units (KUs) which may consist of texts, audio and video presentations, or animation. At this point the problem of granularity of learning objects arises. Following Wiley (2002, p. 10) "the decision regarding learning object granularity can be viewed as a trade-off between the possible benefits of reuse and the expense of cataloging. From an instructional point of view, alternatively, the decision between how much or how little to include in a learning object can be viewed as a problem of scope. While reality dictates that financial and other factors must be considered, if learning is to have its greatest chance of occurring, decisions regarding the scope of learning objects must also be made in an instructionally-grounded, principled manner."

A heuristic approach helps to balance between economical and instructionally-grounded criteria: The most basic learning object is understandable on its own and coherent, which means without references to other learning objects.

Combination of learning objects leads to the following hierarchy of learning objects:

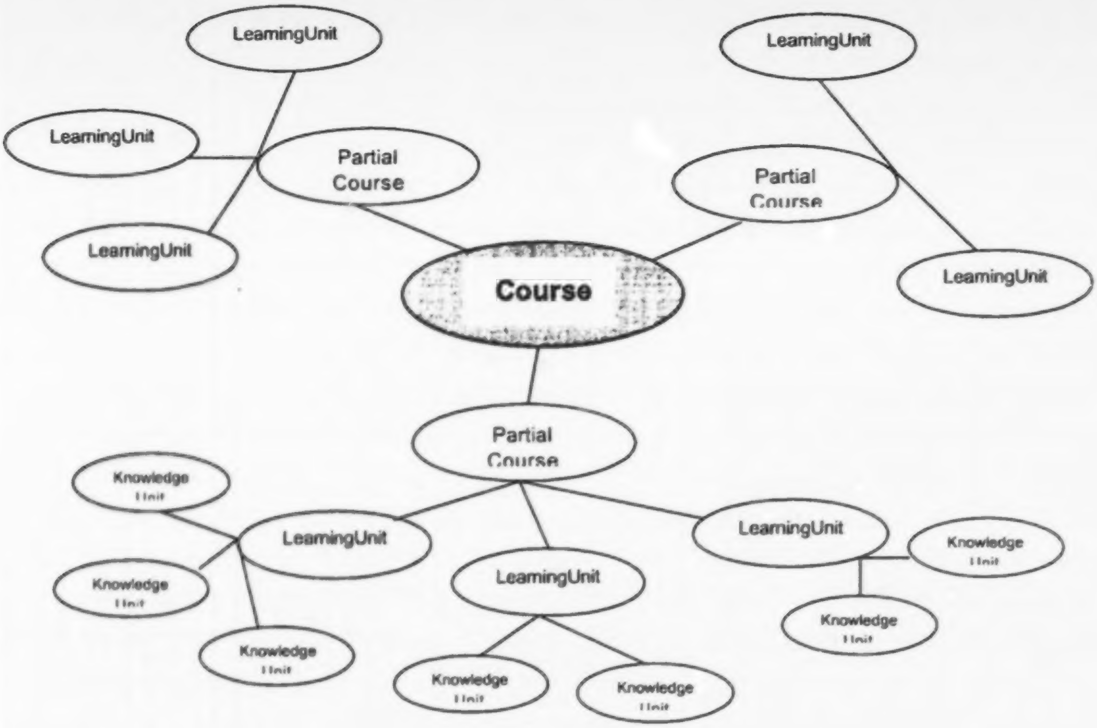

LearningUnit
LearningUnit
LearningUnit
Partial Course
LearningUnit
Partial Course
LearningUnit
Course
Partial Course
Knowledge Unit
LearningUnit
LearningUnit
LearningUnit
Knowledge Unit
Knowledge Unit
Knowledge Unit
Knowledge Unit
Knowledge Unit
Knowledge Unit
Knowledge Unit

Figure 2: Hirarchy of learning objects

Hierarchy of learning objects

Course

Courses are defined as a sequence or network of learning units. Courses may - especially considering their reusability in other contexts - be divided into smaller, partial courses. A course encompasses about 30 to 60 hours of active learning time (ALT).

Partial course

Being containers, partial courses can comprise learning and knowledge units as opposed to learning units, which are solely made up of knowledge units. Partial courses are primarily designed as containers for learning units and should therefore not solely be made up of knowledge units. A partial course encompasses about 3 to 6 hours of active learning time (ALT).

Learning Unit

Learning units[7] are containers for thematically related knowledge units. Learning units are self-contained and can be, for example, reused in another course. The learning units' structure and order are defined as the macrostructure of the learning environment.
One learning object encompasses about 20-40 minutes of active learning time (ALT).
Learning units can be classified according to a three-tier thematic outline into fields (highest level), areas

---

[7] The definition in this context is based on essays by Merrill (no year given) who speaks of so-called knowledge objects in conjunction with his instructional-transaction-approach.

BEST COPY AVAILABLE

(second level), and themes (lowest level).

Using learning units makes it possible to easily exchange contents or to integrate them by combing them with other learning objects to make a new system. In this way, a high degree of exchangeability, expandability, and adaptivity can be achieved on a whole. Isolated knowledge pertinent to a particular theme can thus be more easily reused. In addition, the translation of learning environments into different languages based upon the independent management of media elements such as texts and sounds is notably eased.

In order to be able to make flexible and meaningful (re)use of learning objects in different (learning) contexts, at least three different types of knowledge objects must be present: an "orientation knowledge" object, an "explanation knowledge" object, and an "action knowledge" object. Practically speaking, a learning unit is has to have a good deal more knowledge units in order to meaningfully and cohesively portray a thematic subject. Representing a knowledge unit in several different media is, for example, very useful.

Knowledge unit

Knowledge units are the smallest elements of knowledge. Knowledge units make up the components of a learning unit within which they can be flexibly combined. As opposed to a traditional learning system and a "tightly wired" hypertext, they can be combined in any arrangement desired. The respective structure and order of knowledge units within a learning unit is defined as the learning environment's microstructure. When defining the size of a knowledge unit it is assumed that it is no larger than one monitor sheet, or, in regard to videos or mini-CBTs, it should not be any longer than 2-4 minutes of active learning time (ALT).

Within this framework, a knowledge unit is clearly defined according to the following dimensions:

	Receptive Knowledge Units	**Interactive Knowledge Units**	**Cooperative Knowledge Units**
Thematic Dimension	Three or more tier thesaurus		
Competence Dimension	Bloom's Taxonomy (possibly refined)		
Media Dimension	Ontological outline of presentational media	Ontological outline of interactive media	Ontological outline of communications media
Knowledge Dimension	Ontological outline of type of knowledge answers to questions	Ontological outline of types of tasks / filling out blanks	Ontological outline of forms of cooperation (Knowledge communication)
Relational Dimension	Thematic relation (didactics for guided tour)	Integration in learning object with didactic relations (didactics belongs in this context)	Thematic relations in regard to cooperation themes, otherwise didactic relations

Figure 3: Typing-Dimensions for Knowledge-Units

Three different types of knowledge units can be distinguished:

1. *Receptive* knowledge units
2. *Internally interactive* knowledge units the size of the smallest interactive learning sequences (up to 5 minutes) and
3. *Cooperative* knowledge units which have no time limits and are defined by communicative tasks.

The learner's role in the respective learning objects varies:

- *Receptive learning objects* place the learner in the role of merely consuming information, i.e. he or she is receptive. The learner's activity takes place outside of the module regarding the selection of a particular module, the order of the modules, as well as the time spent on the modules.
- *Internally interactive learning objects* integrate the learner in the human-computer-interaction. The learner is either CBT guided - albeit in a mini-CBT sequence - or is given the framework of his or her activities via simulation.
- *Cooperative learning objects* demand communicative activities of the learner such as brainstorming, debating, or problem solving with other learners in a group.

Cooperative learning objects are defined as "Points of Cooperation" (PoC). A PoC is thus a passage of the learning and navigation processes in which several learners can work together on a (learning) task or work on and solve a problem together.

It can be distinguished between:

- *iPoCs* (intentional *Point of Cooperation*) if the cooperation is intended by the learning material or trainer/tutor and is integrated in the course plan during the course of navigation and
- *sPoCs* (spontaneous *Point of Cooperation*) which refer to occurrences during the course in which learners spontaneously and indiscriminately cooperate with one another.

Accordingly, sPoCs can occur at any time the learner wishes whereas iPoCs are predetermined by the course material and can only be activated at certain times.

Each knowledge unit is thus typed according to the following didactically relevant dimensions:

1. In the *thematic dimension*, meaning a didactical object is classified according to a given topic (semantic/subject didactic dimension). According to the thematic area, this typification is carried out using a controlled vocabulary in the form of a three or more tier thesaurus.

2. In the *competence dimension*, meaning an ability correlates to the didactical object (pragmatic dimension). Here we make brief use of a typification similar to Bloom's Taxonomy (cognitive, emotive, sensorimotor) supplemented by the social dimension. As the definition of competence regarding a mode of operation is problematic and a part of this information is a dependent upon the type of knowledge, it remains uncertain whether or not a typification in the competence dimension is necessary.

3. In the *dimension of media presentation forms*, meaning at least one medium exists in which the knowledge contents can be portrayed and acquired.

4. In the *knowledge dimension*, meaning as an answer to questions, as the type of tasks, or as didactically pre-structured dramaturgy of knowledge (forms of cooperation).

5. In a *relational dimension*, through which the course of acquiring knowledge can be determined.

In the following I will discuss and exemplify the didactical typification of receptive knowledge units in more detail according to the knowledge types "orientation knowledge", "explanation knowledge", "action knowledge", and "source knowledge".

Types of knowledge in the receptive knowledge units

Knowledge is understood as an answer to posed questions . The types of knowledge in the receptive knowledge units are classified according to the questions "What is there?" and/or "Is there anything at all?"

(*orientation knowledge*), "Why is something the way it is?" and "What is it if it does exist?" (*explanation knowledge*), "How can it be applied?" (*action knowledge*) and "Where is there more knowledge?" (*source knowledge*). The following is a brief description of the different types of knowledge:

2.3.1 Orientation knowledge

Orientation knowledge answers the question: "What is there?"
This deals with knowledge needed in order to understand one's world and/or a particular field without having to explain or act in a specific manner.
Orientation knowledge offers a primary sketch of a topic and its further context. It motivates further exploration and awakens interest. Scenarios, stories, and facts are especially appropriate for an orientation.

2.3.2 Explanation knowledge

This deals with knowledge which explains why something is the way it is or gives arguments which must be supported by statements and recommendations.

2.3.3 Action knowledge

Action knowledge is knowledge based upon actual human activities (practices, techniques, methods, and strategies), abilities, and skills (know-how).

2.3.4 Source knowledge

Source knowledge is knowledge about sources of information (know where). It answers the question: "Where is further knowledge?"

Outlook: Generic navigational Structures

Within this conceptual framework courses are defined as a sequence and/or network of learning units. Individual learning units are in turn made up of a sequence and/ or network of knowledge units. This hierarchy results in more complex reusability and guarantees logical learning objects (i.e. learning units).
The goal of further development is to implement so-called *generic navigational structures* based upon the hierarchy concept and didactical typification in order to support writing and learning processes.
Generic navigational structures relate to the question of how teaching contents should be sequenced, in more concrete terms, which pre-structured navigation opportunities should be presented to the learner in the learning environment.
Transparency of relationships existing between knowledge units and between learning units respectively forgoes this kind of regulated navigation.
The number of modules for a certain topic form a learning unit. The learning process within a learning unit is called a micro-process. It is – as in conventional lessons – extremely adaptive, meaning dependend upon the situation (upon learning type, communication among other marginal conditions). For this reason all modules in a learning unit are reciprocally linked to one another, otherwise the adaptivity mentioned would not exist. Partial reduction of this link complexity can be considered: for example, a single link could exist to a part of the action knowledge modules whereas all action knowledge modules are linked to one another.
Depending upon the topics, the internally complex learning units are linked according to semantic networks and/or cognitive maps (knowledge maps). This structure is called a macro-didactical structure. The main questions are: Which relationship exists between term A which, as a super-character, defines topic A' to term B, which, as a super-character, in turn defines topic B'? Which learning prerequisites lie within term C which, as a super-character, identifies topic C'? etc. These generic navigational structures are to be understood as analogue to a guided tour, as recommendations, not as strict regulations. An author giving a guided tour suggests the navigation sequence but does not make it mandatory (although this should also be possible). In the same way, the system suggests navigation structures according to certain marginal conditions. Such navigation *recommendations* could be: exemplary teaching/learning in the micro-field with a top-down-structure in the

macro-field, spiral in the macro-field, and action oriented in the micro-field, to name a but a few. Such system structures are to be seen as a didactical advice the learner can follow but does not necessarily have to.

References

Kerres, Michael: Multimediale und telemediale Lernumgebungen. Konzeption und Entwicklung. München 1998.

L³: Lifelong Learning. Homepage of the BMB+F Lead-Project: URL: http://www.l-3.de

Merrill, M. David (no year given): Instructional Transaction Theory. Instructional Design based on Knowledge Objects. URL: http://itech1.coe.uga.edu/itforum/paper22/paper22a.html

SAP Learning Solution (2002): https://www005.sap-ag.de/learningsolution

Schaper, Joachim: Lebenszyklusunterstützung in kooperativen Lehrsystemen. Shaker-Verlag, Aachen 1996.

Wiley, David A. (2002): Connecting Learning Objects to Instructional Design Theory: A Definition, a Metaphor, and a Taxonomy. In: David A. Wiley (Ed.): The Instructional Use of Learning Objects. Agency for Instructional Technology and Association for Educational Communications & Technology, Bloomington, Indiana, pp. 3-23.

Enhancing E-Learning Assessment and Evaluation Strategies

Thomas C. Reeves
Professor, Department of Instructional Technology, The University of Georgia
604 Aderhold Hall, Athens, GA 30602-7144 USA
Main Contact E-Mail: treeves@coe.uga.edu

William D. Aggen
CEO and President, LearnWright, LLC
12231 Parklawn Drive, Suite 200, Rockville, MD 20852 USA
baggen@learnwright.com

Mental Models of E-Learning

E-learning has gone through a major reality check since the global economic downturn of the last two years. Fortunately, it has survived, unlike web-based grocery delivery and any number of other "hot" ideas for e-businesses. Some have argued that once e-learning developers work out technical kinks such as interoperability standards and security issues, the e-learning enterprise will attain even the most optimistic forecasts for changing the way people learn in the 21st Century (Rosenberg, 2001; Schank, 2001).

Setting the unresolved technical issues aside, there are three other changes that are needed before e-learning realizes it fullest potential. First, we must expand our basic mental model of what e-learning is. Second, we must improve the quality of assessment within our e-learning products. Third, we must get serious about investing in rigorous evaluation of e-learning initiatives.

Cognitive psychologists define mental models as conceptions of systems or phenomenon that we construct in our minds (Gentner & Stevens, 1983). A person might have a good mental model of how an internal combustion engine runs, but a weak one of how microware works. Mental models are important cognitive structures that influence how people react to change and solve problems. They are often based on analogies or metaphors (Norman, 1983). For example, when people first began using word-processing software more than twenty years ago, they usually thought of word-processors as analogous to typewriters. A mental model of word-processing as similar to typing worked in some ways, but failed in others, such as when novice users continued to hit return at the end of every line of text rather than relying on the word-wrap function. Today's learners, for whom typewriters are as unfamiliar as slide rules, do not suffer from such misconceptions when learning how to word-process.

People also have different mental models of e-learning, depending on their relationship to it and their experiences with it. Commercial vendors of products such as learning management systems and multimedia authoring software frequently promote a mental model of e-learning as media events using terms such as "full motion video" and "dynamic learning objects." Instructional designers are more likely to describe e-learning by referring to instructional activities analogous to traditional training events such as "presentations," "discussions," and "quizzes." Subject matter experts, by contrast, tend to formulate a mental model of e-learning as an alternative vehicle for distributing content via "electronic books" or "real time databases."

Rather than as technologies, activities, or content collections, a mental model of e-learning can be based upon the concept of "outcomes." Outcomes are achieved objectives; they are the evidence that learning has occurred, performance has changed, and results have been attained. Outcomes assessment has been a major movement in education for at least a decade, reflecting a general shift from an emphasis on teaching to a focus on learning (Huba & Freed, 1999; Marzano, Pickering, & McTigh, 1993).

In the business world, a mental model of e-learning as outcomes will encourage a sharper focus on the ultimate goals of e-learning, namely performance and results. After all, what are the ideal outcomes of e-learning if not performances tied closely to the mission and goals of the organization that yield desirable results such as greater profitability, better safety records, or larger market share?

Another benefit of thinking of e-learning as outcomes is that it forces us to consider how we will certify that the outcomes have been achieved. In other words, the nature and quality of assessment becomes paramount in a mental model of e-learning as outcomes.

New Directions in E-learning Assessment

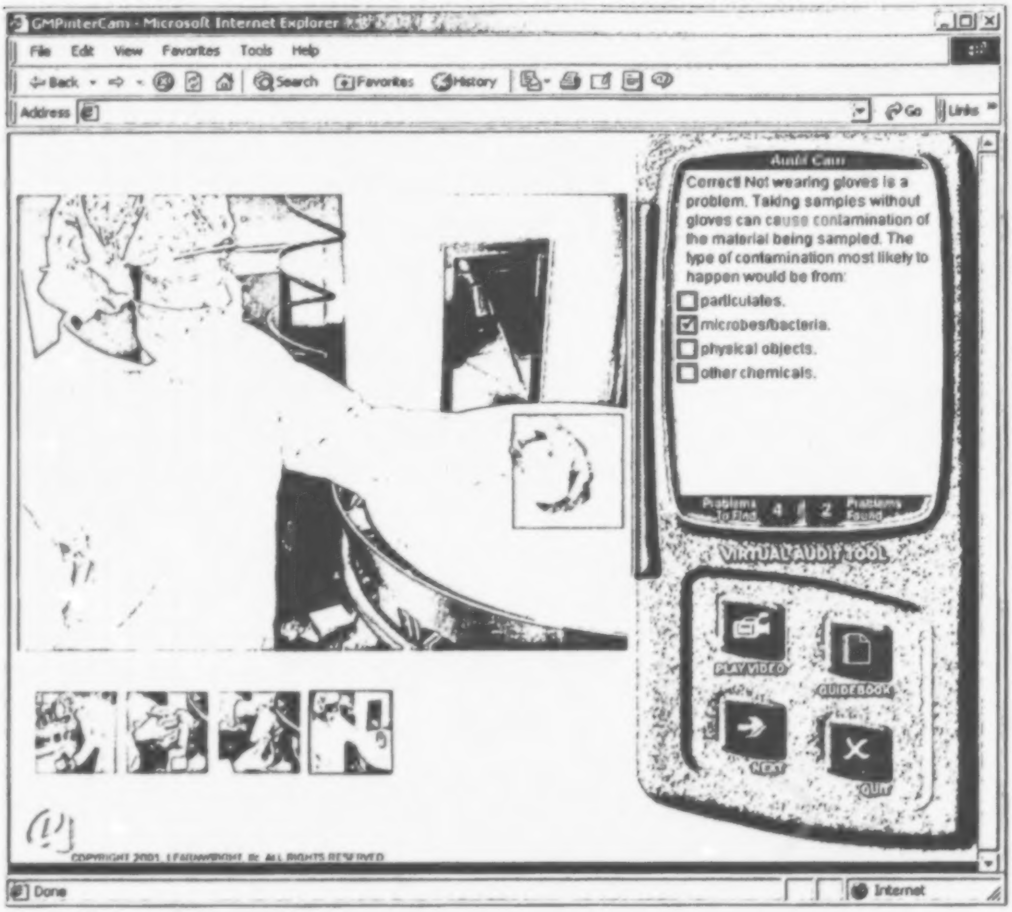
Assessment, defined as the activity of measuring learning, is still a relatively weak component of most e-learning programs (Schank, 2001). In fact, vendors, instructional designers, and subject matter experts alike appear to struggle with conceiving of assessment as anything more than a multiple-choice test. Despite the sophisticated multimedia features of many e-learning programs, a closer look at the assessment strategies in these programs suggests that developers, perhaps limited by today's still primitive authoring systems to highly predictable algorithms, often fall back upon overly simplistic multiple-choice test items that primarily measure low-level retention of isolated facts.

This is not adequate. The knowledge workers of the 21st Century workplace are rarely confronted with clearly delineated choices from which they must select; instead they must generate original solutions to unique problems. Traditional multiple-choice tests cannot tap into the critical ability to frame and resolve ill-defined problems. Fortunately, a few good examples of alternative assessment in e-learning for business and industrial training are emerging.

In this paper, we describe one such example, specifically the innovative assessment approaches found in the e-learning courseware developed by LearnWright of Rockville, Maryland, USA (www.learnwright.com). LearnWright specializes in the development of training for regulated industries such as pharmaceutical companies. One type of e-learning developed by LearnWright is Good Manufacturing Practices (GMP) training that is mandated by the U.S. Food and Drug Administration (FDA). LearnWright GMP courseware includes a number of innovative performance assessment strategies such as:

- AUDIT CAM ("What's wrong with this activity?")
- AUDIT CVR ("What's wrong with this conversation?")
- AUDIT DOC ("What's wrong with this document?")

The screen capture in Figure 1 illustrates a typical assessment approach used in the LearnWright GMP courseware. This assessment item presents the learner with multiple comprehension and application challenges. The learner must first watch a brief video that illustrates the performance of a worker in a pharmaceutical manufacturing environment. The learner is then required to locate performance problems in the video, specify the nature of the problem, and finally, identify the specific type of GMP regulations violated in this problem. In terms of outcomes, this type of item engages multiple types of higher-order cognitive processes including classification, interpretation, abstraction, application of rules, and judgment.


GMPinterCam - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites History
Address
Go
Links
Audit Cam
Problems To Find 4
2 Problems Found
VIRTUAL AUDIT TOOL
PLAY VIDEO
GUIDEBOOK
NEXT
QUIT
COPYRIGHT 2001, LEARNWRIGHT, llc. ALL RIGHTS RESERVED
Done
Internet

Correct! Not wearing gloves is a problem. Taking samples without gloves can cause contamination of the material being sampled. The type of contamination most likely to happen would be from:

☐ particulates.
☑ microbes/bacteria.
☐ physical objects.
☐ other chemicals.

Figure 1. Virtual Audit Tool in GMP Training developed by LearnWright.

One of the distinctive features of this type of assessment is that it blends assessment with learning. In traditional training, assessments are usually distinct activities clearly separated from instructional events. For example, after trainees have attended a number of classes, they are given some sort of examination. Or, after a worker reads a given number of screens in an e-learning program, he or she is linked to a quiz. However, a major advantage of e-learning environments is that assessment activities can be embedded unobtrusively into the interactive structure of the program themselves. As described above, the assessments developed by LearnWright provide excellent examples of this approach. Learners are engaged in a series of increasingly complex problems, complete with detailed guidance and feedback. These interactive learning activities blend naturally with the virtual audit tools for activities, documents, and conversations that are integral to workplace performance.

Figure 2 illustrates how LearnWright has moved its interactive training products from a traditional e-learning model whereby instruction (usually in the form of didactic presentations) is separated from assessment (usually in the form of simple multiple choice questions) to an enhanced model whereby instruction (in the form of increasingly sophisticated simulations) is

BEST COPY AVAILABLE

blended seamlessly with assessment (in the form of Virtual Audit Tools and performance assessments). A major advantage of the approach illustrated in Figure 2 relates to "alignment," probably the most important characteristic that should be evident in thinking of e-learning as outcomes. Alignment is evident when there is a clear degree of synchronicity among learning objectives, content, the tasks in which learners are engaged, technological features, and assessment strategies. Many of the flaws in existing e-learning programs stem from a lack of alignment.

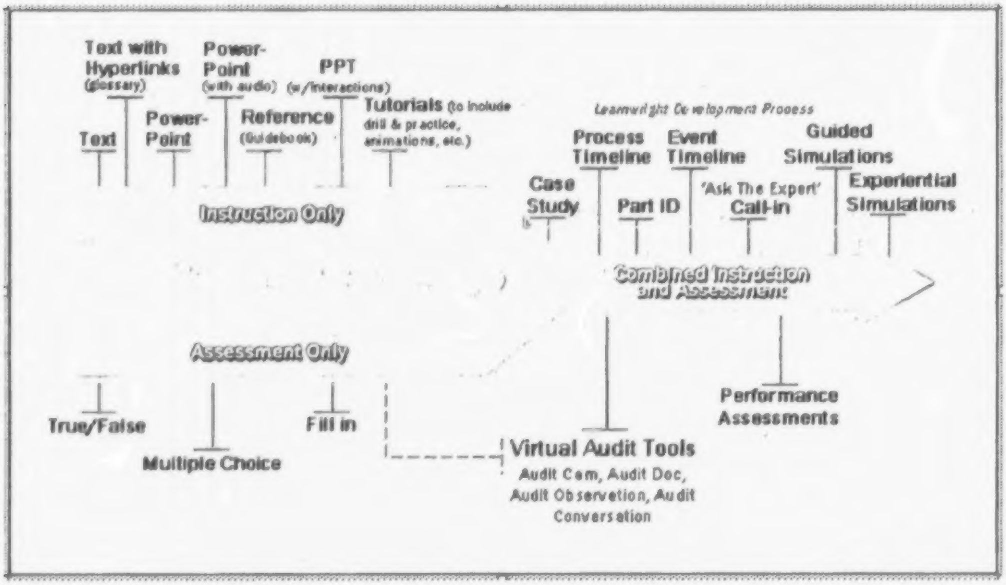

Text with Hyperlinks (glossary)
Power-Point (with audio)
PPT (w/interactions)
Text
Power-Point
Reference (Guidebook)
Tutorials (to include drill & practice, animations, etc.)
Instruction Only
Learnwright Development Process
Process Timeline
Event Timeline
Guided Simulations
Case Study
Part ID
'Ask The Expert' Call-in
Experiential Simulations
Combined Instruction and Assessment
Assessment Only
True/False
Multiple Choice
Fill in
Virtual Audit Tools
Audit Cam, Audit Doc, Audit Observation, Audit Conversation
Performance Assessments

Figure 2. LearnWright models of instruction and models of assessment.

For example, consider the integration of Web resources into an e-learning course that might be offered in a higher education context. Such courses often provide access to extended digital resources such as electronic journals, real time databases, and online discussion forums that students are expected to utilize to enhance their learning. But academic developers are often disappointed by the degree to which learners actually use these and similar online resources. However, learners may simply perceive that these resources have little relationship with assessments in the course (such as writing a paper or taking a final exam), and so they "wisely" choose to target their cognitive efforts on those learning activities that they perceive as more clearly aligned with attaining the highest scores on assessments. After all, students are only human, and although course developers might wish that students will access all resources simply because of the desire to learn, they are more likely to use only the resources that have obvious links to assessments. Clarification of the alignment within e-learning courses is an important role for evaluation specialists. Unfortunately, many e-learning development teams neglect to include evaluators (either internal or external), and so alignment goes unchecked.

Assessment in e-learning programs can have multiple roles ranging from narrow, formative purposes (Did the learners master the skills to be learned in one section of the program, indicating their readiness to proceed to the next section?) to broad, summative ones (Do successful e-learners perform on the job in ways that contribute to institutional success?). The development of assessment strategies in e-learning should be guided by a common set of questions such as:

- What is the purpose of the assessment, e.g., formative (to provide information for helping someone learn) or summative (rendering a judgment of a learner's competence)?
- What is the scope of the assessment, e.g., a quiz administered within an individual module or a final assessment of learners to certify that they are ready to be awarded a license or certification?
- What is being assessed, e.g., knowledge, skills, attitudes, mental models, or higher order thinking capacities?

Outcomes come in many forms. Some are psychomotor involving specific physical skills such as the proper way to lift a box by bending at the knees. Some are affective such as the motivation to show up at work on time or pitch in when there is a crisis. Many are cognitive, ranging from knowledge of simple concepts and rules to robust mental models such as a deep understanding of Good Manufacturing Practices (GMP) within the pharmaceutical industry or the commitment to safety in any workplace.

Corporations are increasingly concerned with higher order outcomes such as problem-solving, ethics, creativity, and commitment. The latter are much harder to assess, and most authorities advocate basing assessments upon a range of indicators rather than seeking one precise measure. Instead of asking "what test should we use?," e-learning designers should ask themselves "what can we possibly count as evidence that learners have attained these higher order outcomes?" Assessments of complex outcomes such as ethical reasoning inevitably require a variety of indicators to "triangulate" them.

LearnWright has adopted the following guiding principles in developing assessment strategies for its e-learning products:

- If it hasn't been assessed, it hasn't been learned.
- The closer the assessment tool is to how the job is performed, the more valid the assessment is as a predictor of how the person will perform on the job.
- Reliable, valid, and authentic assessments serve multiple purposes:
    - improve learner performance,
    - improve courseware quality,
    - improve organizational effectiveness,
    - qualify training performance to other stakeholders (e.g., regulatory agencies and consumers), and
    - foster better evaluation.

Better Assessment Can Lead To Better Evaluation

Although the terms are often used interchangeably, assessment and evaluation actually have two distinct meanings (Worthen, Sanders, & Fitzpatrick, 1996). Assessment is defined as the activity of measuring learning whereas evaluation involves judging the effectiveness and worth of programs and products. In short, we assess people and evaluate things. The terms are often confused, perhaps because the same data can be used for both functions. An exam in an e-learning course in a professional continuing education context can be used to assess student learning and provide the basis for awarding certification. The same exam results, however, might be used to evaluate the effectiveness of a course, especially if other versions of the course are available for comparison.

Advancements in assessment strategies are being made as evidenced by the cutting-edge outcome assessments created by LearnWright described above. Although we readily acknowledge that there is other creative work being done in e-learning assessment elsewhere (Rossett, 2001;

Schank, 2001), the state-of-the-art of assessment in general is almost as weak as the state-of-the-art of e-learning evaluation.

What is the basis for this claim? According to the American Society for Training and Development, evaluation lags behind because most e-learning programs are only evaluated at the lowest level of Kirkpatrick's classic evaluation model, simply finding out if learners like e-learning (Rossett, 2001). But if developers and their clients begin to think of e-learning as outcomes, not only will assessments improve, but attention to higher levels of evaluation will follow because we shall be able to more easily address questions such as:

- Do learners master the desirable knowledge, skills, and attitudes?
- Do learners transfer their new learning to performance in the workplace?
- Does enhanced performance contribute to the bottom line such as higher profits?
- Given positive results, what was the return-on-investment for e-learning?

These are the evaluation levels that are sorely needed in the rapidly evolving world of e-learning (Reeves & Carter, 2001). Changing our mental model of e-learning to one focused on outcomes is a step in the right direction toward improving both assessment and evaluation. But more than a cognitive change is required. The e-learning industry as a whole must commit to more realistic investments in evaluation of its products. Amazing advances emerge almost weekly from the pharmaceutical field, primarily because of the extensive research and development that industry supports. For the e-learning industry to realize analogous results, we must invest at least ten percent of our funding in multiple levels of evaluation. There is no time better to start this level of investment than now.

References

Gentner, D., & Stevens, A.L. (Eds.). (1983). *Mental models*. Hillsdale, NJ: Lawrence Erlbaum Associates.

Huba, M. E. & Freed, J. (1999). *Learner-centered assessment on college campuses: Shifting the focus from teaching to learning*. Needham Heights, MA: Allyn & Bacon.

Marzano, R., Pickering, D., & McTigh, J. (1993). *Assessing student outcomes: Performance assessment using the dimensions of learning model*. Alexandria, VA: Association for Supervision and Curriculum Development.

Norman, D. A. (1983). Some observations on mental models. In D. Gentner and A. L. Stevens, Eds., *Mental models (*pp. 7-14), Hillsdale, NJ: Lawrence Erlbaum Associates.

Reeves, T. C., & Carter, B. J. (2001). Usability testing and return-on-investment studies: Key evaluation strategies for web-based training. In B. Khan (Ed.), *Web-based training* (pp. 547-557). Englewood Cliffs, NJ: Educational Technology Publications

Rosenberg, M. J. (2001). *E-learning: Strategies for delivering knowledge in the digital age*. New York: McGraw-Hill.

Rossett, A. (Ed.) (2001). *The ASTD e-learning handbook: Best practices, strategies, and case studies for an emerging field*. New York: McGraw Hill.

Schank, R. C. (2001). *Designing world-class e-learning*. New York: McGraw-Hill.

Worthen, B. R., Sanders, J. R., & Fitzpatrick, J. L. (1996). Program evaluation: Alternative approaches and practical guidelines (2^{nd} ed.). New York: Addison-Wesley.

Object Oriented Learning Objects in Online Education: A Framework and Example

Lilian Rincon
Faculty of Computing Science & Business Administration
lrincon@sfu.ca

Drew Parker
Faculty of Business Administration
drew@sfu.ca

Simon Fraser University
Burnaby, British Columbia, Canada V5A 1S6

Abstract: Online learning is coming of age in both postsecondary education and industry. The range of courses now offered online ranges from kinesiology to mathematics to complete M.B.A. programs. The growing popularity of online education has created a need to reduce costs without diminishing the value of the edification. In response to this need, an instructional technology concept commonly referred to as the "learning object" was born. This paper explores the learning objects concept, their value to an online education, as well as an applied outlook into the use of learning objects in an online environment. The paper concludes with a discussion on how learning objects can be integrated into a specific example of an online course.

Introduction

An online course often forces its creator to expend onerous amounts of time creating the course's lessons, assignments, and exams. This necessitates high time and cost investment (Rumble, 2001). By sharing similar learning materials the costs of an online course could be greatly reduced. Learning objects are a means of encouraging this type of collaboration.

Due to the promise of their innate simplicity and to their cost and time saving implications, learning objects have become one of the few concepts predicted to alter the landscape of learning in the near future. Groups from academics to multi-billion dollar organizations such as Microsoft are discussing and testing the potential impact of learning objects. Professors at Brigham Young University in Provo, Utah, for example, will be soon be able to develop, capture, and deliver learning objects through their own university wide system (South, Monson 2001). Microsoft's Learning Resource (LRM) interchange toolkit is a product geared towards developing and manipulating learning objects.

This paper discusses the rapidly growing topic of learning objects. First a plethora of 'learning object' definitions are reviewed as groundwork for a working definition of the learning object term. A brief discussion of the relationship between learning objects and other object-oriented frameworks is followed by a classification scheme for learning objects. The potential positive consequences of learning objects on an online education are then outlined. The practical applications of learning objects on an online environment are discussed with a particular emphasis on the construction of an online course and its components. Finally an example application of how to start to transform an online course to a learning-object based online course is offered.

Learning Objects in an Object-Oriented Framework

Another means of understanding the learning object term is to view them as object-oriented elements.

In the last decade or so object-oriented techniques have dominated the information technology community. This community defines object-oriented objects as "a self-contained entity that consists of both data and procedures to manipulate the data" (Tech-glossary, 2002). The object's data, also referred to as attributes, is used to represent important information about the object. The object's procedures, on the other hand, represent things that the object can do. For instance, a dog object would consist of attributes, such as furry hair and four legs, and would also be composed of procedures, such as barking.

In order to allow learning objects to be easily accessible, each learning object must have at least a title and/or author associated with it. Hence a learning object's *attributes* could consist of things such as a title and author. Since learning objects are modular building blocks, they must have the ability to be combined and separated. The combining and separating actions performed by a typical learning object are some of its *procedures*. Since learning objects satisfy the prerequisites of possessing both *attributes* and *procedures*, they are object-oriented objects.

Background

Nearly a decade ago Wayne Hodgins, a learning and informant futurist, gave birth to the term "learning objects." Hodgins coined the term while watching his children play with Lego. The plug-and-play and reusability characteristics of the parts ignited the idea of objects that, in a similar manner to Lego parts, could be used to build learning modules (Jacobsen, 2001).

Learning objects have since become an extremely popular topic. As a result there have been numerous groups attempt to provide a definition for what they believe learning objects to be. There currently exist hundreds of definitions for the learning objects term in the World Wide Web. With such a vast number of differing explanations, it can be a struggle to merely define learning objects let alone understand how to use them. It is easiest to view these definitions as a spectrum with those who view a learning object as an abstract *concept* at one end, and those who view learning objects as a *product* in the other.

At one end of the spectrum the Learning Technology Standards Committee (LTSC) characterize learning objects as "any entity, digital or non-digital, which can be used, re-used or referenced during technology supported learning" (LOM, 2000). This definition views learning objects as an extremely broad and abstract concept. By allowing any entity "referenced during technology supported learning" to be a learning object, LTSC allows most persons, places or things to fall under the learning object classification.

At the opposite end of the spectrum commercial vendors, such as Cisco, often provide more focused and product based learning object definitions. Vendors' definitions tend to encapsulate their, often proprietary but sometimes open standard, products. Cisco's Reusable Learning Object (RLO) is defined as "a sum of one or more Cisco Reusable Information Objects (RIO)" (Barron, 2000). A Cisco RIO is defined to be "any concept, fact, process, principle, or procedure" (Barron, 2000). The fact that each RLO is made up of one or more Cisco RIO's, and that learning object based solutions are implemented by Cisco's own "Converged Voice, Video, and Data Products" (Cisco Systems, 2001), demonstrates that Cisco's learning object's definition encapsulates their own products.

To avoid the trap of providing a very narrow definition that depends on a particular company's products, or of having a definition so abstract that even a single piece of paper could be considered a learning object, A learning object will be defined here to be:

> "A digital, reusable, modular, and easily accessible building block comprised of a *content* and an *assessment* component"

The digital characteristic constrains a learning object to something that can be distributed through some sort of electronic medium. The reusability characteristic ensures that a learning object may be produced once and reused many times thereafter. Since a learning object can be an online lesson, or merely a portion of it, the learning object must also be modular. The modularity characteristic implies that, like most building blocks of any sort, multiple learning objects can be combined into larger learning objects. Finally, learning objects must be easily accessible, so that it is possible to locate a particular one in a reasonable amount of time. The content portion of the learning object is meant to encapsulate the knowledge this object is supposed to teach. Whereas the assessment portion encapsulates numerous questions that can be used to assess that particular learning object's content.

Classifying Learning Objects

Attributes of learning objects such as title and author allow a learning object to be easily found. The type of information that allows us to classify and consequently find learning objects is called "Metadata."

Roberts and McGreal define Metadata as "data about data" (2001). In a library the information in the book catalog is a collection of metadata about books. A book's author, book name and publisher are all pertinent data to that book.

In order to satisfy the easily accessible characteristic of learning objects, it makes sense to provide metadata similar to a book's metadata. Currently the Learning Objects Metadata Working Group is creating standards that specify the metadata for learning objects (such as Title, Author, Version, Format, etc.). These standards will be crucial to the use of learning objects since they will allow learning objects to be effortlessly classified. Once all learning objects abide the metadata standards, individuals creating learning content will be able to find the learning objects they are searching for without difficulty.

Learning objects in online instruction

A working definition of the learning object term precedes an analysis of the importance of learning objects to online education. Typically an educational online content creator may spend countless hours building a single educational component. Using learning objects can help reduce the time and monetary costs associated with the repetitive construction of online and, potentially, face to face instruction. Learning Objects are able to eliminate costs by promoting content reuse and by allowing multiple and simultaneous access of the content. Additional positive side effects of learning objects include ease of use, familiarity in instructional content creation, and the potential for personalized instruction.

1. Content Reuse. The fundamental idea behind learning objects is that instructional designers can build small instructional components (or learning objects) that can be reused a number of times in different learning contexts. For example all first year calculus courses, regardless of faculty, have at least one lesson on trigonometric differentiation. Rather than have to create separate lessons on this topic for each calculus course, learning objects reusability characteristic allows the creation of a distinct trigonometric differentiation lesson from the same learning object. They may all use different examples to elaborate on the topic but, since the essence of the topic is the same, the same learning object can be used to provide a more rapid and cheaper instructional content construction than with typical online content construction.

2. Multiple and simultaneous access. Since learning objects are digital entities, they are deliverable over the Internet. As a result any number of people can access and use learning objects simultaneously (Willey, 2001). Time is saved since multiple and simultaneous access implies that when creating online lessons multiple content creators can access the same learning object concurrently.

3. Familiarity in instructional content creation. Reigeluth and Nelson suggest that when teachers first gain access to instructional materials, they typically break the materials down into their constituent parts, and then reassemble these parts in ways that support their instructional goals (1997). Since learning object's can be sequentially combined, the task of creating online content is a natural one.

4. Personalized Instruction: Individuals have differing learning needs, interests and learning styles; therefore they can benefit from instruction that is personalized to their needs. Learning objects can accommodate a learner's preference and style because of their inherent characteristics. In particular, learning objects' accessibility, ease of use and reusability characteristics promotes the use of differing instructional strategies to fit that of the learner's

Issues in Applying Learning Objects

How Are Learning Objects Intended To Be Used?

A surplus of techniques for creating and interacting with learning objects exists. The basic handling of learning objects is intended to be:

1. Allow access to learning objects in an on-demand fashion
2. Allow the creation and submission of learning objects

Building this type of interaction necessitates a repository where learning objects can be uploaded and downloaded. Due to the modular characteristic of learning objects discussed previously, our repository will contain learning objects of various granularity types. At the lowest end of the granularity spectrum, an *atomic* learning object is defined as a learning object that solely focuses on one topic. Higher-order learning objects differ from atomic ones in that they focus on more than one topic, and hence are an amalgamation of distinct learning objects. In the sections that follow various techniques for creating higher-order learning objects shall be explored.

An Application: Systems Analysis and Design

A senior undergraduate course in Business Administration has been offered both place-based and online for several years. Each has an identical set of learning objectives, but the delivery format differs in the Spring versus Summer and Fall offerings. Using the above definition, learning objectives could be categorized, learning objects derived, and the course offered more consistently in both formats and updated in a more modular fashion. First, an inventory of topics is outlined. A weekly lecture, for example, is typically made up of one to three topics, such as 'Introduction to Systems Analysis,' 'The Systems Development Life Cycle,' and 'Problem Finding and Problem Solving Methodologies' in a first week of such a course. Each topic is then stored separately with a series of attributes. In the systems analysis course, the attributes are:

- Text title(s) and chapter(s) (text)
- Online lecture notes (html)
- Face to face presentation file (MS Powerpoint)
- Weekly exercise outline (text)
- Discussion question(s) (text)
- Examination question(s) (text)
- Relevant WWW links (text listing)

A course outline, then, links a series of such objects into a repository. Each topic serves as a kernel to comprise an overall course, and seeds a course web site (another higher level object) which presents the elements relevant to the audience. Over time, multiple teachers could add elements, examples, and new links to each object, and objects could be used in different combinations for different audiences and related topical overviews.

Tools to Support Learning Objects

Standards for support, such as XML objects, have been touted as 'Learning Objects.' The concept is more a modularization of course elements than identification of a software or standard at this point, but certain tools will prove beneficial as this concept matures. No single standard has yet surfaced that will converge the concept of Learning Objects, but the formalization of the topic promises to standardize elements used to build support for a learning outcome.

A final caveat remains with the notion of 'art' versus 'science.' Support materials for courseware can be standardized and stored, but excellent support cannot guarantee excellent learning experiences. New examples constantly emerge, and different personalities teach with different approaches. A support repository containing categorized objects and methods, however, will offer us a language to communicate among different teachers of the same material, and build on past successes rather than reinventing the discussion each time. The concern of a single

References

Hodgins, Wayne. (2000). *Into the future* [On-line]. Available: http://www.learnativity.com/download/MP7.PDF

Jacobsen, P. (2001) Reusable Learning Objects [On-line]. Available: http://www.elearningmag.com/elearning/article/articleDetail.jsp?id=5043

LOM (2000). LOM working draft v4.1 [On-line]. Available: http://ltsc.ieee.org/doc/wg12/LOMv4.1.htm

Singh, H. (2001) Introduction to Learning Objects [On-line]. Available: file:///C:/Documents%20and%20Settings/lrincon.SUPERSTAR/Local%20Settings/Temporary%20Internet%20Files/Content.IE5/2EX2XZBQ/292,1,Introduction to Learning Objects

Nichani, Maish (2001) LCMS = LMS + CMS [RLOs] – How does this affect the learner? The instructional designer? Available: http://www.elearningpost.com/elthemes/lcms.asp

Dennis, Alan and Wixom Barbara. (2000) Systems Analysis and Design.

Gemino, A. (2000) Bus 362, Information System Analysis and Design: week 6 The Object Approach and the Unified Modeling Language.

Tech-Glossary (2002) "Object" Definition [On-line]. Available: http://webopedia.lycos.com/TERM/O/object.html

Reigeluth, C. M. & Nelson, L. M. (1997). A new paradigm of ISD? In R. C. Branch & B. B. Minor (Eds.), *Educational media and technology yearbook* (Vol. 22, pp. 24-35). Englewood, CO: Libraries Unlimited.

Wiley, D. A. & Nelson, L. M. (2001). Connecting learning objects to instructional design theory: A definition, a metaphor, and a taxonomy [On-line]. Available: http://wiley.ed.usu.edu/writings2.pl

Robert Toni & McGreal Rory (2001), A Primer On Metadata For Learning Objects, http://www.elearningmag.com/elearning/articleDetail.jsp?id=2031

Rumble, Greville (2001), The Costs and Costing of Networked Learning, *Journal of Asynchronous Learning Networks*, Vol5, Issue 2, September 2001. http://www.aln.org/alnweb/journal/Vol5_issue2/Rumble/Rumble.htm

South, Joseph B. & Monson, David W. (2001), A University-wide System for Creating, Capturing, *and Delivering Learning Objects*

http://www.google.com/search?q=cache:YrDs0U1dZAkC:www.aip.org/tip/INPHFA/vol-7/iss-5/p28.pdf+online+learning+is+growing+at+a+rapid+pace&hl=en
Nancy Forbes "E-Learning Advances by Degrees" The Industrial Physicist (2001)

Cisco Systems "Cisco E-Learning Technology Solutions" (2001) http://www.cisco.com/warp/public/10/wwwtraining/elearning/implement/solutions.htm

Tom Barron, ...http://www.learningcircuits.org/mar2000/barron.htm

Impact Evaluations of Corporate eLearning

Geoff Ring, Ph.D.
ICUS Pte Ltd
#1-13B, The Synergy, 1 International Business Park
Singapore, 609917
Geoffrey@icus.net

Thomas C. Reeves, Ph.D.
The University of Georgia
Instructional Technology, 604 Aderhold Hall, Athens, GA 30602-7144 USA
treeves@coe.uga.edu

Abstract

This paper describes key issues in conducting impact evaluations of corporate eLearning and reports the results of a study to evaluate the impact (including ROI) of an eLearning implementation by a large telecommunications company. The programme was designed to multi-skill over 1,000 Customer Service Officers (CSOs) using custom-designed eLearning courses that provided coaching as an integral element. The two critical business objectives of this initiative were to save training costs and to reduce training time. More were realized.

1 Key Issues in the Design of Impact Studies

Impact evaluation is the greatest challenge faced by evaluators of any type of educational programme (Reeves & Hedberg, in press). Not surprisingly, it is also the most neglected facet of evaluation. It is not easy to determine the impact of different learning approaches in any environment. There are invariably alternative explanations and influential factors for most findings such as marketing initiatives, new processes, economic conditions, internal company politics, and the like. Reeves and Hedberg (in press) recommend that it is appropriate to consider "impact" in terms of Kirkpatrick's (1994) Level 3 (Behaviour) and Level 4 (Results) as well as Phillips' (1997) Level 5 (ROI). Further, they advise "building a case" for the impact of an eLearning programme rather than attempting to demonstrate conclusive findings in a traditional scientific sense. Several factors that must be considered when designing an impact evaluation for corporate eLearning are described below.

1.1 Evaluation Decisions, Issues, and Questions

One of the first steps in impact evaluation is delineating the issues on which the impact evaluation will focus. Are you or your clients primarily interested in improvement in work performance? Reduction in costs? Increase in sales? Reduction in complaints? Greater profitability? Return on investment (ROI)? For each of the critical issues specified by you or your clients, you should identify potential decisions that must be made about these issues. For example, if the issue is reduction in costs, what decisions will be made concerning the eLearning programme if it can be demonstrated to have a positive impact on reducing cost? Will it be implemented company wide? Or perhaps marketed as an eLearning product for use by other companies? Once the decisions are identified, you will be able to define the specific evaluation questions that will be addressed. For example, what was the average time and cost of a customer service call before and after eLearning implementation? Or what is the morale of the sales training force in the wake of a large scale eLearning initiative?

1.2 Elapsed Time

Impact studies require that sufficient time has elapsed between implementation and evaluation in order to determine whether the programme had a lasting impact on learning. The specific amount of time is related to the nature of the learning outcomes. Changes in customer relation techniques are likely to show up in the bottom line sooner than changes in the mental models that workers have of good manufacturing processes. However, the longer the time

BEST COPY AVAILABLE

between eLearning implementation and impact evaluation, the more likely that there will be rival claimants to any positive results detected by the evaluation.

1.3 Sample

The sample size must be sufficient and representative (preferably random) for the study to yield valid results. Most impact evaluations utilize pre-test, post-test designs rather than the more rigorous control group designs. Few corporations have the time or resources to conduct control group studies, not to mention the liability issues that can arise in experimental approaches. Regardless of the design, sample sizes of at least 30 learners are recommended in most evaluations to permit the use of appropriate inferential statistics.

1.4 Instruments and Techniques

There are many different instruments and techniques for collecting impact data, including interviews, questionnaires, observation, self-reporting, diaries, and so forth. Regardless of what type of data collection instruments are used, they should be examined for reliability and validity. If feasible, unobtrusive data that is already routinely collected should be utilized, e.g., length of service calls or sales figures.

1.5 Data Collection

Since establishing direct causal links is difficult in education and training contexts, triangulation of data sources is the best approach to take. Triangulation involves seeking to compensate for the imperfections inevitable in any single type of measure by using multiple methods that may give you a clearer estimation of what you are evaluating. Other strategies for improving data collection include:

- allow anonymous responses to enhance validity;
- encourage high response rates to surveys and questionnaires;
- ensure subjects don't feel pressured to give 'expected' results, e.g. if surveys are distributed by the boss;
- even though most corporate evaluations occur "on-the-job," try to be as non-intrusive as possible; and
- include responses to both closed and open questions to maximise the amount (and type) of information obtained.

1.6 Interpretation of Results

It is a natural inclination to claim that any positive results stemmed from the eLearning, and that any negative, perhaps unexpected results were caused by uncontrollable factors. It is best to be cautious in your impact claims because of the number of other variables with potential impact that may not have been measured. It is especially important to acknowledge reliability limitations when placing a heavy reliance on self-reported, impressionistic data of the kind that is yielded by methods such as interviews and focus groups.

1.7 Secondary Benefits

Don't ignore relevant side effects and extra benefits. Even if it may be difficult to attribute something as concrete as increased sales to eLearning when other things are occurring (e.g., advertising campaigns), it may be enough to demonstrate that there are self-reported and supervisor-observed increases in morale among the sales staff.

1.8 Data for the Future

Instead of conducting isolated impact evaluations, it is better to collect data that is relevant to future planning and can be relied upon to inform future training decisions by the client on an on-going basis. You should keep any raw data in a database. This can help you plan for future course maintenance and updating as well as in budgeting.

1.9 Who Evaluates?

If possible, the credibility of your impact evaluation will be enhanced if you utilize external evaluators rather than internal members of the development team. At the same time, whenever possible, development team members should take part in impact evaluations so that they can observe the results of their efforts firsthand.

2 The Case Study

2.1 Background

This study collected data from a random sample of CSOs who completed two new eLearning courses: General Billing Service (GBS) and Wireless Data Products and Services (WPS). The sample is from the first few intakes of these courses that occurred between May and July, 2001. The total enrollment in these intakes (for both courses) was 155. The total number of evaluation participants was 77 and the two sample sizes were 37 (GBS) and 38 (WPS), with no overlap. Data were also collected from the supervisors of CSOs for each sample to determine whether they observed any impact of the eLearning courses on their staff. The primary issues of concern for the evaluation clients were saving training costs and reducing training time.

Data were collected via three questionnaires for CSOs and a separate questionnaire for supervisors (for each of the two courses). Subjects in the sample received the questionnaires via e-mail and responses were anonymous in that they were sent by and returned to an external evaluator employed by the eLearning provider, not their supervisor. The evaluator was also independent of the eLearning course development process.

The first questionnaire for CSOs had 15 items and asked respondents how often they used each of the specific tasks taught in the course (everyday, most days, occasionally, never). A major purpose of this non-threatening questionnaire was to put the subjects at ease with the study, a factor that can positively affect reliability. The second CSO questionnaire had 15 items and asked about impact. Specifically, it asked the extent to which respondents performed each of these tasks after the eLearning course in comparison with how they performed the tasks prior to the course (much better, better, same, worse). The third CSO questionnaire had 9 "yes/no" items and three open-ended items, and asked whether certain behaviours and attitudes had changed because of this eLearning. The supervisor questionnaires had six closed items and one open-ended item, and asked the extent to which they observed the impact of eLearning on their staff. The open-ended items in the third CSO and Supervisor questionnaires suffered from low response rates (14 and 10) and failed to provide any significant information that had not already been derived from the closed items.

The courses in the eLearning programme had clear and specific objectives. The tasks in a given course were all relevant to one specific kind of customer call. The calls were either about wireless data products and services (WPS) or billing (GBS). The WPS course addressed 18 tasks (or how to handle 18 kinds of calls). These tasks involved explaining, assisting, guiding, and helping customers. The GBS course addressed 15 tasks, including updating customer particulars, determining correct procedures, resolving complaints and disputes and advising or informing customers.

2.2 Results from CSO Questionnaire #2 (impact)

WPS Course

The four tasks with the highest percentages of "much better than before [eLearning]" responses follow. Three of these tasks are among the most frequently used tasks, which makes these results more significant.

- Explaining the benefits of using GPRS (56%)
- Explaining the types of equipment needed to access Mobile Office (48%)
- Guiding callers in setting up their equipment to access e-ideas on the WAP (48%)
- Explaining the kinds of equipment needed to use GPRS (43%)

GBS Course

The four tasks with the highest percentage of "much better than before [eLearning]" responses follow. That these tasks are among the most frequently used tasks makes the impact even more significant.

- Determining correct procedures for reconnection of services (63%)
- Negotiating with customers for agreement on partial or deferred payments (58%)
- Interpreting basic account and payment information from the customer profile (56%)
- Advising customers on suitable payment modes for paying bills (52%)

2.3 Results from CSO Questionnaire #3 (behaviours and attitudes)

WPS Course
Between 90 and 100% said "yes" to each of the following statements:

- I now know more about wireless data products and services than I did before [eLearning].
- I now have more confidence dealing with callers [than I did before eLearning].
- I feel I can give better answers to callers' questions [than I could before eLearning].
- I don't have to transfer as many calls to others as I did before.
- I share information with more colleagues than I did before [eLearning].
- If I need more information to answer a caller's inquiry, I know where to find it on my own.

GBS Course

- Between 90 and 100% said "yes" to each of the following statements:
- I now know more about general billing than I did before [eLearning].
- I now have more confidence dealing with callers [than I did before eLearning].
- I share information with more colleagues than I did before [eLearning].
- If I need more information to answer a caller's inquiry, I know where to find it on my own.

2.4 Results from the Supervisor Questionnaire

The supervisor questionnaire had six closed items and one open-ended item. This questionnaire asked supervisors whether they had observed the following changes in their staff after the eLearning courses. The closed items were:

- The staff seem to know more about wireless data products and services [or general billing] than they did before the eLearning
- They seem to have more confidence dealing with callers
- They seem to be able to give better answers to callers
- If they need more information to answer a caller, they can find it on their own
- They seem to share information with colleagues more than they did before eLearning

The WPS supervisors reported that 97% of their staff in this sample seemed to transfer fewer calls than before and 93% seem to have more confidence dealing with callers [after eLearning]. The two items with lowest impact were: seem to know more about wireless data (74%) and if they need more information to answer a caller, they can find it on their own (72%).

The GBS supervisors reported that 100% of their staff in this sample seem to be able to give better answers to callers than before [eLearning] and to transfer fewer calls than before, and that 97% seem to have more confidence dealing with callers. The two items with lowest impact were: seem to know more about general billing (72%) and seem to share more information with colleagues (86%).

2.5 Interpreting Results: Design Concerns

The fact that the subjects in the study were busy workers functioning in a very busy environment resulted in some constraints. For example, intrusive methods such as observation were not possible. With the relatively small samples represented in this evaluation, generalisations must be made with caution. However, the fact that the sample was chosen randomly ensured that the sample could be considered to be representative of the population as a whole.

A more serious concern has to do with the percentage of CSOs and supervisors in the samples who completed and returned the questionnaires. In this study, the response rate was 67% for the CSOs and 54% for the supervisors. However, the important evidence in this study seems so unambiguous that confidence in it is high despite this shortfall in the response rate.

That the evidence in the study comes from self-reported, impressionistic data has to be acknowledged. With self-reported data, reliability is often a concern. This might be more of a concern if the data were not so strongly skewed in a positive direction. Also, the collection of corroborative data from the supervisors of the CSOs in the sample provided some triangulation of data.

While there was no rigorous formal validation of the questionnaires, the data collection instruments were carefully designed to provide data that were likely to provide acceptable levels of validity and reliability. The focus of the items was narrow and the subjects were highly familiar with the tasks. In some evaluations, there is a concern that respondents will give "expected" or "socially desirable" responses instead of revealing their true feelings. This is always possible since a respondent could guess what a desirable response might be. The actual likelihood of this having occurred was minimised by the fact that the responses were anonymous and questionnaires were returned by e-mail to the independent external evaluator rather than to the subjects' supervisors.

2.6 Effectiveness of the eLearning Courses

Data from the CSOs in the sample studied showed that they felt they could handle customers' calls better after eLearning than they could before it. Data from their supervisors indicated that they observed the impact of this eLearning on these members of their staff.

The CSOs also reported that they:

- had more confidence dealing with customers than they had before eLearning
- can now provide better answers to callers' questions
- know more about the field they studied
- transfer fewer calls to others
- have made several other desirable behavioural and attitudinal changes.

In specific terms, the majority of learners in both classes felt that their performance had improved at least somewhat in almost every task taught. Between the two courses 33 relevant tasks were taught. In 30 of those tasks, the majority felt their performance had improved. The lack of ambiguity in the data does provides confidence in the conclusions and lessens any technical concerns we might have about reliability or return rates or self-reported data.

2.7 Business Results (ROI)

Three types of ROI results were reported: 1) cost savings, 2) training time savings, and 3) indirect savings. The savings shown below are based on a comparison between the costs of the total eLearning programme of four courses (the two reported in this paper and two more) and the costs of the "equivalent" instructor-led programme. Throughout the analysis, in order to be conservative, it has been assumed that 800 CSOs will take the programme rather than the 1,000 predicted. Total savings with the new programme were over SG$2M. Net savings, after deducting the costs for development of the new programme were SG$348,518.

ITEM		COST SAVINGS (SG$)
Staff productivity gain (a result of diminished training time)		828,800
Reduction in instructor costs		44,000
Training materials		19,200
Reduction in training room costs		280,000
Participant replacement costs (at 40% replacement)		808,960
Refreshments		63,200
	Total savings	2,044,560
	Less hardware & software costs	-80,042
		1,964,518
	Less development costs	-1,616,000
	Net savings	$348,518

The new eLearning courses required 25 eLearning days whereas the equivalent instructor-led courses required 39.5 days. This gave a reduced training time of 37%. For each day a staff member took the "equivalent" instructor-led course, she/he was away from the work site resulting in a complete loss of productivity. With the eLearning programme, the CSO was away from her/his workstation only twelve hours, and never for a full day. Except for these twelve hours, the CSOs took the course via the company intranet at his/her workstation. Most CSOs scheduled their learning for slow times so that down time was minimised.

Because eLearning occurred at the workstation, operational benefits resulted. eLearning time could be scheduled to suit individual needs. There was no need to provide coverage for a staff member away on a training course. Both scheduling and rescheduling of eLearning experiences was flexible and relatively easy.

The following indirect savings were not included in the ROI calculation above:

- Technology transfer: the client acquired expertise and processes to run eLearning programmes (and has since done so).
- A group of instructors has received eLearning and practice in the skills needed to function effectively as eCoaches for eLearning courses.
- A large number of the company's employees are now comfortable and competent in learning via the eLearning approach used (initially they had been quite negative) – more than two-thirds "liked learning this way" and more than three-quarters were "quite willing to receive future training using eLearning."
- The company can extend the new programme to additional CSOs without incurring additional expense except deployment costs.
- Although certain "soft benefits", such as CSOs' increased confidence in serving callers and in providing better answers to callers, are difficult to quantify and assign a dollar value to, it is likely that they will have a positive effect on the quality of service and job satisfaction.

2.8 The Bottom Line

Two critical business objectives of the company's eLearning initiative to multi-skill its CSOs were to maximise training dollars and to reduce training time. Both were achieved and the savings in eLearning costs and eLearning time were not made at the expense of quality or effectiveness.

3 Conclusion

The impact evaluation described in this paper is not intended to be promoted as the ideal impact evaluation. Instead, it is a realistic portrayal of a typical impact evaluation that can be conducted in a corporate context at a reasonable cost within a satisfactory timeframe. More extensive and more rigorous evaluations would certainly be possible, but they would also take more time and cost much more money. This evaluation was able to build a case for impact using multiple data sources as opposed to providing unassailable scientific data that the eLearning caused the observed results. We think that this will be viewed as a more viable approach in most corporate contexts.

4 References

Kirkpatrick, D. L. (1994). *Evaluating training programs: The four levels*. San Francisco: Berrett-Koehler Publishers.

Phillips, J. J. (1997). *Return on investment in training and performance improvement programs*. Houston, TX: Gulf Publishing Company.

Reeves, T. C., & Hedberg, J. G. (in press). *Interactive learning systems evaluation*. Englewood Cliffs, NJ: Educational Technology Publications.

MyLibrary: A Web personalized Digital Library

Catarina Rocha, Geraldo Xexeo, Ana Regina C. da Rocha

COPPE/UFRJ Federal University of Rio de Janeiro,
Caixa Postal: 68511 CEP: 21945-970, Rio de Janeiro- RJ, Brazil
{catarina, xexeo, darocha}@cos.ufrj.br

Abstract: With the increasing availability of information on Internet information providers, like search engines, digital libraries and online databases, it becomes more important to have personalized systems that help users to find relevant information. One type of personalization that is growing in use is recommender systems. This paper presents Mylibrary, a web personalized digital library that provides personalized services and a recommender system (RecDoc) to support the user task of finding useful information. MyLibrary offers an environment where users can store read documents in a user profile, can rate and comment these stored documents, can visualize the documents percentage rate in a chart representation, and share information with other library users. With the information stored in the user profiles, MyLibrary offers a recommender systems, RecDoc, that indicates documents based in already read documents by the user (content-based) or based in the collaboration with other users (collaborative filtering).

Introduction

The progressive growth of online information available through information services on the Internet, like search engines, digital libraries and online databases, makes people feel information overloaded. These information services provide a search and a retrieval system to the web community, but they do not provide any personalized support to individual users, or poorly support them (Amato 1999). According to (Lawrence 2000), Web search engines generally treat search requests in isolation. The results for a given query are identical, independent of the user. Consequently, few results returned by a search engine may be relevant to a user (Mizzaro 1997). Next generation search engines will make increasing use of context information from users (Lawrence 2000). One example of this attempt is the Yahoo experience in designing personalized features, presented in (Manber et al. 2000).

Providing personalized information search and delivering services, is likely to be the first step to make relevant information available to people (Amato 1999). One type of personalization that is growing in use is recommender systems.

Recommender systems improve access to relevant products and information by making personalized suggestions based on previous examples of a user likes and dislikes, or use collaborative filtering methods that built their recommendations on other users' preferences (Mooney & Roy 2000). Recommender systems have been developed in response to an actual need: helping people deal with the world of information abundance and overload. They enable people to share their opinions and benefit from each other's experience (Terveen & Hill 2001).

Digital libraries, such as others information providers, should be able to assist readers by providing personalized services and automated recommendations (Mooney & Roy 2000). Guided by this premise, a personalized environment, named MyLibrary, was developed to the Software Engineering

Digital Library. The library stores the scientific production of the Software Engineering group at the Federal University of Rio de Janeiro. The library also collects references to documents produced by related research centers, and universities.

MyLibrary provides a personalized environment where users can store read documents in a user profile, rate and comment these stored documents, visualize the documents percentage rate in a chart representation, share information with other library users and take advantage of their experiences to select documents evaluated with better rates. With the information stored in the user profiles, MyLibrary offers a recommender system, RecDoc, that indicates documents based on the premise that the user would like to have access to similar documents defined in his profile (documents already read by him) or documents that have been rated by similar users (collaboration with other users).

This paper is organized as follows: a first section that shows the Software Engineering Digital Library with information about the collection and the library search system. Then, a second section describes MyLibrary, a personalized environment based on user profiles that offers a recommender system. Finally summary and work in progress are shown.

Software Engineering Digital Library

The Software Engineering (SE) Digital Library centralizes the scientific production of the Software Engineering group at the Federal University of Rio de Janeiro and stores references to documents produced by others related research centers, and universities. The participants of the research group are professors, researchers, and MSc. and PhD students. In this educational environment, a library is useful to maintain an updated bibliographical collection, and to provide courses' materials. Besides, the library is available online on the Internet, so the students can search the collection to support their research activities anytime and anywhere.

According to (Entlich et al. 1997), the most important characteristic of a digital library is its collection, whose main requirement is the selection of qualified materials. Thus, the SE group opted to maintain a manual control of documents selection and classification. They use a catalog system available at the library to register and classify documents. The library collection is composed of congress articles, journal articles, thesis, technical reports, books, and technical standards.

The SE digital library search system is based on specific fields of this type of application, such as title, author, and keyword. Besides, other search options was added to library search system to attend educational requirements of this research group, for example, search by course, by project, and by conference. All search options of the library is represented in (Figure 1). The main search interface showed in this figure is the search by keyword option where the user can combine a group of keywords or can select a keyword in the library keyword list.

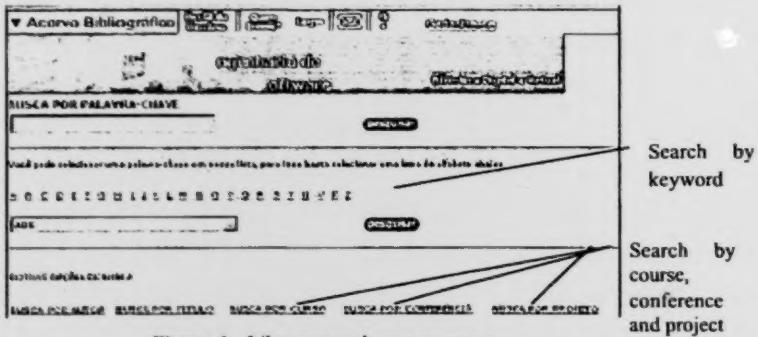


Figure 1 - Library search system screen

BEST COPY AVAILABLE

According to actual needs, digital libraries, like others information providers, should offer personalized functionalities and delivery services. Guided by this premise, a personalized environment (MyLibrary) and a recommerder system was developed to the SE Digital Library. MyLibrary is described in the following section.

MyLibrary: a personalized environment to the SE digital library

Concerned to provide personalized services to the SE Digital Library, the first step toward personalization was the addition of a user profile to represent user information needs. The second step was the development of a recommender system that manipulates the user profiles to find relevant information. The resulting personalized environment, MyLibrary, is available only to registered users. The library search system is still available to any user that accesses the library, as ilustrated in (Fig. 2). This figure also shows MyLibrary architecture.

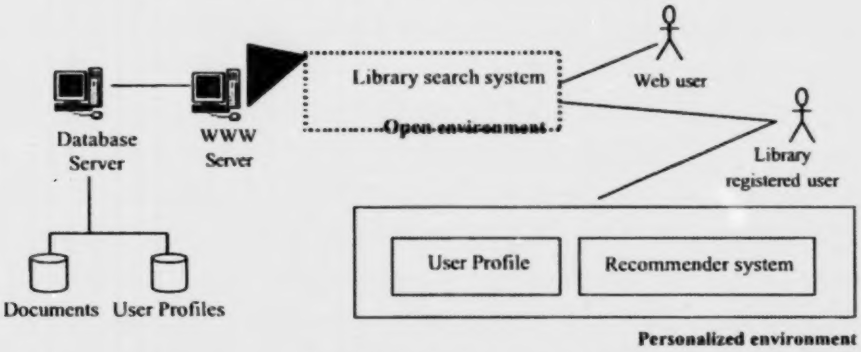

Database Server
WWW Server
Library search system
Open environment
Web user
Library registered user
Documents
User Profiles
User Profile
Recommender system
Personalized environment

Figure 2 - MyLibrary architecture

The *Web user*, not registered at the library, has access to the environment called "open system". Through the open system, the user interacts with the library search system, querying documents by title, author, keyword, course, project, and conference.

The *DL registered user* has access to the personalized environment and the recommender system. There are two databases composing the library: Documents database that stores all documents; Profiles database with the user profiles representation.

MyLibrary embraces personalized services, such as keep document in the user profile, rate and comment these stored documents, and send a document to a friend by e-mail, as shown in (Fig. 3). This figure also represents the document description, average rate, a graphical representation of all rates for the document, and a list of comments made by the users.

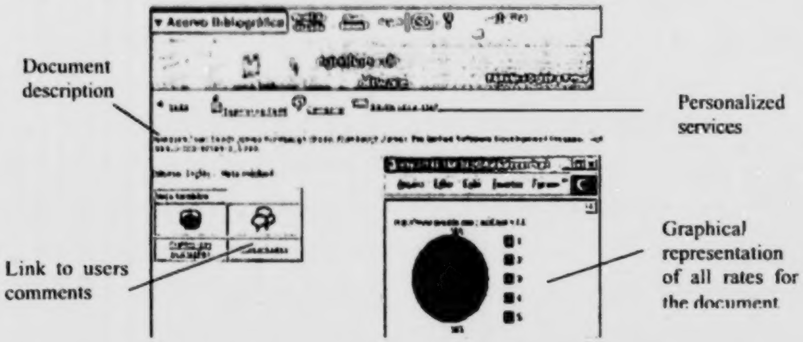

Document description
Personalized services
Link to users comments
Graphical representation of all rates for the document

Figure 3 – Document description and personalized services at MyLibrary

BEST COPY AVAILABLE

With the documents evaluation, a average rate can be associated to documents and displayed in the list of documents returned by the library search system. A user can takes advantage of others users experience to choose better rated documents in this list. Besides, the users' comments are showed when the document is selected in list, as illustrated in (Fig. 3).

User profile

A user profile schema to digital libraries, proposed in (Amato 1999), was adapted to MyLibrary according to particularities of the SE Digital Library. The resulting profile schema is showed in (Tab. 1) below, and includes all information to be represented in the user profile.

Personal data category	• Name, e-mail, password and user occupation (student, professor, etc.)
Gathering data category	• A user keyword list that represents user interesting area. • Digital documents are available in PDF format. • The user only query the library database.
Delivering data category	• Delivery mode: the system sends an e-mail to the user suggesting new interesting documents. • Delivery time: the recommended items is available in the personalized environment when the user enters the system.
Actions data category	• Stored read documents. • Rated documents (from 1 to 5) • User relevance feedback (the users explicit rate documents and recommendations).

Table 1 - Mylibrary user profile schema

Initially, the profile is created when the user submits a registration form available at the library. This form contains information about personal data, academic data, and a list of keywords. While the user interacts with the library search system, stores documents in the user profile, submits rates and comments about them, the profile has been continually updated. The list of read documents and their evaluations are available at the user profile, as illustrated in (Fig. 4).

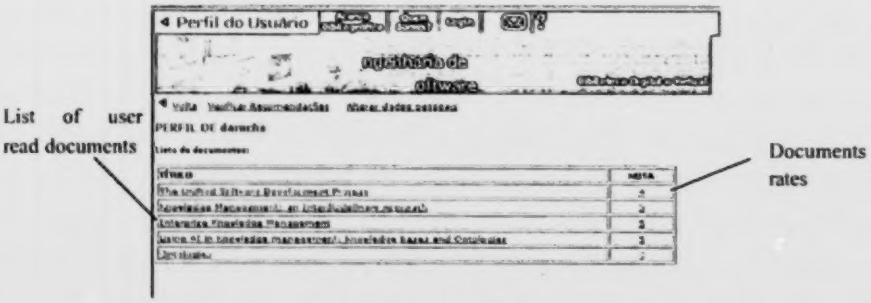


Figure 4 - User profile screen

With the information stored in the user profiles, a delivery service has been implemented through a recommender system named RecDoc. The system is described in the section below.

BEST COPY AVAILABLE

RecDoc: Document Recommender System

Having emerged in response to technological possibilities and human needs created by the WWW, recommender systems aim to mediate, support and automate everyday process of sharing recommendations (Terveen & Hill 2001). There are two main recommendation systems approaches (Balabanovic & Shoham 1997): content-based and collaborative filtering. In the content-based approach, the document recommendation is done through comparison of similar documents to those the user has already seen and rated . The collaborative approach explores techniques for matching people with similar interests and then making recommendations on this basis (Sarwar et al. 2001).

Content-based approach has its origins in the Information Retrieval research community and employs many of IR techniques and algorithms. Content-based recommenders believe in the intuition "find me things I have liked in the past". Documents are recommended based on the comparison between their content and user profiles (Balabanovic & Shoham 1997). Systems that use this approach are InfoFinder and NewsWœder (Lang 1997).

Recommendation systems adopt collaborative filtering based on the premise that people looking for information would like to know what other people already found and evaluated. Systems that use this approach are GroupLens (Resnick et al. 1994), Fab (Balabanovic & Shoham 1997) and Firefly .

RecDoc uses hybrid approach taking advantage of these two approaches: content-based and collaborative. The Fab system, developed by Stanford University, also uses the hybrid approach for recommendation of Web pages.

RecDoc provides to the user:

1. to receive, for each database update, new documents that are interesting to the user trough the comparison between the document keywords and the user profile (**content-based approach**).
2. to receive documents rated by similar users (**collaboration approach**).

RecDoc applied one K-nearest neighbor algorithm to perform the collaborative filtering recommendation. These algorithm is one of the most successful recommendation technique to date on the Web (Sarwar et al. 2001).

Every time that RecDoc indicates a document, the user is suggested to evaluate the recommendation, accomplishing what is called relevance feedback. Accurate profiles are so much important in the content approach (to guarantee appropriate recommendations) as in the collaboration approach (to guarantee that users with similar profiles are really similar).

Summary and Work in progress

This paper presented the SE Digital Library, available on the Internet. The library has been in use to support activities and courses of the software engineering research group at the Federal University of Rio de Janeiro.

Then, MyLibrary a personalized environment based on user profiles and a recommender system (RecDoc) was described. RecDoc is an implementation of a hybrid content-based/collaborative document recommender system. The recommendation of documents seems to be a useful service to deliver relevant information to the library users.

At this moment, a prototype of RecDoc has been evaluated trough a testbed database.

876

References

1. Amato, G., Straccia, U. (1999). User Profile Modeling and Applications to Digital Libraries. Proceeding of ECDL Conference, Paris.
2. Lawrence, S. (2000). Context in Web Search. IEEE Data engineering Bulletin, 23(3): 25-32.
3. Mizzaro, S. (1997). Relevance: the whole history. Journal of American Society for Information Science, 48(9):810-832.
4. Manber, U., et al. (2000). Experience with Personalization on Yahoo!. Communications of ACM, volume 43(8): 35-39.
5. Terveen, L., Hill, W. (2001). Beyond Recommender System: Helping People to Find Each Other. Proceedings of HCI in the New Millennium, Jack Caroll, ed., Addison-Wesley.
6. Mooney, R., Roy, L. (2000). Content-based Book Recommending Using Learning for Text Categorization. Proceedings of ACM Digital Libraries, pp.195-204.
7. Entlich, R. et al (1997). Making a digital library: the contents of the CORE project. Communications of ACM, 15(2).
8. Resnick, P., Varian, H. (1997). Recommender Systems. Communications of ACM, 40(3).
9. Resnick, P. et al (1994). GroupLens: An Open Architecture for Collaborative Filtering of Netnews. In proceedings of ACM Conference on Computer-Supported Cooperative Work.
10. (Balabanovic & Shoham 1997) Balabanovic, M., & Shoham, Y., Fab: Content-Based, Collaborative Recommendation. Communications of the ACM, 40(3): 66-72.
11. Sarwar, B., et al. (2001). Item-based Collaborative Filtering Recommendation Algorithms. In: proceedings of WWW10 Conference.
12. Lang, K. (1997). NewsWeeder: Learning to Filter NetNews. In Machine Learning: Proceedings of the Twelfth International Conference. Lake Tahoe, California: Morgan Kaufmann.
13. Shardand, U., & Maes, P. (1995). Social Information Filtering: Algorithms for Automating "Word of Mouth". In Proceedings of the CHI-95 Conference, Colorado.

An Agent Architecture for Asynchronous Learning

Stephen Rochefort
Department of Electrical and Computer Engineering
University of Calgary
Calgary, AB T2N 1N4
rochefor@enel.ucalgary.ca

Abstract: Education delivery systems have evolved from content delivery mechanisms to collaborative environments. The next step in this evolution is to provide greater support for asynchronous learners, those that progress through course material with little or no support from the instructional team. The integration of web technologies with artificial intelligence techniques and multi-agent environments provides an architecture that supports the development of asynchronous-based systems. Autonomous agents are capable of providing ease of use and guidance through the introduction of natural language interfaces, knowledge processing, inferential reasoning and interactive wizards.

Introduction

Research and the application of distance education techniques has been the center of much attention in recent years. Numerous educational institutes are now providing some form of distance education curriculum. For example, Athabasca University in St. Albert, Alberta uses networking software to offer correspondence degrees. Memorial University in Newfoundland offers courses using audio-conferencing with computer linkups. Video-conferencing is also widely used since Queens's University in Kingston, Ontario, pioneered its use for a master of business administration program.

Distance education technologies have progressed from the user of paper materials to audio and video conferencing to Internet delivery, with many variations in between. The latest technology, the Internet, provides up-to-date materials retrievable instantly on-line from sources across the globe.

Advancements in the use of the Internet for distance education have focused on the publishing environment that the World Wide Web has become. Instructional teams are able to make course materials available on-line. More recent advancements have delved into supporting advanced pedagogies based on the principles of active learning, collaboration, multiplicity, and knowledge building (Harasim, 1995; Harasim, 1996). These educational systems facilitate course design, management, and evaluation, by providing software to enter and maintain, for instance, grade information or shared documents. They also provide virtual conferencing facilities, which allows for messages to be broadcast to virtual groups, which then can be organized by reply threads in order to follow up on a given discussion subject. Paramount behind these concepts is the idea of engaging learners in cooperative rather than competitive pursuit of knowledge.

Unfortunately, education delivery through the Internet stills falls short of the great possibilities that exist. There are two essential extensions that are required to harness the medium. First, current systems have little or no support for asynchronous learners who require support that enables them to find their own solutions and approaches to learning the course material. Second, communication in distance delivery systems still proceeds on an individual-to-computer basis with the learning software in charge of organizing the communications into coherent threads that the users can consult individually. Simultaneous interaction between various students and teachers is simulated and mediated, rather than facilitated, by the software.

This paper describes an architecture for Internet-based education delivery systems that provide asynchronous learner support and facilitated interactions. This architecture makes use of a distributed and mobile, multi-agent system, using artificial intelligence techniques. The architecture has been implemented and tested in the Logic Programming in Education for Asynchronous Learning Environments (LPed ALE) system.

LPed ALE

The Logic Programming in Education for Asynchronous Learning Environment (LPed ALE) system is a full distance education delivery tool (Rochefort & Dahl, 1999; Rochefort et al, 2000). It provides standard education delivery facilities such as content delivery, communication, and course management and evaluation. Beyond these basic features, LPed ALE provides tools that support asynchronous learning through real time communication, a natural language interface allowing the user to control the tools with natural language, concept based searching and indexing, and interactive software agents that work with the user in their activities in the system.

LPed ALE expands previous work on the LogiMOO virtual world for distributed group-work over the Internet (Rochefort et al, 1998). These systems integrate web technology, via the Java programming language, and artificial intelligence techniques, via the Jinni logic programming language (Tarau, 1999). The integration allows for greater support of natural language interfaces, knowledge processing and interactive student assistant wizards. The use of artificial intelligence techniques allows for the development of systems that provide a more interactive and supportive environment for asynchronous learners. Furthermore, these techniques allow knowledge about the interactions to be captured and used to guide the learner through their experiences within the system.

The natural language interface uses a controlled subset of English that is translated into commands that are executed in the environment (Rochefort et al, 1997). Natural language processing techniques such as anaphora, relatives and multi-sentential input through an original mechanism, Assumption Grammars (Dahl et al, 1996; Tarau et al, 1996), enable the system to keep contextual information about the user's interactions and customize responses and queries to the user.

Concept-based hierarchies are used to index source and, in turn, allow the user to query the system for information. When a user queries the system through the natural language interface, concepts of interest are extracted from the semantics of the text and then matched to concepts listed in the index hierarchies. Sources that match a user's interest and intent in the query are then presented. Concepts can further be generalized or specialized to assist in locating relevant information.

Interactive student wizards are provided through agent technologies. These mobile software robots provide asynchronous support by traveling to student computers to interact with the student, receiving queries and determining appropriate responses, and interacting with the student to solve their problem(s). The agents are capable of traveling to course machines in order to process knowledge bases and to locate information and answers to student queries.

Supporting Asynchronous Learners

The basic components of an educational environment include ease of communication, ease of presentation, and ability to expand. For a cooperative learning environment, these basic components are extended with multi-user capabilities and interactivity. For asynchronous learners, there must be support for guiding students through a learning path with little or no interaction from the instructional team.

The abilities to organize shared information intelligently and to provide guided and response system support are paramount for the feasibility of such objectives. Systems that do not possess any kind of inferential capability ultimately fail the task. Logic programming, or other automated deduction mechanisms, will come to be recognized as the necessary way to extend educational delivery systems.

LPed ALE provides the basic components of educational environments through the web-based facilities that support extensible material presentation. It also supports collaborative work, allowing students working on the same project to interact amongst themselves and the instructional team. Asynchronous support is offered in LPed ALE through a system of collaborating and mobile agents.

LPed ALE implements asynchronous support through various features. The natural language interaction hides the complexities involved in interacting with a large software system and it encourages conversation interactions which can later be extended to voice-based interactions. A frequently asked questions (FAQ) knowledge base allows students to ask and receive answers in an automated way. The student assistant agents is a mobile software robot that interact with students to lead them down a path of learning and uses mobility and collaborative techniques to assist the student. An instructional assistant agent is used to administer instructional goals, such as interactive examinations, to a group of students.

LPed ALE Architecture

The LPed ALE system is a web-based, collaborative multi-agent environment implemented in Jinni (Tarau, 1999), a lightweight, multi-threaded, logic programming language, intended to be used as a flexible scripting tool for gluing together knowledge processing components and Java objects in distributed applications. Jinni allows the web-based components and the artificial intelligence components to be isolated. The result is that static aspects of the system such as the user interface are created only once in Java while the dynamic aspects of the system such as the agents, which are implemented using artificial intelligence techniques, can be updated while the system is executing.

Multi-Agent Systems

Agent and Multi-Agent Systems (MAS) are a new software development paradigm where the principle idea is that software systems can be broken down into small, efficient, and autonomous software robots. These agents work on behalf of a user to solve more complex computing problems than those achieved by more conventional algorithmic programming. An inherent characteristic of MASs is the spatial and temporal distribution of processing knowledge.

Agent systems have advanced from the basic notions of beliefs, goals, plans, roles, and groups. The intent is that agents are "individuals" that have goals and responsibilities that are accomplished in an autonomous nature. In order to accomplish goals, agents make use of knowledge about themselves, other agents and the environment in which they exist in order to develop beliefs, plans, and roles.

Distance education delivery systems can benefit from multi-agents systems because of their inherent nature of distributed processing and knowledge. The use of agents creates a partnership with the learner and together the two can address learning issues encountered in asynchronous learning. In order to take full advantage of multi-agent systems, education delivery systems require an architecture that supports the various aspects of asynchronous learning.

Education Delivery System Architecture

The LPed ALE multi-agent system architecture (Figure 1) consists of three main components. A Java manager application executes on course servers to provide services to the instructional team including content delivery, student management, and agent configuration. On each student machine, a Java manager application provides a portal for the student to retrieve course materials, complete course assignments and interact with system agents. The third component consists of the mobile, collaborative agents that provide asynchronous learner support.

LPed ALE Manager Applications

The *Site Manager* is a Jinni process managing a blackboard of information related to all course sites and student sites that exist. In either case, when a course site becomes active to offer its contents or when a student comes on-line, these two types of sites must register with the Site Manager. This effectively makes the Site Manager a global "phone book" of all course sites and student sites currently active. Once a site has registered with the Site Manager, it can participate in all networked activities. This includes information access, mobile agent interactions, and chat.

The Site Manager must be located on a computer that makes accessing optimal. This could be a remote machine unrelated to a specific course site or student site but typically it would be the main site where an institution would set up its courses.

The *Student Manager* is a Java process responsible for providing access to core activities that a student would require to use the system. This process is located on a networked computer set up to interact with web-based delivery sites. A Student Database is kept on the same site to store all information collected during student activities (student notes, communications, agent interaction results) as well as maintaining a student profile. A student profile contains information specific to the student including login parameters, course enrollment identification, along with data on student activities.

The Student Manager provides a controlled natural language interface through a web-browser. This interface allows students to interact with the system using a natural language such as English. A natural language interface enhances the point and click nature of the interface. This provides students with the opportunity to interact and directly manipulate the environment.

The activities that can be performed through the Student Manager include:

- Course registration/deregistration/login/logout.
- Course participation (accessing and participating in course activities).
- Support agent access.
- Chat.

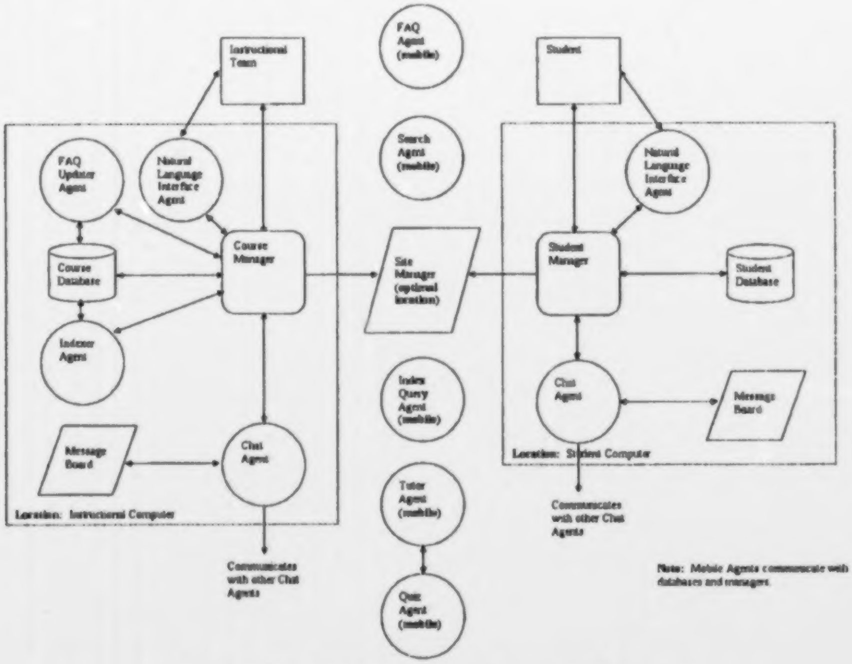

Instructional Team
FAQ Agent (mobile)
Student
Search Agent (mobile)
FAQ Updater Agent
Natural Language Interface Agent
Natural Language Interface Agent
Course Database
Course Manager
Site Manager (optional location)
Student Manager
Student Database
Indexer Agent
Index Query Agent (mobile)
Chat Agent
Message Board
Message Board
Chat Agent
Location: Student Computer
Location: Instructional Computer
Tutor Agent (mobile)
Communicates with other Chat Agents
Communicates with other Chat Agents
Note: Mobile Agents communicate with databases and managers.
Quiz Agent (mobile)

Figure 1: LPed ALE Multi-Agent System Architecture

The *Course Manager* is a Java process responsible for providing access to the core activities that an instructional team would be involved in to set up and administer a course site. This process is located on a networked computer set up to deliver web-based material. A Course Database is kept on the same site to store all information about the course(s) (lecture notes, demos, frequently asked questions, instructional team profiles, and any links to information resources) as well as maintain information related to course statistics, and student grades and profile information.

Each course on the course site is given a course profile which provides links to the different components of the course information set. This profile is also used to store statistical information such as timestamps indicating the last update and page access information.

BEST COPY AVAILABLE

The Course Manager includes a controlled natural language interface that allows the instructional team to interact with the support agents (FAQ, search, etc.) just as a student would. This is useful for testing facilities from a student's point of view.

The activities that can be performed through the Course Manager include:

- Course creation and management.
- Course enrollment.
- Grade management.
- New course material indexing.
- Frequently Asked Questions knowledge base update.
- Support agent access.
- Chat.

LPed ALE Agents

As described in earlier, agents are modules of software, situated within a computing system, that are knowledgeable of the environment and their responsibilities within that environment, and are capable of autonomous actions to accomplish goals. Within LPed ALE there are numerous agents, implemented in Jinni, interacting with the external entities, databases, and managers. The agents have a key role in providing assistive support to all external entities (i.e. the instructional team and students).

The *Natural Language Interface (NLI) Agent* is responsible for tokenizing and parsing controlled natural language input, in the form of English statements, into system commands and then invoking those commands. This agent exists in both the course application alongside the Course Manager and in the student application alongside the Student Manager.

The NLI Agent communicates with the respective manager, which maintains a kernel of commands, to invoke system commands. These invocations can then lead to information being retrieved and displayed or agents being activated or deactivated.

The *Chat Agent* is responsible for processing incoming and outgoing chat messages. Incoming messages received from other Chat Agents are placed on the *Message Board* until they are processed. When they are processed, the Chat Agent presents the incoming messages to the user through the web browser interface. These messages are formatted to show the sender of the message.

Outgoing messages from the User are stored on the Message Board until they are processed. At processing, the Chat Agent looks up the recipient of the message through the Site Manager and then the message is passed to the respective Chat Agent at the recipient's site.

The *Message Board* is a process managing a local blackboard of chat messages. This blackboard stores the messages being sent from and sent to the local user. These messages are managed by the Chat Agent. All messages are stored with sender and receiver information to make identification easy.
The *Frequently Asked Questions (FAQ) Agent* is a mobile agent that processes queries on a FAQ knowledge base. A user activates the FAQ agent through the respective manager's NLI Agent by asking a question in a controlled form of English. The NLI Agent will parse the question and log it with the FAQ Agent through a system command in the respective manager.

When a FAQ Agent receives a query, it parses the query and then searches for related questions in the FAQ knowledge base. When a match is found, corresponding answers are retrieved and returned to the respective manager which then displays the results.

The FAQ knowledge base stores representations of questions in categories based on their relevant topic. The relevant topic is the key to making a match between the user's question and the question-answer pairs stored in the knowledge base. The result returned to a user will be all question-answer pairs that correspond to the topic of the user's question.

The *Search Agent* is a mobile agent that receives queries via the NLI Agent and the respective manager. When a query is logged with the Search Agent, the agent will return to the Course Manager to compare the search parameters with the categorization of course documents stored in the course database. The resulting matches will be returned to the respective manager to present the user with a list of links that correspond to related documents. These links are presented in the web browser portion of the user interface thus allowing the user to click on the link and load the respective document.

The *Index Query Agent* is a mobile agent that is used to provide concept hierarchy information to requesting users. The Course Database contains a concept hierarchy related to the specific course. This hierarchy ranges upwards in a computing science tree fashion with generalized concepts while ranging downwards with specialized concepts.

Users can make controlled English requests for a generalization or specialization of a specific topic. In the case of generalization the Index Query Agent returns the parent of the specified topic. In the case of specialization the Index Query Agent returns a list of child concepts.

The *Tutor Agent* is a mobile agent responsible for interacting with a user through a question-answer paradigm. The user is able to make queries of the Tutor Agent via the NLI agent and the respective manager. When the Tutor Agent receives a question, it parses it and determines a course of action and where possible solutions may exist. The agent then moves to and interacts with the Course Manager and other agents to resolve the requests. The interaction between user and Tutor Agent continues until the user asks the Tutor Agent to deactivate.

The Tutor Agent acts as a facilitator of the other agents. Dependent on the query, the Tutor Agent may communicate with one or more of the other support agents in order to provide answers and further interaction.

The *Quiz Agent* is a mobile agent responsible for delivering quizzes to students. The quizzes are configured by the instructional team. A set of questions can be entered by the instructional team. Then the team constructs a test by assigning a set of questions to a test. Finally, the team can identify which students are to take which test.

Once the quiz agent has been configured, it waits for specified students to log in. When a student logs in and they are required to take a quiz, the Quiz Agent activates and starts a quiz.

When a student is taking a quiz the agent receives answers from the student and compares their answer to the correct answer. If the answers match, the agent continues with the next question or ends if there are no more questions. If the answers do not match, the quiz agent communicates the topic of the question to the Tutor Agent that then activates and starts an interaction with the student. When the student is done interacting with the Tutor Agent, and hopefully has a better understanding of the particular topic, the Quiz Agent resumes with the next question.

Status of the LPed ALE System

The LPed ALE system is a fully operational system with an implementation of the aforementioned architecture and agents integrated into the core distance delivery system. The system has been tested on a small subset of students from an Introduction to Computer Science class. Preliminary results indicate that students have a preference to the LPed ALE system over static delivery systems because some of their basic knowledge discovery questions and concerns could be handled by the system using the natural language interface and the supporting agent infrastructure. The results also indicate a need for a more elaborate support mechanism including handling exploratory questions in topical areas related to the core course materials, providing flexibility in the exploration scenarios, and providing a more robust set of semantics in the natural language interface.

Conclusions

The LPed ALE system is an implementation of a multi-agent system architecture. With the advent of autonomous agents, educational delivery systems will see a greater support for asynchronous learners. These agents will interact with and guide students as they progress through the learning process. They will act as surrogates for the instructional team providing answers, advice, and direction.

The future of systems such as LPed ALE will involve the exploration of agent usability. If a platform can be provided that enables end-users, such as the instructional team, to program the agents without the need for highly specialized training we could expect a fundamental change in the use of the educational delivery systems. If we consider the potential of a large population of instructional members and institutes capable of programming agents in these systems, we can expect a significant increase in the quality and the use of such systems..

It is through the development of easy to use multi-agent systems that educational environments can be expanded to support the natural learning behaviors of distance students. The use of artificial intelligence techniques is key to extended educational systems because of the intrinsic knowledge processing nature. Since course delivery is the passing of large amounts of knowledge it only makes sense to use tools that can manipulate the knowledge effectively.

References

[1] Dahl, V., Fall, A., Rochefort, S., and Tarau, P. (1996). *A Hypothetical Reasoning-Based Framework for NL Processing.* 8th International Conference on Tools with Artificial Intelligence.

[2] Harasim, L., Calvert, T., and Collings, D. (1996). *A Networked Learning Environment for Continuing Engineering Education*, The Professional Engineer, 47.

[3] Harasim, L. (1995). *The Virtual University: New Approaches to Higher Education in the 21st Century*, Australian Society for Computers in Learning in Tertiary Education Conference.

[4] Rochefort, S. and Dahl, V. (1999). *LPed ALE: An Application of Logic Programming in Distance Education.* International Conference on Logic Programming, Workshop on Distributed and Internet Programming with Logic and Constraint Languages, Las Cruces, New Mexico.

[5] Rochefort, S., Dahl, V., and Tarau, P. (1998). *A Virtual Environment for Collaborative Learning.* Systematics, Cybernetics, and Informatics, Orlando, Florida.

[6] Rochefort, S., Dahl, V., and Tarau, P. (1997). *Controlling Virtual Worlds Through Extensible Natural Language.* AAAI Symposium on Natural Language Processing for the World Wide Web, Palo Alto, California.

[7] Rochefort, S., Dahl, V., and Tarau, P. (2000). LPed *ALE: New Trends in Asynchronous Learning.* 6th International Conference on Information Systems Analysis and Synthesis, Orlando, Florida.

[8] Tarau, P. (1999). *Prolog Interpreter in Java: Jinni – Online Documentation.* Binnet Corporation. Note: http://www.binnet.com/Jinni.

[9] Tarau, P., Dahl, V., and Fall, A. (1996). *Backtrackable State With Linear Affine Implication and Assumption Grammars*, Proceedings of Asian Computing Science Conference.

Why web pages annotation tools are not killer applications? A new approach to an old problem.

Marco Ronchetti and Matteo Rizzi
{marco.ronchetti, matteo.rizzi}@dit.unitn.it
Dipartimento di Informatica e Telecomunicazioni, Università di Trento
38050 Povo (T N) - Italy

Abstract

The annotation of web pages, and the possibility to share the notes with others, seems to be a powerful tool for an e-learning environment. Although several tools already provide such possibility, they are not widely popular, as one would expect them to be. We try to explain this fact, and propose a novel architectural approach that is, in our view, particularly suited to e-learning. We also present a tool that implements the proposed architecture.

Introduction

The idea of annotating Web pages is not a new one: early proposals date back to 1994, i.e. more or less to the pioneer-age of the WWW. Such functionality is appealing because it stresses the interactive character of the Web (that is most cases is instead sadly becoming more and more like a TV, where the highest level of "interaction" is to zap to another channel). Many uses can be supported by this functionality, so it is rather surprising that the idea did not have a large degree of success.

In particular, a tool providing the ability to add notes to a web page, and to share the note with other users seems to be particularly well suited to an e-learning environment. In fact, e-learning platforms aim not only at providing content to the student: in order to be effective they must support the learning process. For this reason virtually every e-learning suite provides at least some tool for asynchronous collaboration, like bulletin boards etc. Very often however these tool offer a poor degree of integration with the content of the e-courses. In many cases discussion among the "actors" (students and teachers) is carried on a forum: the forum though is a different tool, so it is separated from the presentation material. While sometimes this is perfectly acceptable, in many cases it is rather inconvenient since the discussion happens out of context, and many external references are necessary, making the whole process rather cumbersome.

Annotations on a Web page could in many cases be used instead of forums. A forum is certainly very well suited for the discussions of broad topics (as the metaphor implicit in the name implies). In many cases however the emphasis is on clarifying a point in a lecture. For instance, in the context of a programming course students are likely to discussing the code presented in an electronic lecture: in those circumstances, continuous references to "line X of code Y on page Z" make the writing and reading of the notes an exhausting task. Some discussions might even start using notes, and then move to forums. In other cases a discussion on a forum might be supported by notes included on a web page: we therefore see an interesting potential in using annotations.

Other uses might include assignments to the students that are published though a web site: in such a case the teacher could grade the assignment adding notes to it.

Yet another use could be a collaborative work made by students who cooperate producing a report: notes could be used in the same way, as revisions are possible using tools like MS Word.

Given the richness of scenarios that could be supported by web annotation, it is really puzzling that the tools publicly available on the web do not encounter more favor. In fact, since the early web years, sever projects have produced various tools for annotating pages. A list of them can be found on the "Collaboration, Knowledge Representation and Automatability" page of the W3C [COL], and a comparison among several such tools is available in [GAR].

We believe that lack of a wide success can be probably traced to a few different factors. On the one hand, too much a broad scope for an idea can be counterproductive: it is often better to address specific needs in a precise way rather than offering general support for a rather vague functionality. Most tools try to solve the problem of "annotating whatever page you want, wherever it is", and, to our knowledge, do not try to address a specific domain.

BEST COPY AVAILABLE

Another factor might be the absence of a ripe technology, that forces to use hacks ending up with a rather clumsy product. Early efforts were certainly penalized by the absence of a suitable technology. The resulting (annotated) pages were rather heavy, for instance using frames for showing the notes, or di add the annotations as footnotes, making the reading of the page sub-optimal.
Recent attempts (e.g. [KOI]) try to leverage the newest technologies, like the Resource Description Framework (the RDF specifications [RDF] provide a lightweight ontology system to support the exchange of knowledge on the Web), and use the notion of Xlink [XLI] and Xpointer [XPO]. Such a road, although very interesting and probably correct on the long run, makes however the deployment of the tool now (and in the next few years) almost impossible: the only browser that supports such choices today is, to our knowledge, the experimental browser of W3C: Amaya [AMA].
In the light of these considerations, we revisit the idea of web pages annotation. We restrict the focus to the domain of e-learning; we examine the existing software architectures supporting the annotations, and propose a different architectural approach. We also examine the technology that is available *now* in a *standard* way to obtain a user interface that is suitable for our application domain. We also set as a requirement the possibility of integrating our proposed approach in (virtually all) e-learning platforms. Finally, as a proof of concept, we implement a portable tool that allows introducing annotations in existing e-learning systems.

Software architecture: possible alternatives

The annotation tools that are available today are based essentially on two alternative architectures. The first possibility is to modify the behavior of the browser, so after fetching a regular URL and rendering the related document, it allows writing notes that can be stored locally, or on a separated web server. Similarly, for every page it can enquiry the (local or remote) notes repository, and visualize existing notes with the document. The approach is certainly interesting, since it completely de-couples the original material from the notes. The choice of having the notes stored locally is limited, since it doe not allow to interact with other people. The main limit of this approach is that modifying a browser is not a trivial task: the best solution could be one based on the notion of plug-in. However this would require maintaining different plug-ins for different browsers, and even for different implementations of the same browser (e.g. Windows vs. Mac vs. Linux, or version 5 vs. version 6).
The second major architecture is based on the concept of an "Annotation-server". The idea is to have an intermediate web server (proxy) that gets the requests, forwards them to the page server, gets the response and decorates it with the notes. Similarly, the proxy accepts the new notes and stores them. This architecture has some major advantages: it does not need a customized browser, and still preserves the separation between notes and content. However, the requested URL must be coded in a special way: "http://url_of_the_proxy?//http://url_of_the_resource": "real" URL is passed as a parameter to the proxy server. This can be an advantage (the same URL can be annotated through several proxies unaware of each other) but is also rather annoying, since every URL has to be "preprocessed" by the user in order to obtain the desired behavior. Moreover, following a link from a page does not pass through the annotation proxy, unless the proxy itself does not take the rather heavy burden of parsing all pages it delivers in order to suitably change all referenced URLs.
A third approach (not found in literature) could be possible: the Annotation-server could be registered by the user as the standard proxy used by the browser. In such way all requests pass through the Annotation server, and the problem of explicitly coding the URL would be completely solved. This solution is simple and brilliant, but it collides with the typical notion of a Proxy (a *local* machine, typically used for optimizing the network traffic, and often employed also for by-passing a local firewall).
By examining these architectures, one finds that the common denominator is the separation between the content server and the annotation server. This choice has obvious advantages:

a) the content server needs not to be aware of the existence of the annotation server;
b) one can define multiple annotation servers, supplying notes to (possibly closed) groups
c) it is possible to annotate just about every resource available on the web.

However, the limited success of the existing system witnesses that the balance problems overcome the advantages: some companies that offered an annotations as a commercial service discontinued their offering [THI].
We therefore think that it is worth revising the fundamental choices. In particular, we try to drop the nice but ambitious idea to be able to annotate any possible page. We focus on an e-learning platform that typically gets the (main) content from a limited number of servers (very often just one): our goal becomes therefore to be able to annotate only the pages of these servers. At this point, even the separation between annotation server and content server becomes less relevant, and we can concentrate

the whole job on the same server. This approach does not require a customized browser neither needs to pass through an intermediate server, relieving both problems encountered above. The last problem to be solved is to make the look and feel of the pages appealing, and to integrate the two functions (providing content and notes) in the same server.

The solution we suggest is to add the annotation functionality to a web server as Java servlets [SER]. Servlets are platform independent, and are supported by virtually every Web Server available on the market. The servlet gets the request for a page, locally searches a database that stores the notes, and builds an annotated page that is served back to the user. Similarly, another servlet gets new notes and stored them in the database. The original page is almost unchanged: we only require that:

a) It is written in valid XHTML (an HTML extension that is XML compliant)
b) The page contains a definition of the contexts to which notes can be appended.

The transformation from normal (even incorrect!) HTML to XHTML can be easily done by a free tool (Dave Raggett's HTML TIDY [TYD]). The definition of the contexts can be done automatically, with the chosen granularity: for instance each phrase, or each paragraph could be a context).

The notes are rendered in place using the standard subset of JavaScript that is commonly recognized by the most diffused recent browsers (Netscape Navigator and Internet Explorer versions 4 and above, Opera, Mozilla).

In summary, the architecture we provide contemplates:

a) an (automatic) conversion of HTML pages to a suitable (still HTML!) format
b) the filtering of each request though a system based on servlets
c) the storage of the notes on a database residing on the server that provides content.
d) The rendering of the notes in various way based on JavaScript.

In addition, we introduce the notion of users and groups so that the visibility of the notes can be restricted to particular actors (a class, the teachers, on particular person etc.). Such addition reflects the spirit of supporting or particular domain of election, i.e. e-learning.

Implementation: WebNotes

To proof the concept, we implemented a tool called WebNotes according to the architecture we suggest.

A first art of WebNotes is an automatic tool that performs the preprocessing of the page. During the conversion process the granularity of the markable context that can be annotated is chosen: it can be each word, each phrase or each paragraph. As we mentioned the process is necessary in order to guarantee that the resulting pages are XHTML compliant, and that the contexts are suitably defined. The resulting page is still normal HTML, although it conforms the more restrictive rules that make it XML compliant.

The pages requested by the user are filtered through a servlet enabled Web server, which maintains a set of notes and their properties (like ownership, visibility etc). Notes are shown in the text as tiny icons embedded in the page. Public notes are visible to everybody. After the user identifies him/herself through a login process, s/he can see all notes allowed by her/his privileges.

The user can toggle between two modes: browsing and editing. While browsing, when s/he moves the mouse pointer over an icon that shows the presence of a note, the note pops up on place. When moving the mouse away the note disappears, unless it was stuck by the reader, in which case it disappears only when explicitly closed.

In order to edit the page (adding or modifying a note) the user enables editing mode and simply clicks on the location where s/he wants to add the note. A popup window appears, and the users can edit/modify the note. In the basic version the note contains only text, without any formatting. In an enhanced version of WebNotes, the window contains an applet that allows writing HTML in a simple "What-You-See-Is-What-You-Get" fashion. We kept the applet separated in order to minimize the requirements we make on the browser, and in order to avoid delays related to its downloading.

The system is currently in the final stages of development, and already underwent some extensive testing with different browsers.

Although WebNotes can be used in various contexts, it was explicitly designed for deployment in an e-learning environment. We envision its use for performing some of the discussions that presently happen on electronic forums.

At the moment of writing, we plan to use its preliminary version on the field in some e-courses at the University of Trento during the last bimester. By the time of the conference we expect to have gathered statistics on its use and feedback by the users.

Since WebNotes is made by a series of Java Servlets, it can be deployed on any Servlet-enhanced Web Server (nowadays virtually every serious Web Server can has a servlet-compliant engine). We do not assume any special requirement on the client side, the only request being the support of (the standard subset of) JavaScript (that is available on all recent browsers). We tested our annotated pages with all the major players (i.e. Opera, Mozilla, Netscape, Internet Explorer) on several platforms without encountering problems. The notes are simple text, so their writing and the editing is performed in a normal web page. Also the administration of the system (e.g. group creation and maintenance) occurs in a web page. An enriched version of our tool also includes a Java Applet that is a HTML composer: this allows formatting the notes in a reach way, using the full power of HTML. Since the Applet adds functionality but is not needed to make the system usable, WebNotes can be configured according to the preference of the deployer. Thanks to these choices WebNotes can be integrated in most e-learning platforms, enriching them with a new functionality.

Related Work

As we mentioned at the beginning, although much emphasis has been given to the support of collaboration via web since the early WWW years [COL], a convincing technology has not yet emerged. Interesting approaches run from an almost uncontrolled interactive editing of web pages (wiki's [CUN]) to more controlled annotations. In particular, adding notes to a Web page is not a new idea *per se*. Tools comparable to what we present have been proposed in the past, but in most cases their architecture was dissimilar from the one we've chosen. The main architectural choices were either based on browser-specific tools, or on external mediator servers. A comparison of some available tools can be found in [GAR].

Brower specific tools (e.g. [COM]) require the use of a customized browser, which is certainly an inconvenient choice.

In the proxy-based approach, the annotation process is taken care of by an intermediate server, that collects the notes, gets the original page and present to the user a page decorated it with the annotations. This allows taking control of the annotation process, and in some cases is offered by commercial enterprises [ANN] [THI]. A non-commercial instance of this class of tools is CritLink [CRI].

Our tool is rather based on an automatic pre-processing of an HTML page to include the fields that (with the chosen granularity) define the markable locations, and rely then on a basic browser and on a standard web-server architecture to deliver the content. This promises to be a winning point, since it allows an easier integration with existing e-learning platforms.

Bibliography

[ANN] http://www.annotate.net/ Annotate

[AMA] Amaya, W3C's Editor/Browser, http://www.w3.org/Amaya/

[COL] "Collaboration, Knowledge Representation and Automatability" http://www.w3.org/Collaboration/

[CUN] Cunnigham, W.: wiki (wiki wiki web) http://c2.com/cgi/wiki?WikiHistory

[CRI] CritLink http://crit.org/http://crit.org/index.html

[COM] ComMentor http://hci.stanford.edu/commentor/, by Martin Röscheisen, Christian Mogensen, and Terry Winograd at the Stanford Digital Library Project

[KOI] Koivunen, M.R. et al., "The W3C Collaborative Web Annotation Project ... or how to have fun while building an RDF infrastructure", submitted to UIST 2000, http://www.w3.org/2000/02/collaboration/annotation/papers/annotationinfrastructure

[GAR] Garfunkel, J., "Web Annotation Technologies", http://look.boston.ma.us/garf/webdev/annote/software.html

[RDF] "Resource Description Framework", http://www.w3.org/RDF/

[SER] "Java^{TM} Servlet Technology" http://java.sun.com/products/servlet/

[THI] ThirdVoice http://www.thirdvoice.com/ Following the link, one discovers that: "As of April 2, 2001, we are no longer supporting the consumer version of the our search and annotation tools."

[TID] Tidy http://www.w3.org/People/Raggett/tidy/

[XLI] XML Linking Language (XLink) Version 1.0, W3C Recommendation 27 June 2001, http://www.w3.org/TR/xlink/

[XPO] XML Pointer Language (XPointer) Version 1.0, W3C Candidate Recommendation 11 September 2001, http://www.w3.org/TR/xptr/

A Conceptual Framework for the Development of WBT-Guidelines

Oliver Bohl, Dr. Jörg Schellhase, Prof. Dr. Udo Winand
Department of Business Informatics
University of Kassel
Germany
{bohl,schellhase,winand}@wirtschaft.uni-kassel.de

Abstract: Guidelines represent an important instrument in the development of Web-based Trainings (WBTs). They help to create reliable, portable, and interoperable, standardized WBTs of high-quality. The development of guidelines can be considered as a key success factor regarding the effectiveness of WBTs. The effects of Guidelines can be both, favourable and restrictive. Guidelines that are too rigid and strict could have counter productive effects. Therefore an optimum at guidelines is to be aimed at, taking notice especially of producers and learners. This article discusses potentialities and restrictions of WBT Guidelines, supplies a description framework for WBTs and illustrates its realization on the basis of a case example. It can thus be of assistance in the project-specific development of guidelines.

Introduction

The education network WINFOLine is an inter-universitarian online education network. It concentrates on internet-based training in the field of business informatics through high-quality online courses. The universities of Göttingen, Kassel, Leipzig, and Saarbücken form the core team. The network has various partnerships with universities and companies. On the basis of a pool of online-courses the network can supply customized online-courses for universities, suppliers of further training courses as well as for companies. From winter term 2002/2003 onward the network will offer an accredited master program. The Educational Network WINFOLine increases the choice for other suppliers of web-based trainings. The wider range of content, even of previously inaccessible content, can also create immediate benefit for students, university graduates or employees. The basis is a network that enables profits for its partners. Through the cooperation every partner shares specific professional competence. The student profits by the competences of renowned partners (best-of-peer). The Education Network WINFOLine focuses on a vast number of clients:

- *Educational institutions* with the focus on business informatics: as completion or enlargement.
- Other *educational institutions*: as a completion of already existing trainings as well as for the creation of new courses of study.
- *Graduates*, who are interested in further training in the field of business informatics. The offer can consist in a single WBT or in a complete course of study. In addition the network offers a Master Degree Program for Information Systems. This course of study aims at working people and graduates.
- *Corporations* can obtain contents from the network for the creation of their own special trainings in the field of business informatics. The contents can be used for single training or within a Corporate University.

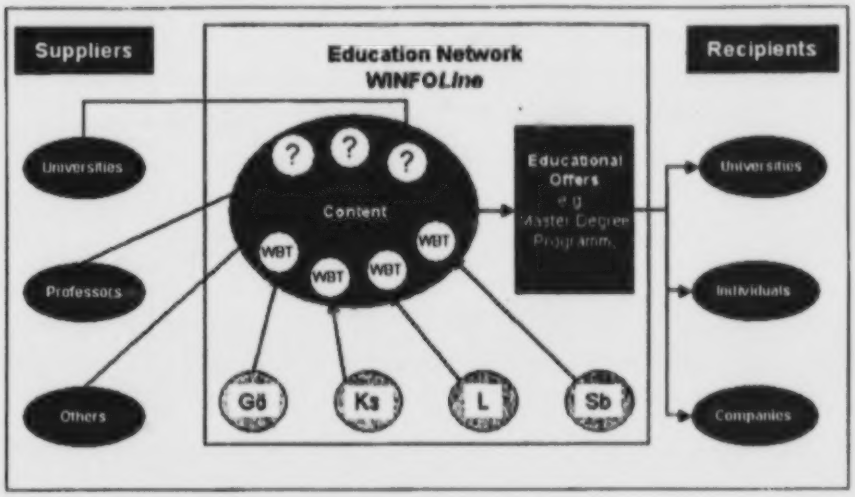


Figure 1: Structure of the Education Network WINFOLine

In order to guarantee a high quality of the online-courses it was necessary to develop a quality insurance concept on the basis of well defined guidelines for the courses of the education network WINFOLine. Two guideline catalogues have been developed for the production of WBTs. One of the catalogues contains guidelines referring to the production of online-courses within the network (produced by the core team of the network). These courses meet the high demands regarding the uniformity as well as the technical and didactical quality of the online-courses. The second catalogue defines a minimum standard concerning the technical and didactical quality of online-courses produced by external partners. Both catalogues distinguish between recommendations and compulsory guidelines.

The development of guidelines for WBTs serves to guarantee a high quality and reliability. The effective application of this control instrument can have crucial influence on the achievement of standards. The definition of guidelines is closely connected to quality assurance functions, media-didactical concepts, tutoring concepts, and the evaluation of successes in learning. Regarding these functions, guidelines can be considered as an instrument which should not be underestimated.

Different types of guidelines do not always have an obligational character. In most cases guidelines are published by institutions in order to establish or prescribe certain ways of behaviour within a small scope of discretion. In case these rules are neglected there can be sanctions. Generally, guidelines are systematically developed decision making aids with regard to appropriate methodologies in specific situations and there is still a certain scope of discretion, which allows to deviate from the rules in specific situations. However, they draw attention to noteworthy circumstances and serve users in forming a judgement. The term guideline used in this article covers the meanings of direction, instruction as well as recommendation, so the respective binding character of the guidelines has to be indicated explicitly. The approaches for developing guidelines, presented in this article, focus on producers and providers of Web based trainings (WBTs) in producer/provider networks.

Potentials and Restrictions of WBT Guidelines

Guidelines support the creation of uniform and high-quality WBTs. Even if a provider/producer network agrees on the application of a certain authoring tool, the definition of guidelines is necessary. Many guidelines, which serve the ensuring of a certain minimum quality, can not or not exclusively be guaranteed by only one authoring tool. WBTs, which are produced with the same authoring tool, often indicate a common basic characteristic. This does not mean, however, that WBTs, which are produced with the same authoring tool are uniformly structured. Flexible authoring tools permit a large and creative scope.

BEST COPY AVAILABLE

Guidelines aiming at a uniform Look & Feel of WBTs, require a consent of the WBT authors. It is important that all partners adhere to this consent in order to achieve a standard. On the one hand one should consider that the appointment of certain guidelines is necessary in order to obtain a uniformity regarding functionality and optics, as well as a desired quality level. On the other hand strict and too closely seized guidelines can lead to unwanted side-effects. In the process of defining guidelines different aims have to be considered carefully.

Learners, customers (e.g. enterprises or education brokers), and creators of WBTs benefit from the definition of guidelines. From the learner's point of view a higher quality of the WBTs, an increased attractiveness of learning, a uniform appearance, a uniform structure of the WBTs, uniform functionalities within the WBTs, uniform services and simplified management avoid a cognitive overhead. The customers can take full advantage of a higher quality of the WBTs, an increased motivation on the side of the learner, a uniform appearance (Corporate Identity), the uniform structure of the WBTs, and of an increased acceptance on the part of the user. Content developers benefit from a higher quality of the WBTs, a Corporate Identity, an increase of the everyday suitability and acceptance on the part of customers and learners, more economic development, maintenance, administration of the WBTs as well as of he simplicity to handle tutoring.

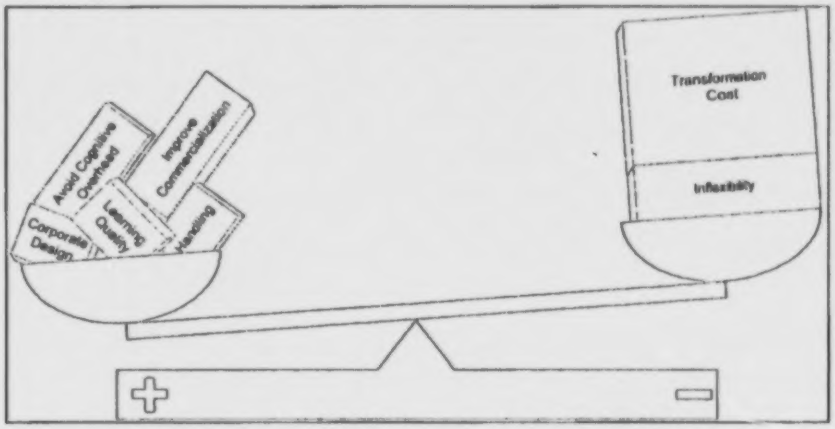


Figure 2: Advantages and Disadvantages of Guidelines

However, disadvantages or restrictions can result from too rigid guidelines. The realization of guidelines is very often problematic. Depending on production process or assigned tools certain guidelines are realizable only at very high expenditure or not realizable at all. Guidelines can form a barrier for any partner. The revision or adjustment of already existing WBTs could cause very high expenditures or not be feasible at all, since e.g. a tool is used, with which certain guidelines can not be fulfilled. The entrance barrier is even higher when already existing WBTs of other producers have to be integrated into the product portfolio of the network. A further consequence could be the incompatibility with the products of prospective customers. These could require for their part the adherence to certain guidelines, then WBTs would have to be adapted to the Corporate Design of the customer. This special adjustment of WBTs usually has high transformation costs as a consequence. Last but not least, the increased inflexibility regarding modifications in the design of WBTs, functionality extensions and technical advancement has to be considered. Because an innovation process in the production of WBTs is necessary, modifications of the guidelines must be implemented within a provider/producer network. This becomes the more difficult, when the network is large and when the production processes are varied. Modifications of the guidelines can lead to the problem that all WBTs have to be redesigned and can thus involve high expenditures. Therefore, too rigid guidelines could impede innovations in the production of WBTs.

If one regards these pros and cons, it becomes obvious that an optimum at guidelines is to be aimed at, in order to realize the advantages and avoid the disadvantages. On the one hand guidelines should guarantee the highest possible quality as well as a minimum of uniformity. On the other hand guidelines

BEST COPY AVAILABLE

should not have an effect that is too restrictive. The readiness of prospect providers to participate in a provider/producer network is influenced negatively by high costs of adjustment of available materials to defined guidelines. In addition guidelines should guarantee some room for prospective providers to realize their own ideas (e.g. the creation of multimedia contents). Too rigid and strict guidelines promote neither the quality of learning contents, nor do they meet the principle of the freedom of teaching. The freedom of editing WBTs should therefore not be limited unnecessarily.

A Framework for WBTs

The framework presented in this passage can be used as a basis for the definition of guidelines. It contains the following categories: construction of WBTs, production of multimedia content, design and layout, interchange of data between the WBTs and the learning management system and technique. The framework contains background information and examples.

Construction of WBTs

Guidelines of this category define the structuring of contents, the navigation concept, access structures, functionalities, support of different learning styles, orientation hints, tests, and communication services of WBTs.

- *Structuring of Contents.* Learners are used to hierarchical structures and linear sequences, hierarchies and sequences can serve a lot to structure the contents of WBTs. (Schellhase, 2001)
- *Navigation.* There should be a concept for the navigation in WBTs. Navigation aids can support the learner. In order to support the navigation process web-browsers include special functionalities such as e.g. backtracking, indication of already followed hyperlinks, history-lists, and bookmarks. WBTs can offer additional support in navigation for the acquiring of contents, examples are the possibility for achieving a quick overview (e.g. through an optional hierarchical or non-hierarchical structure, like a table of contents or site-maps), the indication of already read material (already acquired content could be marked in the table of contents or in the site-map), different types of links maybe with support by the use of visual signs and an obvious classification between the different types and different search-features like meta-information and keywords. (Moser, 1998, p.43)
- *Access Structures.* Appropriate access structures support search activities of the learners. Internal and external referential hyperlinks could be shown in a separate list. A list of figures and videos enables the learner to get direct access to any figure or video. Furthermore a list of references allows direct access to all parts of the WBT where a reference has been used.
- *Functionalities.* WBTs could provide several functionalities like e.g. full text search mechanisms, plugin-testers, administration of bookmarks, learning-account, direct addressing of content, keyboard control, glossary as well as direct access to self learning exercises. While creating new WBTs the focus has to be on aspects about the usability and the reliability.
- *Support of Different Learning Styles.* WBTs could offer configuration options that leave the choice to the learner in which way he would like to use the WBT (e.g. acoustic and/or visual). One can imagine many more configuration options and possibilities for creating a WBT that could support different learning types, learning phases, and learning situations.
- *Orientation Hints.* Orientation problems are a typical problem using hypertexts. (Schaumburg, 1996, p.109) remark that in particular beginners do not know how to handle the explorative freedom of hypertexts. Orientation problems can effect the learning process negatively and should therefore not be underestimated. (Schaumburg, 1996, p.110) The avoidance of orientation problems by means of a high quality hypertext-design represents an important point in the creation of WBTs. (Lynch, 1999, p. 43f.) For that reason WBTs should contain several options that support the orientation within the WBT. The offering of a list of milestones could be helpful.
- *Tests and Exercises.* WBTs which are used for further training require special tutoring options and services. Tutoring includes the supply with exercises that can be solved by the learner during the learning process. (Sasse, 1998) show a detailed catalogue of requirements with regard to web-

based systems for the support of tutoring and supply of exercise material. The following types of exercises could be used: multiple-choice-questions, crossword-puzzles, gap texts, open questions with sample solutions, drag and drop exercises, matching exercises, general interactive/multimedia exercises, and case studies. Types of exercises can be classified into self learning exercises and tutored exercises. (Moser, 1998, p.46) The access to the exercises can be offered through lists of exercises and within the learning content. The exercise results could be shown in a personal learning account. Furthermore the WBT should be able to interchange data with legacy systems via defined interfaces.

- *Communication Services.* Various synchronic and asynchronic communication elements can be used for the support of the learning process. Typical elements are e-mail (possibly context-related), web-based forums, and chats. Sometimes WBTs provide more complex communication elements, like e.g. video conferencing.

Production of Multimedia Content

The production of multimedia contents depends a lot on the contents of the WBTs. For example a WBT on modelling could contain animations which show each single step in the modelling process. This animation can be accompanied by short texts in written or spoken form. Other WBTs could use short videos to support certain parts of the lecture. There is a lot of room for the creation of additional learning materials. It should not be restricted by standardisation efforts.

Design and Layout

The design and layout of WBTs has great influences on the acceptance and attractiveness of WBTs. The layout should meet variety as well as constancy.

Data Interchange with the Learning Management System

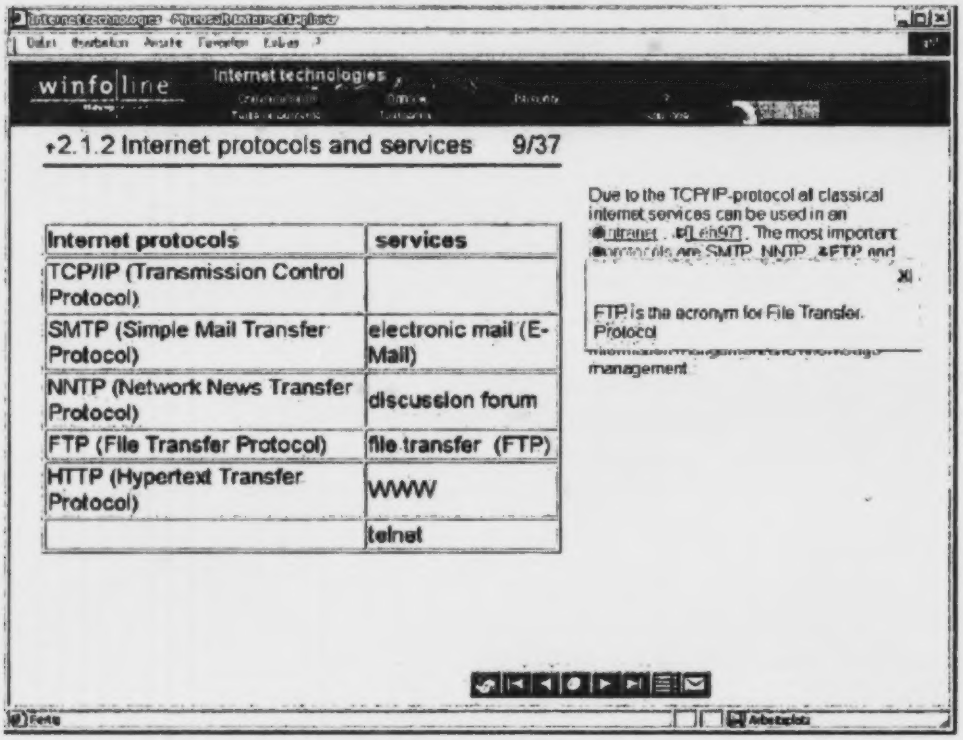
The access to WBTs is often offered via learning management systems (LMS). The communication between the WBT and the learning management system should be based on established standards. An optimum data interchange between LMS and WBT is an essential basic requirement for lots of WBT-related services of the LMS. AICC and SCORM are standards that are appropriate for data interchange between the WBT and the LMS. The SCORM-standard is based on both the AICC-standard and the IMS-standard. (Cohen, 2002) One essential advantage of these two standards is the portability of contents between different LMS and the independency on the chosen learning management system. The expenditures for the adaptation of the WBTs to a certain learning management system fall. WBTs conforming to the standards offer essential advantages: they can be used on any learning management system conforming AICC/SCORM-standard, they offer authentification mechanisms and are able to interchange certain data like general user data, meta data on any learning unit as well as a multiplicity at interaction data, e.g. path choice, current position in the WBT, comments, retention times, and test results in a standardized way.

Technical Aspects

Requirements concerning hardware and software should be specified. This includes the system requirements (browsers, operating systems, and plugins). Multimedia elements that require a high bandwidth should be provided through a CD-ROM/ DVD. Complete WBTs could be offered online and offline. In this way communication costs on the side of the learner can be reduced.

Case Study: Guidelines of the Education Network WINFOLine

The above described framework served as a basis for the definition of project-specific WBT-guidelines. Many guidelines base on lists of criteria concerning the WBT-/CBT-design or on experience evaluation results gained during the project. The guideline catalogue contains 160 items on the construction of WBTs, the production of multimedia elements, and the data interchange between the WBT and the learning management system. These are completed by 31 guidelines concerning the production process and the test-phase, separate guidelines in the form of a style guide, and other guidelines concerning the definition of learning objectives and special terms. The WBT presented in the following sections is subject to the guidelines, which were set up for the internal production of WBTs. The user-interface of the WBT is divided into three frames: the top frame contains the register, the middle frame shows the content and the lower frame contains the navigation. Guidelines define the standardized creation of the register and the navigation and thus guarantee the uniformity of the WBT. The appearance of the middle frame which contains the content can differ through the use of various types of multimedia elements. In this case the guidelines only have recommendation character regarding the creation of multimedia elements and of the background. The arrangement and designation of the respective registers within the register area, their contents and their functionalities were specified. The functionalities are differentiated into obligating, recommended, and optional functionalities. The definition of the colour, optic, and functionality of the navigation bar contributes to a uniform appearance. The appointment of a uniform layout supports a uniform look & feel and is at the same time an important orientation aid for the learner. (Schellhase, 2001)



+2.1.2 Internet protocols and services 9/37

Internet protocols	services
TCP/IP (Transmission Control Protocol)	
SMTP (Simple Mail Transfer Protocol)	electronic mail (E-Mail)
NNTP (Network News Transfer Protocol)	discussion forum
FTP (File Transfer Protocol)	file transfer (FTP)
HTTP (Hypertext Transfer Protocol)	WWW
	telnet

Due to the TCP/IP-protocol al classical internet services can be used in an intranet . [illegible] . The most important protocols are SMTP, NNTP, FTP and [illegible] management

FTP is the acronym for File Transfer Protocol

Figure 3: Screenshot of a WINFOLine-WBT

The screenshot shows that the content frame is divided into a slide-area on the left hand side and a text-area on the right hand side. The learner can choose whether he wants to look at both areas or only wants to look at the slides. An arrow beside the title symbolises that other pages of the WBT refer to this page (incoming, referential hyperlinks). The title is completed by the indication of the learning section and the section-specific numbering. Different types of hyperlinks are characterized by means of small symbols.

BEST COPY AVAILABLE

On a click on a semantic hyperlink a separate pop-up window is opened. The bar then appearing on the left hand side symbolizes that the learner is following an excursus, this means he leaves the sequential course structure and navigates independently. The following figure shows the production process of the WINFOLine-WBTs.

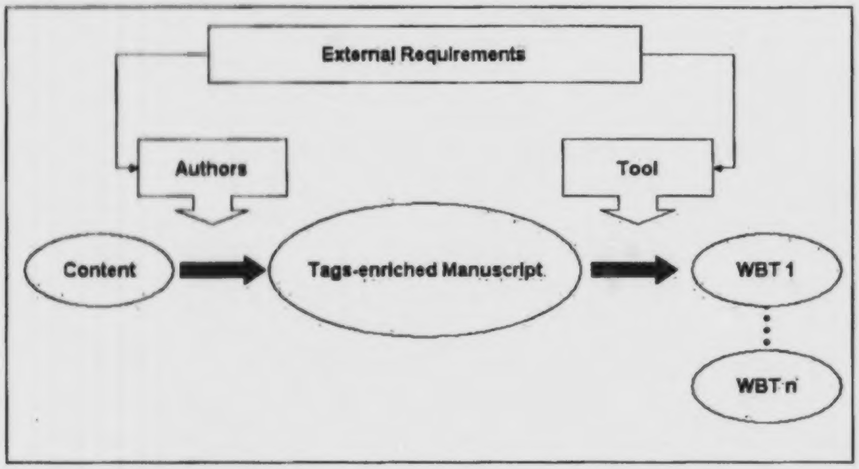


Figure 4: Production Process of WINFOLine-WBTs

For the production of a WBT the authors use WYSIWYG-editors. They have to employ some semantic tags. In this way the manuscript is automatically transformed into a WBT by a tool. This approach makes it possible to produce numerous variants of WBTs. Contents can thus be used several times (see Winand, 2002). The screenshot has shown a WBT that meets the specific guidelines of the elearning network WINFOLine. The WBT was produced by the WBT authoring tool VLEG (see Winand, 02). The authoring tool VLEG can be used to produce flexible und configurable WBTs. The VLEG helps to reduce the development expense for WBTs significantly. In addition, the maintenance process is simplified. The WBTs automatically have many sophisticated features and are especially well suited for Web-based learning.

Conclusions

This article has shown potentials and restrictions of WBT Guidelines. From our point of view, guidelines represent an important success factor for the production of high-quality standardized WBTs. Their development can be considered as a key success factor regarding the effectiveness of WBTs.

The definition of guidelines depends on the specific situation of the producer. The framework described in this paper contains several suggestions for the development of WBTs and can be of assistance in the project-specific development of guidelines. An optimum at guidelines is to be aimed at, taking notice especially of producers and learners.

Guidelines have to be developed continuously; they have to be adapted to changing internal and external requirements. Thereby international standardisation efforts should be paid special attention.

References

Cohen, E. J. (2002). *The Emerging Standards Effort in E-Learning. Will SCORM lead the way?* In: e-learning Magazine. http://www.elearningmag.com, 2002-03-18.

BEST COPY AVAILABLE

Lynch, Patrick J.; Horton, Sarah; Rosdale, Ray M. (Eds.) (1999). *Erfolgreiches Web-Design*. München.

Moser, Mattias (1998). *Web Based Training Systems and Document Annotation – Implementations for Hyperwave.* Master's Thesis in Telematics. Institute for Information Processing and Computer Supported New Media, Graz University of Technology. Graz.

Sasse, Martina Angela; Harris, Christopher; Ismail Ismail; Monthienwichienchai, Peter (1998). Support for Authoring and Managing Webbased Coursework: The TACO Projekt. In: Hazemi, Reza; Hailes, Stephen; Wilbur, Steve (Eds.). *The Digital University – Reinventing the Academy.* London, p. 155-178.

Schellhase, Jörg (2001). *Entwicklungsmethoden und Architekturkonzepte für Web-Applikationen unter besonderer Berücksichtigung von Systemen zur Erstellung und Administration Web-basierter Lernumgebungen.* Wiesbaden 2001.

Schaumburg, Heike; Issing, Ludwig J. (1996). Lernen mit Hypermedia: Verloren im Hyperraum? In: *HMD – Theorie und Praxis der Wirtschaftsinformatik* 190, p. 108-121.

Winand, Udo; Schellhase, Jörg (2002). The VLEG based production and maintenance process for Web-based learning applications. In: Becker, Shirley A. (Eds.). *Data Warehousing and Web Engineering.* Hershey London Melbourne Singapore Peking.

A Critical Discussion of Standards for Web-based Learning

Oliver Bohl, Dr. Jörg Schellhase, Prof. Dr. Udo Winand
Department of Business Informatics
University of Kassel
Germany
{bohl,schellhase,winand}@wirtschaft.uni-kassel.de

Abstract: Learning technology standards are increasingly gaining in importance in the field of Web-based teaching. At present, two standards dominating the market are taking shape. These are the AICC standard of the AICC organization and the SCORM standard of the ADL initiative. Up to now, only the AICC standard can be certified. But in the near future the SCORM standard will be certifiable, too. Based on the AICC and LOM meta data standards, the SCORM standard stands the chance to become the standard dominating the market. A number of restrictions are involved with the mentioned standards, though. This article examines general deficiencies of the mentioned standards, as well as the problems resulting from their application to learning management systems.

Introduction

Over the past few years several initiatives developed, at first in the USA, aiming at the standardization of computer based teaching components. This article focuses on the AICC standard of the AICC organization and the SCORM standard of the ADL initiative. Why are standards important for Web-based learning environments and technologies? Considering the increasing number of virtual learning environments, it is obvious that the same contents are processed several times for multimedia use because they cannot be found or used straight away. This is where standardization efforts start from.

Influential Factors on the Interface between WBT/LMS

LMSs offer tools which manage and generate different sorts of data. The term LMS can denominate simple course management systems as well as highly complex LMSs with extended functionalities. These additional functionalities include interfaces to other information systems as well as reports, registration, and online collaboration. (Hendricks, 2001, p.20) Web-based Trainings (WBTs) should work with any Learning Management System (LMS). For this to be possible, the exchange of data must work.

There are many authoring systems on the market to produce learning units with. The decision on a certain system often binds the vendor of learning content to that system. This is not surprising because some of the possibilities the individual systems offer differ considerably. Up to now, it is not possible to transport learning units between different authoring systems without any difficulties. Therefore, a future change of authoring systems correspondingly turns out to be difficult. This causes problems for developers of WBTs. The exchange of WBTs between different LMSs leads also to some difficulties. In this field as well has developed a multitude of systems in the meantime. But none of these systems has achieved a dominating position, yet. The selection is made on application-specific criteria. (Hagenhoff, 2001)

Requirements for Standardization

To facilitate the exchange of knowledge between different institutions, the content to be exchanged has to be standardized. The aim is to be able to use LMS components efficiently and independent of system environments, the authoring systems used, and further technical infrastructure.

The most important influential factors on the effectivity and efficiency of learning technology, and thereby on Web-based elearning, are aspects of the reusability of the content, the interoperability/ portability of the content objects, the recombinability of content, methods and specifications, the recontextualization of the content in various contexts, the flexibility regarding the granularity of the content, the simplicity to use the standard and the efficiency of a standard. (Pawlowski, 2001, p.58).

AICC

Having developed from the US-American aviation industry, the industry-wide standardization committee AICC has more than ten years of experience in the field of computer based learning and today deals with the development of interoperable learning technologies. AICC's guidelines define standards, which permit LMSs and WBTs to exchange data. These guidelines are developed continuously. It is the purpose of the AICC standard, to facilitate the development of WBTs independent of a concrete LMS. With the help of structure files, a WBT conforming to AICC can quite easily be integrated in a leaning management system conforming to AICC. Lessons of a WBT are launched by the LMS. According to the AICC specifications, the LMS and the AICC compatible lessons must have common interfaces for data exchange. Thus, the LMS has the ability to start learning content as well as to track the learner's progress.

WBTs and LMS conforming to AICC can be certified. The certification is limited to a period of two years and has to be renewed thereafter. The following paragraphs show in detail which data is defined by the AICC standard and how the data exchange is realized.

Communication between LMS and WBT

When starting a lesson, the LMS sends static learner data (e.g. the name of the learner), dynamic data (produced during the previous learning session) as well as messages and comments from the tutor. Lessons completed or aborted by the user send data to the LMS. This data is utilized for the analysis of the learning progress.

Data Groups

The AICC standard defines the following 9 groups of data:

- *Core data:* Core data contain basic data of the learner, the learning session, and the learning success. (AICC, 2001, p.63)
- *Lesson data:* This is where individual information for the next start of the lesson is stored. This data is drawn up during a learning session and is stored and managed by the LMS. Among other things, this is data about where a learner has left a lesson. It facilitates the learner's return to the exact position of that lesson. (AICC, 2001, p.77) Furthermore, the learner's way through a lesson is recorded.
- *Core data of the vendor:* Vendor specific data, necessary for some lessons. (AICC, 2001, p.193)
- *Comments:* With help from the LMS, the tutor can send help texts to the learner. (AICC, 2001, p.79) The other way round, the learner can write comments about a lesson to the tutor. In doing so, the position the comment refers to is sent to the LMS. (AICC, 2001, p.193)
- *Evaluation:* During learning sessions data about learner performance and his or her objectives status can be ascertained. (AICC, 2001, p.81)
- *Objectives status:* Objectives can be given in each lesson. It is recorded, whether the learner has achieved the lesson's objectives or not. (AICC, 2001, p.85). In addition, the achieved score and the required time are recorded. (AICC, 2001, p.213)
- *Learning data:* This group of data supports the adjustment of a learning unit to the performance of the learner. Thus, a learner can be offered a starting point according to his or her knowledge level. Furthermore, data on the learner performance is transferred. (AICC, 2001, p.91f.)
- *Student Demographics:* With the personal data available to the LMS, learning content can be individualized, e.g. by selection of the language. (AICC, 2001, p.98)

- *Student preferences:* This data group stores parameters chosen by the learner to adjust the learning environment. Among other things, this includes audio and video settings.

Course Structure and Level of Complexity

First of all, the definition of the course structure serves for the simple exchange of courses. The definition of the course structure stipulates the ways the learner can or must take through the learning unit. This information is stored in the structure files. The AICC standard defines four levels of complexity (1, 2, 3a, 3b). The levels show how complex a course is and which data the LMS requires. For level 1 information the AICC standard uses the six data groups core data, lesson data, comments, objectives status, learning data, and student preferences. While the evaluation data of level 1 refers to the lesson as a whole, the optional second level facilitates further, more detailed evaluation data on learner performance and behaviour. (AICC, 2001, p.137)

SCORM

The Advanced Distributed Learning Initiative (ADL) is financed by the US department of defense in cooperation with the White House Office of Science and Technology Policy and deals with the interoperability of learning courses. The initiative sees itself as an integrating approach and a coordinating institution. Coordinated by the ADL, the AICC, the IEEE (Institute of Electrical and Electronics Engineers), and the IMS (Instructional Management System Global Consortium, http://www.imsproject.org) have agreed on facilitating the cooperation of LMSs and WBTs of different vendors.

The ADL initiative mainly focuses on the design and development of sharable courseware objects. These shall be retrievable from a global information network in real time. (Fletcher, 2000) To achieve these goals, the ADL initiative formulated higher requirements for learning content like reusability, accessability, durability, and interoperability and, based on this, developed a reference model for sharable learning objects. (Dodds, 2001, p.1-3f.) This reference model, the Sharable Content Object Reference Model (SCORM), defines a Web-based model for the aggregation of learning content (content aggregation model) as well as a run-time environment for learning objects. The SCORM's purpose is to connect developing technologies and commercial as well as public implementations. (Dodds, 2001, p.1-4) SCORM focuses on key interfaces between learning content and different LMSs but is not specific about features and abilities of a certain LMS. (Dodds, 2001, p.1-31) An LMS must be able to track learner progress and to assess mastery of learning content. Among other things, this includes collecting learner profile information, delivery of content to the learner, tracking of key interactions and the performance within the content as well as determining the learner's next assignment.

The SCORM Run-time environment includes support for the communication with and the tracking of content in Web-based environments and is based on the run-time environment functionalities as defined in the AICC Guidelines for Interoperability. It provides mechanisms for a standardized learner tracking. The control flow regarding reusable and interoperable learning objects is managed externally by the LMS. But the LMS does not control the control flow within the learning objects. (Dodds, 2001, p.1-32)

SCORM Content Aggregation Model

The Content Aggregation Model supports the assembling of Sharable Content Objects (SCOs). It describes a nomenclature for learning content and references the IMS learning resource metadata information model, which for its part is based on the LOM specifications of the IEEE-LTSC (Learning Technology Standards Committee, http://www.ltsc.ieee.org). The Content Aggregation Model determines how learning content can be identified, described, assembled, and transferred from one LMS to another. In the SCORM Content Aggregation Model learning content consists of assets. Assets are electronic representations of media (e.g. text, pictures, sound, and websites). An asset can be tagged to a metadata document in an XML format, which supports the locating of assets and their retrieval from online-repositories. (Dodds, 2001, p.2-3)

A Sharable Content Object (SCO) represents one or more assets which use the SCORM run-time environment to communicate with different LMSs. An SCO represents the lowest level of content granularity which can be tracked by an LMS. An SCO should be independent of learning context to be reusable in different learning situations. Moreover, several SCOs can be assembled to form learning or exercise units on a superordinate level. To make a potential reuse practicable, SCOs should be small units. They can be the basis for sharable content repositories which facilitate their exchange. Only an LMS may launch an SCO, an SCO must not launch other SCOs. (Dodds, 2001, p.2-4) With the mechanism of content aggregation, content objects (SCOs, assets) can be assembled to form bigger learning units (e.g. course, chapter). This mechanism determines the structure and performance as well as the sequence of the individual SCOs. (Dodds, 2001, p.2-6)

The mechanism of content aggregation supports the reuse of learning content und reduces the dependency of a course on a particular LMS. The structuring mechanism of content aggregation is derived from the computer managed instruction (CMI) specifications of the AICC. (Dodds, 2001, p.2-102) According to the content aggregation description, the LMS interprets respectively processes the rules for navigation defined within the aggregation of SCOs. (Dodds, 2001, p.2-102) The navigation for the SCOs is determined by the structuring mechanism of the content aggregation and is not part of an SCO. It is the LMS which is responsible for launching the SCOs in the defined sequence in run-time. This is important because content would not be reusable, if it contained course context-specific information. (Dodds, 2001, p.2-7)

Metadata in the SCORM

The metadata of the SCORM is based on the IEEE-LTSC LOM standard and on the IMS metadata specifications. (Dodds, 2001, p.2-10) There are nine categories of metadata elements altogether: general metadata, lifecycle metadata, meta-metadata, technical metadata, pedagogical metadata, metadata concerning rights, relational metadata, metadata on annotations and classifications. For the SCORM, a number of metadata elements were marked to be binding. In addition, further specific metadata elements can be stipulated. With the help of the metadata elements, the learning objects to be managed can be described in a standardized way. (Dodds, 2001, p.2-11) Guidelines concerning the use of metadata should be defined based on the specific requirements of the respective organisation.

Analysis of AICC and SCORM

Fundamental objectives of the presented standards are the easy portability of learning content from one LMS to another as well as the reusability of learning objects. The easy portability of WBTs creates an additional benefit for vendors of learning content and LMSs because the high costs for portation are reduced. WBTs can exchange data with the LMS via standardized interfaces. Above all, the metadata model of the LOM standard integrated in the SCORM supports the retrieval of learning objects in varying constellations. AICC denominates the smallest unit which can be administered by an LMS as an assignable unit (AU). This corresponds with the SCORM's Sharable Content Object (SCO). In the following, AUs and SCOs will be summarized under the term learning module. If common characteristics of the AICC and the SCORM standards are adressed, the general term "standard" is used and if a distinction between AICC and SCORM is necessary it is made explicit.

Potentials of AICC and SCORM

An important advantage of standard conforming WBTs is that they are basically interoperable with all standard conforming LMSs. In addition, they can exchange important user data, metadata on learning units, and a variety of interaction data (e.g. choice of path, current position in the learning unit, comments/annotations, duration, scores) in a standardized way with standard conforming LMSs. The basic metadata of a standard conforming learning unit is transferred to the LMS in the form of files when the learning unit is delivered, so that this metadata does not has to be fed to the LMS separately.

When using standard conforming learning units, an LMS can offer learners a learning account. Learner scores can be managed course comprehensively in a standardized way via this learning account. Though with AICC the possibilities the learning account offers are limited because not the complete test results but only results concerning single basic questions/exercises can be transferred to the LMS. Furthermore, the learner can take a look at a table of his or her learning status relating to single learning modules at any time. Learning module-specific comments a lecturer has left for a certain learner can be displayed when the learning module is started. The administration of the current position in an individual learning module can be done by the LMS, so that this information can be transferred when the learning module is launched. Annotations/comments transferred from the learning modules to the LMS can be managed by the LMS and be presented to the lecturer in a well-structured form. For the AICC standard must be observed, that student annotations can be transferred to the LMS, but the AU cannot request them from the LMS again later. The diverse data, which according to AICC/SCORM can be transferred to the LMS facilitates the comfortable supervision of the learning progress. The LMS could offer aggregated representations of test results and which learning modules have already been worked on by how many learners. Learning histories of the learners could be managed. Tracking data, transferred from the learning modules to the LMS, could be presented to the tutors in different views, so that they receive valuable indications concerning the further design of content. A long time on average spent on certain content pages could indicate that the content has to be processed better. Again, a low number of accesses on certain pages could indicate a lack of interest in the content.

Difficulties with AICC/SCORM conforming LMSs

The statements above basically show which potentials are connected with the use of standard conforming LMSs. But AICC and SCORM do not determine the use or processing of data transferred from learning modules to the LMS. In an extreme case it is possible that an LMS receives interaction data from a learning module but does not store it. This means that for the decision on a certain LMS it is not sufficient to see that the LMS is conforming to SCORM or certified by the AICC. It should be exactly analyzed how the AICC/SCORM standards have been implemented in the LMS and what the resulting possibilities for learners and lecturers are. AICC certified or SCORM conforming LMSs, which only provide minimal information for the learner (e.g. number of launches of the learning module, duration of learning with a learning module) for standard conforming learning modules and do not support the lecturer with evaluation data at all, fulfil the formal label of being AICC certified or conforming to the SCORM but by far do not use all the possibilities these standards do offer. Astonishingly, these statements are not as trivial as they may seem at first glance. Even some LMS market leaders use the possibilities offered by the AICC/SCORM standards only insufficiently.

Deficits of the AICC and the SCORM

In addition, there seems to exist a conflict between the principle of reusing learning modules and the classic web paradigm of using links to show relations between content. Neither in the AICC nor in the SCORM it is possible to realize hyperlinks from one learning module to another. The reason given for that is that it otherwise would not be possible to realize the principle of reusing learning modules. At the same time it is advised to produce as small learning modules as possible. Thus, referential links are only possible locally within the learning module and to external websites. Structural hyperlinks, however, are managed by the LMS. Each learning module has to be explicitly started by the learner via a menu on the LMS. Even an explicit textual reference within a learning module, referring to another part in another learning module, would not be advisable because it would also contradict the principle of reuse. In our opinion, and in contrast with the argumentation of the AICC and the SCORM, these standards could be extended in the way that at least a partial referential linking even between learning modules is possible. During the combination of learning units invalid learning module comprehensive hyperlinks and further referential text parts would have to be automatically recognized and filtered, though.

Theoretically it is possible to develop WBTs conforming to the AICC/SCORM consisting of merely one learning module. In this case, any number of hyperlinks can be integrated and WBTs can be developed, which support explorative learning. Indeed many developers follow this path currently. The described variant limits the possibilities for reuse provided by the AICC/SCORM, though, and many of AICC/SCORM's possibilities remain unused. The LMS would receive and manage only some basic metadata (course name, course developer, etc.) and annotations/comments (unit-specific) as well as path information. The LMS does not have any information about the course structure and the administration concerning the learning status in learning modules is inapplicable. At least the authentification mechanism can be realized through the AICC/SCORM standards.

The previously put forward demand to extend the AICC/SCORM standards is important because the current limitations of the AICC/SCORM lead to standard conforming WBTs either not being able to make full use of the possibilities of the web paradigm or the AICC/SCORM. If the AICC/SCORM standards were extended appropriately, the objective of reusability could be supported better, the various advantages of the AICC/SCORM standards could be reached, and with the technique of referential linking, high-quality and learning module comprehensive functionalities could be integrated in the WBTs to better support the learning processes.

Conclusion

This article has explained the potential benefit of standards in the field of learning technology by example of the AICC and the SCORM. The main advantages are in the field of portability of learning content, the standardized communication interface between the LMS and CBTs/WBTs as well as in supporting the reusability of learning objects. A wealth of possibilities for support connected with the standards on the part of the LMS were shown clearly. But the article has also shown the basic difficulties of standards and the weaknesses of LMSs concerning the full use of the possibilities connected with standards. The effort of standardization should not too rashly be viewed negatively. The development of standards is a continous process. But in the framework of further developments, the criticized aspects mentioned above should be taken into consideration.

References

AICC (2001). Aviation Industry Computer Based Training Committee (Eds.): *CMI Guidelines for Interoperability*, Revision 3.5. http://www.aicc.org, 2002-03-25.

Cohen, E. J. (2002). *The Emerging Standards Effort in E-Learning. Will SCORM lead the way?* e-learning Magazine. http://www.elearningmag.com, 2002-03-18.

Dodds, P. (2001). *Advanced Distributed Learning, Sharable Content Object Reference Model Version 1.2*, Release 2001. http://www.adlnet.org, 2002-03-25.

Fletcher, J.D.; Dodds, P. (2000). *All about ADL*. In: Learningcircuits May 2000. http://www.learningcircuits.com/may2000/fletcher.html, 2001-06-26.

Hagenhoff, S.; Schellhase, J.; Schumann, M. (2001). Lernplattformen auswählen. In: Hohenstein, A.; Wilbers, K. (Eds.). *Handbuch E-Learning*. Köln: Fachverlag Deutscher Wirtschaftsdienst. 2001.

Hendricks, W. (2001). Plattformen für E-Learning werden von Unternehmen weltweit etabliert. In: Thomas, U. u.a. (Eds.). *Anytime, Anywhere – IT-gestütztes Lernen in den USA*. p. 20 –22.

Pawlowski, J. M.; Adelsberger H. (2001). Standardisierung von Lerntechnologien. In: *Wirtschaftsinformatik*. Heft 1. p. 57-68.

Anatomy of a Web-based Course: How Visualization Types & Techniques Can Impact Student Engagement & Learning Outcomes

Ann M. Shortridge, Ed.D.
Dale Bumpers College of Agricultural Food & Life Sciences
University of Arkansas, Fayetteville
United States
ashortr@uark.edu

Jason L. Emmert, Ph.D.
Dale Bumpers College of Agricultural Food & Life Sciences
University of Arkansas, Fayetteville
United States
jmmert@uark.edu

Abstract: Today, although much debate surrounds the effectiveness of including graphics in web-based distance education courses, most course authors agree that such courses should productively engage students so that quality learning actually occurs. But just what is productive engagement in a world of electronic communication and text? This paper offers interested readers with a possible answer to this question by providing evidence that the use of graphics can enhance on-line teaching. The evidence includes a description of: the use of four different visualization types and techniques as instructional tools, the positive perceptions of 22 undergraduate students towards the use of these types and techniques, and the beneficial impact of their use on learning outcomes in an on-line undergraduate science course.

Introduction

In 1998, the Department of Poultry Science at the University of Arkansas, Fayetteville was awarded a United States Department of Agriculture (USDA) Higher Education Grant to address a growing instructional void in introductory poultry science. The objective of this project was to address the demand for this instructional need by developing two web-based poultry production courses that would cover the management of broilers, turkeys, breeders and layers. The Internet was chosen as the platform for course delivery because it is asynchronous and may be accessed from any connected site around the world. A content expert, an instructional designer and a graphic artist carefully reviewed a variety of instructional techniques and determined that a combination of visualization types and techniques could aid the learning process in the proposed on-line courses. Their unique instructional interface combined the use of static graphics, hypertext pop-ups, animation and concept mapping exercises to establish greater interaction or engagement between the students and course content. After the first course (Broiler & Turkey Production) was developed and implemented, the impact or benefit of these visualization types on the learning process was explored through document analysis and student interviews within a case study format.

Theoretical Underpinnings

The choice to use visualization as a method to engage students was based upon a review of two separate bodies of research and corresponding literature that assert that the visual representation of information increases a student's ability to learn in text-based environments. The first body of research addresses visual literacy, the second body addresses the development of mental models.

In regards to visual literacy, Levie and Lentz (1982) provided a comprehensive meta-analysis that addressed the effects of illustrated texts on learning by summarizing the results of 155 separate experimental comparisons.

> Forty-six of those (155 studies) studies compared learning from illustrated text material versus *(learning) from text alone*. In all but one of these 46 cases, the group mean for those reading illustrated text was superior to that of the group reading text alone...in 39 of the 46 comparisons, the difference was statistically significant...and the average group score for the illustrated-text group was 36% better than for text -alone groups (Levie & Lentz, 1982, p. 198).

A deeper examination of the impact of the use of graphics and illustrations on learning from textbooks was detailed by Braden (1996) and Rieber (1994). These authors both discussed Paivio's 1971 Dual Coding Theory of memory and cognition in detail. In essence, Dual Coding Theory postulates that humans encode information to long-term memory both verbally and visually, and that verbal concepts are hung on nonverbal pegs in memory; i.e., imagery is the effective variable in recall of concrete verbal/written information. Further, "this means that if some piece of information is coded both visually and verbally, the probability of retrieval is doubled" (p. 113). Dual Coding Theory ties nicely to the research on mental representation as discussed by Winn and Synder (1996).

In 1996, Winn and Synder asserted that cognitive psychology and science research may be divided into two major categories which link visual imagery and the creation of mental models to learning: mental processes and mental representation. According to Winn and Synder their review of the literature in this area supports the argument that individuals learn new information and solve problems by creating their own visual metaphors or envisioning complex processes. According to their analysis of Salmon's research, human thinking "uses various symbol systems as tools" to gain new knowledge (p. 117).

Designing Instructional Graphics

The effective design of instructional graphics is best achieved when it is anchored within a specific learning theory. Thus, it is important to note that while Levis and Lentz's (1982) meta-analysis may be viewed independently from any specific learning theories, Dual Coding Theory and mental representation are obviously best understood when related to cognitive and constructivist learning theories. An insightful theory-based guide that addresses these issues was published by Lloyd Rieber in 1994. In his book, *Computer, Graphics & Learning*, Rieber suggested that Gagnes's events of instruction support five applications of graphics to teach that lie within the cognitive-constructivist continuum: "cosmetic, motivation, attention-gaining, presentation and practice" (p. 45). Applying Gagne's events of instruction, Rieber asserts that content experts and instructional designers should include graphics in instructional materials in conjunction with verbal/written content to serve precise instructional functions and only if they fulfilled specific instructional objectives. Further, Reiber asserted the function of a graphic may be arbitrary or may be used to create a realistic representation or an analogy. Representational graphics depict reality or a simplified version of it as seen in Figures 1 and 4. Arbitrary graphics can be graphs or charts, etc. or may depict a mental model of a system or phenomena as seen in Figures 2, 3 and 5.

Rieber (1994) also asserted that the research on visually literacy can be viewed according to Blooms' Domain of Learning Taxonomy. Reiber argued that cosmetic and motivational graphics impact the affective domain while attention-gaining, presentation and practice graphics impact the cognitive domains. Further, effective cognitive domain graphics gain and focus student attention selectively. I.e., effective attention-gaining and presentation graphics help students to filter out external distractions, but should not be a source of distraction or cognitive overload themselves. (Cognitive overload happens when too much information is presented all at once.) Effective practice graphics support students in higher-level cognitive processes such as the integration of new information into prior knowledge.

Rieber's review of research concerning the use of instructional animations revealed that little research has been done in this area. However he was still able to make some important points. Rieber asserted that as with static graphics, animations should be used "to demonstrate or elaborate concepts, rules or procedures" (p. 50). In addition, he highlighted two special effects produced by this type of graphic based upon his own research in this area. Animations are able to show changes over time and changes in direction or the trajectory of an object or phenomena.

This paper focuses on the use of graphics for attention-gaining, presentation and practice. Another important aspect of the use of graphics in web-based courses that is not addressed by this study is user interface design. Navigation disorientation negatively affects learning outcomes and can be very frustrating to for the learner. This topic is extremely important and as such should be examined separately.

Description of the Visualization Types and Techniques

Effective Attention-Gaining Presentation with Static Visuals, Hypertext Pop-ups and Animation

The following examples represent a sequence of web pages in a module within the first course that covers physiology. This module teaches students about temperature regulation in poultry by using static visuals, hypertext pop-ups and animation.

Figure 1 illustrates the two basic or primary features of poultry physiology important to homeostasis (the ability to maintain a constant body temperature) through a static graphic. In this case the design of the graphic was intentionally kept quite simple in order to focus students on basic pre-requisite information/knowledge. The graphic visualizes the most important facts presented. The student's instructional objective was to grasp that poultry, like other mammals, are warm-blooded and must maintain a nearly constant inner body temperature (around their internal organs, or core).

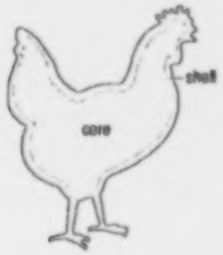


Figure 1: Static Visuals

Figure 2 guided students to build a deeper understanding of the physiology of homoeothermic animals by engaging students with hyper-text pop-ups windows. Clicking on each of the zones activated the appearance of a second image that contained additional information as seen in Figure 3. A bird's thermal environment may be described by several temperature zones. Different species' physiological reactions to a particular temperature may differ, but many animals go through similar behavioral and physiological changes as temperatures increase or decrease. The student's instructional objective was to describe each of the temperature zones to which poultry may be exposed, listing the thermoregulatory mechanism(s) that might be used, including specific examples.

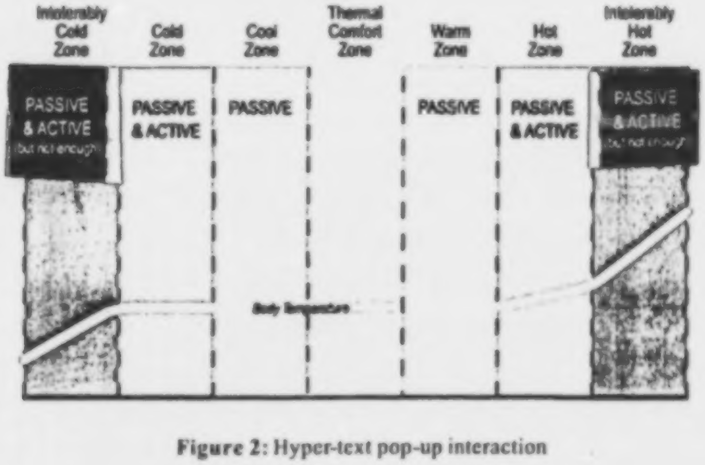
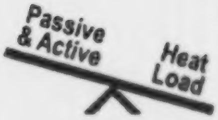

Intolerably Cold Zone
Cold Zone
Cool Zone
Thermal Comfort Zone
Warm Zone
Hot Zone
Intolerably Hot Zone
PASSIVE & ACTIVE (but not enough)
PASSIVE & ACTIVE
PASSIVE
PASSIVE
PASSIVE & ACTIVE
PASSIVE & ACTIVE (but not enough)
Body temperature

Figure 2: Hyper-text pop-up interaction

BEST COPY AVAILABLE

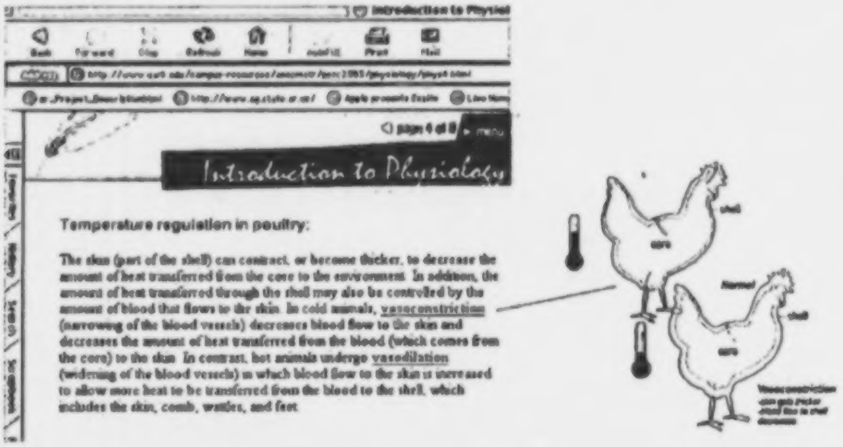


Intolerably Hot Zone

In this zone, an animal has used up all active and passive thermoregulatory mechanisms to stay cool. The animal cannot sustain its body temperature for very long, and death will eventually result.

Figure 3. Pop-up Hypertext/Second Browser Window for Intolerably Hot Zone Bar
(A mouse click on the red bar in Figure 3 causes this information to pop-up along with Figure 3.)

Figure 4 presents two important definitions with hypertext pop-up windows and animation. A mouse click on either of the two hyper-linked terms highlighted in blue (vasoconstriction and vasodilatation) activated a second pop-up browser window that revealed a graphic illustration of the concept. In this case the pop-up illustrations were animations. These hypertext pop-up animations emphasized key concepts by prompting students to attend to and explore important terms and definitions. The student's instructional objective was to define the terms vasoconstriction and vasodilation, and indicate how heat flow from the core through the physiological shell is impacted by these processes. Each of the simple two part animations revealed a progression in temperature change specific to the each of the two terms presented. The animations presented students with the normal state of poultry at two temperatures. A graphic representation of a thermometer changed to correspond with physiology changes in the poultry as the temperature changed. The use of animations to teach these concepts provided an excellent opportunity for the students' to learn an invisible and complex scientific phenomena that could not be demonstrated otherwise. In this case the animations are able to show changes over time and changes in direction or the trajectory of a phenomena.



Temperature regulation in poultry:

The skin (part of the shell) can contract, or become thicker, to decrease the amount of heat transferred from the core to the environment. In addition, the amount of heat transferred through the shell may also be controlled by the amount of blood that flows to the skin. In cold animals, vasoconstriction (narrowing of the blood vessels) decreases blood flow to the skin and decreases the amount of heat transferred from the blood (which comes from the core) to the skin. In contrast, hot animals undergo vasodilation (widening of the blood vessels) in which blood flow to the skin is increased to allow more heat to be transferred from the blood to the shell, which includes the skin, comb, wattles, and feet.

Figure 4: Hypertext Pop-ups and Animation

Effective Practice with Concept Mapping Exercises

Figure 5 shows a detail of a concept map. Concept mapping exercises were imbedded into the course's content where ever applicable, to force students to articulate and reevaluate their knowledge by creating a mental model. These exercises represent graphics used to promote higher-level cognitive

BEST COPY AVAILABLE

processes. Concept maps graphically illustrate relationships between ideas and their use in traditional classroom settings has been shown to greatly aid students in the process of restructuring their own knowledge and/or expanding their own conceptual understanding (Novak & Gowin, 1984; Novak & Musonda, 1984; Kennedy & McNaught, 1997). Within a concept map, two or more concepts are linked by words that describe their relationship. A concept is "a perceived regularity in events or objects or records, designated by a label" (Novak & Wandersee, 1990, p. 29). The student's instructional objective was to design a concept map that described the transitions a bird undergoes in each of the temperature zones, including references to passive and active thermoregulatory mechanisms, using real-world examples of different types of heat transfer.

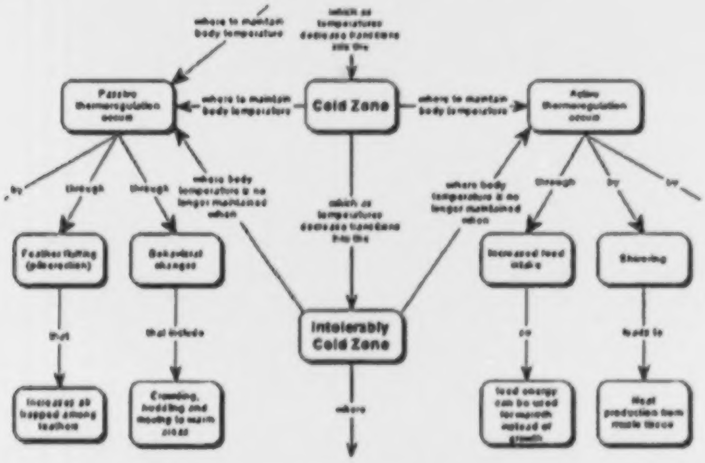

where to maintain body temperature
which as temperatures decrease transitions into the
Passive thermoregulation occurs
where to maintain body temperature
Cold Zone
where to maintain body temperature
Active thermoregulation occurs
by
through
through
where body temperature is no longer maintained when
which as temperatures decrease transitions into the
where body temperature is no longer maintained when
through
by
by
Feather fluffing (piloerection)
Behavioral changes
Increased feed intake
Shivering
that
that include
Intolerably Cold Zone
so
leads to
Increases air trapped among feathers
Crowding, huddling and moving to warm areas
where
feed energy can be used for warmth instead of growth
Heat production from muscle tissue

Figure 5: Concept Map Detail from Expert Map

Sample & Methods

The developed course (Broiler & Turkey Production) contained eight sections of content presented within a modular format: historical insight, hatchery operations, brooding management, grow-out management, housing, physiology, introduction to nutrition, and financial aspects of poultry production. As stated previously, the visualization examples in this paper were all drawn from a single module that covered physiology. This module was chosen as the focus of this study because it contained the most difficult content within the course. Twenty-one students volunteered to participate in the case study conducted on the physiology module. All twenty-one students completed pre- and post-content knowledge concept mapping exercises and six students were chosen to participate in the nominal group interview process based upon their concept mapping exercises. The purpose of the interview was to: examine user patterns and probe student perceptions and attitudes. The sample in this study placed limitations upon the type of interview process that was conducted. A true focus group could not be established because the participants knew each other and were not randomly selected. The choice of a nominal group interview process however was not seen as detrimental to the outcome of this study; nominal group interviews are particularly productive when researchers are seeking to provide consensus or recommendations concerning alternative solutions (Krueger, 1994, p. 19).

Student Perceptions of the Visualization Types and Techniques

All six of the interview participants asserted that the incorporation of static graphics, hypertext pop-ups, animation and concept mapping exercises within the poultry physiology content successfully increased their interest and engagement by causing the courseware's print-based interface to take on the

BEST COPY AVAILABLE

role of the teacher or instructor. This is particularly noteworthy as one of the primary goals of this study was to determine if the use of graphics could establish greater interaction or engagement between the students and course content to compensate for the decreased dialogue between the students and instructor common in distance learning situations. For example, Lindsey talked about how the various components helped to take the place of face-to-face contact with the instructor by stating: "...the icons helped tremendously because if you don't understand something you could go into those icons, and it gave detailed information about whatever he [the instructor] may actually be talking about. If you don't have a teacher and you can't ask him...for some of the students in ACTA [the Arkansas Consortium for Teaching Agriculture] schools [pause] I know take some of ours classes and stuff [pause] if they don't have that, then it would be kind of difficult [pause] if you don't have a teacher there…so the icons helped tremendously."

Further, Mickey elaborated on how various visualizations caused the content to be more dynamic by saying: "The diagram [Figure 2 and 3] that he [another student/Ken] mentioned was really, really helpful. You could click on the different parts [temperature zones shown in graphic form] and get information, but there was also a line showing [pause] how they [the poultry] were able to change their body temperature. I memorized that line, and that way I did not have to memorize every zone. Also you could click on vasodilatation and vasoconstriction on another page for further details..."

In specific regard to the use of concept mapping exercises, although only three of the 6 interview participants specified that concept mapping was a useful tool that enhanced their learning experience, all of the participants asserted that completing the concept mapping exercises required them to: increase their interaction with the course content and re-think their ideas about poultry physiology. For example, Hank affirmed the impact of concept mapping on his learning experience by saying: "It was useful. It was definitely useful…I would have to say as far as the temperature changes and things like that go... "

And Lindsey remarked on the differences between learning from the content alone and learning by creating concept maps by saying: "I think [pause] just basically putting everything into an organized manner [pause] if you just read the material than you are just getting a whole bunch of material, but when you do the concept map it showed like what you started with and what you ended with [pause] it helped [me] to understand the material."

In addition, the following comments indicate that it was not just one particular kind of visualization, but the combination of the other visuals used with concept mapping that created a better on-line learning opportunity. Hank describes his use of a hypertext pop-up graphic that showed various temperature zones during the post-concept mapping exercise by saying: "Whenever I read through the stuff on the web on that certain page that told all the temperature zones and how [pause] what effect it had on each one [pause] that was basically how my concept map was set up. It had the chicken in the middle, and then it had all the temperatures branching out from that and telling if it was passive or active or neither or both [pause] and each of the temperature zones and how they effected the chicken..."

Tom also elaborated on how the combination of graphics within the courseware helped him to learn temperature regulation in poultry by saying: "When doing the concept map, I just noticed throughout the physiology section that they would have words highlighted if they were scientific terms, and when you clicked them a pop-up screen would come up. Sometimes it would be a graph and sometimes it would be a definition, but it would pretty much explain it."

Concept Mapping, Changes in Mental Models & Learning Outcomes

A quantitative scoring scheme designed by Novak and Gowin (1984) was used to evaluate two concept mapping exercises administered before and after the students studied the on-line poultry physiology materials (Edmondson, 1999, p. 25). The goal of this evaluation was two fold: revealing changes in student mental models of temperature regulation in poultry, and as an alternative method of assessment. In contrast to other types of graphic organizers, Novak's concept mapping emphasizes the importance of specifying the links between key concepts, including cross-links across branches of any given hierarchy and adding examples to anchor concepts to the real world (Trowbridge & Wandersee, 1999). The scoring scheme is shown in Table 1. Changes in concept mapping scores are shown in Table 2. Please note that the concept map scoring data was analyzed from a qualitative rather than a quantitative viewpoint as attempts to establish the reliability and validity of concept maps has been shown to be problematic in previous studies. In addition, when reviewing the scoring scheme please note that the number of possible answers for each category was established using an expert concept map as a guide, however the expert map was not made available to participating students at any time during the study. The highest possible score was figured by multiplying the number of possible answers by the point value. The concept mapping exercise data takes the evaluation of the visual types and techniques used in this project a step beyond student perceptions by actually measuring learning outcomes. This data strongly indicated that student knowledge of introductory poultry production increased significantly because concept mapping exercises were imbedded into the courseware. Concept mapping acted as a tool for problem solving through the creation and invention of student mental models. Further, the student interviews plainly showed that students used other visualization types and techniques in order to complete their concept mapping exercises. Therefore it can be asserted that the inclusion of certain types and combinations of visualization positively impacts learning outcomes in web-based distance courses.

Category	Possible Answers	Po int Value	Highest Possible
Valid Relationships	55	1	55
(Conceptual) Hierarchy	13	4	52
Cross-links	14	10	140
Examples	30	1	30

Table 1. Concept Mapping Scoring Scheme

		Average Number of Answers	
Category	Possible Answers	Pre	Post
Valid Relationships	55	0	0
(Conceptual) Hierarchy	13	2.81	9.20
Cross-links	14	0	11.20
Examples	30	7.47	10.35

Table 2. Changes in Concept Mapping Scores

Implications and Future Directions

A triangulation of all of the data gathered this study indicated that the inclusion of certain kinds and combinations of visualization types can be used to productively engage students and thereby positively impact learning outcomes for web-based courses. The benefits of most of the visualization types used in this study as teaching tools have been clearly established by previous studies. However, this study is unique as it examines the use and impact of traditional graphics used in combination with animations and concept mapping on student engagement and learning outcomes within web-based courses. Therefore, the findings of this study are significant.

To place this study further into context an additional review of the literature concerning the instructional effectiveness of web-based courseware was conducted. This review revealed that only a few good studies of this nature currently exist. The most significant of these studies evaluated teaching practices within 486 educational web sites and concluded that use of the web caused teachers to choose ineffective teaching methods; of the courses sampled only 5.0% provided students with opportunities for problem solving, only 4.6% provided opportunities for creation and invention, whereas 52.5% left students with few options other than rotate memorization (Mioduser, Nachmias, Lahav and Oren, 2000, p. 63). Mioduser's, et al study did not examine web-based distance education courseware specifically, however their findings are still applicable to the study presented in this paper. Mioduser's, et al conclusions strongly support the argument that the courseware described in the preceding paragraphs was effective because it provided students with tools that prompt higher-level cognitive processes, such as problem solving and creation/invention.

In conclusion, the study presented in this paper is a single case study and as such cannot be broadly generalized. The results of one case study may be insightful, but the results of a series of case studies that examine the same topic would be more conclusive. Further case-based evaluation of the use of the visualization types and techniques presented in this paper is currently underway and will provide the opportunity for a meta-analysis of multiple case results.

References

Braden, R. A. (1996). Visual literacy. In D. H. Jonassen (Ed.), *Handbook of research for educational communications and technology*. (pp. 491-520). New York: Simon & Schuster Macmilliam.

Edmondson, K. M. (1999). Assessing science understanding through concept maps. In J. J. Mintez & J. H. Wandersee & J. D. Novak (Eds.), *Assessing science for understanding: A human constructivist view*. (pp. 15-40). San Diego: Academic Press.

Kennedy, D., & McNaught, C. (1997). Use of concept mapping in the design of learning tools for interactive multimedia. *Journal of Learning Research, 8*(3/4), 389-406.

Krueger, R. A. (1994). *Focus Groups: A practical guide for applied research*. London: Sage Publications.

Levie, W. H. & Lentz, R. (1982). Effects of illustration: a review of research. *Educational Communication and Technology Journal 30*, 195-232.

Mioduser, D., Nachmias, R., Lahav, O. & Oren, A. (2000). Web-based learning environments: Current pedagogical and Technological State. *Journal of Research on Computing in Education, 33*(1), 55-76.

Novak, J. D., & Gowin, D. B. (1984). *Learning how to learn*. New York: Cambridge University Press.

Novak, J D., & Musonda. D. (1991). A twelve-year longitudinal study of science concept learning. *American Educational Research Journal, 28*(1), 117-153.

Novak, J. D., & Wandersee, J.H. (1990). Perspectives on concept mapping. *Journal of Research in Science Teaching, 27*(10).

Rieber, L. P. ((1994). *Computers, Graphics & Learning*. Dubuque, Iowa: Brown & Benchmark.

Trowbridge, J. E., & Wandersee, J. H. (1999). Theory-driven graphic organizers. In J. J. Mintez & J. H. Wandersee & J. D. Novak (Eds.), *Teaching science for understanding: A human constructivist view*. (pp. 95-130). San Diego: Academic Press.

Winn, W., & Snyder D. (1996). Cognitive perspectives in psychology. In D. H. Jonassen (Ed.), *Handbook of research for educational communications and technology*. (pp. 491-520). New York: Simon & Schuster Macmilliam.

Elearning translates to experiential learning
In a
Communication theory class

Mukhbir Singh
E-mail: mukhbir@unforgettable.com

> What you have discovered is receipt for recollection, not for memory. And as for wisdom, your pupils will have the reputation for it without reality; they will receive a quantity of information without proper instruction, and in consequence be thought very knowledgeable when they are for the most part quite ignorant (Plato, 1973).

It is not of much use to see literacy as just reading and writing, ignoring the advanced demands that modern, industrial cultures have routinely placed on students in terms of these skills. It is not realistic to expect that merely by "reading" (one sided-engagément) of the text, students should be able to understand something of which they have little or no prior knowledge, or that all people and not just a privileged few, should be able to create texts that others may find useful and appealing. In a certain way, the heart of this issue lies the complexity of the connection between literacy and technology (Tuman, 1996). To understand this connection we must examine some of the common pedagogical practices and try to develop an understanding and see what is a viable and effective approach in the fast paced techno-industrial society of today.

The traditional model of pedagogy has its roots in linearity. This probably came about in the literate world because of the reproduction of language, as a means of instruction, in the form of a book. The advent of the printing press was a major step in this direction. As literacy changed, from its original oral to the written form in pedagogical practices, linearity became an important asset for the reproduction and creation of knowledge. This model of pedagogy is what we commonly use in the classroom today and is called Instructionism. Linearity over the years became a standard method of teaching as well as the construction of knowledge. This model therefore gave rise to the belief that knowledge could be transmitted through a linear method of instruction and is most common model today.

On the other hand, the constructionist approach to learning has its roots in the constructivist pedagogy, which claims that knowledge cannot be transmitted to a learner; rather the learner needs to construct knowledge by her/his own. The constructionist approach stresses the physical construction of artifacts by learners as a crucial method for them to be able to construct knowledge in their minds. This approach implies that the task of learning largely be left in the hands of the learner. She/he is free to structure knowledge as they maybe inclined to, even if it is in the wrong direction. This particular situation has significance from the point of view of creation of knowledge and understanding of theoretical concepts, in particular, concepts related to communication theory.

One method of instruction, therefore, could use the instructionist approach to teach these concepts, which are often described as difficult and abstract by undergraduate students. The other method could use the other, constructionist approach, to teach these concepts to these students. However, in the absence of feedback, students could likely construct a different meaning of theory(ies). To overcome the shortcomings of both pedagogical approaches, an integrated approach to teaching communication theory may prove to be more useful. The purpose of this paper is to analyze feedback given by students of a communication theory class, which uses an integrated approach to help students learn the concepts of communication theory. This analysis will seek to determine how this integrated approach helps students understand communication theory, if at all it does help them.

Before beginning the analysis, it is necessary to describe the pattern of teaching that is followed. The class clearly consists of two parts, the first part being the instructionist part. In this part of the class, the students learn about communication theory by reading about it in a prescribed book as well as scholarly articles. The students are also tutored through lecture/exercises. In addition to this, in order to mark the progress of the student as well as to ensure that they are keeping up with the text a short quiz is given to them at the beginning of each session. These quizzes as well as the exercises serve the function of feedback to the students in the class. Feedback is associated with linear instruction (Instructionism), which typically has the following sequence: students are presented with information, followed by a question. After providing an answer, a feedback is presented to the students. The continuation of the learning path is determined by structured interaction. In the second part of the class, the constructionist part: the part where students learn how to represent theory using hypertext. Hypertext, by the original definition, is the opposite of the traditional linear text. Hypertext can be browsed in a non-linear way, that is, it does not require the user to follow by the default sequence of words, sentences, paragraphs, and so forth. Historically, designers of hypertext for educational purposes have used the notion of non-linear text not only with regard to textual and other media delivered in their program, but also the structure of the instructions embedded within the program(s) (Spoehr, 1994). This allows learners to freely navigate throughout the various resources of the program, according to curiosity, associations, or any other motives they might have. However, in the structure of this class the learners were not given a hypertext program to browse through instead it took it one step further by making the students develop their own hypertext, in the form of web pages for the World Wide Web, to represent the communication theories they had learnt.

The objective of this part of the course was to let the students construct their own hypertext pages as per their thought processes. The students were free to use any format for the development of an argument for explaining the concepts according to a theory of their choice. This did not mean that the students were left to their own devices to develop their hypertext pages and the links to other pages. They were tutored by a group of peers who had already taken the course, as well as the instructors. The objective of this tutoring was not to focus their thoughts in a linear structure but rather to focus on helping the students developing their hypertext so that it did not miss out any of the finer nuances of the theory that they were working with. This tutoring, by the peers and the instructors, serves the function of feedback as in the instructionist model. It becomes relevant to integrate it in the constructionist model so that the paths the students followed, in setting up their hypertext pages, lead to the important places and they did not miss out on relevant information and/or contradictory information, which could confuse them. This process is meaningful since the student is actively engaged in thinking about the topics in the theory that they were working with. In the absence of feedback, misconceptions could occur in the students minds about their construction, if for example, it turned out to be inaccurate or irrelevant (Phillips, 1995).

This feedback mechanism serves as a connecting link between the two pedagogical approaches. However, the type of feedback differs according to the approach. While feedback in the instructionist mode serves a corrective function – it is an indicator to the student to fill a gap, which may exist. On the other hand, feedback in the constructionist approach is contingent on content more than on learning objectives. This shift of focus helps shift the students' attention to content of the hypertext pages thereby encouraging them to construct their own version of knowledge – the theory that they are working with. Feedback, in this way occurs at each step of the learning process. This enables the students to move from the instructionist mode to a constructionist or hypertext mode when feedback fades out. It works in the other direction too -- feedback appears, giving the students an opportunity to move back into an instructionist mode when required. The students also make use of an Elearning software package called Blackboard to exchange notes, HTML codes, set schedules, and coordinate the presentation of hypertext, within their group(s).

Teaching the students to use hypertext in formulating their own learning, in one context, involves the use of computers and broadly speaking technology. Hypertext is created using HTML (Hyper Text Markup Language)for creating pages for the World Wide Web. The use of technology in society has its critics and supporters. The supporters of technology have been at the forefront of introduction of computers in the classroom. Whereas, the critics have constantly been at loggerheads with this approach. The most notable being the Unabomber who modeled his critique of technology, given in his manifesto, based on the work of Jaques Ellul. However, the Unabomber manifesto uses the word "computer" frequently in connection with "control" and "technology." Nevertheless, the objectives of this mode of instruction are a step towards reducing the instructors control over the construction of knowledge by learners. By using technology in a productive fashion a synthesis of two approaches encourages the student to test her/his creativity in organizing knowledge, as they feel fit. Therefore, the critique of technology as set forth by Ellul is not relevant in this case. Ellul envisioned widespread social destruction by the use of technology but, he based his observations on the existing state of technology in the 1960's and then extrapolated its linear trend, not accounting for social evolution or economic growth and prosperity. Ellul could not envision the redistribution of technological power, allowing individuals to publish content on an equal footing with large organizations (1964). The use of hypertext is empowering for the students in the classroom as it enables them to find a new voice and encourages them on a road to independent learning.

Another objective of this class concept is to encourage the students to write their own conception of communication theory. This is done to encourage students to be involved in the text and write to learn. This follows from the movement of writing across curriculum (WAC). Traditionally there is little time devoted to writing by the student because this was reserved for a language class. Writing across the curriculum believes that writing should not be its own subject; rather writing is a way for students to understand all subjects (Hill, 1992). This phenomenon of writing as mode of learning can be traced to two closely related movements in American education: the process-over-product movement and the reemergence of cross-curricular writing programs. The rise of new rhetorical scholars in the 1960's the process movement gained momentum. This led to a fusion of rhetoric with psychological and linguistic theories of creativity, composing, and problem solving. Many of the "new rhetoricians" were interdisciplinary, merging linguistics, philosophy, literary theory, communication theory, and cognitive psychology with rhetorical theory and writing instruction. This made possible the link between scholarship and process-over-product approaches. Using this linking approach, we encourage students to write their own conception of theory. Thus, writing and learning becomes a different project when the objective is to promote the understanding of the discipline. The high number of published accounts of successful classroom practices based on a writing as a mode of learning suggests that such practices offer the potential to transform the classroom environments (Ackerman, 1993). This methodology in actuality stimulates the thought-expression dialectic and encourages the student to construct a balanced view of knowledge of the discipline. It encourages them into self-expression through writing and leads them sequentially and by self-indexing into the public world of formal discourse.

One of the objectives of the course is to promote independent and experiential learning, thereby constructivism, amongst the students and move them away from the standard pedagogical mode of Instructionism. To know more about this the students are encouraged to write a self-assessment report for extra credit. Analyzing these reports reveals a considerable thought that goes into writing them. One student for instance said:

> "I have seen that I have been able to understand these complex (communication) theories, design a web page, talk about them with others outside of class; I have been able to do all of this on my own. If you had asked me if I would have been able to do this at the beginning of the quarter, my answer would have been a simple "NO!". I am pleased with my growth as an independent student, and I plan to take what I have learned and apply it to everything I do in life."

There are other criticisms of the use of technology. There is a feeling that the much-touted literary revival is a myth. People who used to talk to each other, even on the phone, now use e-mail. What really gets churned out on e-mails and web-groups is second-rate literary stuff (Stoll, 1995). Nevertheless, e-mail has been found to increase interactivity in discussions amongst students. In terms of successful learning, these students need a tutor's guidance but this guidance should treat them as mature people (Marttunen, 1998). In the design of this course structure, the students were given guidance at the multi-levels, from their peers, as well as from the instructors. This multi-level mentoring has its rewards in helping the students develop into independent thinkers while being team players. One student's comments read:

> "I believe that my independence has really blossomed. During the first three web-pages, I almost always ended up calling another member of my group or our tutor in a state of panic about what I had done wrong. I can now gladly say that I did the last two pages completely on my own, and what an amazing feeling that is! Along with independent learning, I have realized how to be an independent worker while working within a group."

The unfortunate part is that pedagogical practices that use technology for, or to assist instruction, do not attempt to use the possibilities of the technology to the full. They could be more effective and economical using standard print. A lot of them are a mixture of linearity and explorations, not very different from practices that existed in the print form about twenty years ago. They fall short of the desired expectations because they do not follow some basic principles of educational programs: (1) Active participation, by learners, in the learning process; (2) Immediate knowledge of results and corrective feedback; (3) Avoidance of excessive errors on the part of the learners (Romiszowksi, 1988).

In the experience of conducting this class, which makes a strong attempt to integrate, both Instructionistic and Constructionistic principles, the results are quite encouraging based on some of the comments that we have seen earlier. The boost in the self-confidence of the students, as stated in their self-assessments is a strong indicator of this. However, it is necessary to point out that these assessments were done by the students for an extra credit so they could be affects by the bias of getting a higher score. Although, some of them are quite candid in expressing their remarks, which reveal their frustration at not being able to sort out some glitches in the technology which is being used:

> "Words can't even describe the level of stress that I have right now because of this stupid fetch program. Because it is not directly linked to the oak (the Web Server for the university) system, it takes forever to get anything from my public file. I understand that is an educational experience you want all to participate on, but let me tell you, this not an option for Mac people (Macintosh users) if they do not have dial-net."

Since then every effort has been made to make these technical problems not interfere with the learning. In reality, however, these kinds of problems are a little window to the professional challenges that the students may face once they leave the university and pursue their careers. It is a kind of preparation for them not to expect that all things would work smoothly at all times. On the other hand, however, this kind of a pedagogical practice makes the student dependent on technology to a large extent. The teacher at this stage appears to be more of a technician. What the student wants at this stage the teacher may not be able to provide. This is the kind of criticism that is being pointed towards technology in the classroom. Education, as Talbott (1995) interprets Papert, needs to be integrated with life, put fun into exploration, learning, and the value placed on abstract reasoning is a major obstacle to progress in education. Although these comments are based on the issues faced by educators today, they are however relevant to this study. The students do start being dependent on the willingness of the computer to place its mimicking intelligence at their service and sometimes may diminish their intelligent capacity to cope.

Through the integration of Constructionist practices with standard Instructionist pedagogy using technology, a very strong attempt has been made to help forge a different and quite distinctive pedagogical strategy to overcome some of the issues that limit both methods, Instructionism and Constructionism, individually. The results of this strategy are quite encouraging and constant effort is made to enrich the creation, exploration, and learning of knowledge of communication theory.

References

Ackerman, J.M. (1993). The promise of writing to learn. Written Communication 10 (3) 334-370.

Ellul, J. (1964). The technological society. New York: Vintage Books.

Hill, M. (1992). Writing to learn. Electronic Learning, 12 (3) 20-27.

Marttunen, M. (1998). Electronic mail as a forum for argumentative interaction in higher education studies. Journal of Educational Computing and Research, 18(4), 387-405.

Phillips, D. C. (1995). The Good, The Bad, and the Ugly: Many faces of Constructivism. Educational Researcher, 24(7), 5-11.

Plato. (1973). Phaedrus and letters VII and VIII. New York: Penguin.

Romiszowksi, A.J. (1988). The Selection and use of Instructional Media. New York: Nichols Publishing

Spoehr, K.T. (1995). Enhancing the acquisition of conceptual structures through hypermedia. In K. McGilly (ed.), Classroom Lessons: Integrating cognitive theory and classroom Practice (75-101). Cambridge, MA: MIT Press.

Stoll, C. (1995). Silicon Snake Oil. New York: Doubleday.

Talbott, S. L. (1995). The Future Does Not Compute. Sebastopol, CA: O'Reilly and associates.

Tuman, M. C. (1996). Literacy Online. Annual review of Applied Linguistics, 16. 26-45.

Abstract:

The purpose of this paper is to analyze feedback given by students of a communication theory class, which uses an integrated approach to help students learn the concepts of communication theory. This analysis will seek to determine how this integrated approach helps students understand communication theory, if at all it does help them. This paper draws upon the scholarship of teaching and learning to analyze the emergent situation in the class room. The students make active use of Blackboard – an eLearning tool to facilitate interaction amongst themselves as well as the instructors. The paper focuses on the impact of such technologies to supplement pedagogical techniques in making them more constructive and effective.

Communication and Collaborative Learning at Work: Views Expressed in a Cross-Cultural E-Learning Course

Virpi Slotte
University of Helsinki, Finland
virpi.slotte@iki.fi

Päivi Tynjälä
University of Jyväskylä, Finland
paivi.tynjala@ktl.jyu.fi

Abstract: This study focuses on the prerequisites for successful communication and collaborative learning in a large multinational company experienced by human resource development (HRD) practitioners who participated in a cross-cultural e-learning course. The participants were Finnish and Chinese employees (n=17) who used an asynchronous web-based tool to study adult education in a virtual university course. The web discussions of the one-year university course were used as a material for this study. The discussions were analysed by the phenomenographic method. On the basis of the analysis three main themes concerning communication and collaboration at work could be identified: 1) prerequisites for collaborative activities, 2) cultural differences, and 3) the role of management. We discuss the implications of these aspects for the development of e-learning solutions for professional and organisational development.

Introduction

Technological progress and changes in organisational infrastructures have increased the significance of collaborative learning for professional development. How knowledge is constructed, shared and communicated in organisations and how teams and organisations learn have become pivotal questions in organisational development (e.g. Argyris & Schön, 1996; Nonaka, 1994). The ability to learn collaboratively with others, both within and outside of their organisation, often means the difference between success and failure. Employees, who cannot network with others to share and build knowledge, will clearly fall behind those of their peers with such abilities.

This study is part of the larger project which aims to enhance cross-cultural collaborative learning through a university course in the workplace (Slotte & Tynjälä, 2002). As previous studies have showed effective use of computer supported collaborative learning in workplace depends on much more than simply purchasing a state-of-the-art package (e.g., Corrie, 2001). Organisational structures and practices as well as pedagogical arrangements and solutions together form a framework which much determines the success of any learning program. In the present study, we are interested in how experts in human resource development (HRD) view the prerequisites for successful communications in a large multinational company. As HRD practitioners work as key professional in organisational development (see, Slotte, Tynjälä & Hytönen, 2002), their views can provide important starting points for developing elearning programs to enhance professional and organisational development.

Communication and Collaborative Learning at Work

Collaborative learning is the process of generation of new knowledge and the capability that emerges when two or more individuals explore the target information together and produce shared outcomes (e.g. Dillenbourg, 1999; Roschelle & Teasley, 1995; Urdan & Weggen, 2000). Collaborative learning requires that the participants are open-minded, tolerant and make their thinking processes transparent. Sharing workplace experiences in a non-competitive spirit may benefit the individual and the organisation.

Building knowledge together with others may lead at its best to the accomplishment of something more than could be achieved by the individual alone. Bryans et al. (1998) have stated that persons who adopt a collaborative mindset maintain an active awareness of the collaborative learning potential in every work-based transaction. Thus, making collaborative learning and career development available to people at work may offer direct benefits to employees, making learning an integral part of the enterprise.

Co-operation between universities and working life organisations has extended rapidly during the last few years (see, e.g. Bryans et al., 1998; Otala, 1998; Slotte & Tynjälä, 2002; Tynjälä, Välimaa & Sarja, 2002). Whilst university courses provide new tools for continuous professional development for fulltime employees, the completion of a long-lasting course can be a daunting task in itself. In addition to the familiar problem of finding time to study, the courses themselves may require employees to apply collaborative learning activities they are not familiar with. In particular virtual learning programs call for awareness and readiness on the part of participants to reflect their own way of learning and working. The virtual learning environment provides a freedom that, at the same time, involves taking responsibility for one's own learning process. This is difficult if the individuals rely on mere co-operation based on dividing the task in question into subtasks using a fixed division of labour and on transmitting existing knowledge from peer to peer. Although this kind of information-sharing in groups and teams is also helpful, it tends to maintain the status quo and signals acquiescence with the power hierarchy in order to avoid "rocking the boat" (Corrie, 2000).

Collaboration, instead, aims at producing a joint outcome and thus requires sharing and generating new knowledge with peers. In this way it provides better opportunities to individuals to use high-order thinking skills and problem-solving in the construction of their ideas about practice (Jonassen, 2000). Collaborative learning is based on a simple but powerful idea: to create groups or learning communities that ground their development on mutual learning processes. It requires that participants are positively interdependent to socially shared knowledge, e.g., the members of a group are selected so that they need each other in order to accomplish their joint task. This, in many cases, calls for acquiring new learning skills. The need to develop learning skills is of especial relevance for employees whose memories of formal education date back several years or even decades. The key notions here are being active and developing initiative.

Aim of the Study

In the present study, attention was not paid to how participants learn collaboratively but to how they describe the corporate communication and collaboration processes, i.e., what they think are the prerequisites and challenges for successful communication and collaborative learning in a large multinational company. In more detail, the following research question was addressed: How do HRD practitioners describe communication and collaborative learning in a large multinational company?

Study Design

Material for answering our research question was gathered from a web-based adult education course arranged for HRD practitioners working in a large multinational company. Altogether 17 participants (14 female and 3 male) from Finland and from China volunteered for the course. The course was given by the University of Jyväskylä, Finland. It consisted of all the content areas generally included in the degree program of adult education (15 credits) but was modified to support the HRD in a global company (see, Slotte & Tynjälä 2002).

A special emphasis in the course was in understanding the complicated relations between learning, communication and development in workplace. For this reason, many of the web-based discussions as part of the course were focussed on the questions of communicating and collaborating at work. We used these web discussions as a material for our study. At the end of the course this formed a database of 159 pages (Word document with single line spacing). In addition, three group interviews were carried out in China to complement the results.

All of the participants'comments were analysed qualitatively to obtain the major themes that characterise communication and collaborative activities in HRD practitioners' view. For this purpose, the principles of the phenomenographic analysis (Marton 1988) were applied.

Results

The analyses of the web-based conversations showed that HRD practitioners dealt with a great variety of different themes concerning communication and collaborative learning in workplace. In general, all participants emphasised the importance of collaboration at work and "the tremendous potential that lies within people". This was also explicated in some comments such as the following: "if we just study by ourselves and never test our thoughts with others, many good things will never come up".

As a result of the phenomenographic analysis, the themes discussed by HRD practitioners could be classified into three basic categories: (1) prerequisites for corporate collaborative activities, (2) cultural differences and (3) the role of management. In the following sections we will describe the contents of these categories in more detail. We will start with the first theme, within which, five different categories of description could be further identified.

Prerequisites for Corporate Collaborative Activities

Five categories of description for the prerequisites for corporate collaborative activities include:

(1) Individual responsibility
(2) Social skills
(3) Technical tools to support human interaction
(4) Atmosphere; open and constructive communication
(5) Adaptation to continuous change

The first category includes comments related to core of collaboration, that is building the knowledge together, emphasis being at individuals responsibility to add value to the communication process:

> Of course, we as part of the organizational network need to add value to the information and communication processes. It's not enough to store information somewhere in the Intranet or on various databases, if we do not filter and process them in a way that makes them valuable for those who need to retrieve this information. In the end, our organization is great in storing information. However, this information is usually hard to find and / or digest for those who need it.
>
> Besides, we are not only part of the network as such – we are also responsible to form, build and continuously re-build this network as to meet changing needs. Usually, elements are connected in a certain way. But in our environment, we need to make sure that the communication channels, the 'who-provides-what-to-whom' are always up-to-date.

In addition to the importance of collaboration, the course participants broadly discussed about the social skills and individual preferences of interaction taking place in connection with everyday work activities. These descriptions stressed the modest level of awareness and willingness to actively improve communication skills.

> The fact is that everyone is an expert in some area, the competence and knowledge each of us has, could help someone else if shared it with people. But the fact is that we often aren't aware of our own expertise until we start conversing with people, and through conversation find out what I could give to my colleagues and what I in return could get from them. This process of collaborative learning is in fact a joint effort to share and refine information, knowledge, opinions and ideas for mutual and organisational benefit. It is almost obvious that the prerequisite for this kind of collaborative knowledge creation

> among colleagues and superiors will be based on trust, mutual respect, and open and supportive communication, which is a two-way dialogue.
>
> In our organization that is technically very strong, the soft side of skills are often neglected or underestimated. It is not yet fully understood how important good relationships are for good organizational functioning and performance, and in the long run for the overall success of the company.
>
> I strongly agree that in our organization we should use collaboration more and encourage people to share their ideas and experiences. However, most often people are accusing that there is no time to talk with each other's, or they don't think what could be the best way to do it.
>
> When using collaboration as a method we should also remember that not everyone likes to discuss and share his or her ideas with each other's. Extraverted persons may be the noisiest ones and willing to share their thoughts as soon as possible. Introverts meanwhile need time to reflect and then maybe speak up.

Closely related to the topic of individual preferences comes the question of technical tools and the appropriate methods to support human interaction. Face-to-face communication was generally expressed to be the most rewarding method. Slightly more participants preferred face-to-face contacts to online communication although the benefits of technical tools around them were commonly acknowledged. Their usefulness was seen as "facilitating and making communication easier and faster" The following examples illustrate the opinions of the suitability of various communication tools:

> We often forget interaction between people and just send emails and at the same time we loose something very human - joy of learning together. You Nina mentioned that we should create the environment where people are participating more and they should build together something new. Do you think that it is possible only via emails? I do not think so.
>
> We needn't go to classrooms, separate courses or any other special place to learn, if we were able to see the learning opportunities around us every day.
>
> What comes to interaction it shouldn't go through paper, neither through computer, but face to face communication. I think we still have space for improvement in this area. Quite often email or the Internet are very good ways for communication, but it is not very good if we are too much depend on them. Sometimes we are just sending an email, shooting the ball in the air and wait for someone to take it.
>
> In a way this kind of online communication here in writing requires to interpret others in the way they have intended the meaning to be interpreted. In this kind of discussions, and in fact in all kind of communication, feedback is crucial, otherwise one wouldn't know how one's messages and thoughts have been understood and interpreted.

How people co-operate with each other's and create the common ground to share mutual understanding, beliefs and pre-suppositions is further challenged by continuous change. In these cases, the participants often mentioned that "change" is not really change unless it has been adopted by all the employees in the organization. Further, the participants mentioned constructive atmosphere and openness as being the most important issue to adapt to changing needs in global business. The following comments exemplify the descriptions of both categories:

> The concept of perceptual change has been mentioned several times. But what may be difficult, is how to live with it, and adopt to all those novel situations and ways of working so rapidly and constantly. I think in the process of change, constructive, open and honest communication and sharing of thoughts and concerns may facilitate the adapting process and make it easier.
>
> The everlasting change of things and organizations is a valid comment. It is not enough to learn to communicate to certain group of people. You have to learn to be able to

communicate to target group that is always changing and might have different kinds of background, opinions etc.

The nature of information we process and distribute is subject to continuous change. Only if the structure of the network and the speed fully support the business, will we be able to become a learning organization.

Cultural differences in corporate collaboration

Cross-cultural university course resulted in a large number of comments concerning the cultural differences in corporate communication and collaborative learning. The participants generally agreed that all collaborative actions are context-specific and they can be understood properly only by understanding the situation where they have been uttered. Therefore, "if a piece of communication is extracted from its original context, and expressed in another social context, it is most likely to be misunderstood and misinterpreted." These kinds of misunderstandings in human interaction were described to be rather common, especially when people from different cultural backgrounds were involved. This was partly because of "more often than not we tend to take comprehension for granted, without taking the other person's background, level of knowledge and experience into account".

> Communication is often claimed to be very ambiguous, maybe because meanings are not in words, but in people. People have different social and cultural backgrounds, education, worldviews, beliefs, norms, and attitudes against which they try and interpret other person's meanings, which again have been formulated against his/her own sociocultural background. It is a universal fact that these backgrounds seldom match. This is one of the facts that makes communication complex, and puts extra demands on the act of communication, and on how things should be said, and meanings negotiated.
> We should remember to take into account cultural differences. For example in China it is unheard of people to speak openly in front of their senior managers.

When the participants discussed about cultural differences they described it for the most part from the corporate communication point of view. In most cases, the descriptions derived from what people had been taught. These notions reflect the challenges for collaboration, which are primarily based on their previous experiences about who to talk with and how much it is appropriate to talk in certain situations:

> In the Chinese hierarchy environment, communication used to and sometimes still is perceived as top down, one-way approach. Even in the freer company context, not everyone is aware that they are supposed to respond; they are expected to explain their ideas assertively and are entitled to say no. We call it a "dead box", which means, after information goes into it, nothing is produced and it vanishes. With the discouragement, the information provider can become silent very easily, and eventually nobody takes the initiative to share.
>
> I see cultural differences here, because Finnish people are not taught to boast with something they know. And unfortunately it might sometimes be taken like that if you start telling about your experiences with an issue or telling another person how to do things. You just keep it to yourself and that's it.
>
> One point that Ann made is very important: the Chinese education and social systems do not encourage young people to criticize people of authority, i.e. parents, teachers, bosses, etc.
>
> Marianne, I also see the cultural difference HERE in China. Chinese are taught to play low on oneself on the one hand, which is recognized as modesty and on the other hand, knowledge and information are seen as power/advantage over others. There is a fear that if you "give" it to others, you don't have it any more. It sounds sad, isn't it? However, if we consider the huge population and notice the resources per capita, it gives no surprise. The scarcity of resources defines the Scarcity Mentality.

The role of management

Managers' way of confronting others openly and directly was described as the key for constructive communication culture:

> I think that managers are in a crucial position in creating and inspiring an encouraging communication culture through their teams.
>
> Where we have to become much stronger though is in changing the corporate culture. No training course can replace the motivation by the boss or other peers. We talk about intrinsic motivation as being crucial for the learning. But this also comes from the possibility to exchange and pair up with others. If the culture were an employee needs to teach others or at least summarize the most important learning points, if the boss really cared for the changes planned – then, a training course would be a big thing, a step into developing a learning organization.
>
> In the future I'd like to see the concept of collaborative learning in the form of conversation to spread also to the management level. Top management have a lot of valuable information to share, which would benefit the lower levels of management, and speed up the circulation of information and special know-how. They could act as guest speakers or facilitators in multiple occasions of learning, whether face-to-face or online. In fact, I think that this concept could be easily applied to our everyday lives if we only feel receptive for it, because in our immediate environment there is so much new to discover.

When the participants discussed about the managerial experiences, they usually criticized managers' willingness to improve their communication and other soft skills. This was seen as significant because "there are so much knowledge of effective collaborative learning that has not yet been applied into practice".

> I agree with you that practice isn't up to theory yet, and a lot needs to be done, especially in the area of management skills. Even if the management styles have changed for better direction, and 'regular' people get more and more responsibility, I still think that it is managers who with their own behavior and communication styles set the pattern for the whole team.
>
> People still tend to look for their superiors as role models. But as you said, very many managers don't seem to understand the benefit this would do to the performance and success of their teams, and that way to the whole company.
>
> It is strange that we talk about the improvement of communication and open, trusting atmosphere, but they still seem to stay on the level of words only. Often I think when participating in a course that deals with interpersonal, team building and communication skills, that more managers should participate, but they never do.

Discussion and conclusions

Three main themes emerged from the analysis of the HRD practitioner' e-learning discussions about collaboration and communication at work. First, the practitioners dealt with the general prerequisites for true collaboration and functional communication. Second, they raised the question of cultural differences that are present in the multinational workplace, and, third, they emphasised the role of management in creating the context and atmosphere for collaborative activities.

Given that the participants of the e-learning course were experienced practitioners in corporate human resource development activities, those three themes can be seen as a reflection of actual communication cultures of the company, and of the needs for developing possibilities for collaborative learning. Consequently, they can also be seen as a data which provides important hints for developing e-learning solutions to enhance communication and collaborative learning at multinational companies. In the following passages we briefly suggest some aspects to be taken account while e-learning is applied for corporate training.

As prerequisites for corporate collaborative activities the participants mentioned not only technical tools but also individual and social characteristics such as individual responsibility, social skills, adaptation to continuous change and open communication atmosphere. These are factors that cannot be taken for granted in collaborative e-learning courses. For example, supporting atmosphere has to be constructed in mutual understanding between co-workers and co-participants. In an ideal case, a face-to-face meeting before starting e-communication could provide a context for building such an atmosphere. If face-to-face meeting is not possible, the informal introduction of people and negotiation of "the rules of the game" is important. Individual responsibility grows in an environment that positively emphasises mutual dependence.

Creating a learning environment that really supports communication and collaboration at work is not an easy job. It requires strong pedagogical insight, and eye for social situations and skills of guiding others. In this respect, the role of tutors of e-learning course is pivotal. Without skilful and experienced tutors e-learning situations may not reach the level on which significant learning experiences may take place.

In addition to creating a proper context for e-learning, taking account cultural differences between participants is important. This is a question that concerns not only multinational corporations but also other large companies. The ways of communication differ between countries and ethnical and social groups. How this can be taken into account in a way that respects all parties is a different question. Maybe becoming to know different cultural practices could be an important content and aim for multinational e-learning courses. We believe that current e-learning solutions provide excellent tools for increasing intercultural awareness and respect – given that the courses are run by teachers and tutors who themselves are familiar with different cultures and cultural practices.

The role of management in collaborative corporate learning and communication was the third main theme that was discussed by our subjects. The discussions reflected a concern about the distance between the ideal of organisational development and the actual managerial practices. We suggest that in corporate training programmes – conducted either in traditional forms of as e-learning solutions – the participation of the managerial level personnel would be of fundamental importance. If e-learning courses are designed for promoting professional and organisational development it requires the participation of the whole organisation.

In sum, for the development of successful e-leaning courses for professional and organisational development we emphasise the importance of the following four principles: 1) creating open communication atmosphere, 2) use of skilful and experienced tutors, 3) arranging cross-cultural training, and 4) involving the whole organisation, including management, in professional development programmes.

References

Argyris, C. & Schön, D. (1996). Organizational learning II: theory, method and practice. Reading, MA: Addison-Wesley.

Bryans, P., Gormley, N., Stalker, B. & Williamson, B. (1998). From collusion to dialogue: Universities and continuing professional development. Continuing Professional Development, 1, 136-144.

Corrie, L. (2000). Facilitating newly qualified teachers' growth as collaborative practitioners. Asia-Pacific Journal of Teacher Education, 28, 111-121.

Dillenbourg, P. (1999). Introduction: What do you mean by "Collaborative learning?" In P. Dillenbourg (Ed.) Collaborative learning. Cognitive and computational approaches. Advances in Learning and Instruction Series. Amsterdam: Pergamon, 1-19.

Jonassen, D. H. (2000). Transforming learning with technology: Beyond modernism and post-modernism or whoever controls the technology creates the reality. Educational Technology, 21-25.

Marton, F. (1988). Phenomenography: Exploring different conceptions of reality. In D.M. Fetterman (Ed.) Qualitative approaches to evaluation in education. The silent scientific revolution. (pp. 176-205). New York: Praeger.

Nonaka, I. (1994). A dynamic theory of organizational knowledge creation. Organzation Science 5 (1), 14-37.

Otala, L. (1998). Industry-University partnership: Implementing life-long learning. Continuing Professional Development 1, 100-110.

Roschelle, J. & Teasley, S. (1995). The construction of shared knowledge in collaborative problem solving. In C. O'Malley (ed.) Computer supported collaborative learning. NATO ASI Series F: Computer and system sciences, vol 128 (pp. 69-97). Berlin: Springer.

Slotte, V. & Tynjälä, P. (2002). Industry-university collaboration for continuing professional development. Submitted for publication.

Slotte, V., Tynjälä, P., & Hytönen, T. (2002). Examining HRD practitioners' views of learning at work. In proceedings of EARLI Learning and Professional Development SIG meeting, 2002, Turku, Finland. http://www.kas.utu.fi/EARLI-PDSIG/index.htm

Tynjälä, P., Välimaa, J. & Sarja, A. (in press). Pedagogical perspectives on the relationships between higher education and working life. Studies in Higher Education.

Urdan, T. A.& Weggen, C. C. (2000). Corporate e-learning: Exploring a new frontier. WR Hambecht+Co. Equity Research, pp. 1-92.

Webb, N.M. & Palincsar, A.S. (1996). Group processes in the classroom. In D.C. Berliner & R.C. Calfee (Eds) Handbook of Educational Psychology (pp. 841-873). New York: Simon & Shuster Macmillan.

Acknowledgements

This study was funded through an Academy of Finland Grant, 200034.

E-feedback to reflect legitimate peripheral participation;
towards a redefinition of feedback in online learning environments

John D. Smith
CPsquare, Portland OR, USA
John.Smith@CPsquare.com

Drs. Marc J.J. Coenders mld
Ph.D. student Utrecht University, The Netherlands
marc.coenders@chello.nl

Abstract

Design of feedback in an online workshop is considered from the perspective of legitimate peripheral participation. A tool for gathering and reporting feedback in an online workshop has evolved and been tested in the context of ongoing practice. Social and software design issues are considered together.

Introduction

Theories of learning can be classified according to whether the underlying metaphor is one of acquisition or of participation (Sfard, 1998). With the introduction of concepts like social construction of knowledge and legitimate peripheral participation (Lave and Wenger, 1991), the participation metaphor has gained legitimacy and richness, suggesting new approaches to the design of e-learning. This paper discusses feedback as an element of design in an e-learning workshop and presents a tool to organize and focus feedback about participation. The design includes social and software components, which have evolved together and are considered together.

The use of the Internet for educational purposes is often assumed to support an acquisition perspective on learning (Brown & Duguid, 2000). But computer-mediated communication (CMC) technologies such as chat rooms, instant messages and others afford entirely new ways of participating in conversations, social networks and communities. Salmon (2000) shows how the development of the competence that participants and e-moderators need (in both technical and social aspects of CMC) is a significant learning task in and of itself. Her model of teaching and learning online through CMC includes both acquisition and participation. An individual's increasing "amount of interactivity," as suggested by the model, moves from early stages ("access and motivation" and "online socialization") to the later stages ("knowledge construction", and "development"). This suggests an increase both in the amount and a shift in the kind of participation toward meaning-making. The design of an online workshop about communities of practice must focus on that shift–by making it visible and making it a subject for extended reflection.

The problem: feedback and online learning from different learning perspectives

In connection with learning, feedback is most often an attempt to assess the performance of a ***teaching*** process: it's the transmission of evaluative or corrective information about an action, event or process to the originating or controlling actor (Wing, 1990) and it's not the learner who is in control. The most common kind of feedback in an acquisition-oriented learning situation is given by the teacher as an assessment of the student, stating whether the material that has been presented has been properly or completely acquired. The notion of legitimate peripheral participation (Lave and Wenger, 1991) suggests that a learner's position as he or she moves toward an emerging center of a community of practice is a reflection of competence. "Position" and "center" are visible to learners in a myriad of social cues. Movement towards the center involves an evolving sense of identity: this is a more complex assessment process than whether acquisition has been completed properly.

Legitimate peripheral participation in online settings is no different than in face-to-face settings, although online communities of practice may form more slowly, some of the social cues may be harder to detect, and the expression of identity may take different forms. But these differences are magnified when the learning process takes place in a time-delimited episode such as a workshop. A community of practice perspective should influence the design of feedback to and from the learner as much as possible.

Online workshops designed as a community of practice suggest that feedback be reconceived from the perspective of the participant. In agreement with Putz and Arnold (2001, 194) we would argue that the design of such a workshop never completely determines the learning practices. The participants make use of the learning space offered by the workshop and co-create their learning through (constant) interactions with each other. Our design of a Community Barometer offered workshop participants opportunities to reflect on their interactions with each other, with "the content," and on their experience of the process itself.

When the subject of the workshop is "communities of practice," the importance of carefully designing the feedback increases. This project has taken an action research approach by reflecting on theoretical issues and, at the same time, reporting on the evolution of a tool that was used in just such an online workshop. The challenge has been to design a feedback tool that helps workshop participants learn–and gain insights into the general process of learning in a community setting. This implies that feedback is *"feedback to the community"* rather than to an authority figure. It's simultaneously *"feedback about the community"* and, significantly, *"feedback from the community."* Figure 1 suggests how the Community Barometer and the discussions around it can be the center of a reflective process.

This approach has further implications for software design as a support for social arrangements among workshop participants. As the design of the social process has evolved, the software to capture and represent the experience has had to evolve as well. Situating information capture and representation in the workshop space then becomes an important design problem.

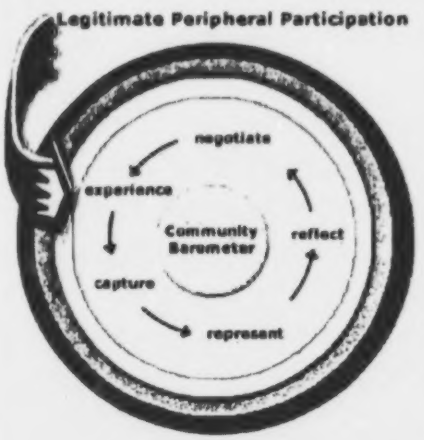


Figure 1: Conceptual model of Community Barometer use

Case description

Our feedback tool was developed in the context of an online workshop in which readings about communities of practice were discussed and in which a community of practice was simulated. Although the workshop involved teleconferences, email messages, and side conversations in various media, the main "space" where the workshop met was a customized conferencing site on a Web Crossing platform. As the design and delivery of the workshop have evolved over 4 years and 10 offerings, many elements have been introduced to help workshop participants visualize their own participation in relation to that of others. These examples of visible participation are illustrative:

- The foundation for the workshop was the online conversation over the course of five weeks. It offered several different kinds of conversations, playful and formal, all designed to encourage participation and reflection on participation. These different spaces are in effect "a curriculum," representing different facets of a community's life. Each offers a different kind of interaction and embeds different feedback characteristics.

BEST COPY AVAILABLE

- A "Community Directory" supports "back-channel" participation by providing each participant's name, thumbnail photograph and contact information such as telephone number, organization, and email address. In addition, it calculated a participant's local time and length of time since last login.
- The customized workshop platform provided a readily available instant messaging facility and a way to see who is "present" on the website. The list of people who are present linked to an instant message tool, which provided a much-used resource for chit-chat and feedback of various sorts.
- Workshop participants were asked to take on specific leadership tasks and roles that supported the activities and learning of the workshop community. These tasks were a version of stewardship roles described in Wenger (2000). Participants read brief descriptions of what these "leadership tasks" entailed, signed up for them at the beginning of the workshop, and then were coached by one of the facilitators as they carried out their duties. Each of the tasks involved reflection on community needs, trajectory, and general attitude. Participants signed up for leadership tasks as teams–with other members of small groups to which they were assigned at the beginning of the workshop.

There were many other ways in which both the design and production of this workshop emphasized participation and social learning processes. Feedback was woven into the design and production on many different levels. It began with the first contact before the participant had actually registered and continued through follow-up contacts after the end of the workshop.

Method

This paper uses an action research framework, since the authors were participants in the workshop, playing several different roles at different points in time (Baskerville, 1999). In this stage of the research Grounded Theory coding has not been used. Each iteration of the research process consists of five phases: diagnosis, action planning, action taking, evaluation and specific learning. Although work in this area began earlier, this paper focuses on the workshop offerings in Fall 2001, Winter and Spring of 2002.

Design issues: the software and the social system

The main issues regarding the design of feedback in this workshop are:

- The workshop was quite short (5 weeks) and the learning curve was rather steep in the sense that many participants were struggling to understand the readings that were being discussed as they were confronting a complex CMC environment for the first time.
- Voluntary participation served as a test of relevance. Most participants in the workshop had full-time jobs and had underestimated the amount of time that participation in an online workshop entailed. The voluntary aspect of discussions and tasks were as important in this workshop as they would be in any community of practice: attention acted as a built-in relevancy test and was an element of community rigor. Attention, therefore, is a fundamental kind of feedback.
- The workshop was co-produced with the participants. Workshop participants were asked to carry out tasks that illustrated community leadership roles that normally emerge over much longer periods of time (Wenger, 2000). Some of these roles (such as organizing and facilitating teleconferences) were relatively intuitive and familiar to the participants. Others (such as some of the reflective tasks) seemed more difficult for participants to conceptualize and execute. There was a natural tension between allowing participants to shape their own roles and insuring that the work of the simulated community actually got done. The very notion of a community of practice

suggests that too much facilitation (or facilitation that is too directive) can undermine the self-organizing capacity, even of a simulated community such as this workshop.

- Although the workshop was artificial in some ways, the relationships and the learning that occurred during the workshop were real. Participants were invited to reflect on the process of community formation and the related learning issues.

All of these design issues served as a kind of diagnosis: the feedback process needed to be somewhat formalized, the process needed to engage the attention of workshop participants voluntarily, and their attention needed to be drawn to issues at a community level. The focus of the feedback needed to be on the community development process, but the feedback process itself could not be too directive or depend too much on the intervention of the workshop leaders.

Design process

The online questionnaire that has developed addressed the foregoing issues and was used in the Fall 2001, Winter 2002 and Spring 2002 workshops. The process of design evolution is expected to continue.

Originally the Community Barometer was conceived from a spatial perspective (Coenders 2002). The questions were suggested by a spatial metaphor whose logic was roughly: an online "space" accommodates activity, interaction and insights that enable learning. The "amount" of space and the functioning of the space may have a significant effect on enabling a workshop's outcomes. Space in this view is a mix of virtual, mental and interpersonal space and is compatible wth the concept of "Ba" as introduced by Nonaka. This led to a survey that combined closed-form questions and open-ended responses. It was used experimentally as a participant mini-project in the Spring 2001 workshop and subsequently evolved into the Community Barometer.

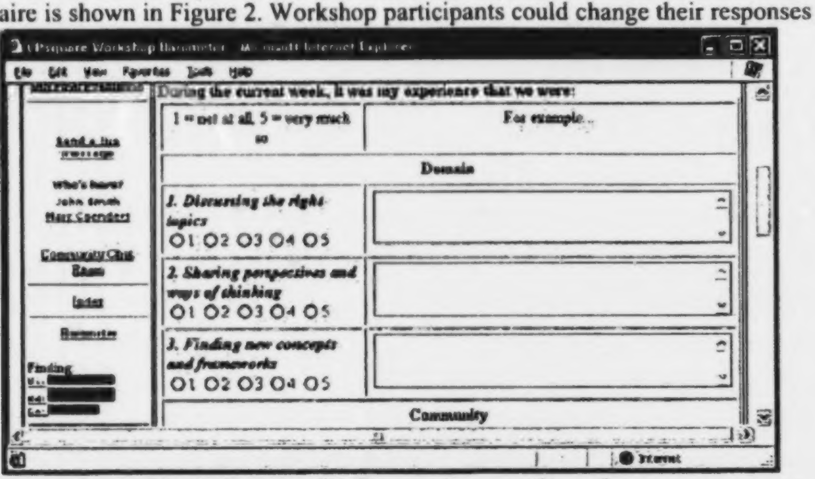
As a result of the first trial, the questions were re-organized, the questionnaire was automated and the administration of the questionnaire was incorporated into the Fall 2001 workshop. The questions which had been developed independently were found to fall nicely into the model that Wenger (1998) had developed for a community of practice. The Web Crossing platform provided good facilities for storing information such as questionnaire responses in the user record and its programming languages enabled the automatic aggregation and reporting of stored data. Through a connection between the Community Barometer questionnaire and a discussion titled "Reflecting on our experience," workshop participants were brought indirectly into the feedback design process.

Implementation

The Community Barometer questionnaire added two forms of feedback to the discussion: closed-form responses and open-ended questions. The closed form component asked participants to rate the extent to which they experienced the workshop community as:

Domain	1. Discussing the right topics
	2. Sharing perspectives and ways of thinking
	3. Finding new concepts and frameworks
Community	4. Being together with each other
	5. Developing enough trust for deep discussion
	6. Building collaborative relationships
Practice	7. Participating in setting direction and tone
	8. Evolving communication practices along the way
	9. Working towards useful outcomes

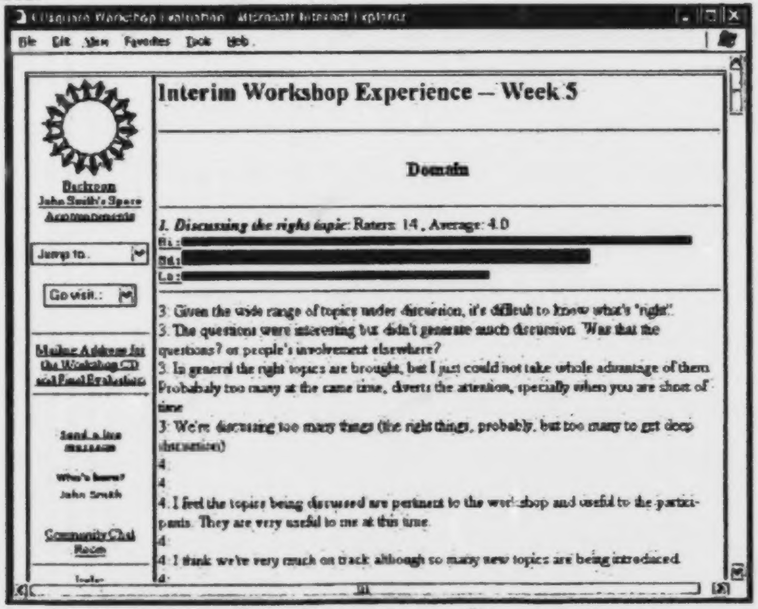
The open-ended response component of the questionnaire asked respondents to give a brief example to illustrate their experience of the closed-form question. A screen-shot of the questionnaire is shown in Figure 2. Workshop participants could change their responses at any time during a week. Notice that the Community Barometer questionnaire page, like all others in the workshop, had a navigation bar along the left which provided access to several different resources, including the Barometer questionnaire and the Barometer results summary page. The bar chart in the lower left hand corner of Figure 2 represented the median and quartiles of one question and was a link to that section of the Barometer results summary report. Which question was represented, as well as where in the summary report the link takes you, depends on the location in the workshop. For example the Domain questions pictured in Figure 2 were associated with formal discussion spaces in the workshop while questions associated with the concept of community were associate d more informal and playful spaces.


File Edit View Favorites Tools Help
Send a line message
Who's here?
John Smith
Community Chat Room
Index
Barometer
Finding
Internet

During the current week, it was my experience that we were:

1 = not at all, 5 = very much so	For example...
Domain	
1. Discussing the right topics ○1 ○2 ○3 ○4 ○5	
2. Sharing perspectives and ways of thinking ○1 ○2 ○3 ○4 ○5	
3. Finding new concepts and frameworks ○1 ○2 ○3 ○4 ○5	
Community	

Fig 2: Community Barometer questionnaire


File Edit View Favorites Tools Help
Backroom
John Smith's Space
Announcements
Jump to...
Go visit...
Send a line message
Who's here?
John Smith
Community Chat Room
Index

Interim Workshop Experience – Week 5

Domain

1. Discussing the right topic: Raters: 14 , Average: 4.0

Hi:

Md:

Lo:

3: Given the wide range of topics under discussion, it's difficult to know what's "right".

3: The questions were interesting but didn't generate much discussion. Was that the questions? or people's involvement elsewhere?

3: In general the right topics are brought, but I just could not take whole advantage of them Probabaly too many at the same time, diverts the attention, specially when you are short of time

3: We're discussing too many things (the right things, probably, but too many to get deep discussion)

4:

4:

4: I feel the topics being discussed are pertinent to the workshop and useful to the participants. They are very useful to me at this time.

4:

4: I think we're very much on track although so many new topics are being introduced.

4:

Fig 3: Community Barometer results summary page

BEST COPY AVAILABLE

All workshop participants were able to see an anonymized summary report of all responses at any point. As shown in Figure 3, the summary report grouped the open-ended comments by the corresponding closed-form score. Therefore, for each of the nine questions, the open-ended responses at a given point on the scale from one to five were shown together. Since the questionnaire and the results summary changed each week, the responses and the summaries pertained to a specific week. During the course of the workshop, the summary reports from the preceding weeks were available, permitting comparisons from one week to another. The responses illustrated in Figure 3 represent the lower end of a symmetrical distribution that ranges from 3 ("neutral opinion on whether the right topic is being discussed") to 5 ("strongly agree").

There were two ways in which the Community Barometer was woven into the social fabric of the workshop community. The first was to tie it closely to an ongoing discussion titled "Reflecting on our experience." The navigation bar on every page in the workshop website linked directly to both the Barometer questionnaire and to the summary report. These in turn linked directly to the "Reflecting on our experience" discussion. Although many discussions in the workshop were time-bound (e.g., the "Welcome to the workshop" discussion was only active at the very beginning), "Reflecting on our experience" was an ongoing discussion that went on for the duration of the entire workshop.

The second way was to have the leadership team facilitate the "Reflecting on our experience" discussion. This team explicitly signed up to consider the development of the sense of community, to encourage participation in the reflection process, and to interpret the Barometer summary report. The team facilitating the community-wide discussion typically held small-group discussions in their own personal space about the facilitation task, about the Community Barometer, or about the reflective process in general. The team's personal space was open to others but was infrequently visited by people not on the Barometer team.

Feedback produced

The following feedback was produced by the Community Barometer:

- The number of responses, the average, median, upper- and lower-quartiles were calculated and provided in appropriate locations, shown as numbers and represented graphically. (See Figures 2 and 3.)
- Each participant could see how his or her scores compared to the group statistics.
- The comments of each participant on each question were shown anonymously in the Barometer summary report.
- Each participant could see how his or her comments compared to those of others.
- Cumulative data was not automatically displayed but was made available to the Barometer facilitation team, which, in some workshops, published week-to-week comparisons.

Outcomes & observations

The Community Barometer was used in three workshops, during the Fall of 2001, the Winter of 2002, and the Spring of 2002. The following observations were made during these workshops:

- Most workshop participants completed the questionnaire and many offered rich and insightful comments about their perceptions of and reactions to the workshop experience. The percentage of workshop participants completing the questionnaire declined over the course of each workshop. Less than half of the completed questionnaires contained open text "examples."

- Support and guidance for the leadership team that volunteered to work with the Community Barometer turned out to be crucial. Just as the software implementing the Barometer questionnaire and summary report evolved through experimentation, the instructions to the leadership team evolved as the meaning of the task was negotiated, as different team members offered new skills and perspectives, and as the workshop leaders gained experience in the process. For example, because of the amount of work entailed by this leadership task in the Fall of 2001, three different teams were recruited in the Spring of 2002, one team for each of the active weeks. The effort involved in understanding the task and stepping into the leadership role was such that in the Spring of 2002 we reverted to the simpler but more onerous design where one team took on the task for the duration of the workshop.
- Messages from the leadership team inviting participants to complete the Community Barometer or to join the discussion "Reflecting on our experience" were effective and fit into the self-organizing spirit of the workshop.
- Although the Community Barometer summary did come up in the discussions on "Reflecting on our experience", it was not necessarily the center of the discussion: the Community Barometer could be ignored as such even though the discussion (about, for example, the appropriate length of postings) touched on issues that were also mentioned in the Community Barometer summary report.
- Workshop facilitators referred to the Community Barometer summary report and found that it reflected events, concerns and emerging topics. Although it did not provide easy answers, obvious "fixes" or suggest course corrections, it was a useful resource.
- The comments in the Community Barometer and in the discussion "Reflecting on our experience" were fairly divergent. Careful attention and skill on the part of the leadership team was needed to keep the discussions focused and productive.

Conclusions and discussion of what we've learned

The reflection which we have encouraged in the workshop is an unpredictable process in the sense that it is multi-layered, is only partly visible and it interacts with all of the other online activities. The same can be said for the process of writing this paper. Here are several issues that rise to the surface in reflection on the development process as a whole.

- The Community Barometer should be regarded as a social "affordance" (Norman, 1988 and Norman 1993) in the workshop community's life. The way it appears to the community suggests meaningful improvisation and additional uses. Its actual use is a combination of many factors, ranging from its mechanical design, its wording, its placement and availability, the leadership of a team of volunteers and the coaching they receive. The community's response is quite complex and changes over time.
- It is worth speculating whether synoptic community awareness is too lofty a goal for a barometer in a fast-paced online workshop; a more modest goal that a tool (and associated practices) might aim for is something like proprioception, in the sense that different actors in a community sense the amount of "stretch" or effort that's appropriate for their function.
- Designing feedback for an emergent entity–a community that doesn't exist at the beginning of the workshop, but which is in the process of forming–involves some subtle paradoxes. Distinguishing between assumptions, intuitions, and evidence in a fast-paced online environment is a challenge both for workshop leaders, the designers, as well as the participants.
- The temptation to assess the assessment tool with a questionnaire was strong. Resisting the temptation seems, in retrospect, to be very much in the spirit of learning

suggested by Lave and Wenger (1991) and Wenger (1998). Ongoing reflection and discussion by the participants in a workshop seems to be a productive strategy for the development and assessment of a tool. That belief has general implications for the development of software tools.

- Using the barometer questions, software, and practices in other settings would nevertheless be productive.

Just as a common barometer indicates a possible change in weather conditions, the Community Barometer described in this paper provides evidence of community conditions–that community members must interpret with care. It captures and presents subjective experiences and as such supports an intersubjective reflection and negotiation process. As weather fluctuates within a dynamic range of equilibria, a community fluctuates along three dimensions: community, practice and domain. The Community Barometer aims to indicate some fluctuations so people are alerted to areas and issues that deserve attention. The Community Barometer is a way to prepare participants for the sunny and rainy days of community life!

References

Baskerville, R. & Pries-Heje, J. (1999). Grounded action research: a method for understanding IT in practice. *Accounting Management and Information Technologies, 9,* 1-23.

Brown, J. S. & Duguid, P. (2000). *The Social Life of Information.* Cambridge, Mass.: Harvard Business School Press.

Coenders, M. (2002). The Spacing of learning in organisations: Towards a model of community space. *Third Conference on HRD Research and Practice Across Europe.* Edinburgh, Napier University.

Lave, J., and Wenger, E. (1991). *Situated Learning; Legitimate peripheral participation.* Cambridge: Cambridge University Press.

Nonaka, I. & Konno, N. (1998). The Concept of "Ba"; Building a Foundation for Knowledge Creation. In *California Management Review, 40(3),* 40-54.

Norman, D. A., *The psychology of everyday things* (New York : Basic Books, 1988).

Norman, D. A., *Things that make us smart: defending human attributes in the age of the machine* (Reading, Mass.: Addison-Wesley Pub. Co., 1993)

Putz, P. and P. Arnold (2001). Communities of Practice: guidelines for the design of online seminars in higher education. In *Education, Communication & Information*, Vol. 1, No. 2, 181-195.

Salmon, G. (2000). *E-moderating: The Key to Online Teaching and Learning*. London, Stylus Publishing, LLC.

Sfard, A. (1998). On two Metaphors for Learning and the Dangers of Choosing Just One. In *Educational Researcher, 27 (2)* 4-13.

Wenger, E. (1998). *Communities of Practice; Learning, Meaning and Identity.* Cambridge: Cambridge University Press.

Wenger, E. (2000) Communities of practice: stewarding knowledge. In Despres, C. and Chauvel, D. (eds.) *Knowledge Horizons: the Present and the Promise of Knowledge.* Butterworth-Heinemann, Boston.

Wenger, E., McDermott, R, & Snyder, W. M. (2002). *Cultivating Communities of Practice.* Cambridge, Mass: Harvard Business School Press.

Wing, K. T. (1990). Implications of feedback research for group facilitation and the design of experiential learning. In *Small Group Research, 21 (1)* 113-127.

Exploring Opportunities for Online Instruction for Individuals with Severe Disabilities

Nathan M. Sparks
Virginia Alternate Assessment Program
Division of Assessment and Reporting
Virginia Department of Education
United States
natesparks@excite.com

Abstract: This article examines the current state of available programming and content delivered via the Internet for individuals with severe disabilities. An examination of current research points to a lack of free programming and content devoted to the educational needs of these students. Currently available resources for individuals with more significant disabilities are limited by many factors including costs for training and materials, lack of accessible web-sites for individuals with significant disabilities, relevant programming and information, lack of free programs, understanding the interrelationship between student learning needs and instructional delivery systems, and the ability for developers to address the programming needs of this small population of end-users. Programming for this population should focus on functional academic support, daily living skills instruction, job exploration, and online recreational opportunities. Access to programming should provide multiple points for end-users and provide content in varied formats to suit individual needs. It seems the challenge of using the Internet for instruction of students with severe disabilities may require educators to examine a new paradigm of instructional delivery.

Foundations

"As technology becomes more advanced and technologies are merged, it becomes more important that technology and learning relationships are thoroughly explored and understood. Until these relationships are better understood, there is a good chance that technology will continue to have much less impact on special education than we all believe is possible" (Hasselbring, 2001).

The Internet has had a profound affect on instructional programming for many student populations. The purpose of this article is to examine the feasibility of providing online course materials and support for students with more significant disabilities. For purposes of this discussion, this article will consider the definition of mental retardation and severe disabilities as specified in the Individuals with Disabilities Education Act, 1997. "Mental retardation means significantly sub-average general intellectual functioning existing concurrently with deficits in adaptive behavior and manifested during the developmental period, that adversely affects a child's educational performance" (IDEA, 1997). Individuals typically considered as having significant (severe and profound disabilities) will usually demonstrate IQ levels below 40 and may also have additional disabilities, including movement difficulties, sensory losses and/or multiple disabilities which may foster behavior problems. This article will examine existing technologies for Internet access and the specific programming needs of individuals with significant disabilities.

The practice of using the Internet as a delivery system for educational programming has flourished in the past decade. Entering "online course" in a web search engine will generate upwards of 263,000 entries (www.alltheweb.com search results, April, 2002). Most major universities across the globe have developed and provide some form of online instruction to offer class content, support or information. Likewise, the public school environment has begun to develop and implement online course content for students at all levels. With continued improvements occurring in technologies associated with the Internet, these trends are likely to continue (Hofstetter, 2001). Currently available technologies for computer access exist for students with significant disabilities, however programming and content on the World Wide Web (WWW) is limited to purchasing programs from selected vendors and web-sites that are sometimes

BEST COPY AVAILABLE

inaccessible to this population. The Internet can be used as a resource and instructional tool for these students, however content and accessibility must be addressed in the design of web-sites and programs for this population (Hasselbring, 2001).

Available Technology

Internet technology has revolutionized instructional delivery systems for many populations. However, many localities may have a difficult time finding funding and resources to provide Internet access for students. Therefore, "very little hard evidence is available showing what learning gains might be expected from infusion of high technology, in part because there are very few classroom situations where an entire class has ready access to technology throughout the school day" (Tiene & Luft, 2001). This points to one of the serious challenges facing implementation of Internet instructional systems; the ability to provide computer technology, training and related equipment for students and teachers. This becomes even more difficult as it relates to special education and the needs of individuals with significant disabilities. Most students falling into this category of disability will need hardware designed to offer them access to the Internet (Snell & Brown, 2000). This could include switch technology, alternate keyboards, voice recognition software or hardware, and interface programming and hardware to allow functionality. All of these technologies are costly, and in some instances, hard to locate. Findings from the 2001 Report on Special Education Programs in California point out that "technology and equipment for instruction and mobility of students with perceptual and/or motor disabilities is not available or very outdated" (CDE, 2001). Dr. Fred Hofstetter sums up the current situation as follows, "In theory, the ubiquity of the Internet provides the opportunity for teachers and students to remain in touch virtually when they cannot interact personally in the classroom. In practice, educators need software that enables them to put courses online, view student performance data, identify problems when students encounter difficulty, and provide scaffolding to help students overcome the difficulties" (Hofstetter, 2001).

Even with all of the difficulty surrounding accessing the Internet for instructional purposes, most teachers, parents, and students view the Internet as a viable instruction tool. When questioned about Internet educational delivery practices in a study conducted by Lewis, Harrison, Lynch and Saba, teachers and administrators stated that technology use improves academic performance, increases student on-task time, provides quicker access to information and learning, and exposes students to new "types" of learning (Lewis et al., 1994). We can conclude from this study that teachers and administrators see online educational structures as positive learning systems. Unfortunately, these systems may be costly to divisions in meeting training and equipment needs (CDE, 2001). "The many years of under funding and the inequitable distribution of what funds were available, has resulted in some districts capable to provide while their neighbors struggled to meet minimal standards" (CDE, 2001).

Internet technologies have made access to instructional materials and content easier for those populations able to access the World Wide Web. Further, access to the web provides students with multiple occasions to interact with a broad range of learning opportunities and environments (NCIP, 2001). Access to the web may be in the form or programming or hardware, but systems must be designed to address the specific needs of varied users with disabilities (Tinker, 2001). This access needs to be expanded to include students with more significant disabilities. In order to provide this access, systems to address the needs of these students should make use of available technologies and access systems to minimize expense and training demands for potential end-users.

Providing Programming for Students with Severe Disabilities

There are many challenges and rewards to be found in providing programming and instruction to students with severe disabilities via the Internet. There are many characteristics of typical individuals with severe disabilities (Snell & Brown, 2000) that are well-supported and enhanced via Internet technologies and computer instruction delivery systems. Independent learning, self-paced access, variable levels of support, and repeated practice are important factors identified as effective instruction for individuals with significant disabilities (Snell & Brown, 2000).

The format of instructional delivery lends itself to independent interaction and learning, which has been a cornerstone in the individualized programs used by these students. When teachers use the Internet with these students, the role of the teacher is altered and the computer becomes the instructor, which fosters student-driven discovery and learning (Sprague & Dede, 1999). Students are allowed to access the information at their own speed and control repetition of content.

Students with more severe disabilities are often using picture communication systems as their mode of communication (Downing, 2002). Internet technologies have made images readily available over the WWW. Using pictures can make curriculum more accessible for students with significant disabilities. "They are able to use visual clues without struggling with text" (McInerney, 2000). This is an example of how Internet instructional delivery may be superior to other modes when working with certain populations of students. Images can be combined with narration to provide learning experiences that are more accessible to the student.

"Clearly, one could argue that in many cases, students with disabilities have a greater need for accessing technology than do their non-disabled peers. This may be especially true for students who need technology just to function within the school environment, such as students with sensory and physical impairments. However, even many students with high-incidence disabilities, such as learning disabilities, require technology to function in the school environment"(Hasselbring, 2001).

Instruction in leisure activities is a component of most programs for students who have severe and multiple disabilities. The Internet can provide a large array of visual and auditory content to address this area of needed instruction. Students with severe disabilities can use computer access and currently available Internet web-sites to explore leisure activities and make activity choices (Dattilo, 1986). One type of leisure instruction could be Internet field trips for students. Students can exchange information about where they live and visit locations via web-sites to experience different settings (Harris, 1994). Although this has been proven to be an effective delivery system for this population and content area, many students with severe disabilities "under-utilize assistive technologies" related to leisure activity instruction (Wehmeyer, 1999).

The Internet can provide opportunities for repeated exposure to the same content and lessons driven by student needs. Finding content that is focused towards those needs for students with significant disabilities is difficult. It is important that teachers examine the relationship between the capabilities and inherent qualities of the Internet and their specific student (Hasselbring, 2001). It is not enough to simply provide these students with access systems to "surf" the web, we need to provide them with instructional programming that is relevant to specific student needs and Internet experiences that are enriching to the student's daily life. Some of these areas of identified instructional need include functional academics. Content focusing on support of functional skills, such as purchasing foods at a grocery store, writing checks at a bank, or utilizing public transportation can be supported and instructed through visual presentations delivered via the internet. Daily living skills, such as washing hands, doing laundry, doing dishes, or using the telephone can also be adapted and instructed in various formats delivered over the internet. Job exploration can be accomplished through descriptive and visual formats that provide students with significant disabilities information about job expectations and skill requirements.

A major issue relating to available Internet content for students with severe disabilities has been the lack of free content specifically designed for access and use by these students. Content needs to be modified to provide students with significant disabilities avenues of access that are meaningful and useful to their individual educational program. This requires many individuals coming together to create content and programming focused on the student with severe disabilities. "Realizing the potential of the new educational technology for learners with special needs will require a coordinated effort that in not going to happen by itself" (Hofstetter, 2001). The main difficulty with available content for this population has been that the number of possible end-users has not been high enough to warrant site and program development. The "too narrow market" has limited commercial appeal and therefore, limited choices for this population of student (Tinker, 2001). Organizations and educational institutions need to examine funding and explore grant possibilities to provide web-sites devoted to the programming and content needs for this population of students.

A final consideration that needs to be addressed in providing content and programming for students with significant disabilities is the need for adaptable programming. Adaptable programming should provide content and programs that can be modified by end-users to fit specific access or use issues.

BEST COPY AVAILABLE

These access issues may be the need for an end-user to use a single switch, multiple switches, simplified graphic presentations, color or monochrome graphics, auditory supports or extensive auditory prompting, or visual supports that are flexible enough to allow use of the specific program without audio. All of these adaptability issues must be built into content and programs offered to this population because of the wide array of student skills and needs presented when dealing with individuals with significant disabilities.

Conclusions

The Internet can provide educational instruction to a wide variety of individuals. The qualities of Internet instructional delivery systems seem to fit well with the educational needs of students with severe disabilities. Instruction over the Internet can provide independent practice, repetition of materials, visual and auditory learning experiences, vast resources for exploring leisure activities, and student discovery learning. However, currently available resources for individuals with more significant disabilities are limited by many factors. These include costs for training and materials, lack of accessible web-sites for individuals with significant disabilities, relevant programming and information, lack of free programs, understanding the interrelationship between student learning needs and instructional delivery systems, and the ability for developers to address the programming needs of this small population of end-users. Programming must address the functional academic, daily living skill, recreation and vocational needs for this population of students, as well as the various access issues surrounding use of the Internet and computer technology. It seems the challenge of using the Internet for instruction of students with severe disabilities may require educators to examine a new paradigm of instruction. "Using technology for providing access and delivering instruction is inadequate by itself. Special educators must adopt a new model for learning to meet the challenges of the next century, and they must use technology in new ways to meet these challenges" (Hasselbring, 2001).

References

CDE, (2001). 2001 Sunset review report on special education programs. Available at http://www.cde.ca.gov/spbranch/sed/snst01rpt.pdf

Dattilo, J. (1986). Computerized assessment of preferences for persons with severe handicaps. Journal of Applied Behavior Analysis, 19, 4.

Downing, J. (2002). *Including students with severe and multiple disabilities in typical classrooms.* Baltimore, Md.:Paul H. Brooks Publishing

Harris, J. (1994). Information collection activities for students of the information age. The Computing Teacher Journal, March, 1994.

Hasselbring, T.S. (2001). A possible future of special education technology. Journal of Special Education Technology, 16, 4.

Hofstetter, F.T. (2001). The future's future: Implications of emerging technology for special education program planning. Journal of Special Education Technology, 16, 4.

Lewis, R.B., Harrison, P..J., Lynch, E.W., & Saba, F. (1994). Applications of technology in special education: A statewide study. Learning Disabilities: A Multidisciplinary Journal, 5.

McInerney, P. (2000). Worth 1000 words. Learning and Leading with Technology, May, 2000.

NCIP, (2001). National Center to Improve Practice. Available at http://www2.edc.org/NCIP/library/telecom/toc.htm

Norman, J.M., Collins, B.C., & Schuster, J.W. (2001). Using an instructional package including video technology to teach self-help skills to elementary students with mental retardation. Journal of Special Education Technology, 16, 3.

Snell, M. E., & Brown, F. (2000). *Instruction of students with severe disabilities, 5th edition*. Upper Saddle River, N.J.: Merrill

Sprague, D. & Dede, C. (1999). If I teach this way, am I doing my job?: Constructivism in the classroom. Learning and Leading with Technology, Sept., 1999.

Tiene, D. & Luft, P. (2001). Classroom dynamics in a technology-rich learning environment. Learning and Leading with Technology, Dec., 2001

Tinker, R. (2001). Future technologies for special learners. Journal of Special Education Technology, 16, 4.

Wehmeyer, M.L. (1999). Assistive technology and students with mental retardation: Utilization and barriers. Journal of Special Education Technology, 14, 1.

The Use of Electronic Portfolio's in Allied Health

Jeffrey V. Stewart, III, PhD, Macon State College,
Kenneth E. Wright, DA, The University of Alabama,
Vivian H. Wright, PhD, The University of Alabama

Introduction

Information technology permits expanded and more substantial student evaluation opportunities than is possible with traditional evaluation techniques. Additionally, technology use provides links to the educational process in ways never before possible, by helping to overcome the constraints of distance and time. In the education and training of students, educators must develop emerging tools and techniques to enhance the students' educational and professional development.

The electronic portfolio is such a tool in the professional development of students as well as being utilized as an evaluation method by faculty members. The electronic portfolio allows students an opportunity to reflect upon professional development, supply documented evidence of professional growth, and provides a unique tool for assessment throughout the academic career and clinical experiences.

Faculty members continue to search for effective ways to access students using practical outcomes. The electronic portfolio offers faculty the opportunity to focus on the learning and assessment of the students. When introduced to the concept of creating an electronic portfolio, many students ask, "What is an Electronic Portfolio?"

What is an Electronic Portfolio?

An electronic portfolio is an active learning reflective tool created by the students to assess both learning and knowledge (Cambridge, 2001). The electronic portfolio allows a student to document both academic and professional growth over a period of defined time using a digital collection of examples which are sometimes posted on a student website and sometimes saved to removable media such as a CD. The faculty member responsible for the particular student's academic development often defines the period of time, which can be as short as a one semester course or as long as an entire academic program.

Upon completion of the portfolio, the student has a practical product that can be assessed by faculty members as well as a tool that can provide evidence of a high level of learning to multiple audiences. Potential employers may use this tool as an example of a multi-skilled professional, which is highly desirable in today's workforce.

Quizzes, papers, and tests are the usual forms of assessment which many students fear (Cambridge, 2001). These measures provide a threat of poor grades, which often produces some level of incentive to study, but they do not produce encouragement for active learning. Hansen and Stephens (2000) write, "many college students today (unrealistically) judge their own academic competence to be high, and tend to blame low performance on poor instruction" (p.42). They further stated, "Schools tend to condition students to focus on products and ignore the process that leads to those product" (p.45).

The electronic portfolio allows students to focus not only on the outcome, but also on the process of creating the final product. The portfolio can not only be used as an evaluation method, but also once started; it can be continuously updated much like a more in-depth resume or curricula vita.

Framework of the Electronic Portfolio:

Once a faculty member has introduced the elements to be included in the electronic portfolio, the student may then begin to accumulate the different elements in preparation for creating the final product. Specific items that may be included in the portfolio could consist of a resume, personal information, professional presentation, example of writing, personal reflection on and evaluations of a professional experience, current research agenda, as well as many other items. The development of the electronic portfolio is a direct result of the purpose of the product and the audience for the product (Yancey, 2001).

Four characteristics adapted from Liz Hamp-Lyons and William Condon's *Assessing the Portfolio: Principles for Practice, Theory, and Research* (1998) provide the framework for the development of electronic portfolio:

- *Multiple examples of work can be featured.* Student progress can be documented through multiple examples of work over a given period of time. Students are able to produce evidence in their own progression toward increased critical thinking skills if examples throughout the process are provided.

- *Examples of work can be provided in the proper context.* Not only can an example of the students ability to write be included in the portfolio, but also included can be the actual assignment and grading rubric for the particular assignment so that the example may be seen in the proper context, not just an abstract example of the work.

- *Opportunities for self-assessment and selection are created in the electronic portfolio.* Students have the opportunity to make decision as to what will be included in the portfolio based on a selected set of criteria, the reader should be exposed to examples of the highest quality from the student. This is an important component of the portfolio, as the student must choose products that are desirable to the audience.

- *Evidence of development over time can be achieved.* Creators of the portfolio can demonstrate their learning over a period of time. This is done because the portfolio provides the opportunity to reflect on previous entries as well as continue to add work as appropriate.

No matter the model of development of the electronic portfolio, the creation of the product is a direct result of both the audience and overall purpose of the end result. Students learn to document learning and professional development that takes place in a given time.

The use of the Electronic Portfolio in Allied Heath

Many allied heath disciplines use clinical experiences as an essential component in the curriculum both on the undergraduate and the graduate level. Other ways of gaining practical skills is through the use of internship opportunities. Typically, students are employed by campus organizations for some pre-arranged period of time. One of the challenges of these types of courses is the evaluation of such an experience. Many of the internship or clinical experience coordinators are more than willing to complete mid-term and final evaluations on the candidates, which will allow assessment in such areas as commitment to the organization, willingness to work with others, but these types of evaluations do not allow the student to reflect on the experience.

An electronic portfolio gives the student the opportunity to reflect on the clinical or internship experience. They are able to document the results of the experience in many different aspects of professional development. They are able to show what their role was during their experience, which they worked with, what skills they used and improved as well discuss some issues that were discovered during the opportunity that may be important in the workforce. (Yancey, 2001, Springfield, 2001).

Electronic portfolios can also be utilized as an outcome for an entire program. The development process occurs not just during one course or term, but also over the complete academic program. Using this model, students have the ability to reflect on their academic growth over a much longer period of time using several examples of documentation. Assessment then takes place in some format such as a final presentation activity where all students completing the specific program would come together and present the electronic portfolio to a select group of faculty members. One potential application would be in addition to or in lieu of a comprehensive written exam.

Conclusions:

As technology continues to become an ever-increasing component of the academic process, where and when to utilize technology is critical to the educational mission of academic programs. The electronic portfolio is one tool that provides opportunities for documentation of learning as well as assessment. In addition, students creating an electronic portfolio can use this tool for reflection over a give period of time and to record, interpret, and evaluate his or her own learning.

The electronic portfolio has many potential uses in allied heath disciplines including an outcome for a specific course, clinical or internship opportunity or as a final project upon completion of an academic program. Once the parameters have been determine as to the purpose of the electronic portfolio and the elements to be included, the creation of the product shifts to the student to collect, select, and reflect on their accomplishments for inclusion in the electronic portfolio.

REFERENCES

Cambridge, B. (2001). Electronic Portfolios as Knowledge Builders. In B.L. Cambridge, S. Kahn, D.P. Tompkins, & K.B. Yancey (Eds.), *Electronic portfolios: Emerging practices in student, faculty, and institutional learning* (pp.1-14). Washington, DC: American Association for Higher Education.

Hamp-Lyons, L., & Condon, W. (1998). *Assessing the Portfolio: Principles for Practice, Theory and Research.* Cresskill, NJ: Hampton Press.

Hansen, E.J., & Stephens, J.A. (2000, September/October). The ethics of learner-centered education: Dynamics that impede the process. *Change* 32(5), pp. 40-47.

Springfield, E. (2001). A Major Redesign of the Kalamazoo Portfolio. In B.L. Cambridge, S. Kahn, D.P. Tompkins, & K.B. Yancey (Eds.), *Electronic portfolios: Emerging practices in student, faculty, and institutional learning* (pp.53-59). Washington, DC: American Association for Higher Education.

Yancey, K.B. (2001). Digitized Student Portfolios. In B.L. Cambridge, S. Kahn, D.P. Tompkins, & K.B. Yancey (Eds.), *Electronic portfolios: Emerging practices in student, faculty, and institutional learning* (pp.15-30). Washington, DC: American Association for Higher Education.

Localization vs. Internationalization: E-Learning Programs for the Aviation Industry

Judith B. Strother

Introduction

An increasing amount of research is being done on the topic of internationalization and localization of communication products. However, much of the focus is on the world of Information Technology. While that is certainly critical, especially in this era of web-based communication, the consideration of character sets supported by a particular operating system and expansion of text due to translation issues are not the only issues. In many cases, the content of the communication itself must be localized because of such elements as varying legal requirements and regulations, and linguistic elements such as dialectal variations.

E-learning programs – especially those that are designed to be delivered around the world – have their own set of issues with localization. This paper presents a case study of a web-based English language training program in the field of Aviation.

English is said to be the *lingua franca* of the world of aviation because it is supposed to be used by pilot and air traffic controllers the world over. However, the Aviation English used in Europe is not the Aviation English used in the U.S. and neither of those may be the version of English used in other parts of the world. While there are continuing attempts by international regulatory bodies to mandate the use of English and then standardize the English used in aviation throughout the world, the fact remains that differing versions are commonly used in different locales.

What effect does this have on a product whose goal is to teach a standardized version of Aviation English? How does a training program cope with the international need for standardization and the reality that localization is the only way to deliver the significant parts of product?

Case Study – the Aviation English Product

Virtual Languages, Inc., (VL) of Boca Raton, Florida, develops and delivers distance-learning courses that teach English as a Second Language (ESL) within an English for Specific Purposes (ESP) framework. This allows learners to improve their proficiency in English while developing the field-specific language they need in order to perform their jobs. The two main ESP areas of VL courses are Business English and Aviation English, the latter of which is the focus of this paper. Virtual Language's Aviation English courses are based around content-rich themes such as Introduction to Aviation, Aviation Meteorology, Aviation Physiology and Medicine, and Aviation History.

All courses are available at five proficiency levels and focus on the primary language skill areas. Each course has several sections, all based on a content-specific Reading Selection. Vocabulary development, reading comprehension practice, and grammar activities (at the lower levels) are part of each lesson. In addition, a crucial part of each lesson involves two different kinds of listening activities. One provides a variety of listening activities, based on the content of the Reading Selection. The other activities are based on actual ground-to-air communication events. At the lower levels, there are activities that prepare the learner for pilot/ATC communication using standard phraseology and at the upper levels, actual airport tower tapes are the basis for the listening activities to give the learners practice with authentic language delivered in actual context.

The listening section of the Aviation English course, based on radiotelephony phraseology, provides the greatest localization challenge for the global delivery of the web-based product. How can we decide which version of pilot/ATC communication to use: FAA? ICAO? or a real (but sometimes nonstandard) version of one or both?

Localization versus Internationalization

While various organizations use these terms differently, this paper uses the definitions adopted by LISA (Localisation Industry Standards Association), using LEIT (LISA Education Initiative Taskforce) guidelines (LISA 2002).

BEST COPY AVAILABLE

Localization involves taking a product and making it linguistically and culturally appropriate to the target locale (country/region and language) where it will be used and sold. A similar definition for localization is the process of creating or adapting a product to a specific locale, i.e., to the language, cultural context, conventions and market requirements of a specific target market (Localization Institute 2001).

Internationalization is the process of generalizing a product so that it can handle multiple languages and cultural conventions without the need to re-design. This process is particularly relevant during the program and product development phases as well as relevant to decisions made about the documentation to accompany a product. (LISA)

In addition to localization and internationalization, globalization addresses the business issues associated with taking a product global. This involves integrating localization throughout a company, after proper internationalization and product design, as well as marketing, sales, and support in the world market. LISA also uses a new acronym, GIL, to describe the combination of Globalization, Internationalization, and Localization. GIL refers to all aspects of the process of taking products to an international audience.

Localization and Internationalization are the two concepts that form the basis for this discussion since they are relevant to the development of the product, even though the product itself (Aviation English course) is only delivered in English. Other globalization issues, such as culturally translated marketing materials, are not within the purview of this paper.

The Problem

While international regulatory bodies continually attempt to standardize the English used in aviation throughout the world, different versions are commonly used in different locales. How does a web-based e-learning program cope with the international need for standardization and the reality that localization is the only way to sell (and thus deliver) the product? This complex process is discussed, including identification of the parts that could be internationalized (usable for anyone in any country) versus those that had to be localized for different world regions.

Aviation English

While English is assumed to be the international language of aviation, in fact, there is not an enforceable requirement for English to be used in all pilot-ATC communication nor is there a minimum or consistently measurable standard of English proficiency for pilots or controllers. Even where English is used as the language of communication, there is no agreement on which form of English (that is, *whose* English) is to be used as the standard.

Proficiency Issues

A great variety of cross-linguistic interactions between pilots and controllers is possible. Consider these few examples:

- both native English speakers but from different dialectal areas (e.g., a U.S. pilot flying into Australia)
- a non-native speaking pilot / a native speaking controller (e.g., a Chinese pilot flying into the U.S.)
- a native English speaking pilot / a non-native speaking controller (e.g., an Irish pilot flying into Venezuela)
- a non-native speaking pilot / a non-native speaking controller in another country, where both speak English as the common language. (e.g., a French pilot flying into Japan)

In the United States, the Federal Aviation Administration (FAA) requires flight certificate applicants to demonstrate proficiency in English, yet there are no assessment standards given to measure their concept of proficiency. Current FAA regulations require pilots to "be able to read, write, speak, and understand the English language." (FAA)

In most of the rest of the world, the International Civil Aviation Organization (ICAO) sets the standard for pilot/ATC communication. In a move to get closer to requiring English as the international language of

BEST COPY AVAILABLE

aviation, ICAO, the UN-affiliated body responsible for setting safety standards for air transport, recommends that control towers and commercial aviation use English, but it is only a recommendation and no proficiency standards have been set.

Standardization Issues

There is a significant body of evidence that confirms that miscommunication has caused numerous accidents and near misses around the world, especially miscommunication between native speakers and nonnative speakers either as pilots or in the control tower without adequate command of English.

In fact, the worst aviation disaster in history resulted from a simple communication error on March 27, 1977, in Tenerife in the Canary Islands. When the pilot of a KLM 747 started his take-off roll down a foggy runway, he radioed the tower "We are now at take-off." The controller misunderstood this ambiguous statement and incorrectly interpreted it to mean "We are at our take-off position and holding." After all, that was what the tower had instructed the KLM pilot to do. Therefore, the controller did not warn the Dutch pilot that a Pan American 747, which was invisible in the thick fog, was still on the runway. The Pam American crew saw the lights from the KLM plane approaching them and made a desperate but unsuccessful attempt to clear the runway before the now, barely-airborne KLM plane sliced through them, killing 583 passengers on the two planes (Cushing).

The issue of standardization of language, specifically ATC phraseology, within the aviation industry is one that has been debated for a number of years. Barbara Kanki, a NASA Ames human factors research psychologist and expert in flight-deck communication problems points out that several groups are studying the disparities between worldwide ATC systems. One of their goals is to examine the differences between ICAO and FAA phraseology and to show what is equal to what. "These are gigantic topics and there is no right or wrong. Each country has its own glossary and we are trying to find a variability that is acceptable" (Carlisle 2001)

While the FAA is primarily a U.S. standard, a number of countries, such as Mexico, which routinely fly into the U.S., also use a version of FAA phraseology. As pointed out earlier, ICAO sets the phraseology for most of the rest of the world. ICAO, through its PRICE (Proficiency Requirements in Common English) Group, has taken steps to standardize the English used in all ground-to-air communication (Matthews, 2001). The recommendations for standardization can only be implemented after all 187 member states adopt them. This is not expected to happen before 2008. Many countries are hostile at any attempt to impose English, even when language diversity is demonstrably a safety issue. (Education Guardian, 2001).

ICAO vs. FAA: Examples of Phraseology Differences

The variations between ICAO and FAA standard phraseologies are numerous (Simon 1998). In fact, a number of organizations have published and continually update their lists of these differences in an attempt to keep their pilots and controllers aware of the phraseology variations they may encounter on international flights.. (See, for example, *Glossary for Pilots and Air Traffic Services Personnel*, published by Transport Canada).

The following are just a few of the differences in standard phraseology between these two aviation regulatory organizations (Pilot's Reference 1999):
ICAO: back track
FAA taxi back

ICAO: clear of traffic
FAA: traffic no factor

ICAO: line up and hold
FAA: taxi into position and hold

ICAO: passing

FAA: leaving

ICAO: Report your heading and level
FAA: Say heading and altitude

These differences represent localization issues that must be dealt with by any company that intends to deliver accurate pilot/ATC communication training.

Again, think about the multiple possibilities of communication among pilots and air traffic controllers. Certainly, English language proficiency is a major issue, but so is the need for all of these communicators to be using standard phraseology. With all of the possible international interactions, it is not difficult to understand the need for standardization of Aviation English and the need for rigid proficiency requirements for pilots and controllers (see, e.g., Matthews 1999 and 2001; University of Redlands, 2001). Since a company that is developing Aviation English cannot control international proficiency and standardization issues, it has to deal with the elements it can control.

The Course: Whose English?

Virtual Languages' main issue, therefore, deals with the question: When an aviation training program or aeronautical university recognizes the need for Aviation English training, exactly which form of English should be taught? Can a web-based training program truly be internationalized for delivery all over the world? How can a company adapt web-based training for localized requirements?

That is the situation that faced Virtual Languages when it began to develop its web-based Aviation English product for use all over the world.

Consultation with International Aviation Authorities

In the content design and review phases, Virtual Languages' content team had to determine the best strategy to deal with the diverse phraseology requirements in different locales. They researched regulations of each body, studied phraseology guidelines, examined areas of difference, and interviewed aviation professionals to get insight into phraseology variations and the use of nonstandard phraseology.

In a strong effort to develop the best possible ATC training segment, officers met with officials from both the FAA and ICAO, as well as several European ATC organizations such as Eurocontrol and Belgocontrol, to discuss strategies to handle the need for divergent ATC communication portions of the Aviation English course.

As a result of these discussions, Virtual Languages became strongly committed to developing a product that promotes ICAO standards for ground-to-air communication. However, this can be a difficult goal to achieve in the framework of an Aviation English training program. One issue is that ICAO standard phraseology is not usually taught in U.S. aviation training programs and is not used at U.S. airports, or in all other non-U.S. countries. The FAA sets the standards for the language used in U.S. controlled airspace; therefore, the company has to cope with this fact as a training issue for some customers.

The Solution

Which parts of the course can be internationalized, or delivered to all clients around the world without regional modifications? In fact, all parts of each course – Reading, vocabulary development, and content-based listening activities – except ATC listening – are appropriate for world-wide delivery. There is, however, the caveat that in the current product, VL uses a variety of American English speakers. An alternative version of the courses using British, Australian, Irish, and other non-American-English speakers is planned. The recorded sections include the text of the Reading Selection, key vocabulary words, and feedback for each question at the lower course levels, in addition to the listening activities.

How does the company handle the need for localization of the ATC sections of the course? In fact, our solution is to develop parallel training packages. Because the company's first potential clients were in the U.S. or Mexico, FAA-based ATC communication was used for the first courses developed. The ATC portion of the courses are always based on actual ground-to-air communication, so tapes from the Miami Control Tower were used as the first set. The tapes were transcribed by pilots and the transcriptions were used as the basis for the listening activities. Thus, FAA standard phraseology is the basis for this version of the product.

Although the FAA sets the U.S. standard, we quickly learned that use of nonstandard phraseology is common in U.S.. That presented a new dilemma. We wanted pilots and controllers or aviation students to hear and practice real language in real contexts, so we needed to use tapes from airport control towers. When dealing with actual tapes, how do we handle nonstandard phraseology issues? To deal with nonstandard phraseology, in the feedback for each activity, information will be given about what the pilot or controller actually said, and then what should have been said using standard FAA phraseology.

The second set of courses will be offered with a variety of English accents (British and others) using tapes from European (or other appropriate) towers. Nonstandard communication will be handled in the same way, with the standard phraseology of ICAO used as the model.

The Future

Eventually, ICAO and FAA should come together on one standard phraseology for international aviation. In fact, Virtual Languages has been invited to participate in this ongoing discussions, next at a panel discussion at the Farnborough Air Show in England in July. If the current differences can be resolved through the standardization recommendations of international organizations, then a big step will have been made toward the internationalization of Aviation English training. When this occurs, most of the localization issues will disappear, at least insofar as terminology and phraseology are concerned. At that time, the main localization issues will be reduced to those of dialects, particularly accents, and colloquial or nonstandard use of the standard phraseology.

Until that day in the very far future, Virtual Languages will continue to wrestle with having to develop a web-based training product that is partially internationalized, but that has sections that are localized for specific clients around the world.

BEST COPY AVAILABLE

References

Carlisle, D (2001). Increasing the Efficiency of Communication. *Aircraft Buyer.*

FAA Advisory Circular No. 60-28. English Language Skills Standards.

FAA Phraseology. Available: [http://FAA.gov/atpubs/fss/fss1401.html]

Guardian Unlimited (2001). Safer air language set for long haul. Available: [http://EducationGuardian.co.uk/TEFL]

ICAO (2001). Aeronautical Mobile Service – Voice Communication. Annex 10, Chapter 5.

LISA (Localisation Industry Standards Association) (2002). Homepage. available: [http://lisa.org/leit/terminology.html]

Localization Institute (2001). Terminology. Available: [http://localizationinstitute.com]

Matthews, E. (2001). Provisions for Proficiency in Common Aviation Language to be Strengthened. *ICAO Journal.* 56(3), 24-26, 41.

Matthews, E. (1999). English Language Training and Assessment: The Scope of the Issue. *Specific Applications in English Language Training,* Sept., 331-339.

Mills, T. S. and J. S. Archibald. (1999). *The Pilot's Reference to ATC Procedures and Phraseology.* 7th ed., ReAVCO Publishing.

Simon, P. (1998). FAA vs. ICAO Procedures. Unofficial notes from Phil Simon, SFOFO, version 2.9., November 20.

Transport Canada (2001). *Glossary for Pilots and Air Traffic Services Personnel.*

University of Redlands (2001). Linguist Promotes Airline Safety Through Language. Press Release.

Communities of Practice and On-Line Support for Dissemination and Implementation Of Innovation

Bronwyn Stuckey
Queensland University of Technology
Australia
b.stuckey@qut.edu.au

Anna Buehring
Sowerby Centre for Health Informatics at Newcastle (SCHIN)
UK
a.l.buehring@ncl.uk

Sally Fraser
Sowerby Centre for Health Informatics at Newcastle (SCHIN)
UK
s.v.fraser@ncl.ac.uk

Abstract: New tools whether developed organisationally, commercially or within a domain may represent innovation in the workplace and can be part of larger scale reform and change. This paper examines community-based web sites to being built about tools in two distinctly different workplaces. The tools *PRODIGY*, a computerised decision support system and *StageStruck*, a performing arts knowledge construction tool are both recognised in their fields as being innovative in both their use of technology and for their potential to improve the practice within the domain. This paper explores the rationale for developing a web-based communication and resource area to support a community of practitioners in their implementation of these technological innovations. The dialogue explores the demographics, design and development issues faced by community managers charged with promotion and support of these innovative products.

The Rationale for Growing Communities of Practice as On-Line Support

Background

The research and product design detailed here set out to ask what part can be played by well-researched and designed on-line activities in shaping the future of, and meeting the needs for change. Over time the community of practice (Lave & Wenger, 1991) emerged as a complex yet attractive solution and the focus to mapping the development and efficacy of a web-mediated community of practice in advancing implementation of an innovation. The focus of this research explores the roster of issues arising as the theory of communities of practice is applied to a specific cases of on-line professional development of teachers and medical practitioners. This paper is a bounded history of the two research projects and their advancement to date.

The dilemma for the developers of both products was to identify and establish ways to promote the diffusion of these technological innovations and to provide valuable and effective professional development towards implementation for the practitioners who do or plan to use them. The community of practice (Wenger, 1998) model emerged for both development teams as an effective strategy for dissemination and knowledge building around the use of these products. This community of innovators will be supported through a purpose-built Web site designed to afford the opportunities and activities that are characteristic of the making of meaning that is at the heart of the community of practice.

The products in outline

PRODIGY (www.prodigy.nhs.uk) is a computerised decision support system (DSS), which provides evidence-based recommendations for the management of a condition in a clinical setting. It sits within existing clinical computer systems and integrates with the electronic patient record. It is in itself an innovation and is part of a reform to the use more of evidence-based medicine (EBM), guidelines and protocols and the computer within the consultation to access this information.

STAGESTRUCK *(www.stagestruck.uow.edu.au)* is recognised as an innovation in the teaching of the performing arts. It is an innovation both as a constructionist multimedia technology for creative and performing arts teaching and learning. More broadly it has been recognised as a pedagogical innovation because of its constructivist underpinnings and the design realisations as a multimedia knowledge construction tool (Hedberg, 1997). In both cases the innovation is a new computer-based tool and that tool that is part of a reform process as well as an increasing application of technology in the practice.

The Theoretical Basis for Community of Practice

Whether change is based on the 90's call to the 'learning organization' (Senge, 1990) or the new millennium's 'knowledge-based organization' (Wenger, 1998), the key to reform appears to be the way the organisation values knowledge and its management. Botkin, (1999, pp.3-4) states 'Good ideas are knowledge waiting to be tapped, and it's the trademark of a smart organization – a fast company – that it knows how to honour and legitimise the tacit knowledge that its people have stored up in their work practices and make it visible.'

Wenger contends that the sharing of tacit corporate knowledge is vital to the organisational success. The knowledge Wenger speaks of is not static. It cannot be fleshed out and then documented in a set of guidelines nor distilled into a discrete data set and stored in an information retrieval system. It is that practitioner knowledge that those in the field, workshop or classroom share on an ongoing and usually need-to-know or need-to-share basis. Co-workers help each other to solve problems, affirm actions, seek new challenges, and in doing so advance the goals of the organisation and the practice.

A community of practice specifically centres its interest on the practices of the workplace. McDermott (1999 pp.1) simply and succinctly distinguishes the community of practice from other types of communities. 'But communities of practice are not just celebrations of common interests. They focus on practical aspects of a practice, everyday problems, new tools, developments in the field, things that work and don't.' While these communities are obviously not new the recognition of their value to education and industry is. In a summary of complexity theory and educational change processes, Fullan (1999, pp.15) supports Wenger's contention about the value of sharing tacit knowledge. 'In brief, the secret to success of living companies, complex adaptive systems, learning communities or whatever terms we use, is that they consist of intricate, embedded interaction inside and outside the organization which converts tacit knowledge to explicit knowledge on an ongoing basis.'

Given the community of practice seems to lend itself as a model for dissemination and professional development, the next question became; How can that community be developed and /or supported on-line? It is necessary to explore each of the individual innovations and their on-line stages of development towards community to see how similar these two disparate communities really are.

The Tools Examined *Product 1: PRODIGY*

At the present time PRODIGY can be used by General Practitioners (GPs) in England and has the potential, subject to legal changes, to be used by other health professionals such as nurses and pharmacists. There are various potential uses of PRODIGY including during a consultation to provide options for prescribing, non-drug advice, patient information leaflets and referral advice. It also includes referenced clinical information to access outside the consultation, enabling GPs to keep up to date and abreast of the latest developments in prescribing and healthcare.

The PRODIGY project team consists of Research and Evaluation, Software Development, Authoring and the National Dissemination Office (NDO) (www.schin.ncl.ac.uk). These groups are crucially interdependent in developing the technology, updating clinical content and promoting PRODIGY use amongst the GP community. The NDO model of dissemination is based upon an integrated approach of communications and marketing, training and education and support (Figure 1).

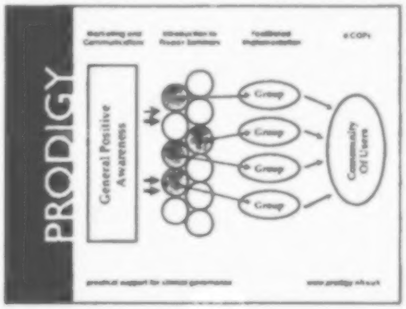


Figure 1 The PRODIGY Dissemination model developed and implemented during 2001

The support element of the model comprises the website, including access to the clinical guidance, education and training materials, GP system supplier specific information and the development of an on-line community of practice (e-CoP).

The Domain and Practice

GPs work predominantly in an individualistic way characterised by a high level of autonomy their in decision making. As a discipline they tend according to McWhinney (1996) to define themselves in terms of their relationship with the patient, which takes precedence over a more mechanistic approach to medicine. The effect of this value on relationships, places experience rather than disengaged reason, at the heart of general practice decision-making where he argues, *"experience engages... feelings as well as... intellect"* (McWhinney, 1996, p433). The impact of these characteristics is likely to affect the decision-making processes specifically in relation to the use of evidence-based medicine (EBM), guidelines and protocols and the use of the computer within the consultation to access this information.

The use of EBM by GPs has been identified as problematic (Mears & Sweeney, 2000; Cranney et al, 2001) displaying GPs mistrust of the research and it's applicability in a specific patient context. In this respect GPs may regard PRODIGY as a threat to the more traditional and intuitive ways of working and GP autonomy in decision-making. With this in mind, the community of practice being developed for PRODIGY users aims to facilitate a forum through which GPs can share their views and knowledge about using PRODIGY in a practical environment. This also provides an opportunity to discuss the application of PRODIGY in relation to other NHS goals such as National Service Frameworks (NSFs), Clinical Governance (CG) and re-validation.

BEST COPY AVAILABLE

On-line Community of Practice Design (e-CoP)

The PRODIGY website has been designed to reflect the multi-faceted nature of PRODIGY not merely as a decision support tool, but in providing referenced material used in the production of the guidance, patient information leaflets, and background information about specific conditions listed in PRODIGY. Whilst GPs may commonly use the computer for routine tasks such as repeat prescribing, the use of the computer during the consultation is less frequent (SCHIN, 2001a). The website aims to offer practical contextual support and information in relation to using the computer in the consultation (UCCR), as well as highlighting how using PRODIGY will support GPs in relation to Clinical Governance and National Service Frameworks.

Three types of visitors to the website are envisaged; *non-users but potential users* who are seeking information about what PRODIGY is, what it does and how they can use it. *Current users* who are seeking ways to use PRODIGY in a broader context; and *non-users* interested in promoting and facilitating use, for example Primary Care Trust (PCT) trainers, GP Clinical System Suppliers. One of the functions of the website is to provide training support, information about how PRODIGY can be switched on, and how PRODIGY can be recognised on the different GP computer systems. Therefore the website and the development of the community of practice is intended very much as an ongoing support service to users and potential users of PRODIGY.

In the first instance the aim is to develop, facilitate and sustain an electronic community of practice for users described above. The methodology and framework, which will be formulated during the development of this user group, can then be used to extend the e-community to other groups within the UK healthcare domain. It allows anonymity amongst users, with the potential for different professionals to communicate more freely (i.e. GPs and nurses) in a relatively safe environment. Initially a member of the NDO team and a GP working for SCHIN will facilitate the e-Community of Practice. The structure of the e-CoP is based on asynchronous message boards, email lists and a messaging tool, rather than a chat facility.

In order to access the current PRODIGY community of practice users have to be registered and given a login. This has been kept deliberately simple at this stage so as not to deter users from registering, and currently identifies to SCHIN staff the email address and professional group of the user. Since the commencement of registration in February 2002 the number of registered users at July 2002 was approaching 3000. This figure continues to increase with an average of 80 new registrations per week. The benefits of being a registered user are; access and potential to participate in the message boards; ability to register for a discussion list; and an onsite messaging tool enabling users to make direct contact with other registered users, without disclosing personal identities.
Users will eventually have a profile around key interests[1] of users and encouraged through the facilitators to generate discussion topics within and between different participants. Invited 'experts', for example PRODIGY GP Champions, technical IT people, and clinical authors will also be used to lead particular discussions around their area of interest. Registered users will be encouraged to submit further detailed information through the use of the online message tool, normal email to all those who have given permission to receive more PRODIGY information, and online banners and bulletins on the PRODIGY site.

Through the extension of the user profiles registered users will also be able to search for other community members with specific interests, enabling the organic growth of communities. It is hoped that through the growth of such communities the development and transfer of knowledge will take place both within the community and to the "outside world" including informing further PRODIGY development.

The steady increase and high numbers of registrations is very encouraging although further work still needs to be done to ascertain their actions whilst on the site. Despite this the use of the message board and email lists have been slow to develop. It is not unusual for it to take time for such tools to be fully embraced, or for communities to shift from a demographic group to being a network (Diagram, 1). The planned facilitation is to continue to encourage use through the website, but to also be aware of any hot issues arising that might provoke discussion or the need for GPs to communicate quickly and directly. Plans are afoot to place a news banner containing the latest health-related headlines and provide a link to the message board to encourage discussion around this topic.

---

[1] Cancer Referral Advice, Cardiovascular System, Dermatology, Eyes and Ears, Gastrointestinal, Haematology and Endocrine, Infection, Injuries, Neurology, Obstetrics and Gynaecology, Psychiatry, Respiratory, Rheumatology and Orthopaedics, Urology

This is only the beginning of the establishment of an online community of practice, but feedback is constantly sought from users through the message board and email lists. The future development of PRODIGY will be to encourage use by different health professionals (i.e. nurses and pharmacists) as well as GPs, and this might provide new and different needs from users.

The PRODIGY e-CoP project is still in the early stages and whilst modelled on existing communities of practice and experiences, the success and growth of such a community cannot be foreseen, and will largely depend upon the shared needs and experiences of the community itself. However, the role of the facilitators is to try and establish the framework and support as necessary conditions to enable it to take place. It will be a learning experience for all those concerned.

The Tools Examined Product 2: Stagestruck

STAGE STRUCK
STAGE STRUCK

Figure 2 StageStruck Online Community Design

StageStruck, produced by Wollongong University and National Institute for Dramatic Art (NIDA), was one of 10 CD-ROMs produced in *Australia on CD* as a Creative Nation[*] federally funded Cultural program. Over $AU6 million was committed to produce 10 CD-ROMs designed to bring Australian culture to the public using new media technologies. Sadly it was never intended nor were any resources committed to any promotion or professional development for teachers in each or any of these products. Copies were distributed to every school in the country in the first semester of 1999. *StageStruck* has been recognised as an innovation in the performing arts. It is an innovation both as a multimedia technology for creative arts teaching and learning. More importantly it has been recognised as a pedagogical innovation because of its constructivist underpinnings and design realisations as a multimedia knowledge construction tool (Harper & Hedberg, 1997). Despite widespread distribution and acclaim, having won several prestigious Australian and International awards (AMIA 1999, BAFTA and EMMA 1998), preliminary discussions with educators indicated that many (perhaps most) are unaware of *StageStruck's* existence let alone its educational benefit.

The Domain and Practice

While healthcare reforms might seek a move to more evidence based medicine, educational momentum moves toward the creation of more constructivist and constructionist learning environments. Tools are being developed to motivate new teaching practices and support constructivist student-centred learning and StageStruck has been recognised an exemplar amongst those tools. In-service teachers are in many ways as independent and inexperienced with, and mistrustful of, new technology as many medical practitioners. Reilly sums up the in-service teachers' lack of connectedness graphically when he states that; *Educators are "islands of excellence" with no ferry service to connect them to each other or to groups of their peers.* (Reilly 1999 p60)

---

[1] Creative Nation Australia's Cultural Network http://www.acn.net.au/articles/1998/05/ozcd.htm

BEST COPY AVAILABLE

The group being formed around StageStruck might develop into a community or the Web site might stand to service smaller face-to-face communities in the in-service domain. This K-12 creative and performing arts community did not exist before people were drawn to become members on-line. While members are likely to each belong to other communities and they may have ties through these to some members on-line, no one community already exists that ties all the disparate groups (primary, secondary, drama, dance, design, creative arts, English) and distributed individuals together. They do more correctly constitute a demographic group (Andrews et al, 2001 pp.1) with the potential to become a community if ties and roles can be effectively established through the on-line engagement and collaboration.

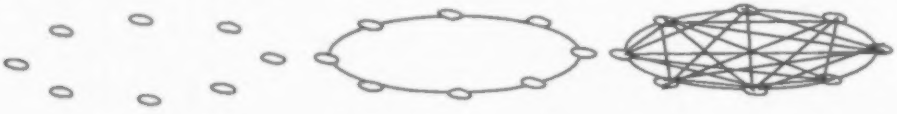
Adoption of curriculum and pedagogical uses of technology in schools has been slow and inconsistent. This lack of adoption can be linked directly to the lack of resources devoted to in-service teacher professional development or to the ineffectual nature of the training offered. Teacher needs in relation to ICT beyond access to the technology (hardware and software) have consistently been for effective professional development with explicit links to curriculum and the "stuff" of classroom teaching. As hardware and high speed connectivity becomes more readily available in classrooms, educators are turning to focus more on the issues of support, ongoing professional development, recognition of ICT skills and leadership, accreditation for high level skill development, access to high quality resources and equity delivery formats and languages.

The National Foundation for the Improvement of Education Report *Teachers Take Charge of Their Learning* (NFIE 1996 pp.1) asserts that; *To improve student achievement, public schools must weave continuous learning for teachers into the fabric of the teaching job. This work can and should be initiated by the teaching profession itself in partnership with other educators, communities, districts, and states.* There is an imperative for new professional development strategies and for teachers themselves to take control of their personal professional development. For the past ten years it has been recognised that a 'culture of collegiality' is required. This can be achieved through an environment where teachers teach teachers in a supportive network of practice. (Little 1993, Lieberman & Miller 1991, Warren & Roseberry 1992). There are no simple remedies, but it does seem understood that communication and collaboration are two of the keys.

On-line Community of Practice Design (e-CoP)

The symbiosis between education reform and the integration of technology into learning is profound: technology requires the rich learning environments envisioned by reformers; reform demands the power of technology to put people at the centre of their own learning. (Serim, 1996 pp.1) Having established that there is value in community development and its potential for ongoing professional support, it is important to examine the circumstances under which the community of practice could effectively go on-line.

At present stage of development the group being formed represents a potential community. Andrews et al (2001 pp.1) describe these potential groups. *Demographic groups normally do not constitute communities. However, they have the potential for becoming on-line communities when individuals share common interests, needs and goals, have a desire to communicate with a peer group, and can easily find each other to establish relationships.* The StageStruck On-line Community is taking the demographic group of K-12 teachers of the performing and creative arts and linking them together firstly through an on-line network then through to an opportunity to build community with active facilitation and support. This growth from a distributed set of individuals in contact on-line through to a loosely tied network for sharing and on to a fully-fledged collaborative community is a lengthy process determined by the effectiveness of the management and facilitation and the commitment elicited over time from the members.



Demographic group (DG) > **Network** (N) > **Community** (C)

distributed individuals *loosely tied individuals* *interpersonally tied group*

BEST COPY AVAILABLE

Diagram 1: The forming of communication and collaboration between individuals toward community (Stuckey et al, 2002)

It has taken two years in planning and web design and development and promotion to get to what Wenger (1998) describes as the second phase of community development; Coalescing. The focus of 2000 was the research, literature review and study of cases of on-line professional development and the design of the web site in response to teacher needs and concerns. During this year contacts were made and groups identified that might be integral to design of and dissemination about the community site. Finding out just who is in this demographic group has proven to be an ongoing task. In 2001 the development of the architecture became the focus. Advertising the site and reaching out to teacher groups to elicit membership and teacher concerns about focus innovation CD-ROM technology. Establishing a critical mass of members for the network and connecting those people through the web site has taken much longer than was anticipated in this phase. There were 200 members of the site at the time of this publication.

In the naivety of the web design model, the author fell into a trap that has no become legend to those involved in community development. While it is possible to build a static Web site, advertise it well and have thousands of hits follow, community success is both much slower and much more human-to-human interfaced. Users were registering, they were using the examples and demonstrations but they were not communicating with the mangers not with each other. When users were found to not be contributing or sharing, it became necessary to revisit those successful cases of community and find out what necessary to revisit those successful communities and delve deeper into the cases by interviewing community leaders, facilitators and mangers. It became evident that larger group open communication was not the way to start, and this was especially true with teacher communities. All evidence pointed to the need for small more purposeful nodes within the larger community as a way to start the development of bonds and identity within the community. It was about comfort and trust.

In mid 2002 members will see the main activity, communication, collaboration and facilitation is targeted specifically toward community building in smaller group activities. Early adopters of StageStruck are being invited to join projects and to work in teams to produce curriculum support materials for the community and to mentor new users. It is hoped that new users will find the community a safe place to seek technological and pedagogical support and to celebrate the use of StageStruck through the publishing and sharing of student works and teaching resources. Various groups within the performing arts community are to be given areas of the site to make their own and to develop new events, ideas, projects and resources. Initial facilitation on the site will come from the author and researcher, an experienced practitioner from within the domain. Eventually it is hoped that facilitation can be devolved to the community members and indeed that the members will contribute to and design the new spaces and facilities of the site in the future.

In summary

It is argued that computer mediated communication cannot build a community. (Weinrich, 1997; Fernback & Thompson, 1995) and Wenger himself describes establishing communities of practice as 'the art of balancing design and emergence' (Wenger, 1998 pp. 9). Sharp argued that the literature on on-line communities points to '...a weaker sense of community, a discourse commu nity' (Sharp 1997 pp. 6) and he went on to advance a set of actions likely to increase the success of communities of practice. These actions include face-to-face activities and groups wherever possible and opportunities for short-term mentoring. Even in the highly technological environment of the Internet we can see that technology alone cannot support all that true community requires.

It remains to be seen whether the rationale and carefully researched and socially supported on-line structures represented here will develop a level of commitment and engagement that can be described as community or whether as a network they will serve to meet the needs of the practitioner innovators that they seek to serve. There are many technological innovations that need to provide effective pathways and environments for adoption and implementation There are many demographic groups consisting of distributed and independent individuals like medical practitioners or in-service teachers that could be served by the effective design of communication and community built through on-line engagement. The understandings and lessons to be learned, over the next year, as these two projects apply the communities of practice theory to affordances of on-line technologies will have ramifications for those seeking effective long term strategies for adoption of many tools of innovation.

REFERENCES

Andrews, D., Preece, J. & Turoff, M. (2001). A Conceptual Framework for demographic Groups Resistant to Online Community Interaction. IEEE Proceedings of the Thirty Fourth Hawaii International Conference on Systems Sciences http://www.georgetown.edu/faculty/dca4/article-ijec.html [Accessed Feb 22nd, 2002]

Botkin, J. (1999) Smart Business: How knowledge communities can revolutionize your company. New York: Free Press.

Cranney, M., Warren, E., Barton, S., Gardner, K. and Walley, T., 2001, "Why do GPs not implement evidence-based guidelines? A descriptive study", Family Practice, Vol 18, No 4, pp359-363.

Fernback J. & Thompson B. (1995) Computer-Mediated Communication and the American Collectivity: The Dimensions of Community Within Cyberspace. Abridged version Valid at 13/07/01 http://www.rheingold.com/texts/techpolitix/VCcivil.html

Fullan, M. (1999) Change Forces The Sequel. Falmer Press PA

Harper, B & Hedberg, J (1997) Creating Motivating Interactive Learning Environment: a constructivist view Australian Society for Computers in tertiary Education Conference Perth 1997

Hedberg, J.G. (1997). Creating Motivating Interactive Learning Environments. Invited Paper to the Conference on Technological Education and National Development. Abu Dhabi, April 6th to 8th, pp. 203-218. Available http://crm.hct.ac.ae/020hedberg.html [Accessed Feb 22nd, 2002]

Little, J.W. (1993). Teacher's professional development in a climate of educational reform. Educational Evaluation and Policy Analysis , 15(2)

Lieberman, A. & Miller, L. (Eds) (1991). Revisiting the social realities in professional development. In Miller, A.L. (Eds) Staff development for education in the 90's: New demands, new realities, new perspectives. NY Teachers College Press

McDermott, R. (1999) Knowing in Community: 10 Critical Success Factors in Building Communities of Practice. Community Intelligence Labs. . [Accessed Feb 22nd, 2002] http://www.co-i-l.com/coil/knowledge-garden/cop/knowing.shtml

McWhinney, I. R., 1996, "The importance of being different", British Journal of General Practice, July, pp433-436.

Mears, R. and Sweeney, K. 2000, "A preliminary study of the decision-making process within general practice", Family Practice, Vol 17, No 5, pp428-429.

National Foundation for the Improvement of Education, (1996). Teachers Take Charge of Their Learning: Transforming Professional Development for Student Success. Executive Summary http://www.nfie.org/publications/takecharge_exec.htm [Accessed Feb 22nd, 2002]

Reilly, R.A. (1999) EdNet@Umass: Providing Quality Professional Development via the Internet The Journal Technical Horizons in Education March v26 pp.60

SCHIN, 2001a, Report on Awareness of Prodigy Amongst GPs in England. SCHIN, (Unpublished), Newcastle.

Senge P. M. (1999) The Leader's New Work, Sloan Management Review, Fall. Vol 32(1)

Serim, F. (1996) Building Virtual Communities for Professional Development. [Accessed Feb 22nd, 2002]http://www.ed.gov/Technology/Futures/serim.html

Sharp, J. (1997) Key Hypotheses in Supporting Communities of Practice. Valid at 13/07/01 http://www.tfriend.com/hypothesis.html

Stuckey, B., Hedberg J. G. & Lockyer, L. (2002). Facilitating Teacher Collaboration in On-line Environments. In J. Price, D. Willis, N. Davis and J. Willis (Eds.) Proceedings of SITE 2002 Society for Information Technology and Teacher Education. (in press). Norfolk, VA: Association for the Advancement of Computing in Education.

Warren, B. & Roseberry, A.S. (1992). Equity in the future tense: Redefining relationships among teachers, students and science in linguistic minority classrooms. In W. Secada et al (Eds) New Directions in equity for mathematics education. NY Cambridge University Press.

Weinrich, F. (1997) Global Hearth Fires, CMC Magazine, February. Valid at 13/07/01 http://www.december.com/cmc/mag/1997/feb/weinstat.html

Wenger, E. (1998). Communities of practice: Learning, meaning, and identity. New York: Cambridge University Press.

Wenger, E. (1999) Sited in Lesser, E., & Pussac, L. Communities of Practice: The Social Fabric of a Learning Organization. Valid at 13/07/01 http://www4.ibm.com/software/data/knowledge/media/communities.pdf

Footnote: The authors of this paper met in the **Foundations of Communities of Practice** workshop lead by Etienne Wenger. [http://www.cpsquare.com/edu/foundations/index.htm] This event is significant for it is the topic of community that brings knowledge managers, facilitators, educators and researchers from industry, education, government and non-profits organisations together. It did not take long to realise that supporting medical practitioners to embrace a technology in their evidence-based medicine was not unlike bringing teachers of the performing arts to embrace technology in their teaching of creativity. Indeed after some examination of the concerns of both groups the likeness became even stronger. These similarities will hopefully continue to be drawn out as the research progresses. The authors would be keen to join with any other designers seeking to support the use of innovative technological tools.

Accessing Distributed Learning Repositories through a Courseware Watchdog

Christoph Schmitz, Steffen Staab, Rudi Studer, Gerd Stumme, Julien Tane

Learning Lab Lower Saxony (L3S), Expo Plaza 1, D–30539
Hannover, Germany; www.learninglab.de;
<lastname>@learninglab.de

Institute for Applied Informatics and Formal
Description Methods (AIFB),
University of Karlsruhe, D–76128
Karlsruhe, Germany;
www.aifb.uni-karlsruhe.de/WBS/

Abstract: Topics in education are changing with an ever faster pace. Especially in the field of life-long learning the aspects that need to be taught by information providers must keep up to date with emerging topics. The courseware watchdog is a comprehensive module which allows users to focus on existing subfields of a discipline, but thereby be aware of important drifts and tendencies in the field.

Introduction

In many domains, knowledge is becoming obsolete with an ever faster pace. Therefore, life long learning is gaining high importance for employees in order to keep up-to-date with recent developments in their respective fields (Fischer 2000). For supporting life long learning, E-Learning plays an important role in enabling on-demand learning of the individual employee (Maurer & Sappe 2001). However, only having online access to predefined course material that is stored in a single centralized repository does not meet the needs of such a learning scenario. Rather, the E-Learning approach should support the tailoring of the learning material to the specific needs of the employee being determined by the task at hand and his or her previous experience (Nejdl 2001). Furthermore, the individual learner should be able to keep track of recent developments and new trends in the relevant domains.

The same holds for lecturers, as the life cycle of courseware becomes shorter, and new courses on upcoming topics have to be offered more and more frequently. As there do not yet exist 'classic' text books on these topics, other ways to obtain new courseware material have to be gone. One relevant information source is of course the WWW; but as in old times one will also contact peers, i. e., lecturers and researchers working on the same domain, and ask them if they can help out with some material. As an individual learner, the lecturer benefits from technical support in accessing and tailoring these sources, and in discovering new trends.

The Courseware Watchdog that is described in this paper addresses these challenges by a comprehensive approach that exploits concepts from the Semantic Web, such as ontologies, in an E-Learning scenario (Stojanovic et al 2001). It is part of the PADLR framework (Personalized Access to Distributed Learning Repositories) that builds upon a peer-to-peer approach for supporting personalized access to learning.[1]

---

[1] http: //www.learninglab.de/pdf/L3S_padlr_17.pdf

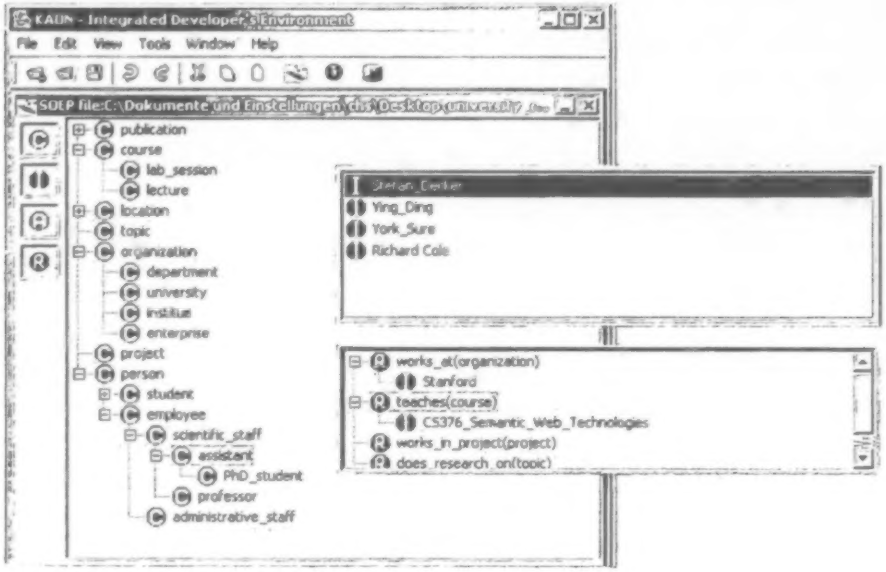

KAON - Integrated Developer's Environment
File Edit View Tools Window Help
SOEP file:C:\Dokumente und Einstellungen\chs\Desktop\university
publication
course
lab_session
lecture
location
topic
organization
department
university
institue
enterprise
project
person
student
employee
scientific_staff
assistant
PhD_student
professor
administrative_staff
Stefan_Decker
Ying_Ding
York_Sure
Richard Cole
works_at(organization)
Stanford
teaches(course)
CS376_Semantic_Web_Technologies
works_in_project(project)
does_research_on(topic)

Figure 1: An ontology about research and teaching topics.

Ontologies are a means of specifying the concepts and their relationships in a particular domain of interest. Thus, they facilitate the sharing of knowledge between actors (Staab et al 2001). A small example of a learning ontology is shown in Figure 1. The left side shows the concept hierarchy. 'Assistent' is for instance a sub-concept of 'scientific_staff'. The upper right box shows the instances of this concept (e. g., 'Stefan_Decker'), and the lower right box shows the relationships the highlighted instance has to instances of other concepts (e. g., 'Stefan_Decker teaches semantic_web_technologies'). As we will see below, this formalization will help to also find the homepage of Stefan Decker when one is searching for course material related to the Semantic Web.

The Courseware Watchdog aims at finding and visualizing relevant educational material on the WWW and in the peer-to-peer network according to the user's needs, and detecting trends and changes within the field of interest. The Courseware Watchdog consists of the following components (see Figure 2):

- A *focused crawler* will find related web sites and documents that match the user's interests. The crawl can be focused by checking new documents against the user's preferences as specified in terms of an ontology.
- Integration into the *Edutella framework* enables the user to annotate educational resources with metadata to support exchange in the Edutella peer-to-peer network.
- As different users may have different points of view, *subjective clustering techniques* are used to generate subjective views onto the documents.
- *Visualization and intelligent browsing* capabilities for the results of the crawling and clustering steps will be provided.
- These tasks are supported by an underlying ontology. In order to reflect changes and trends within the field of interest, ontology learning methods will be employed to facilitate *ontology evolution* (Stojanovic et al 2002).

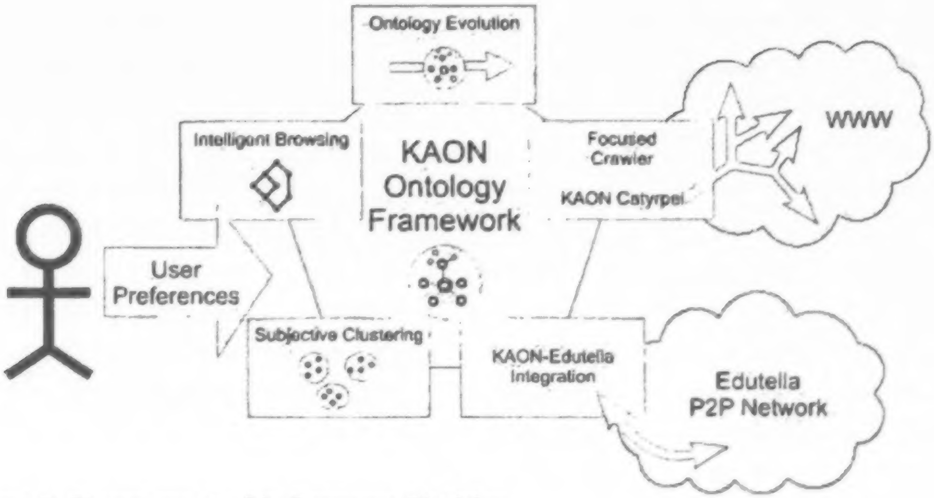


Figure 2: The components of the Courseware Watchdog.

These components are connected through the Karlsruhe ontology framework KAON (Handschuh et al 2001). KAON provides a plug-in infrastructure for ontology-based tools and applications.

The components are discussed in detail in the remainder of the paper, and are illustrated by a running example: consider a lecturer who has to prepare a new course about the semantic web. Although our lecturer has no course material in that field, she is confident that she will find relevant material either on the WWW or from colleagues working on that domain.

The rest of the paper is organized as follows. The next two sections discuss the information sources: the first presents the focused crawler and the second the Edutella peer-to-peer network. The following three sections discuss the treatment and interaction with the courseware collected and address the following components: subjective clustering, intelligent browsing, and the ontology evolution. We then conclude the article.

Focused Crawler

A web crawler is a program that collects data from the web automatically by following links extracted from web documents. Thus, a portion of the web is traversed in a breadth-first manner, usually without regarding the relevance of the collected documents with respect to the user's needs. In order to restrict the traversal to material relevant to the user, the crawling process can be *focused*. Focusing in this context means preferring those links in the crawling process that appear to be pointing to relevant documents.

KAON Catyrpel (Maedche et al 2002a) is an ontology-based focused crawler embedded in the KAON environment for ontology-based tools (Handschuh et al 2001). With Catyrpel, the user can specify topics of interest in terms of an ontology. The user's preferences, i. e. entities in the ontology, and the ontology itself are then used to compute the relevance of documents and hyperlinks. After simple linguistic preprocessing (HTML tag removal, stemming etc.), lexical entries of the ontology are matched against the text and a relevance score is computed. Through the use of the ontology structure a useful measure of relevance can be evaluated, even if no exact match can be found. Several relevance measures can be used, which compared favourably against breadth-first search or simple keyword-based measures.

BEST COPY AVAILABLE

When searching for "Semantic Web", the focused crawler may for instance come across the web pages of Stefan Decker at Stanford University, who has already annotated his pages with RDF statements saying that he is giving a course 'Semantic Web Technologies'. The crawler will add the instances to the knowledge base used by the ontology as shown in Figure 1, and will return the homepage with a certain score.

Integrating the Edutella Peer–to–Peer Network

The Courseware Watchdog includes the possibility to access the Edutella peer-to-peer network (Nejdl et al 2002a). Peer-to-peer (P2P) networks are decentralised networks, which allow for publishing and searching resources based on direct collaboration between its nodes.

The Edutella network applies the P2P paradigm to the exchange of structured information about available learning resources.[2] A common data model facilitates the integration of data sources such as relational database systems or XML and RDF repositories. Thus, all of these can act as Edutella peers, either as repositories or as consumer of the network resources.

For instance, our lecturer may query Edutella. She will be then able to locate relevant material on the P2P network which has been provided by other Edutella users. This way, she may for instance come across further lectures and tutorial about the topic. Moreover she will be able to control and share her own resources by annotating her resources with the annotating tool contained in the KAON framework (Nejdl et al 2002b).

Subjective Clustering

In order to detect trends and tendencies in collections of courseware material, it is necessary to find outliers or groups of outliers. Because users typically do not want to exactly specify their complete profile and because users' profiles tend to change rather often (which is a major problem for recommender systems), we want to give the user views onto existing educational media. Conventional clustering techniques provide a first answer for this purpose.

Typically, however, clustering is used to give a single, "optimal" view on (learning) components. This is not suitable to account for the plurality of views that exist when looking at educational media. We have recently developed clustering mechanisms that allow to provide *subjective views* onto documents (Hotho et al 2001), which are based on an underlying ontology.

For instance, one view may concentrate on differences and similarities of the content of learning material, while another view may concentrate on its presentation form, or on the levels of skills and experiences needed. The lecturer can then use the first view to select the material which addresses the topics which are most relevant to her planned course. She might also use the second view in order to see how the material is distributed over different types of material like presentation slides, exercise sheets, or online demonstrations.

Browsing of Watchdog Data

The results from the crawling and clustering process need to be visualized in order to provide easy access for the user. The browsing component of the watchdog is designed to be based on techniques from Formal Concept Analysis and Open Conceptual Hypermedia in order to visualize the similarities and differences between documents and clustering results through lattices.

---

[2] http: //edutella.jxta.org

Formal Concept Analysis (Ganter & Wille 1999 & Stumme & Wille 2000) is a conceptual clustering technique which provides a hierarchy of concepts. When applied to learning material, the multiple inheritance within this hierarchy provides a rich conceptual landscape for navigating and retrieving the educational media. In particular, it allows to combine the different views created in the subjective clustering step; for instance to find first the most relevant clusters of documents, and second among them the slide presentations to set up the course.

We have recently implemented a Conceptual Email Management system (CEM) which supports exactly this navigation in collections of emails (Cole 2000). Our next step is to extend this approach to courseware material and other documents. This follows the vision that in the near future file, document, email, and web browsers will become tightly integrated in one unique user interface.

While Formal Concept Analysis focuses on the hypernym hierarchy on the concepts, Open Conceptual Hypermedia also considers arbitrary relations between the concepts (Goble 2001). It aims at enriching a web-based open hypermedia link service with semantic knowledge provided by ontologies. By combining both Formal Concept Analysis and Open Conceptual Hypermedia in the user interface of the courseware watchdog, we support thus navigation along both hierarchical and non-hierarchical conceptual relationships. For instance, the lecturer can continue his navigation from the cluster of relevant courseware material as obtained above by following the link 'created_by' to the creators of that material, and then follow on to the projects 'led_by' these researchers. There she may find additional presentation material to illustrate her lecture.

Ontology Evolution

The Courseware Watchdog as presented in this paper so far builds heavily on a proper ontology that reflects what the user is interested in. However, over time such interests will invariably change together with the teaching/learning subject itself. Therefore, the ontology and the topics represented therein need to be updated and one must deal with several requirements incorporated in such updates:

Introducing new concepts: The first requirement is about (*i*) recognizing that a new concept (e.g. a new topic) has appeared in the course material available in the network or on the Web, (*ii*) inserting this concept into the right place of the taxonomy, and (*iii*) linking it via further relations to other concepts.

For instance, Web Services are today an emerging topic, and will probably have to be included in future courses on the Semantic Web. Hence 'Web Services' has to be recognized as a term that denotes a new concept. It must be inserted into the concept hierarchy (e.g. as a subarea of computer science) and it must be related to other disciplines (e.g. to business process modeling and E Business). Only if this has been done the concept can be used by the courseware watchdog. Some example methods for this are proposed, e.g., in (Maedche et al 2002b).

Recognizing concept drift: The subject of "Semantic Web" is currently in flux and the understanding of it will evolve over time (such as that of other disciplines). In order to use the concept appropriately it will be necessary to adapt the concept to its current use (Klenner 1994).

Versioning ontologies: Even when there are ontologies at different points in time, it should be possible to relate them, e.g. in order to explain why "Artificial Intelligence" in the 1970ies included computer algebra, but does not anymore in 2002. For this one needs comprehensive means for versioning ontologies (Heflin & Hendler 2000).

Process: Eventually, updates, drift and versioning will not happen completely automatically. Rather, they will require an organizational process that safeguards critical changes (e.g., deletions of large parts of the ontology). Thus, one needs a process model and tools to handle the process. Some first models exists (Maedche et al 2001, Staab et al 2001) but they need to be refined and adapted to E-Learning needs.

The combination of the different requirements will allow to exploit the benefits of the courseware watchdog, the central objective of which is to facilitate that the lecturer remains up-to-date about the courseware he is responsible for.

Conclusion

The Courseware Watchdog is a comprehensive approach for supporting the learning needs of individuals in fast changing working environments, and for lecturers who frequently have to prepare new courses about upcoming topics. Being based on the Edutella peer-to-peer network the courseware watchdog provides personalized and flexible access to learning material that is offered somewhere on the Web. This functionality is achieved by tying together focused crawling, subjective clustering, flexible conceptual browsing, and ontology evolution.

The components of the envisioned courseware watchdog need further improvement. For instance, focused crawling has to be improved by offering further measures for computing the relevance of documents based on the ontologies and available metadata, and ontology evolution needs further techniques for better reflecting changes in the underlying learning material. Morever, we are also working on a better integration of the diverse functionalities to combine the diverse functionalities of the components.

Nevertheless, the courseware watchdog indicates how a Semantic Web based approach is better able to meet the needs of today's and future learning scenarios.

Acknowledgements

We thank all members of our group for intensive discussions and contributions, especially Marc Ehrig and Andreas Hotho.

This research is partially funded by the German Federal Ministry of Education and Research (bmb+f).

References

Richard Cole and Gerd Stumme (2000). CEM - a Conceptual Email Manager. In Bernhard Ganter and Guy W. Mineau, editors, *Proc. ICCS 2000*, volume 1867 of *LNAI*, Springer, 438–452.

Gerhard Fischer (2000). Lifelong learning – more than training. *Journal of Interactive Learning Research*, 11(3/4): 265–294.

Berhard Ganter and Rudolf Wille (1999). *Formal Concept Analysis: Mathematical Foundations.* Springer, Berlin – Heidelberg.

Carole Goble, Sean Bechhofer, Leslie Carr, David De Roure, and Wendy Hall (2001). Conceptual open hypermedia = the semantic web? In *Proceedings 2nd Intl. Workshop on the Semantic Web (SemWeb'2001), Hong Kong, China, May 1, 2001*, 44–50.

Siegfried Handschuh, Alexander Maedche, Ljiljana Stojanovic, and Raphael Volz (2001). KAON – the Karlsruhe ontology and semantic web infrastructure. `http://kaon.aifb.uni-karlsruhe.de/white-paper`.

Jeff Heflin and James A. Hendler (2000). Dynamic ontologies on the web. In *Proc. of AAAI/IAAI 2000*, 443–449.

Andreas Hotho, Alexander Maedche, and Steffen Staab (2001). Ontology-based text clustering. In *Proc. of the Workshop "Text Learning: Beyond Supervision" at IJCAI 2001. Seattle, WA, USA, August 6.*

Manfred Klenner and Udo Hahn (1994). Concept versioning: A methodology for tracking evolutionary concept drift in dynamic concept systems. In *Proc. of ECAI 1994*, pages 473–477. J. Wiley.

Alexander Maedche, Marc Ehrig, Siegfried Handschuh, Raphael Volz, and Ljiljana Stojanovic (2002a). Ontology-focused crawling of documents and relational metadata. In *Proceedings of the Eleventh International World Wide Web Conference WWW-2002*, May. (Poster).

Alexander Maedche, Viktor Pekar, and Steffen Staab (2002b). Ontology learning part one — on discoverying taxonomic relations from the web. In: Ning Zhong et al. (eds) *Web Intelligence*. Springer, to appear.

Alexander Maedche and Steffen Staab (2001). Ontology learning for the semantic web. *IEEE Intelligent Systems*, 16(2), March/April.

Hermann Maurer and Marianne Sapper (2001). E-learning has to be seen as part of general knowledge management. In *Proc. of ED-MEDIA 2001 World Conference on Educational Multimedia, Hypermedia & Telecommunications*, USA AACE.

Wolfgang Nejdl, Boris Wolf, Changtao Qu, Stefan Decker, Michael Sintek, Ambjörn Naeve, Mikael Nilsson, Matthias Palmér and Tore Risch (2002a). EDUTELLA: A P2P Networking Infrastructure Based on RDF. In *Proc. of the 11th International World Wide Web Conference*, Honolulu, USA

Wolfgang Nejdl, Boris Wolf, Steffen Staab and Julien Tane (2002b). EDUTELLA: Searching and Annotating Resources within an RDF-based P2P Network. In Proc. of the Semantic Web Workshop, 11th Intl. WWW Conference, Honolulu, USA.

Wolfgang Nejdl (2001). Learning repositories - technologies and context. In *Proc. of ED-MEDIA 2001 World Conference on Educational Multimedia, Hypermedia & Telecommunications*, USA, AACE.

Steffen Staab, Hans-Peter Schnurr, Rudi Studer, and York Sure (2001). Knowledge processes and ontologies. *IEEE Intelligent Systems*, 16(1), pages 26-34.

Liljana Stojanovic, Alexander Maedche, Boris Motik, Nenad Stojanovic (2002): User-driven Ontology Evolution Management. Proceedings of the 13th European Conference on Knowledge Engineering and Knowledge Management EKAW, Madrid, Spain, 2002.

Liljana Stojanovic, Steffen Staab, and Rudi Studer (2001). ELearning Based on the Semantic Web. In *Proc. of WebNet2001 - World Conference on the WWW and Internet*, Orlando, Florida, USA.

Gerd Stumme and Rudolf Wille, editors (2000). *Begriffliche Wissensverarbeitung — Methoden und Anwendungen*. Springer, Heidelberg,.

CoCoFolio: A Web-based Electronic Portfolio for Enriching Students Learning by Collaboration

Takeshi Sugiyama, Naoyuki Kakehi, Tsuneko Kura, and Tokiichiro Takahashi
NTT Cyber Solutions Laboratories, Japan
{sugiyama.takeshi, kakehi.naoyuki, kura.tsuneko, toki.takahashi}@lab.ntt.co.jp

Abstract: *We have developed a web-based electronic portfolio, called CoCoFolio, for enriching students learning by collaboration. It consists of two collaboration tools: a multi-layered drawing tool, called "CoCoBoard", and a small bulletin board, called "Discussion Board", for each student's submission. These tools support a series of expression activities: expression, sharing, peer-review, coaching, and reflection. CoCoFolio was implemented in two applications, in a university and in a junior high school, and it was found to improve students' motivation, increase students' knowledge through peer collaboration, and improve their learning process.*

1. Introduction

A portfolio, which is a collection of student work that represents student's efforts, progress, and achievements, has become popular in K-12 and higher education. It offers many possibilities for learning and assessment. Digitizing portfolios (i.e., electronic portfolios) brings the following benefits: (1) operations such as search, copy, and replace become easy; (2) student-learning processes become open to others; (3) teachers can understand how each student is making progress with their studies and can advise them individually.

There are many electronic portfolio programs available such as HyperStudio [HyperStudio], Florida State's Career Portfolio [FSU Portfolio], Stanford's e-Folio [E-Folio] and ePortfolio consortium[ePortfolio]. The first one is a multimedia authoring tool that enables students at all grade levels to create and enjoy their own experiences in learning. The others are web-based portfolios designed to enable students to portray, and instructors to assess, their learning experience in an integrated, sharable format. They are very effective for archiving and sharing learning experiences of all students in various forms of media; however, they provide few tools for collaboration between students or between students and teachers. Without such collaboration, there is a possibility that students will not reflect sufficiently on their work, and without student reflection, portfolios become a mere collection of student work and much of their learning value is diminished.

In response to these problems, we have developed CoCoFolio, that is , an electronic portfolio for enriching student learning by means of collaboration tools. This paper describes the concept of CoCoFolio and explains the implementation of two pilot applications using it.

2. Concept

To explain the concept behind CoCoFolio, first, expression activities involved in learning are explained in the following. It is very important for students to understand themes deeply and acquire knowledge. In addition, Japanese school education has changed its focus from "passive understanding" to "active understanding".

A series of expression activities represent the relation between one student and others. Basically, to think deeply about a study theme, it is important to put one's thoughts together, then express and reflect on them by oneself. In addition, for students to broaden their knowledge, it is important that they share all learning results with peers and stimulate each other. These expression activities can be divided into the following four stages. By repeating these stages, students can develop certain abilities.

- Expression: A student thinks over a study theme, puts their thoughts together, and presents them.
- Sharing: All students share learning results with peers and get a different perspective on their way of thinking.
- Peer-review and advice: Peers review each other's results and comment on each learning result. Teachers advise all students separately in face-to-face talks.
- Reflection: Each student reads the comments and advice and reflects on their learning results.

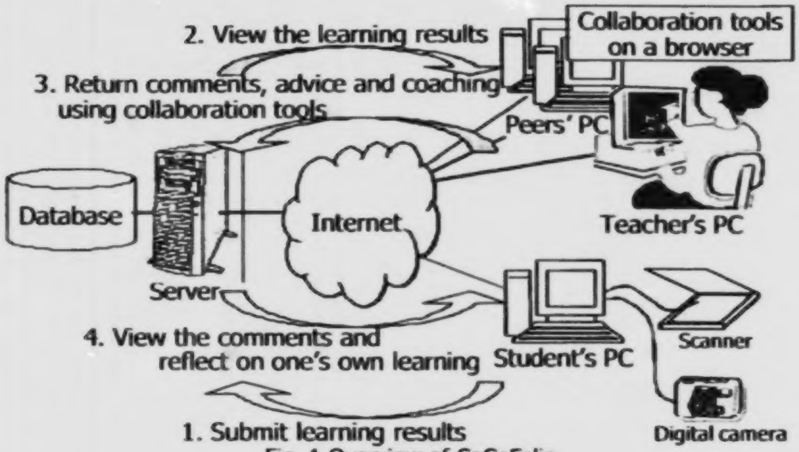

2. View the learning results
Collaboration tools on a browser
3. Return comments, advice and coaching using collaboration tools
Peers' PC
Database
Internet
Teacher's PC
Server
4. View the comments and reflect on one's own learning
Student's PC
Scanner
1. Submit learning results
Digital camera

Fig. 1 Overview of CoCoFolio

CoCoFolio supports each stage of the expression activities by using information technologies as follows.

- Expression: It can provide students with a common space on the Internet to share their learning results.
- Share: It can accumulate all learning results in a database and share them with others.
- Peer-review and advice: It can provide peers and teachers with collaboration tools for commenting and giving advice on each student's work.
- Reflection: It enables a student to retrieve their own learning history easily.

Moreover, management tools are very important to enable teachers to make original classes according to their own ideas. For example, learning management can provide teachers who have little database knowledge with a management tool for editing subjects, learning themes, user assignments and so on easily on the Internet.

3. Implementation

3.1 System overview

With the above-mentioned concepts in mind, we have developed a student portfolio called CoCoFolio, which consists of the Internet, a web application server, a database, and collaboration tools. Figure 1 shows an overview of CoCoFolio, which utilizes WindowsNT Server 4.0 as the operating system and Oracle as the database. The server software is an extension of our educational software "CyberPedia" [Kakehi 2002]. To use CoCoFolio, a user only needs a web browser like Internet Explorer. Teachers and students can therefore easily access the system from school or even from home.

3.2 Data structure of CoCoFolio

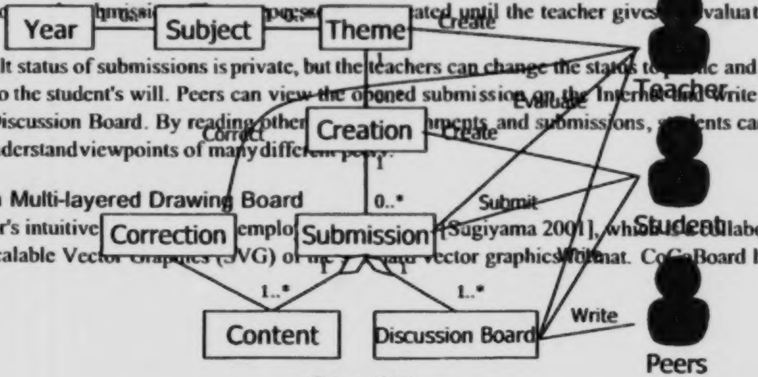
Figure 2 shows the data structure of CoCoFolio. At first, teachers make a learning space by inputting "Year", "Subject", and "Theme", whose relations are similar to directories of a file system. Then, they add some detailed information to the learning theme, such as theme explanation, time limit, and assignment of the students.

The assigned students make their own "Creation" space under "Theme" for submitting their works or creations. "Submission" data is automatically created when the students send their works by a template on a browser. The template allows them to submit a series of "Contents" which consists of a "MediaFile" like JPEG or MPEG, creator's comments and detailed information about submission. Teachers can make their "Correction" directly to each content by using "CoCoBoard" (which is explained in the next paragraph) and write comments by using "Discussion Board" which is like a mini bulletin board [illegible] submissi[illegible] [illegible]ated until the teacher gives [illegible]valuation in terms of a pass mark.

Basically, the default status of submissions is private, but the teachers can change the stat[illegible] t[illegible]ic and post work on the Internet according to the student's will. Peers can view the opened submission on the Inter[illegible] write comments about each other on the Discussion Board. By reading other[illegible] and submissions, [illegible]ents can reflect on their own learning and understand viewpoints of many diffe[illegible].

3.3 CoCoBoard: a Multi-layered Drawing Board

To support a teacher's intuitive [illegible] emplo[illegible] [Sugiyama 2001], whi[illegible]llaborative electronic whiteboard using Scalable Vec[illegible] (SVG) o[illegible] vector graphics [illegible]at. Co[illegible]Board has the following


Year
0..*
Subject
0..*
Theme
Create
Teacher
1
Evaluate
Correct
Creation
Create
1
Student
0..*
Submit
Correction
Submission
1
1
1..*
1..*
Content
Discussion Board
Write
Write
Peers

BEST COPY AVAILABLE

features.

- Shared whiteboard by means of SVG format: Because of its XML-based format, it is easy to convert or reuse other data and to add metadata to drawing objects. Additionally, the SVG format is less demanding than other raster formats such as JPEG and makes it convenient to communicate using the Internet.
- By means of ActiveX component, CoCoBoard is available on the web and can be used in several applications easily.
- Synchronous or asynchronous communication can be customized according to the collaborative situation on demand.
- Multi-layer canvas architecture provides multiple layers and each layer can be set by teacher, so readable or writable access are available (or both). Even if a student has permission to several access layers, they can view any layer they want by selecting or overlaying them.

By using CoCoBoard, teachers directly overwrite their corrections on a student's work on the Web. It is very convenient for teachers to overwrite directly without running other drawing tools. When the teachers finish overwriting, they upload their corrections via the Internet in asynchronous mode. The CoCoFolio server receives and stores them in a database. Students can view the teacher's corrections by using Adobe SVGViewer and learn something from them. The multi-layer canvas architecture enables teachers to overwrite their corrections on each separated layer. It is therefore possible for students to be coached by several teachers; this is called "team teaching". This function enables teachers and students to learn something from other teachers' coaching.

4. Application examples

To test the performance of CoCoFolio, we asked teachers in Kyoto Seika University (KSU) and Oizumi Junior High School (Oizumi), attached to Tokyo Gakugei University, to use it for supporting their lessons using CoCoFolio. In the KSU experiment, CoCoFolio provided solutions for art and design education, called "Manga University", ("Manga" means cartoon or comic in Japanese.) In the Oizumi experiment, CoCoFolio was applied to "Integrated study" for secondary education.

4.1 Application to art and design education: "MANGA University"

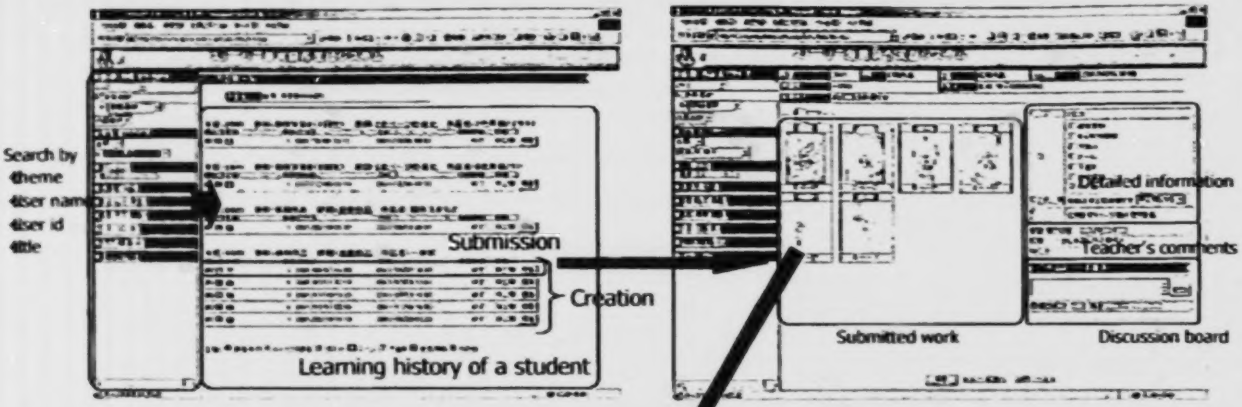
These days, even though there are many web-based education systems, there are few systems for art and design education. This is because it is difficult to aid it by information technology because of its unique features, such as face-to-face coaching and direct coaching through artistic creations. CoCoFolio was applied to solve the trade off between face-to-face coaching and temporal/spatial restrictions.

This experimental project started in May 2001 and involved about 40 students. The workflow of Manga University is as following: (1) The teachers create the themes and assign students. (2) The assigned students submit their scanned creations to the server. (3) The teachers view, modify and comment on each creation by using CoCoBoard. (4) The students view and respond to the teachers' coaching and comments. (5) The students submit new creations.

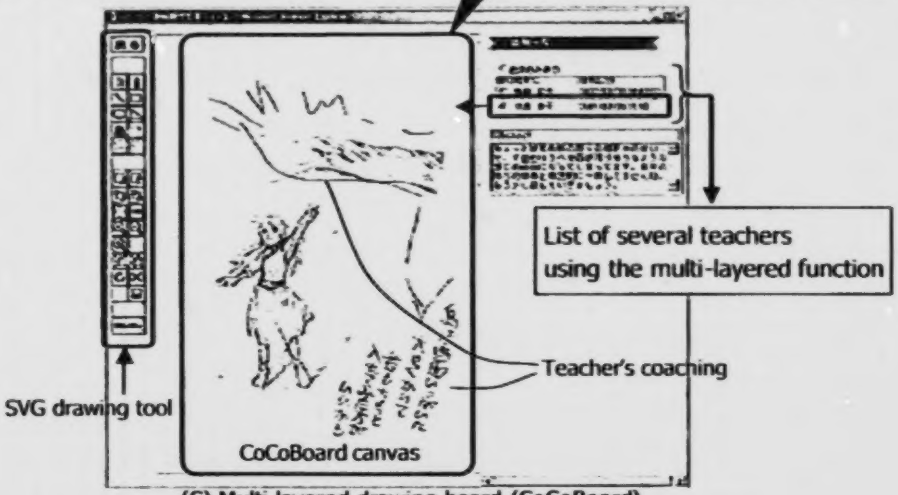
As shown in Fig. 3, the teacher can directly coach student's creations on the Web. The teacher can coach the students remotely anytime, anywhere, at his convenience. Manga University also allows everyone to easily share the coaching of several teachers. Moreover, it enables students to look back over the past and refer to their history as a personal portfolio.

4.2 Application to various subjects in a junior high school

In Japan, K-12 school education has introduced "Integrated study" styles - similar to the project-based learning in the United States - into the curriculum at the beginning of 2002. It aims to help children develop the capacity and ability to discover problems by themselves and solve them appropriately. The key points of integrated study are that it must be linked with each subject such as mathematics and science and it must guarantee deepness of students understanding by means of expression and reflection.


Search by
theme
user name
user id
title
Submission
Creation
Learning history of a student
Detailed information
Teacher's comments
Submitted work
Discussion board

(a) Learning-history window (b) Contents-display window


List of several teachers
using the multi-layered function
Teacher's coaching
SVG drawing tool
CoCoBoard canvas

(C) Multi-layered drawing board (CoCoBoard)

Fig. 3 Screenshots of Manga University

In this application, the Oizumi teachers use CoCoFolio linked with various subjects. This experimental project started in December 2001 and about 130 students are participating in it over a school year. The subjects are science, mathematics, Japanese, and art. Each subject is provided according to the teachers' original ideas. Examples of these classes are given in the following. Note that submitted work from all students (including comments in Discussion Board) becomes the objects of assessment by teachers.

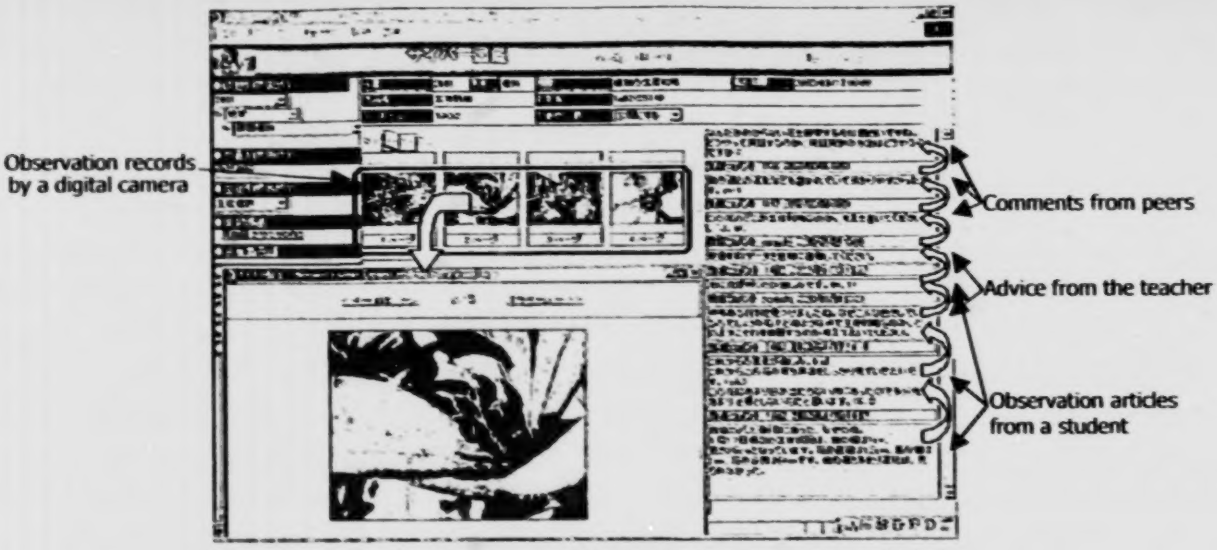
(a) Science class

This 7th-grade learning theme is "plant biology" and involves studying a plant's strategy for existence in winter by observing it regularly. The class flow is as following: (1) Students understand the theme and choose a plant to observe. (2) They observe the plant regularly by using a digital camera and submit articles containing these observations to CoCoFolio. (3) The teacher advises each student on their next activity or on the best way to describe their observations in articles posted on the Discussion Board. The students also give comments and advise on peer's observation articles. (4) They set up a hypothesis concerning the strategy for existence and do an experiment. (5) They make a report and give a short presentation. Figure 4(a) shows the CoCoFolio window containing a student's work. It is clear that the students were thinking deeply by discussing their work on the Discussion Board. Moreover, the teacher's comments were essential to help the student understanding.

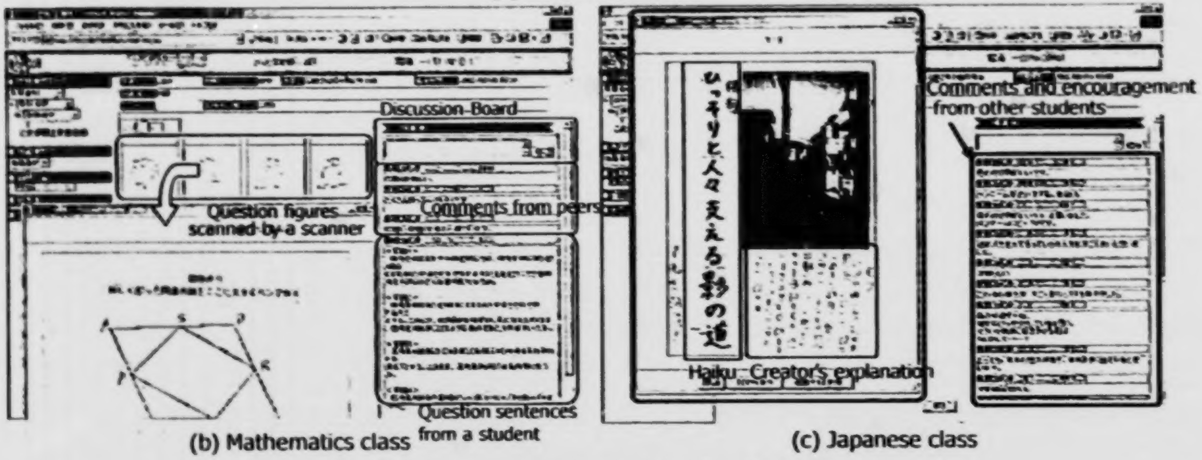
(b) Mathematics class

This 8th-grade learning theme is "similarity" and involves making and answering each student's custom questions. The class flow is as following: (1) Students answer original questions from the teacher. (2) They make custom questions by changing part of the original questions and submit them to CoCoFolio. (3) They answer and correct each other's questions. (4) They classify all questions according to the contents. Figure 4(b) shows the CoCoFolio window containing a student's work. The student uploads questions and figures scanned by a scanner. Then, students' and teachers' comments and

BEST COPY AVAILABLE


Observation records by a digital camera
Comments from peers
Advice from the teacher
Observation articles from a student

(a) Science class


Discussion Board
Question figures scanned by a scanner
Comments from peers
Question sentences from a student
Comments and encouragement from other students
Haiku
Creator's explanation

(b) Mathematics class (c) Japanese class

Fig. 4 Screenshots of various subjects in K-12 education

questions are written up on the Discussion Board.

(c) Japanese class

This 7-9th-grade learning theme is "language expression" and involves enriching language expression by making "Haiku" poems with photos in relation to nature or social phenomena. (A "Haiku" is a Japanese poem of seventeen syllables in 5-7-5 form.) Figure 4(c) shows the CoCoFolio window containing a student's work.

5. Discussion

Through observation of some classes, questionnaires from about 90 students, and discussion with the teachers, we came to the following conclusions concerning the use of CoCoFolio.

- Teachers can provide coaching and students can study anytime, anywhere.

Teachers could coach all students separately with CoCoFolio in non-class time. To coach each student separately took much time, but teachers were satisfied with teaching in a "distant face-to-face" style. On the other hand, about two thirds of students accessed the server from their home. Although this is very convenient, it caused a problem due to differences in home-computer environments of different students.

- Teachers can modify and comment on students' creations and works directly by using CoCoBoard.

In particular, in the case of art and design education like MANGA University, teachers need to modify and comment on students' works directly by using CoCoBoard. CoCoFolio is applicable to several other types of art and design education, such as fashion or industrial design as well as storyboard and GUI design for software on the web. Moreover, it can be used for collaborative design work by distant creators.

- Students can reflect on their learning by interacting with peers actively.

BEST COPY AVAILABLE

Eighty nine percent of students answered that they could reflect on their learning by viewing their peers' learning histories and by discussing their work on the Discussion Board. Many students wrote that they could try various ways of thinking about the same theme.

- Both students and teachers found CoCoFolio to use very easy.

Ninety seven percent of students answered that they could operate the system easily. Teachers could also use it on a browser, without having any technical knowledge, and make original classes.

- Students' motivation to learn is improved.

The Oizumi students had more fun studying and thinking more deeply than learning all together as a group with textbooks. Students' motivation to learn was improved by sharing learning results and comments from peers.

- CoCoFolio shares coaching comments with other teachers.

Informative comments provide other teachers with useful information; therefore, CoCoFolio also functions as a teaching portfolio.

- Submitted work is accumulated as learning materials for junior students in the school.

Contents in CoCoFolio can be used as learning materials or references for junior students. For example, questions made in the mathematics class make good learning materials for the next year. In addition, teachers can assess learning results by comparing them with those of the previous year.

- Discussion Board helps students to exchange opinions naturally.

Ninety one percent of students answered that they could write their comments interactively. CoCoFolio was really effective for exchanging opinions in their own class and between different classes in school. It will help discussion between different school years, for example, when students teach juniors in the same school.

6. Summary

We have developed and experimentally applied an electronic portfolio tool, called CoCoFolio, for enriching students learning. In two test application examples - at Kyoto Seika University and Oizumi Junior High School - CoCoFolio supports a series of expression activities: expression, sharing, peer-review, coaching, and reflection.

To encourage students to perform these activities, collaboration between students or between students and teachers is essential; therefore, we have developed a multi-layered drawing tool and a Discussion Board. Responding to peers' comments and teachers' coaching, Students can formulate new questions and advance their learning. At the same time, they can understand their peers 'different ways of thinking and improve their learning processes.

References

E-Folio, "http://sll.stanford.edu/consulting/tools/efolio/", Stanford University, Stanford Learning Lab.

ePortfolio consortium, "http://www.eportconsortium.org/"

FSU Portfolio, "http://www.career.fsu.edu/portfolio/", Florida State University

HyperStudio, "http://www.hyperstudio.com/", Knowledge Adventure, Inc.

Kakehi, N., et al. (2002), "Concept and Application of CyberPedia: a New Platform for Internet-based Collaborative Encyclopedias for K-12 Education", World Conference on Educational Multimedia, Hypermedia & Telecommunications

Sugiyama, T. and Takahashi, T. (2001), "CollaBoard: Web-based Collaborative Learning System Using SVG", World Conference on the WWW and Internet, pp. 1190-1191.

Acknowledgements

We would like to thank Prof. Gunei Sato of Tokyo Gakugei University, Manga artist and Prof. Keiko Takemiya of Kyoto Seika University, and the teachers of Oizumi Junior High School for allowing CoCoFolio to be used in their classes and for giving their helpful comments. We also thank the other project members of NTT for helping and encouraging this project.

STUDENTS' READINESS FOR ON-LINE DISTANCE EDUCATION IN SLOVENIA

Viktorija Sulcic, M.A. and Dušan Lesjak, Ph.D.

University of Maribor, Maribor, Slovenia

Vika.Sulcic@uni-mb.si, Dusan.Lesjak@uni-mb.si

Abstract

Presence and expansion of on-line distance education (DE) are one of the characteristics of the information society by which we can estimate the level of its development. We witnessed many changes in Slovenia in the last decade, so we were interested in acceptability (and readiness) of Slovene students for on-line DE, especially because the Internet has so successfully penetrated into the Slovene society.

Keywords: on-line distance education, high education, Slovenia

Introduction

Lately, knowledge has been given increasing importance, yet more and more knowledge gained at schools quickly becomes out-of-date and therefore it must be updated. The act of "updating" the existing knowledge is mostly done by the active part of the population, which can hardly afford to leave their work and begin to study. Nevertheless, in the last decade, various forms of education have been developed, which help to solve this problem. One of them is on-line distance education (DE).

On-line DE belongs to the phenomena of the information society, which – with regard to its wide use – can indicate the development of a country (indicator of development by RIS (1999)). It is therefore likely that Slovenia will follow developed countries and that the introduction and usage of on-line DE is inevitable.

In the higher education in Slovenia only the Faculty of Economics, University of Ljubljana (http://www.ef.uni-lj.si) and Doba Maribor (http://www.doba.si) performed DE. DE at the Faculty of Economics is offered in traditional way with one exception, the on-line materials for a course on European Economic Statistics (http://www-lt.fe.uni-lj.si). The second institution, Doba, offers on-line DE supported by WebCT educational environment. On-line DE at Doba started in September 2000 with 35 enrolled students and in this academic year (2001/2002) they have additional 204 students.

On-line DE is being introduced at Faculty of Economics and Business (FEB), University of Maribor, too for an e-business course (http://www.uni-mb.si/~epfpodin) within which an experiment about students acceptability of on-line DE was conducted.

Readiness for On-line DE (an Experiment)

Participants of the Experiment

In spring 2001, an experiment with on-line materials instead of regular lectures for e-business course was conducted in which two groups of 20 students participated (experimental and control group). The control

970

group attended classical lectures, the other one studied with on-line materials (http://epf-se.uni-mb.si/e-gradivo/eb-index.htm).

After the experiment students used a questionnaire, composed of two sets of questions:

- With the first set of questions the participants of the experiment were asked about their IT attitude, usage of forum, on-line materials and obtained knowledge and
- With the second set of questions we estimated and evaluated their acceptability for on-line DE.

Students characteristics and their IT attitude

In Table 1, statistically significant correlation between student characteristics and their IT attitude are shown.

	Characteristics and attitude of students	**2.**	**3.**	**4.**	**5.**	**6.**	**8.**
1.	Gender						
2.	Motivation for studies						
3.	Average grade						
4.	Attitude toward IT						
5.	PC usage (subjective)			0.47**			
6.	PC usage (objective)						
7.	IT usage			0.52**	0.59**		
8.	Attitude toward lectures supported by IT	0.36*	0.45**	0.44**			
9.	Attitude toward lectures supported by AV			0.40*		0.39*	-0.45**

**p < .01 (2-tailed), *p <.05 (2-tailed)

Table 1: Significant correlation of student characteristics and their IT attitude

Among participants exists a positive correlation between the assessment of PC usage and their attitude towards IT (0.47), which shows that students with a more agreeable attitude towards IT also think highly about their ability regarding computer usage. Such users use IT actively (correlation with the variable attitude towards IT: 0.52 and correlation with the variable PC usage estimation: 0.59).

Interestingly, highly motivated students showed a keen interest for the use of IT (0.36). The same holds true for students who think highly about studies going on at EPF (0.45), as well as students who have a keener attitude towards IT (0.44).

In Table 2, regression analysis regarding the dependence of IT attraction to lectures on the independent variables from Table 1 is shown.

Included variable	B	t	Sig.
Average grade	0.162	2.463	0.020
IT attitude	0.119	2.420	0.022
F=7.415 Sig. 0.002; adj R^2=0.286			
Excluded variables: study motivation			

Table 2: Dependence of IT attraction to lectures on the independent variables

The analysis shows that IT mainly attracts students with higher average grades, as well as students who are in favour of IT, which is somehow understandable. We can easily assert that computer literacy leads to a more positive relationship towards IT supported teaching, and consequently, towards a better class participation.

Videotaped lectures were thought highly of by students who were a part of the experimental group (-0.44), who thought highly of IT (0.40) and who placed themselves in the group of serious PC users (0.39).

On-line materials

All participants of the experimental group found their participation in the experiment highly interesting, they wished they could use e-materials as a supplement for their lectures, and they expressed a belief that such materials should have been available for other subjects.

Opinion about usage of on-line materials	Control group	Experimental group
Attraction of on-line materials	81.2%	100%
On-line materials can complement lectures	87.5%	100%
On-line materials need to be used in other subjects	75.0%	100%

Table 3: Usage of on-line materials

As we can see in Table 1, students preferred the usage of on-line materials to traditional teaching.

The biggest obstacle for the use of e-materials through the Internet is high cost. If the costs of e-materials for the Internet usage were lower, 46.7% of students in the control group and 58.8% of students of the experimental group would use them.

Quality of on-line materials

Quality of materials for DE is essential. Quality elements of software evaluated by ISO 9126 standard, which determines 6 characteristics of software, are: functionality, reliability, usability, efficiency, maintainability and portability (ESSI-SCOPE 2001).

Standard does not prescribe the meaning of individual characteristics or the metrics for their assessment, because the meaning and assessment are connected with the purpose of software (ibid.). Therefore, the assessment of quality was left to software users, and was carried out by means of a two-level model. On the first level, students assessed individual components of the used e-materials or activities, which were connected with the usage of e-materials in the experiment. Because not all characteristics are equally important and because the importance of individual characteristics is by nature subjective, we - in order to assess the importance of a characteristics, typical for e-materials in general - decided to include students, who sorted the ten characteristics from 1 to 10, placing on the first place what they considered the most important characteristics and on the tenth place what they believed to be of least importance. On the basis of this information we calculated relative weights (ponder) for each characteristic in the assessment model (Table 4).

	Components of evaluation model	M	Ponder	evaluation
1.	Ease of use	7.67	0.15	1.15
2.	Graphical design	8.24	0.11	0.91
3.	Text understanding	8.21	0.15	1.23
4.	Interactivity	8.16	0.09	0.73
5.	Readability of texts	8.19	0.14	1.15
6.	Links to similar areas	7.81	0.08	0.62
7.	Links to web pages of the course	7.81	0.07	0.55
8.	Entertaining content	7.28	0.06	0.44
9.	Clear learning objectives	8.18	0.10	0.82
10.	Cited literature	6.52	0.05	0.33
	Total		**1.00**	**7.93**

Table 4: Evaluation model of quality of on-line materials

E-materials were assessed as very good, as they were assessed with 7.93 on the scale 1 to 10.

Evaluation of gained knowledge

Gained knowledge was assessed by means of a knowledge test that comprised of 32 questions, which were used to check student's ability of recognising the materials dealt with.

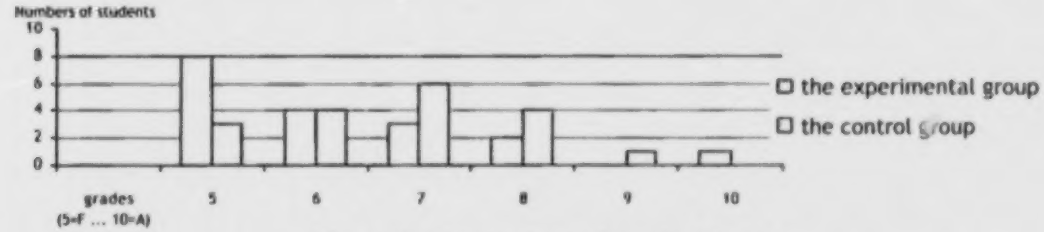


Figure 1: Comparison of results of tests

It can be seen that the members of the control group proved to be much more successful than the members of the experimental group. More than one third of the students of the latter group did not manage to remember enough in one hour of learning to gain a positive mark. Taking into account the fact that the contents of lectures was the same in e-materials and in ordinary lectures, poor results can be explained only by believing that the students of the experimental group did not pay enough attention to learning objectives set at the beginning of the materials. Quite obviously, an ordinary lecture, assessed pretty highly by the participants (M=8.7; on a scale 1=poor to 10=excellent), is still very important for students. The classical lecture was supplemented by practical cases and learning objectives were explicitly given, which probably contributed towards better recall of basic terms.

When we merged the questionnaire of the selected group with the tests, which assessed knowledge we wanted to find out if the result of the test is statistically correlated with any other variable. The results of regression analysis are shown in Table 5.

Included variables	B	t	Sig.
Usage of Internet	6.982	2.614	0.014
Gender	-3.092	-2.424	0.022
F=6.404 Sig. 0.005; adj R^2=0.252			
Excluded variables: motivation, attitude toward IT			

Table 5: Dependence of the students' success in tests

The regression analysis shows that better results were reached by male students and students who used the Internet and e-mail. This at the same time proves the hypothesis that computer-literate students are likely to be more successful in on-line distance education.

We have also proved the hypothesis that the experiment will be interesting for the chosen group, as all members of the experimental group expressed keen interest for the experiment, as well as 81.2% of student in the controlled group.

Readiness for DE

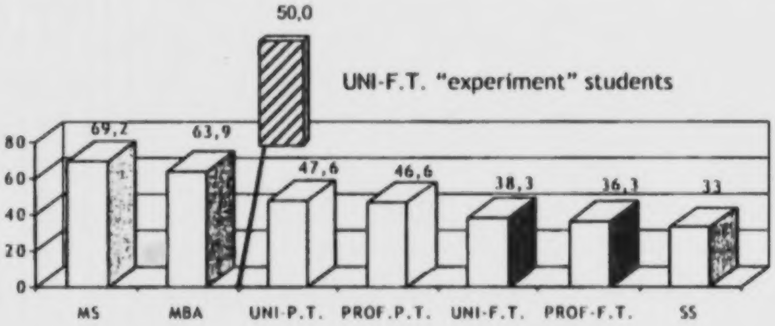
The readiness was evaluated on the basis of the model of acceptability of on-line DE, which includes the following items – participants' characteristics (and their relative weights):

- Motivation (20%),
- Students' connection necessity (8%),
- Possibilities for IT using and relationship to IT (32%),
- Abilities for IT using (30%),
- Usage of e-services (10%).

The students estimated their study motivation and some other characteristics on a five-degree scale. The average value, corrected with standard deviation, was included in the model. The same method was used for assessing their relationship and experience with IT. The estimations of DE readiness, shown in Figure

2, was calculated through corrected average values for some variables and percents of variables and their relative weights for other variables.

We also tried to assess FEB students' readiness for DE in general. Thus 652 students from various FEB programmes (different undergraduate and postgraduate, full time and part time programmes) were inquired and gathered data was analyzed with the model of Internet based DE acceptability. The results are shown in Figure 2, which shows that students in both postgraduate programmes point at a higher DE readiness, which is a consequence of higher motivation, longer learning experience and higher computer literacy.



Legend: MS – postgraduate master of science study; MBA – postgraduate MBA study; UNI – university (4 year) program; PROF – professional (3 year) program, P.T. – part-time study, F.T. – full-time study; SS – secondary school

Figure 2: FEB student's readiness for DE (11)

Based on the gathered data from the students who participated in the experiment and the model of readiness for DE, their DE readiness was estimated, too. The estimated value 50 is higher compared to the readiness estimated for FEB full-time university program students (38.3) (11). Higher acceptability of DE can be explained with their higher computer literacy and with better IT experience in education process obtained by using various on-line materials from the e-business course's web site (http://www.uni-mb.si/~epfpodin).

The estimation of readiness proves that higher computer literacy raise the readiness for DE, supported by IT. Improved computer literacy leads to better chances for the introduction of IT, be it for business purposes or the advancement of e-services.

Conclusion

Major findings of the experiment and its research are:

- The first step toward DE at the Faculty of Economics and Business (FEB) in Maribor has been done (for an e-business course).
- The students prefer on-line materials and DE is generally acceptable especially among postgraduate students so the possibilities for on-line DE at FEB exist and FEB needs to take the necessary steps to exploit this opportunity.

- Keen interest of the participants in the experiment group for the introduction of IT in education is connected with the fact that students can only express enthusiasm about something they have experienced and used. DE supported by IT will begin to flourish only if (and as soon as) IT has been included in teaching properly.

References

Bešter, J., M. Pustišek, L. Zebec, M. Papic. (2000). Analiza možnosti uporabe informacijske in komunikacijske tehnologije pri podpori izobraževanja na daljavo v osnovnih in srednjih šolah. Fakulteta Za Elektrotehniko – Laboratorij Za Telekomunikacije, Ljubljana.

Available: http://www-lt.fe.uni-lj.si/lti/login_osnovna_sola.html [21.07.2000].

Bregar, L. (1998a). Študij na daljavo na Ekonomski fakulteti: Izkušnje za prihodnost. Vzgoja In Izobraževanje 3,14-20.

Bregar, L. (1998b). Študij na daljavo – nove poti komuniciranja v procesu izobraževanja. Ekonomska Fakulteta, Ljubljana.. Available: http://www.ef.uni-lj.si/ncp/slo_1250/papers.html [15.02.2000].

ESSI-SCOPE. (2001). Available: http://www.cse.dcu.ie/essiscope/sm2/9126ref.html [03.12.2001].

Distance-Educator.com. Distance education: An Introduction. Available: http://www.distance-educator.com/portals/research_deintro.html [05.10.00].

Keegan, D. (1991). Foundations Of Distance Education. 2nd Edit. Routledge, London and Ney York.

Lesjak, D. and V. Sulcic. (2001). Beginning and Development Of Distance Education in Slovenia. Issues in Information Systems Vol. 2: 241-247.

Microsoft. (1998). Online Learning Resource Kit Vol.1. Microsoft's Online Learning Strategy - John Dubois.

Mirk (2000). Available: http://www.mirk.si/skoljka/help/help_about.html [21.07.00].

Ris – Raba Interneta S Sloveniji (1999). Available: http://www.ris.org/si/ris99/news/n20000211.html [18.07.2000].

Sulcic, V. (2000). Vpliv informacijske tehnologije na izvajanje študija na daljavo; Seminarska naloga pri predmetu informatika v storitvenih organizacijah - Magistrski študij. Ekonomsko-poslovna fakulteta, Maribor.

Sulcic, V. (2001). Vpliv informacijske tehnologije na študij na daljavo v Sloveniji. Magistrsko delo. Ekonomsko-poslovna fakulteta, Maribor.

Sulcic. V. and D. Lesjak. (2001). DE in Slovenia : where are we? In: Global co-operation in the new millennium / The 9th European Conference on Information Systems, ECIS 2001, June 27-29, 2001, Bled, Slovenia. Vol. 1-2. - Kranj : Moderna organizacija (2001). - Vol. 2, str. 1087-1097.

Surs – Statisticni Urad Republike Slovenije. (1999). Statisticni letopis Republike Slovenije 1999. Available: http://www.sigov.si:90/zrs/slo/index.html [13.07.2000].

The Johns Hopkins University School of Public Health - Distance Education Division. Available: http://distance.jhsph.edu/acpro/cyber_campuses.cfm [08.03.01].

The Whatis.Com. Available: http://www.whatis.com/ [27.07.2000].

CMI Theory and Practice: Historical Roots of Learning Management Systems

Michael Szabo, Ph.D. and Ken Flesher, President, Basecorp Learning Systems
University of Alberta

Edmonton AB

Abstract: Learning Management Systems (LMS) represent a rapidly expanding domain of e-learning which are touted to bring great efficiencies and effectiveness to organizations through growth and training of employees. Their presence is made possible by recent gains in instructional technology of power, speed, and accessibility, enhanced by the demise of the limitations of microcomputers of the 1980s. There is little current LMS research to support the marketing claims made by system vendors, with respect to either organizational or individual change and effectiveness. LMSs in fact have a rich history in theory and practice, derived from numerous projects and studies completed during the days BC (before microcomputers), when mainframes roamed the earth, devouring vast sums of money and programming expertise. This paper will examine key elements of the seminal history of computer-managed instruction (CMI), including developmental writings, theoretical underpinnings, and applications in various fields. It is the hope that lessons will be drawn from this work which may inform those engaged in reinventing the wheel.

LMS and CMI

Learning management systems are computer based database and presentation systems which manage the entire instructional program and learning progress of employees with respect to the competencies specified by the goals and objectives of an organization. Computer managed instruction systems, from which LMSs are derived, manage the learning program of individuals in terms of 1) diagnostic assessment of performance relative to some standards and 2) prescriptive assignment of learning resources relevant to those standards. See Figure 1 for a generalized CMI system.

Historically there are two major defining sources for CMI systems. The first is a paper by Baker (1981) in which the functional specifications of a CMI system are laid out. The second is the development of a numerous sophisticated CMI systems, one of which was at the time the most heavily used software package in the Control Data Education Company's repertoire of extensive courseware.

Baker (1981), at the dawn of the microcomputer age, addressed the question of integrating computer based instruction (CBI) into an enduring fabric of educational systems and argued that CMI is the needed tool because "...modern instructional strategies are becoming more complex and thus harder to manage from an instructional and administrative point of view[s]" (p.23). He outlined a system which would address the instructionally-related functions of: 1) data collection, 2) individualized diagnosis and prescription, 3) performance monitoring, 4) scheduling, 5) resource allocation and 6) reporting. In addition, his specifications included computer-related functions of: 1) man-machine interface, 2) database management, 3) and system-generation. His analysis further specified the data requirements as: 1) assessment, 2) diagnostic, 3) prescription, 4) resource and 5) curriculum evaluation. Finally, he specified the hardware requirements in terms of the dominant hardware of the day, the mainframe with dumb terminals and optical scanning devices attached.

Meanwhile, Michael Allen, creator of Authorware, designed a CMI system for use with PLATO, which was at the time a mainframe system entirely devoted to the delivery of instruction and training. Called PLATO Learning Management (PLM), this system was designed to work with most curricula and was employed to manage the massive amount of courseware produced by the CDC Education Corporation. PLM was also available for PLATO clients to integrate with their custom courseware programs.

Other organizations and individuals developed CMI systems which had varying degrees of impact on their organizations. A CMI system was custom-developed for the University of Illinois PLATO system, which was the original system that became the basis for the CDC PLATO system. The U.S. Air Force developed an optical-scan based CMI system (Automated Instructional Systems) for training of personnel who supported military aircraft. This system evolved over the years into one currently used to train fighter pilots. Several of these systems used by the military were reviewed by Tennyson and Park (1984).

Learning theory

Today's LMS vendors generally do not elaborate the learning theory basis upon which their systems operate, suggesting the lack of such background. What is the learning theory basis of early CMI systems? Since most CMI mainframe systems originated in higher education, it is not surprising they embodied theories of how people learn. Here is a brief summary of five theory-based strategies which have influenced CMI: metacognition, individual responsibility, error correction in human judgment, individualized instruction and deep cognitive processing. Note that these theories may have been modified or superceded since their use as a basis for CMI.

Metacognition

> Metacognitive experiences involve the use of metacognitive strategies or metacognitive regulation (Brown, 1987). Metacognitive strategies are sequential processes that one uses to control cognitive activities, and to ensure that a cognitive goal (e.g., understanding a text) has been met. These processes help to regulate and oversee learning, and consist of planning and monitoring cognitive activities, as well as checking the outcomes of those activities (Livingston, 1997).
>
> For example, after reading a paragraph in a text a learner may question herself about the concepts discussed in the paragraph. Her cognitive goal is to understand the text. Self-questioning is a common metacognitive comprehension monitoring strategy. If she finds that she cannot answer her own questions, or that she does not understand the material discussed, she must then determine what needs to be done to ensure that she meets the cognitive goal of understanding the text. She may decide to go back and re-read the paragraph with the goal of being able to answer the questions she had generated. If, after re-reading through the text she can now answer the questions, she may determine that she understands the material (Livingston, 1997).

CMI systems claim to supplement the self-metacognition strategies with objective, second party information. For example Szabo & Forsyth (1994) found that exposure to a CMI system while studying mathematics initially resulted in increased learning but the effect leveled off over time, leading to the hypothesis that CMI provides a metacognitive model which learners adapted to sharpen their study skills through a better understanding of their own learning approaches.

Individual Responsibility

Individual responsibility theory (IRT), individual responsibility for success or failure to learn, comes from research on motivation (Wittrock, 1979) which largely draws on attribution theory and locus of control. In locus of control, achievement has been increased by teaching learners to believe they can influence their destiny in school by their efforts (deCharms, 1972). Instructors and learners are taught they are the origins—people who cause their behavior—rather than pawns or people largely under control of their environment. The latter is often accompanied by feels of helplessness which can interfere with learning.

Attribution theory (Weiner, 1976) is closely related and posits that success and failures in one's life is largely attributable to luck or task difficulty which are variable or stable external causes. Quite often one's attribution beliefs stem not from the school performance results which they attain, but from the manner in which those results are communicated by the instructor and the social structure of the classroom.

One implication for instruction is to provide information about personal levels of performance in an objective and non-threatening environment with the belief that such information can stimulate self-corrective action. Thus, CMI systems have been used to function in an individualized fashion, providing confidential feedback to individuals on their individual pattern of meeting competencies. In addition, they function in an objective fashion, such that learners receive feedback with respect to what they have learned rather than relative to their standing in some comparison group. Such assessments are called criterion-referenced or norm-referenced, respectively, and much has been written about them in the measurement and evaluation literature. Finally, most CMI systems provide paths to learning resources (diagnostics) and the opportunity to return to the assessment portion to improve their performance (Figure 1); this implies some control over the person's environment.

Error Correction in Human Judgment

This theory is based on the observation that people tend to overestimate their own strengths and underestimate their weaknesses, in short, to be poor judges of their own abilities. When learners are placed in a self-paced learning environment, they must often judge whether they have successfully learned the content before they proceed to the next module, which may have the previous one as prerequisite. They can succumb to either prematurely proceeding to the next module, inadequately prepared, or unnecessarily return to the current module and study excessively. Both strategies are at the best inefficient and perhaps ineffective.

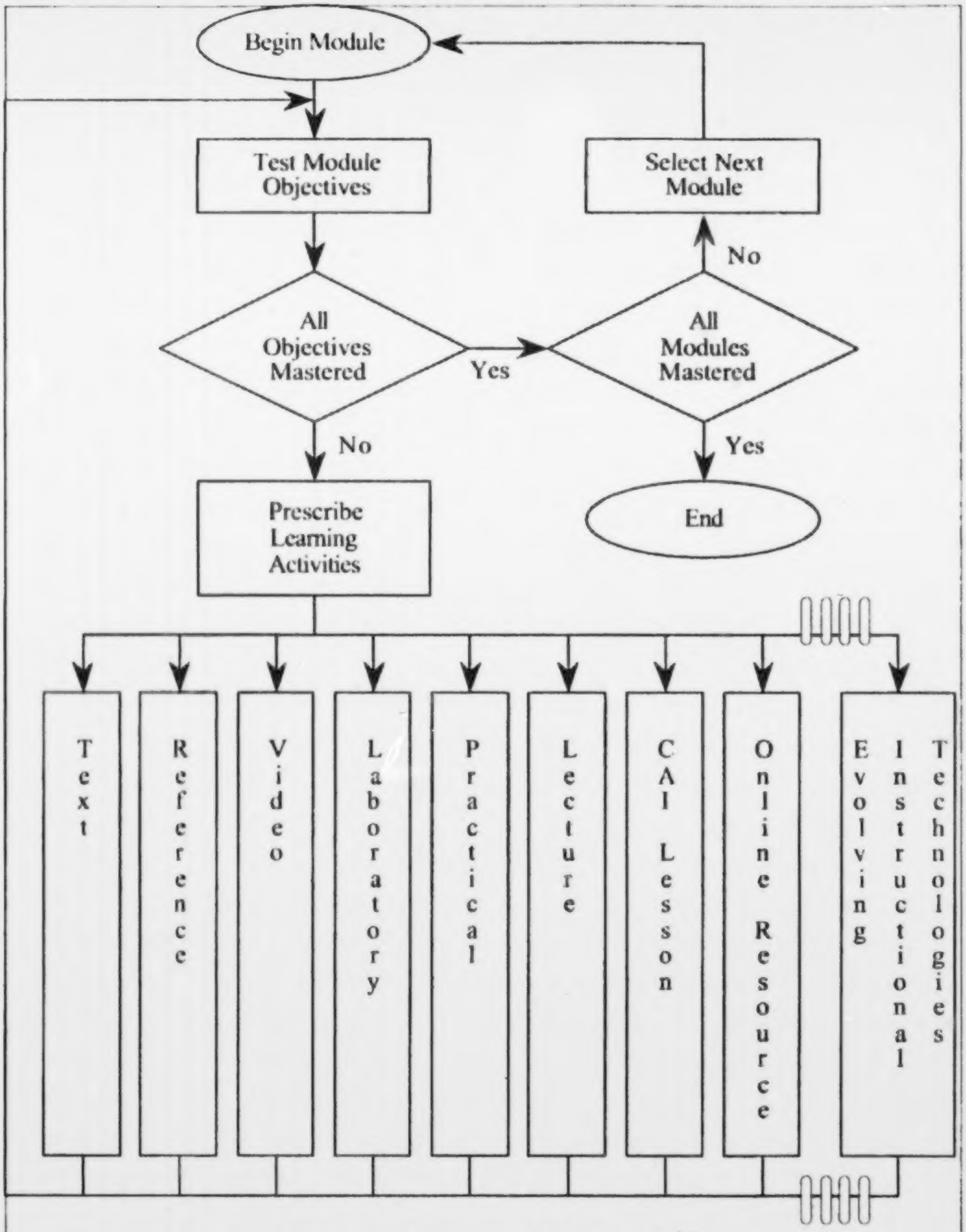
This problem is addressed in CMI by giving learners another source of objective information regarding their own progress. When a student finishes a module and has to decide whether to return or go on to the next module, a CMI system allows the learner to complete an objective assessment of his or her level of performance on the objectives of the module. The instantaneous feedback embedded in the exercise provides an unbiased assessment which can be used to fine tune the decision to proceed or not.

Tennyson (1981) developed such a CMI system which he referred to as an advisement system (Advice by Computer), to provide objective advice to learners to use to check their performance decisions. He found that his advisement system resulted in both increased achievement and increased ability to monitor one's own performance.

Individualized Instruction

The theoretical basis of this approach is that individual performance exhibits great variability within a group of learners. For example, the rate at which a defined group of individuals learn typically varies by a ratio of 5 to 1, suggesting the need for self-pacing. Entering knowledge of individuals with respect to content being taught varies significantly, as revealed by course pretest data. This is particularly true of adults who have had wide ranges of experiences and learning compared with adolescent learners. However, classroom-based instructional strategies, to be administered efficiently, require that all learners cover the same material in the class at the same time and same pace. This leads to inefficiencies and reduced motivation to learn.

Competency-based learning/mastery imply a repeated cycle of instruction and testing until competencies have been met. The iterative nature of the computer offers significant potential to accommodate this cycle through its ability to administer exams with little or no instructor intervention and to clerically process the data and present the performance results in a summary form to the instructor.



Begin Module
Test Module Objectives
All Objectives Mastered
Yes
No
Prescribe Learning Activities
All Modules Mastered
No
Select Next Module
Yes
End
Text
Reference
Video
Laboratory
Practical
Lecture
CAI Lesson
Online Resource
Evolving Instructional Technologies

Diagnostic and Prescriptive Model for Individualized Instruction

Figure 1

Figure 1: Diagnostic and prescriptive model for individualized instruction via CMI.

BEST COPY AVAILABLE

CMI systems can support individualization in several ways. First, each student can be tested over a unique set of competencies as tailored to that person's job classification and performance. The testing can be done through computer-administered instruments, evaluation by expert judges, or both. The study assignments resulting from deficiencies are tailored precisely to those deficiencies. Generally CMI systems accommodate individual differences by allowing learners to: 1) proceed through instruction at a comfortable rate of learning, 2) skip those competencies where they can demonstrate mastery, thus greatly reducing time spent in instruction, 3) start at any point in the instructional sequence, and 4) obtain specific performance indicators and suggestions for what to study to alleviate any performance deficiencies (See Figure 1). Furthermore, this data is tracked, stored and can be recalled and reported for progress and due diligence reports for the individual, training unit, organization and certification agency.

CMI can also accommodate performance competencies requiring demonstration of a performance skill. Once evaluated by a qualified trainer or supervisor, the results can be entered into the system to maintain a comprehensive tracking and reporting system.

A system based on PLATO Learning Management was implemented in the Edmonton Police Department during the 1980s. Officers were able to skip individual units of instruction if their performance on a pretest indicated mastery. A follow up study (Szabo, 1987) indicated the system was instrumental in increasing paper and pencil achievement, on the job performance and reducing training time by 25 percent, resulting in a savings of approximately $350,000 over a 5 year period.

A massive use of PLM involved the basic skills adult literacy curricula (grades 3-8 and 9-10). Pretests indicate what grade and month level a learner should begin in the basic skills of mathematics, science, social studies, reading and English. Student's programs were individually monitored and extensive feedback provided to guide both learners and instructors. Sample reports from this program can be found in Szabo (1994).

Deep Cognitive Processing

This approach evolves from the information processing theory of learning that says that learning is affected by the structure of the mind as perceived to be like an information processing system. A simplistic view reveals its components to be: 1) a system to perceive the external world, 2) short term memory (STM) in which to temporarily store the information which successfully navigates the perceptual system, 3) a long term memory storage system (LTM) and 4) a working memory (WM) where information from STM and LTM are mixed in order to update LTM.

A known problem is that STM is severely limited in the amount of information it can hold (5 plus or minus 2 'bits' of information), and it regularly dumps information which cannot be processed in wm sufficiently to become part of ltm. To solve this problem, theorists have proposed that the process of dumping information into stm be regularly and systematically interrupted and interspersed with activities which stimulate wm. This 'forces' the processing of information by the learner to minimize its loss from stm before it can be integrated into ltm.

An example of this concept is as follows. Instead of assigning 100 pages of reading material, it is assigned in 10 page blocks, or something equivalent, depending on the density of information. After reading each 10 page block, the learner signs on to a CMI program which provides a diagnostic and prescriptive assessment of the information to be learned from those ten pages. In other words, the "dumping" of information into the stm is interrupted by cognitive processing activities, which should enhance learning. Further cognitive processing is provided by arranging the feedback such that the location of the answers are provided rather than the answers themselves. This requires additional cognitive processing. Finally, if the questions are pitched at a high cognitive level, it is argued that deep cognitive processing occurs and learning is improved.

Anderson et. al., (1975) developed a computer assisted study management system (CAISMS) based on the deep cognitive processing theory for use in an economics course. A well-controlled experimental research study compared learners who used CAISMS with those who didn't. Learners in the treatment group read study assignments and immediately completed on-line tests to assess their learning. Successful learning allowed a student to proceed through the syllabus, while unsuccessful learning required continued study of material already covered with retest opportunities.

Results from this study indicated that learners using CAISMS scored significantly higher on all course exams. One student's anecdotal comment is worth noting: "I really think CAISMS helped me a lot in this course, if not for anything else, it made me study regularly and be sure I got the right things out of what I read" (p. 8). Attitudes toward the course and method, as measured in the Anderson et al. study were significantly higher for the CAISMS learners. Attitude scores for learners was improved through the use of CAISMS for large but not for small classes. CAISMS had no overall effect on course completion rate.

A Brief History of CMI Application and Research

Several large-scale projects on managing and individualizing instruction in the 1960s and 1970s found the computer to be valuable in managing instruction: Program for Learning in Accordance with Needs (Flanagan, 1969); Individually Prescribed Instruction (Cooley & Glaser, 1969); and Instructional Management System (Silberman, 1968).

Dozens of mainframe CMI applications have been made over the years with agencies such as United Airlines pilot training, Naval personnel training, and educational courseware at all levels from grade 3 through adult basic education.

A CMI program was developed for a nursing course at the University of Alberta. A controlled study Kot, Skillen & Wales (1986) showed that the CMI group and non-CMI group had equivalent achievement scores and learning times. The instructors in the non-CMI group spent twice as much time per student than the instructors in the CMI group. At the same institution, Boblin & Gibson (1986) reported learners in the CMI class achieved higher marks for all unit tests and final course mark. Because of the lower rate of attrition in the CMI course, the authors raise the possibility that the course with CMI would not function well as the 'first screen' for learners in the program.

In terms of development costs, Fahy (personal correspondence, November 1987) indicated that a CMI application, using the existing PLM system and existing learning resources could be developed in 5 minutes per test item. Szabo & Estes (1978) compared costs of developing computer managed and computer assisted instruction in nursing courses and concluded that the former takes one-fourth the development time compared with the latter.

Szabo & Montgomerie (1992) made the following conclusions a decade ago.

> Much of the research on CBT includes components of CMI, so it is difficult to isolate the specific contribution made by CMI to the effectiveness of the instruction, attitudes towards computers, etc...The very strong impression gained from a review of the studies reported here is that CMI has shown to be efficient, effective and relatively easy to develop compared with other forms of mediated instruction. Experience indicates that CMI can be implemented by instructors, working alone or in teams...A comment often made within developmental teams is that one of the major benefits is the logical re-thinking of a course or curriculum required when implementing CMI...CMI has been shown to be useful in the context of existing courses (e.g., Anderson, et al, 1975; Boblin & Gibson, 1986) as well as in brand new courses (Szabo & Estes, 1978). It has also been used as mainline instruction or as supplementary instruction, (the latter required or optional). CMI has been successfully applied over a wide range of content areas, ranging from nursing to special education to pilot training (p. 127-130).

Two final observations arise from the 1992 article. The first "Although not systematically reported here, there is a rapid proliferation of microcomputer based CMI applications and programs as people begin to apply the microcomputer to the management of student learning" (p. 130) did not happen as rapidly as predicted. It apparently had to wait for the advent of a system which includes worldwide computer networks, massive database storage facilities, creation of CMI software, new programming languages and the Internet.

The second observation "The only bit of advice we would offer here is for aspiring developers to carefully examine the features of the most outstanding mainframe-based CMI systems and avoid reinvention of the CMI wheel (p. 130) is still the recommendation of choice, with the proviso that the focus be LMSs rather than CMI.

Recent Examples

New York-based Vuepoint Corporation worked with Toyota to train its 88,000 Toyota and Lexus dealers and corporate associates in the United States. Vuepoint will design and implement an enterprise-wide e-learning system that Toyota projects will pay for itself within 24 months and realize an estimated net savings of $11.9 million over five years. Vuepoint Learning System 3.0 will provide the base training infrastructure for University of Toyota and allow it to consolidate numerous systems. The platform integrates LCMS, LMS, authoring, and virtual collaboration. Consultant Sapient Corporation is partnering on the implementation. (Learning Circuits Express, 2002).

The Thomson Corporation is celebrating a new multi-year contract to provide e-learning courses to General Motors employees via General Motors University. Thomson's Cardean University, which collaborates with leading business schools, will expand its relationship with GM U to provide an e-MBA program along with custom courses for GM's automotive business. GM already uses some of Cardean's online executive and management development courses. The agreement to expand the full suite of Cardean products to global GM employees follows the successful integration initiated last April of the GMU/Cardean HR Skills for Success program. (Learning Circuits Express, 2002).

Ceridian Canada, Canada's leading payroll management company, has selected San Francisco-based Ninth House to supply online management training for a performance improvement initiative that will focus on managers and customer service. Ninth House courses, simulations, and Instant Advice tool are being rolled out to Ceridian managers throughout the country as part of a program to strengthen Ceridian's management team across a dispersed workforce. (Learning Circuits Express, 2002).

Delta Air Lines has selected Pathlore's LMS to plan, deliver, and manage its training programs. The initiative debuts in May with an enterprise-wide simulation workshop on business literacy. Delta also will use Pathlore's LMS to deploy blended-learning programs. Other training initiatives will include skills management, corporate compliance courseware, a content repository, and professional development. (Learning Circuits Express, 2002).

Summary

Learning management systems have emerged from the ashes of early mainframe-based CMI systems, thanks to the LAN, WAN, Intranet and Internet, driven by large databases in servers. Touted for their ROI, often without substantiation, LMSs possess a rich heritage in learning theory, which has largely been lost or understated by commercial ventures intent on developing systems to manage the corporate training program and hopefully provide increased organizational efficiency. Several benefits have been attributed to LMS. It has been claimed that they can:

1. reduce costs through decreased training redundancy and reduced operational errors and down-time,
2. maximize efficiency through integrating into one system safety issues, operating procedures, maintenance packages, environmental standards, and job reference. This one systems makes auditing easier and less expensive, and
3. leverage existing resources through including established policies and procedures; utilizing existing training material and links to "off-the-shelf" commercial computer-based courseware.

A fair question to ask is What evidence is there to support these claims? Several research questions arise from this exercise.

Is learning (attainment of knowledge, skill and attitudinal competencies) enhanced through the use of a Learning Management System?

Does the addition of a Learning Management System impact the structure or culture of an organization? For example, does it result better alignment between corporate mission, goals, and employee competencies?

Can a Learning Management System be expected to generate a ROI? If so, what magnitude might be expected?

Is there value in reviewing recent developments in learning theory (since the days of the original CMI) to ascertain the appropriateness of LMS' applications?

References

Anderson, T., Anderson, R., Dalgaard, B., Paden, D., Biddle, B., Durber, J., & Alessi, S. M. (1975). An experimental evaluation of a computer based study management system. *Educational Psychologist, 11*, 184-190.

Baker, F. (1981). Computer managed instruction: A context for computer based instruction. In H. F. O'Neil, (Ed.). *Computer based instruction: A state-of-the-art assessment* (pp. 23 - 64). Toronto: Academic Press.

Boblin, SL. & Gibson, B. (1986). *Computer managed instruction at the University of Alberta Hospitals School of Nursing*. Unpublished master's project report, University of Alberta. Edmonton.

Cooley, W.W., & Glaser, R. (1969). An information management system for individually prescribed instruction. Pittsburgh: University of Pittsburgh Learning Research Development Center, (*ERIC Document Reproduction Services No. ED 026 862*).

deCharms, R. (1972). Personal causation training in the schools. *Journal of Applied Psychology, 2*, 95-113.
Flanagan, J.C. (1969). Program for learning in accordance with needs. *Psychology in the Schools, 6*, 133-136.

Kot, P., Skillen, L.D., & Wales, M. (1986). *Learning effectiveness and efficiency using computer managed learning and lecture for health assessment theory* (Final Report). Edmonton: University of Alberta.

Learning Circuits Express. (2002, April). New contracts for VuePoint, Thomson, Ninth House, Pathlore. Washington, DC: American Society for Training and Development. Retrieved 24 April, 2002 from http://www.learningcircuits.org

Livingston, J. A. (1997). Metacognition: An overview. Retrieved 16 May, 2001 from http://www.gse.buffalo.edu/FAS/Shuell/CEP564/Metacog.htm

Silbermn, H. G. (1968). *Design objectives of the instructional management system* SP 3038/001/00, Santa Monica, CA: Systems Development Corporation.

Szabo, M. (1987). A cost-effective implementation of computer based training within a large government training organization. *Interactive Learning International, 4*, 81-84.

Szabo, M. (1994). Enhancing the interactive classroom through computer based instruction: some examples from Plato. *Computer-mediated communications and the online classroom, Vol 1*. NJ: Hampton Press.

Szabo, M. & Estes, C. A. (April, 1978). *A strategy for developing cost effective military instruction using available instructional materials (AIM)*. A paper presented at the meeting of the American Educational Research Association, Toronto.

Tennyson, R. D. (1981). Use of adaptive information for advisement in learning concepts and rules using computer assisted instruction. *American Educational Research Journal, 18*, 425-438.

Tennyson, R.D., & Park, O. (1984). Computer-based adaptive instructional systems: A review of empirically based models. *Machine-Mediated Learning, 1*, 129-153.

Weiner, B. J. (1976). An attribution approach for educational psychology. In L. S. Shulman (Ed.), *Review of Research in Education* (*Vol. 4*). Itasca, IL: Peacock.

Wittrock, M. C. (1979). Applications of cognitive psychology to education and training (pp. 309-318). In H. F. O'Neil and C. D. Spielberger (Eds.), *Cognitive and Affective Learning Strategies*. New York: Academic Press.

Students Develop Real-World Web and Pervasive Computing Systems

Charles C. Tappert
School of Computer Science and Information Systems
Pace University, USA, ctappert@pace.edu

Abstract: In the academic year 2001-2, Pace University CSIS students developed real-world Web and pervasive computing systems for actual customers. We describe the general use of team projects in CSIS at Pace University, the real-world projects from this academic year, the benefits of including real-world projects in the curriculum, and their cost in terms of the instructor load and the project development infrastructure. We found that the benefits of our method of structuring and conducting the real-world projects far outweigh the cost of providing them. The projects provide valuable systems for the customers, allow the students to develop technical and value skills, foster interdisciplinary collaboration, encourage student involvement in the university and local communities, support student and faculty research, enhance relationships between the university and local technology companies, and increase national recognition of the university.

Introduction

In the academic year 2001-2, the School of Computer Science and Information Systems (CSIS) at Pace University used real-world Web and pervasive computing systems as team projects in a two-course capstone sequence in Software Engineering, and in an elective course in Pervasive Computing Systems, in the Master of Science in Computer Science program. Although the students in both these courses develop systems for actual customers, the emphasis of the project work in these two courses is somewhat different. In the software engineering sequence, the customers are referred to as clients. The clients are the source of the project requirements, and the teams focus on developing systems that meet the real needs of the clients. In the pervasive computing course, student invention teams, called E-Teams, the "E" standing for "entrepreneurship," work with customers to build innovative systems that use pervasive computing techniques and that demonstrate the feasibility of potential commercial products. In that course, the customers are referred to as mentors since they are typically the knowledge sources for the systems. In this paper, the term "customer" will be used for both client and mentor in describing 18 student projects.

Developing real-world systems for real customers provides an excellent setting for teaching students team and value skills by following a human-centered development process. While it is clear that students of computing must learn technical skills, current thinking is that they must also learn "value skills" of how to interact with customers to provide them with the promised value-producing systems. Six categories of value skills are described in (Denning & Dunham 2001): coordination (of requests, offers, promises, etc.); customer relations; commitment management; teamwork; lifelong learning; and business and entrepreneurship skills. Dertouzos (2001) also makes a strong case for human-centered computing in which technology adapts to people rather than the other way around.

The real-world projects provide valuable systems for the customers, allow the students to develop technical and value skills, utilize student-centered learning, foster interdisciplinary collaboration, encourage student involvement in the university and local communities, support student and faculty research, enhance relationships between the university and local technology companies, and increase national recognition of the university.

The following sections describe the general use of team projects in CSIS at Pace University, the real-world projects from the 2001-2 academic year, the benefits of including real-world projects in the CSIS curriculum, their cost in terms of the instructor load and the project development infrastructure, and conclusions.

Team Projects in CSIS at Pace University

The Computer Science department at Pace University has frequently used team projects to provide students with the educational experience of working together in teams, similar to what is done in industry, in order to design, build, and test computer information systems. For several years prior to 2001-2 the software engineering course sequence had each student team develop as its project an "Order Processing System." For these "canned" projects the instructor has played a dual role, acting as both project manager and customer.

A project team typically consists of 4 to 5 students: an Architect-Designer, one or two Implementers, a Quality Officer, and a team Coordinator-Liaison (Pressman 2001). Ideally, teams should meet once a week in addition to project work time. Team members should work together and coordinate activities as a unit – for example, communication, including e-mail, between the team and the customer should be done as a group or should be coordinated by the team leader. In recent years, Java has been the preferred language at Pace University for projects that require programming. Although the requirements for the projects come from the customers, the course instructor is the "boss," or "Chief Executive Officer," of the project teams – that is, the person who makes all the major decisions and adjudicates personnel problems.

Real-World Projects in 2001-2 in CSIS at Pace University

Using real-world projects with real customers is not new; for example, the University of Southern California's Center for Software Engineering (USC CSE Website 2002) has been doing this for years in their capstone two-semester software engineering sequence. However, we believe that our program is unique because it focuses on value skills, serves the community, and is organized on a large scale with supporting project infrastructure.

Eighteen projects were completed during the 2001-2 academic year (Table 1). Ten were Web interfaces to backend databases, four were medical applications, three concerned VoiceXML or InkXML, and one was a cluster and grid computing system. The customers were from various Pace University schools/departments and from several outside organizations. The university schools/departments included the School of CSIS; the Lienhard School of Nursing; the Lubin School of Business; the Office of Planning, Assessment, Research, and Academic Support; the Department of Information Technology (DoIT); and the Doctor of Professional Studies (DPS) in Computing program. The outside organizations included Northern Westchester Hospital, IBM Research, the Psychology Department at SUNY New Paltz, and the Fulbright scholarship program. The table column on scripting/database software will be discussed later in the section on project development infrastructure.

	Project	**Customer Affiliation**	**Scripting/database software**
1	Online Course Survey System	Planning & Assessment/Pace	ASP/Microsoft Access
2	Project Group Assignment System	CSIS/Pace	Cold Fusion/Microsoft Access
3	Test Item Reliability Analyzer	CSIS/Pace	PHP/MySQL
4	Genealogy Web Application	CSIS/Pace	Cold Fusion /MySQL
5	Dean's Communication System	CSIS/Pace	Cold Fusion/Microsoft Access
6	PC Maintenance/Tracking System	CSIS/Pace	Cold Fusion/Microsoft Access
7	DPS External Website	DPS Program/Pace	PHP/MySQL
8	Experimental Handwriting System	CSIS/Pace	ASP/Microsoft Access
9	Rare Coin Grading System	DPS Program/Pace	ASP/Microsoft Access
10	User Verification System	CSIS/Pace	ASP/Microsoft Access
11	Nurse Information System (NIS)	Nursing/Pace and DoIT/Pace	–
12	NIS Wireless Extension	Nursing/Pace and DoIT/Pace	–
13	Emergency Pre-Hospital Care Communication System	Northern Westchester Hospital and Business/Pace	–
14	Medical Vital Sign Wearable	CSIS/Pace and IBM Research	–
15	VoiceXML App. Devel. Facility	CSIS/Pace and IBM Research	–
16	VoiceXML Applications	DoIT/Pace, CSIS/Pace, and Psychology/SUNY New Paltz	PHP/MySQL
17	Multimodal Voice/InkXML System	Fulbright Program and IBM	–
18	Cluster/Grid Computing System	CSIS/Pace and DoIT/Pace	–

Table 1: The eighteen Web and pervasive computing projects in 2001-2.

The student teams were required to write technical papers for possible publication describing their systems. Eight, referenced herein, were presented at this year's Mid-Atlantic Student Workshop on Programming Languages and Systems, and PDF versions are available from the workshop's Website (MASPLAS'02 Website 2002).

Web interface to backend database client/server systems

Ten of the eighteen systems consisted of a Web interface to a backend database using the client/server architecture. The simpler ones simply allowed users to enter information into the database and retrieved the data for appropriate viewing. The more complex ones performed calculations on the data, which in some cases was substantial.

The **Online Course Survey System** (Pethe, et al. 2002) was designed to automate Pace University's manual course-end survey system, in which students complete paper surveys to evaluate the courses they have taken. With the new system, students log in to take the survey through a Web interface, results are retained in a database, and survey statistics can be accessed from the Website. The system was tested by running in parallel both the old and the new survey systems on two large CSIS courses at the end of the spring semester. It was also used to obtain surveys for all online CSIS courses, courses for which it was previously not possible to obtain survey results, since the students in these classes do not physically attend class and therefore cannot be given a paper survey to fill out. These tests were successful and it is anticipated that the whole university will soon move to an online system.

The **Project Group Assignment System** (Doyle et al. 2002) is a Web-based system that creates teams (groups) for project work in industry or academia. This system addresses problems that arise in the usual, manual team-creation process, which can be tedious, time consuming, perceived as unfair, and may not get a good mix of expertise. In the automated system, the project managers enter the project information: project descriptions, suggested team size; customer information; and parameter weights for team candidates' project preferences, availability, geography, and experience. Potential team members complete an online survey to record their project preferences, preferred availability times and locations for team meetings, and their academic and/or professional experience. The project manager then executes a Java program that groups the candidates into teams, and team members and program managers can view the resulting teams through the Web interface. Since an exhaustive search for the optimal solution is not possible for more than a small number of projects, the algorithm uses a greedy search approach to obtain a near-optimal solution similar to a previous stand-alone program (Redmond 2001).

The **Test Item Reliability Analyzer** allows instructors to perform statistical analysis on multiple-answer tests. The measures provided by the system give the instructor greater insight into the relative preparedness of the students as well as the validity of individual test questions. The system computes five item (test question) measures: item difficulty (the percentage of students answering the item correctly), item variance (a measure of the variability of the student responses), item discrimination (a measure of the discrimination power of a test item), item correlation (a measure of the correlation between the item and the whole test), and item distraction (incorrect alternatives for a test item that are never chosen and should therefore be removed or replaced). It also computes an aggregate analysis indicator of overall test quality and accuracy. Such objective measures of the questions are valuable, since the things that separate good items from bad items are best not left to the subjective interpretation of the test constructor. The one similar system found (ITEMAL 2002) is proprietary to the University of Delaware, was never intended for public distribution, and is not very flexible or user-friendly. The new system successfully analyzed the quizzes used in the software engineering course and indicated where improvements can be made.

The **Genealogy Web Application** (Barbosa et al. 2002) is an example of developing a Web-based application that improves on an existing commercial product – the shrink-wrapped, stand-alone software application packages for the Microsoft Windows Operating System environment. With the stand-alone genealogy systems, usually one family member researches, inputs, and publishes his family tree and thereby undertake the tedious and never-ending task of updating and maintaining it, a particularly burdensome task for large family trees. In contrast, the Web-based application distributes this burden by allowing several family members to update and maintain their branch of the family tree and to do so remotely from anywhere through a Web interface. Furthermore, all family members can view the family tree information on the Web.

The **Dean's Communication System** assists the Dean of the School of CSIS in her communications with faculty, students, and others at Pace University. It consists of a database backend with both an external and an internal Web interface. The external "Communications from the Dean" site is accessible by all, and the internal one is accessible only by those having access permission. All communication items are stored in the database for tracking and for historical record keeping.

The **PC Maintenance/Tracking System** assists in the maintenance, support, and tracking of PCs in CSIS at Pace University. Information is captured when a PC is reported as having a problem or needing an upgrade (information such as the date, the PC ID, the PC's location, the nature of problem or upgrade), when the problem is fixed (what repairs were made), when software is installed (the software, the installer), when a PC is moved, etc.

The **DPS External Website** team developed a new Website for the Doctor of Professional Studies (DPS) in Computing program (Merritt et al. 2001). This site improves on the old site in terms of elegance, clarity, and ease of navigation. It has a backend database and a link to a back office interface that allows administrators without knowledge of HTML to change or update the look and content of the Website. The site also allows visitors to request information and to submit an application online.

An **Experimental Handwriting System** was developed to investigate the detection of handwriting forgery. The team collected handwriting samples from ten subjects who wrote a set of words in their natural style and attempted forgeries of the other nine subjects' handwriting. These handwriting samples were digitally scanned and stored in an image database. A Web-based quiz was developed to gather statistical data from users trying to distinguish between the original and the forged handwriting samples. Novices and certified document examiners (CDEs) were asked to take the online quiz. Although many students took the quiz as novices, only a few CDEs were willing to do so, and the results were inconclusive. The implications of this and similar studies may have bearing on the admissibility of handwriting testimony in U.S. courts. The database of handwriting samples was also used in a study of handwriting forgery detection by machine (Cha & Tappert 2002).

The **Rare Coin Grading System** (Bassett et al. 2002) was designed to automate the grading of rare coins. In the numismatic community today, the official grading of coins is accomplished by human inspection. This, by its very nature, lends itself to inconsistent results that can misrepresent the actual value of a coin by thousands of dollars; there is also the danger of misrepresentation for personal gain. The team obtained graded coins and created a database for storing their images. Then, they developed a Web interface to an educational quiz environment in which experts and novices can try their hand at grading the coins in the database. Finally, they developed a rudimentary machine grader by extracting three histograms (hue, saturation, and brightness) and an edge detection function from the digitally scanned color image of the coin to be graded, and assigning that coin the grade of the pre-graded coin that it most closely matched. Preliminary results of the machine process appear reasonable and indicate the promise of the approach.

The **User Verification System** (Baker et al. 2002) was developed to investigate combining several biometrics in order to develop a high-confidence user verification system. Such a subsystem can be embedded into any system that requires high security and can be developed using various combinations of different modalities; this project used four: face, fingerprint, handwriting, and voice. Each of the four verification systems involves techniques of pattern recognition to compare signal samples from the input device with those from the database, and each can result in type I (valid user rejected) and type II (invalid user accepted) errors. Combining these four different verification techniques should achieve a high level of confidence. Initial work on this problem focused primarily on face recognition and resulted in a database of digitized photos and preliminary studies of verification by face image.

Medical application systems

Four systems involved medical applications. The **Nurse Information System (NIS)** (Palmer et al. 2002) physical assessment application walks a student nurse through a physical assessment. A legacy system on a proprietary device running an obsolete operating system was ported to a Java 2 Micro Edition (J2ME) implementation. The application was completely redesigned and rewritten using object-oriented design techniques to create portable classes for reuse and for use in future applications. A small prototype was built and scaled up to a full application on Palm personal digital assistants (PDAs) running the PalmOS. A C++ conduit was also written to allow the prototype to transfer data from the Palm handheld devices to a PC for storage and further evaluation.

The same students who developed the above-described NIS in the software engineering course extended that system with an **NIS Wireless Extension** in the pervasive computing course. They provided the earlier system with a wireless extension through the use of Java servlets on a Web server to allow the data to be e-mailed as an attachment to a user-specified e-mail address (Palmer et al. 2002). This ensures that the NIS has a cross-platform future and can migrate from one device to another to take full advantage of the J2ME networking features.

A preliminary study of an **Emergency Pre-Hospital Care Communication System** was conducted for Northern Westchester Hospital (Park et al.). Many hospital emergency departments are exploring new communication and information technologies that will assist them in providing higher quality of care by improving the speed of flow, the consistency, and the accuracy of information shared among all the parties involved in an emergency response team. This study describes some currently available or on-the-horizon communication and information technologies that may be appropriate for use in the emergency services field, discusses three systems currently being used by other hospitals, and provides three alternative approaches to obtaining the type of emergency communication system that will best fit the needs of Northern Westchester Hospital's emergency department. The study found that the solution to be chosen should depend on the time frame allotted for the project, the funds budgeted, and the number and skills of the staff members responsible for implementing the system.

The **Medical Vital Sign Wearable** computer monitors a patient's vital signs, specifically heart rate and breath rate, which serve as indicators of a patient's immediate general health. If performed on a continuous basis and monitored remotely, it could assist medical support personnel. For example, each patient could be equipped with a medical status monitor that constantly reads blood pressure, pulse, respiration, and blood oxygen level, and a built-in expert system could determine when the patient's condition warrants attention and, if necessary, automatically transmit an alarm. This work extends that of a West Point student project in which a liquid-filled sensor pad placed close to the skin captured a signal that was processed by digital filtering to extract the heart and breath signals (Tappert et al. 2001). Recently, we became aware of a new, similar product, the LifeShirt, which is a lightweight shirt with embedded sensors that measure respiratory function, heart rate, posture, and activity level, with optional peripheral devices to measure blood pressure and blood oxygen saturation (VivoMetrics Website 2002).

VoiceXML and InkXML systems

Three projects involved VoiceXML and/or InkXML. The **VoiceXML Application Development Facility** was created to facilitate VoiceXML application development, and several small applications were used to test the system. The lab provides a gateway to develop voice applications, the interface for developing applications together with a template library, the capability to enable novices to use the code library to learn about and to build advanced applications, and facilitates both novice and expert developers in deploying multiplatform applications. The laboratory hardware consists of a Cisco router for Voice Over IP, the IBM Voice Server (provided by IBM), a Local Area Network (LAN), the Public Switched Telephone Network (PSTN), and a Firewall for the Voice Server. A minimal prototype of the facility is now operational, and upon completion of the facility, the architecture of the VoiceXML studio should permit the registration, development, and deployment of an application. The studio essentially enables the user to load his/her application URL that can be referenced by the IBM Voice Server.

Another team worked on **VoiceXML Applications**. The primary one, a voice-enabled Web-based absentee system (Gallivan et al. 2002), was implemented on the TellMe voice portal (TellMe Voice Portal 2002). It was tested by the class of software engineering students; students who intended to miss a class called the VoiceXML telephone number and were led through an automated dialog to record in a database his/her name, the date and time of the call, the courseID, and the date he/she would miss class. The system provides the instructor and other administrators with a permanent record of absentees that can be accessed and displayed in various forms through a Web interface. A more useful application of such a system would be for the university, or for any reasonably sized organization, to record absences or work time missed by its employees. Rather than calling a secretary, employees would telephone the system to report their absences, and the employer could then access this information through the Web interface; other departments (or systems) needing the information, such as payroll, could also access the database. This team also analyzed a telephone survey application requested by a psychology professor at SUNY New Paltz. This application differs from the usual VoiceXML applications because it requires the server to initiate the telephone calls rather than receive them. In this case, the server places the calls and, when the person answers, the application dialogue conducts the survey and stores the responses in a database. Although this application was not implemented because voice portals like TellMe only allow applications that receive calls, it should now be possible to develop such applications on our new VoiceXML facility.

A third XML system, the **Multimodal Voice/InkXML System**, combined voice and pen input using the standard voice and ink XML formats (Trabelsi et al. 2002a, 2002b). Just as a standard VoiceXML format that facilitates the development of voice applications has been accepted, so the acceptance of a standard InkXML format to facilitate pen applications is anticipated once it is developed. The student team developed a multimodal interface architecture that combines standardized voice and ink formats to facilitate the creation of robust and efficient multimodal systems, particularly for noisy mobile environments. By providing mutual disambiguation of input signals and superior error handling, this architecture should broaden the spectrum of users to the general population, including permanently and temporarily disabled users. Integration of VoiceXML and InkXML provides a standard data format to facilitate Web-based development and content delivery. Diverse applications ranging from complex data entry and text editing applications to Web transactions can be implemented on this system, and a prototype platform and sample dialogues were developed.

Cluster and grid computing system

One team proposed its own project, the **Cluster/Grid Computing System**, and developed a high performance computing facility by co-opting idle and/or underutilized computer workstations to create a virtual computing pool (Clarke et al. 2002). While the idea is not new, it is gaining greater acceptance in academic institutions that possess enough raw computing power to do distributive computing without the need to buy a high-end dedicated computer. During the first semester, the team constructed a cluster computer consisting of five PCs and demonstrated a substantial speed improvement of the cluster over a single PC performing the calculations of a standard ray-tracing problem in computer graphics. For the second semester, the team developed a grid computer for molecular calculations by choosing a computation-intensive molecular simulation package and running tests in the student computer-lab facility that is highly used by students during peak hours. Here, depending on the nature of the simulation with respect to the number of atomic interactions that need to be calculated in real time, it was demonstrated that the more compute nodes attached to the simulation the less intrusive the job was to the user of any workstation in the grid.

Benefits of Real-World Projects

In this section we describe the various benefits of having the computer science students develop real-world systems for real customers. Overall, these projects result in a beneficial outcome for all concerned.

Customers receive valuable systems

The customers benefit from the systems created for them by the students. In some cases, this amounts to a monetary savings, because the customers do not have to outsource the projects. The university itself can greatly benefit by having small projects completed by students. Not only is there a monetary benefit, but also students often do a better job because they are more motivated and may have a better understanding of the university's needs. In other cases, the customers receive systems they might not obtain under ordinary circumstances. Sometimes this is simply because funds for the project were not in the budget. For other situations, such as for the research-oriented systems, there is often no standard procedure for getting the system constructed.

Students develop technology, team, and professional skills

Developing real-world systems for real customers is a stellar real-world learning experience for the students, as individual technologists, as team members, and as maturing professionals in computing. Individually, the students learn technology skills, critical thinking skills, and how to be innovative and creative. They learn the technology skills necessary to develop real-world computer information systems. Through project reviews and team presentations, the students also learn about the various technologies used in other projects, and they especially appreciated the exposure to the projects involving cutting-edge technology and research.

Working in teams, the students learn fair-mindedness, intellectual humility, intellectual integrity, and the ability to work with others to produce useful systems and to take responsibility for them. Because most of the students are employed full time in various areas of computing, they bring their knowledge and expertise to bear in their project work, and by exchanging information, they learn from each other in this student-centered learning environment. The students also benefit from interacting closely with fellow students from diverse cultures and with diverse technological skills.

As maturing professionals, the students learn how to act in the computing field not only as technologists but also as value providers. By working with real customers in developing their project systems and focusing on human-centered computing, the students learn important value skills. This learning paradigm fosters lifelong habits for learning and the application of critical thinking and value skills.

Promotes interdisciplinary collaboration and Pace and local community involvement

These projects involved two communities, the university community and the local community external to the university. Within the university community, many of the projects involved interdisciplinary collaboration with other departments, such as the medical projects with the nursing school, the online survey project with the assessment department, and the involvement with the business school and DoIT. The work with the SUNY New Paltz psychology professor extended our collaboration to the greater university community. The projects also extended into the local community, with the projects involving Northern Westchester Hospital and IBM, to provide the students with off-campus experiences and to foster an extended community for learning and growth. With project customers coming from the local community as well as from the university community, the project work brought to light how knowledge of computing and information technology connects with personal and social responsibility. Interestingly, we found that having projects that dealt with both the Pace community and the local community led to a blurring of the boundary between those communities.

Furthers student and faculty research

Seven of the project systems are related to student and faculty computer science research that is ongoing and expected to continue. Three concern pattern recognition: the Experimental Handwriting System, the User Verification System, and the Rare Coin Grading System; and the first two of these are related to security and personal identification. Three concern XML: the VoiceXML Application Development Facility, the VoiceXML Applications, and the Multimodal Voice/InkXML System. Finally, one concerns wearable computing devices: the Medical Vital Sign Wearable computer. Seven other systems are research-related but are not related to ongoing student-faculty research. Two concern wireless technology: the NIS Wireless Extension and the Emergency Pre-Hospital Care Communication System. Two concern education-related research and were of short-term interest to the faculty customers: the Project Group Assignment System and the Test Item Reliability Analyzer. The two nurse information systems concern handheld computers and the J2ME, J2SE, and J2EE computer languages and, although not representing ongoing research by CSIS students and faculty, are of continued interest to the nursing school as a developing application that, due to its cutting-edge nature, should to be of interest to next year's students as a continuation project. Finally, one deals with supercomputing (short-term student interest): the Cluster/Grid Computing System. Clearly, these real-world projects profoundly foster and further student and faculty research.

Enhances relationships between the university and local technology companies

Some projects drew on the intellectual capital pool of local companies. For example, three projects benefited from collaboration with IBM scientists: the VoiceXML facility team received a copy of the IBM Voice Server from the IBM Speech group, the vital-sign wearable computer team received advice and use of an electronics lab from an IBM scientist, and the Voice/InkXML team interacted with the IBM Pen Technologies group. Furthermore, the IBM Pen Technologies group is interested in an extended collaborative relationship to pursue research in areas of mutual interest and to have students test their handwriting research systems.

Increases national recognition of the university

Many of the benefits indicated above strengthen the university's external image and identity. Students can also present papers on their project work at technical conferences, and those working on cutting-edge technologies can enter competitions. This is already happening – for example, students and faculty have presented papers related to these systems at conferences (see references), and several students won prizes in IBM's VoiceXML contest.

Cost of Real-World Projects

Although far outweighed by the benefits, the cost of using real-world projects is significant. There is an increased load on the instructors to solicit and interact with customers, to set up the projects, to work with the computer support personnel to set up the project development infrastructure, and to monitor the systems development process. There is also significant computing infrastructure required to facilitate the development work.

Setting up projects, forming teams, and assigning projects

The first task is to come up with the projects, and this process is conducted primarily during the summer prior to the beginning of the school year. For this year, eight projects came from those interested in developing systems to further their research (CSIS faculty, sometimes in collaboration with local technology companies, and, in one case, with a DPS student), one came from the instructor's course need (Project Group Assignment System), one came from the students' interest (Cluster/Grid Computing System), and the remaining eight came from contacts with and e-mail solicitations to faculty of CSIS and other departments.

The instructor then works with each of the customers to size and shape the project to be an appropriate systems development experience for the students, and this results in a written project description that is posted on the "projects" page of the course Website. For customers not familiar with computing systems, the instructor often performs most of this task independently. The inducement for the customers' involvement with the students throughout the year is the anticipation of receiving a useful system, although they are warned that the primarily purpose of the projects is to provide the students with a good educational experience and that not all projects are successfully completed.

The next task is to form the student teams and assign each team to a project. This year the students formed their own teams, the teams listed their project preferences, and the instructor assigned teams to projects based almost entirely on their preferences. There are significant problems with this approach, such as the tendency of students to choose group members based solely on friendship and that the assignment of projects can be perceived as unfair by students who did not obtain their first choice. For this reason, one of the projects this year was to develop a group assignment system to automatically assign students to project teams based on compatible project interests, compatible time schedules and geography (work and home location) for group meetings, and the diversity and appropriateness of students' computing and leadership experience; this system will be used next year to automatically group students into teams and to assign projects to the teams.

Systems development process

The development of the computer information systems requires a systematic approach by the students and proceeds through an evolutionary process model consisting of analysis, design, build, and test phases. The first phase requires the students to work closely with their customer to understand what is desired, usually by developing use cases and use scenarios about how the system will be used; to plan the project; and to perform a risk analysis, all culminating in a written requirements document. The second phase involves designing the system using various analysis and design tools, and this work varies greatly depending on the type of system. For example, a database backend requires database design methodologies, whereas a Web interface requires interface and Web design engineering. The third phase is the actual construction of the system and, depending on the project, usually requires the use of one or more computer software languages and/or database implementation. The fourth phase is the testing of the system to ensure that it meets the customer's requirements and that all of its functions operate correctly.

In the software engineering sequence, the students were required to complete a working system prototype with the core components of the required functionality by the end of the first semester. Because the first semester of the course focuses on the traditional systems development methodologies and the second semester on the object-oriented ones, the students reengineered their systems using object-oriented techniques during the second semester to culminate in a robust and complete system. For the pervasive computing course, the systems were completed in one semester, which was possible because of the course's greater emphasis on project work and because most of the students were also in the software engineering course and therefore were familiar with systems development.

Project development infrastructure

Since most of the projects used the client/server architecture, a Pentium II NT development server was set up for the students to develop their systems. The software installed included Cold Fusion, PHP Hypertext Processor, Active Server Pages (ASP), MySQL, Tomcat, and Microsoft Office. This server was independent and separate from the other CSIS servers so that students could not corrupt data or interfere with operations on CSIS production servers. A variety of database-related software was used by the ten client/server systems and the VoiceXML absentee system that also used a backend database and a Web interface, the latter as an alternative to the telephone input and for displaying the results (Table 1). The student teams used three scripting languages (Cold Fusion, PHP, and ASP) to communicate with the databases and two database systems (Microsoft Access and MySQL). Several projects also used Java-related software, such as Java servlets, and Tomcat was installed to handle the processing of that code. An additional server was made available for the VoiceXML facility project and six old Pentium I and II PCs, network cards, and network cables were made available for the cluster computer project.

The project development infrastructure will be enhanced next year to reach a higher level of professionalism in project development. The NT development server will be upgraded and a Unix server added – a Solaris-Oracle configuration. A production server will also be added toward the middle of the spring semester to house the final systems and to give the students practice in moving their system from one environment to another.

Conclusions

In 2001-2, Pace University CSIS students developed real-world computer information systems for actual customers. Developing real-world systems provides an excellent setting for teaching students the technological skills of the discipline, team-related skills, and value skills by following a human-centered development process. It also provides a vehicle for fostering interdisciplinary collaboration, encouraging student involvement in the university and local communities, furthering student and faculty research, enhancing relationships between the university and local technology companies, and increasing national recognition of the university.

References

Baker, W., Evans, A., Jordan, L. & Pethe, S. (2002). User verification system. *Proc. MASPLAS'02.*

Barbosa, C., Pandey, N., Pavlenko, O., Cunning, P. & Pramod, S. (2002). A Web-based genealogy application system. *Proc. MASPLAS'02.*

Bassett, R., Gallivan, P., Gao, X., Heinen, E. & Sakalaspur, A. (2002). Development of an automated coin grader. *Proc. MASPLAS'02.*

Cha, S.-H. & Tappert, C.C. (2002). Automatic detection of handwriting forgery. *Proc. IWFHR-8*, Niagara, Canada, pp. 264-267.

Clarke, C., Marino, L. & Pachigolla, R. (2002). Creating a virtual computing facility. *Proc. MASPLAS'02.*

Denning, P.J. & Dunham, R. (2001). The core of the third-wave professional. *Communications of the ACM*, Vol. 44, No. 11, pp. 21-25.

Dertouzos, M. (2001). *The Unfinished Revolution.* Harper.

Doyle, K., Kroha, S., Palchowdhury, A. & Xu, W. (2002). Project group assignment system. *Proc. MASPLAS'02.*

Gallivan, P., Hong, Q., Jordan, L., Li, E., Mathew, G., Mulyani, Y. & Visokey, P. (2002). VoiceXML absentee system. *Proc. MASPLAS'02.*

ITEMAL (2002). http://www.udel.edu/topics/testscan/itemal.html.

MASPLAS'02 Website (2002). http://csis.pace.edu/csis/masplas/.

Merritt, S.M., Grossman, F., Tappert, C., Bergin, J., Blum, H., Frank, R., Sachs, D., Stix, A. & Varden, S. (2001). The Doctor of Professional Studies in Computing: An Innovative Professional Doctoral Program. *Proc. 19th Annual Info. Systems Ed. Conf.*, ISECON 2001.

Palmer, S., Panchee, N., Sullivan, J., Thabet, K. & Westgard, S. (2002). Migrating an application to Java2 Micro Edition. *Proc. MASPLAS'02.*

Park, H.G., Pastore, Jr., J.M. & Tappert, C.C. (2002). Wireless technologies in pre-hospital communications. *CSIS Technical Report,* No. 176.

Pethe, S., Baker, W., Brown, N., Hennings, R. & Misra, S. (2002). Online course opinion survey system. *Proc. MASPLAS'02.*

Pressman, R.S. (2001). *Software Engineering,* McGraw-Hill.

Redmond, M.A. (2001). A computer program to aid assignment of student project groups. *Proc. 32nd SIGCSE Tech. Sym. CS Ed.*, pp. 134-138.

Tappert, C.C. et al. (2001). Military applications of wearable computers and augmented reality. Chapter 20, pp. 625-647, in *Fundamentals of Wearable Computers and Augmented Reality*, ed. Barfield, W. & Caudell, T., Lawrence Erlbaum.

TellMe Voice Portal (2002). http://www.tellme.com/.

Trabelsi, Z., Tappert, C. & Desai, D. (2002). Integrated VoiceXML and InkXML gateway. *Proc. AVIOS Speech Expo 2002*, San Jose, CA.

Trabelsi, Z., Cha, S.-H., Desai, D. & Tappert, C. (2002). A Voice and Ink XML Multimodal Architecture for Mobile e-Commerce Systems. *2nd ACM Int. Workshop on Mobile Commerce 2002*, Atlanta, GA.

USC CSE Website (2002). http://sunset.usc.edu/index.html.

VivoMetrics Website (2002). http://www.vivometrics.com/ce/.

BEST COPY AVAILABLE

Creating and assessing web-based learning environments: the relationship between knowledge type, pedagogy, and technology.

David Tarcy
Educational Technology Faculty
University of Alaska Anchorage
United States
david.tarcy@uaa.alaska.edu

Chris Allen
Educational Communications and Technology
New York University
United States
cga207@nyu.edu

George Henik
Educational Communications and Technology
New York University
United States
gjh210@nyu.edu

Richard Satterfield
Educational Technology Program
University of Alaska Anchorage
United States

Abstract: This exploratory study evaluates descriptive data from two sources; the evaluation of a web-based learning environment and the application of the Living Systems instructional design model to the development of a second, online, distance-education course. This inquiry clarifies the relationship between the nature of the knowledge type, choice of instructional methods employed, and capabilities of the available web-based technologies. This effort seeks to determine the practicality of a design template that matches the structure of specific knowledge types (procedural, declarative, complex-dynamic) with pedagogical methods, and then pairs those methods with the current features of web-based technologies. The results of this initial study will inform the development of a large-scale evaluation of web-based learning environments across varying content areas.

Introduction

This paper discusses the relationship between three salient aspects of web-based learning environments (WBLE): the information architecture of the course material, the interaction design of the content, and the information/page design of the instructional system or site. The Living Systems ID model (Plass & Salisbury, 2001) addresses these three aspects of a WBLE in detail. The information architecture or organization of a WBLE may be derived from a careful assessment of the nature of the knowledge type (procedural, declarative, complex-dynamic) or a combination of these broad categories. The interaction design of the WBLE consists of navigation options and more importantly the pedagogical methods employed in the teaching and learning process. The application of certain pedagogical methods within a WBLE is often mitigated by the affordances of available technologies. This study appropriates the Living System framework and emphasizes the relationship between knowledge type, pedagogical methods, and web-based technologies to create a template by which WBLEs can be developed and evaluated. It proposes to extend Mioduser's (Mioduser, Nachmias, Lahav, & Oren, 2000) analysis of the current state of pedagogical methods and technologies predominantly used in WBLEs by clarifying the relationship between knowledge type, information architecture, pedagogical methods, and available technologies.

The inherent organization derived from various knowledge types leads to specific types of navigation, often mitigating design choices. The interaction designs and navigation options that flow from procedural knowledge, to extend the previous example, tend to be linear. This is contrasted with a more dynamic or complex type of knowledge that would tend to be non-linear with multiple pathways to associated information. The instructional methods are also constrained to some extent by the nature of the knowledge and the organization of the content that is derived from it. Procedural knowledge may lend itself to more behavioral approaches, where component skills are requisite before more complex tasks can be performed.

The information/page design and the technological features incorporated into this example may be different from those used in another application with a different type of knowledge. In a web-based environment, there are a limited amount of tools to choose from. The use of those tools should flow from the pedagogical methods determined in the previous 'step'. However, the technology constrains us to a certain set of methods and an inappropriate use of the tools at time.

Study

There are many different categorizations of knowledge types used for varying reasons. The broad categories typically agreed upon include procedural, declarative, and some version of a dynamic or complex knowledge (often referred to structural knowledge (Jonassen, Beissner, & Yacci, 1993)). An underlying question this study addresses is whether or not content within procedural, declarative, and complex-dynamic knowledge types have an inherent natural order, even if that order is relatively complex and difficult to determine. If it is possible to identify a general order or structure within any of the knowledge types, then it may be possible to create a design template for WBLEs that includes both guides to appropriate navigation and pedagogical methods.

Method

Two WBLEs are the focus of the inquiry. One is currently in development and is to be delivered on-line during the Fall semester of 2002. The second WBLE is currently in use as an instructional website. Interviews with content developers, instructors, and students, and document analyses constitute the data gathering techniques. Evaluation of data occurs in three distinct areas identified within the Living Systems ID model. Data will be assessed based on knowledge type, choice of pedagogical method(s) chosen to communicate content, and how those instructional choices were either constrained or enhanced by available web-based technologies.

Various organizations of differing types of knowledge will be compared with hierarchical, linear/sequential, associative/web-like, and grid structures (Lynch & Horton, 1999) to determine if patterns emerge. A range of commonly accepted constructivist and behavioral methodologies will be matched with the content of the instruction during development of the online course. This range of methods will be used to assess a web-enhanced course currently in use as an additional source of data. A list of available web-based technologies will then be paired with the constructivist and behavioral pedagogical methods to determine suitability of each method on the web.

Results and Discussion

The results will inform the design and direction of a larger survey of WBLEs to be conducted in the Fall of 2002. If patterns and generalities emerge, the practicality of a template for the design and evaluation of WBLE will be furthered explored. The need for considered and parsimonious decision making in the development of WBLEs continues to increase as educational environments continue to migrate in that direction and instructors are faced with a bewildering array of issues and choices.

References

Jonassen, D., Beissner, K., & Yacci, M. (1993). Structural knowledge techniques for representing, conveying, and acquiring structural knowledge. Hillsdale, NJ: Lawrence Erlbaum Associates, Hove & London.

Lynch, P. J., & Horton, S. (1999). Web style guide: Basic design principles for creating web sites: Yale University Press.

Mioduser, D., Nachmias, R., Lahav, O., & Oren, A. (2000). Web-based learning environments: Current pedagogical and technological state. Journal of Research on Computing in Education, 33(1), 55-76.

Plass, J., & Salisbury, M. W. (2001). A living systems design model for web-based knowledge management systems. submitted for publication.

The effectiveness of educational technology: Will the "Enhancing Education Through Technology Act of 2001" really expand our knowledge of teaching and learning with technology?

Introduction

The recent reauthorization of the Elementary and Secondary Education Act of 1965 (EASA), also known as the No Child Left Behind Act of 2001 (NCLB) provided broad changes encompassing many areas of public education in the United States. Accountability, expansion of school choice, increased focus on reading skills, and greater flexibility for state and local authorities are central pieces of the Act. Another area where emphasis and funding have increased significantly with the current reauthorization is educational technology.

In 1994, the reauthorization of EASA known as "Improving America's Schools Act of 1994," (IASA) allocated $200,000,000 for Title III educational technology programs (Improving America's Schools Act of 1994, § 3114 (1995)). While this is a significant amount, Title III funding for fiscal year 1995 pales in comparison to funding for FY 2002. The most recent reauthorization has appropriated $1,000,000,000 for technology in education under the Enhancing Education Through Technology Act of 2001. Of this funding, $980,000,000 is earmarked for state and local initiatives while $20,000,000 has been set aside to fund federal programs. Furthermore, $15,000,000 of the federal allocation has been committed to a long-term evaluation of technology and its effect on teaching and learning (No Child Left Behind Act of 2001, Part D § 2401 (2002)). This longitudinal evaluation on the effectiveness of technology in learning promises to, "address a gap in knowledge that for years has frustrated both educators and policymakers" (Trotter, p.1, 2002). The Department of Education's Office of Educational Technology has yet to announce specific plans for the study so as of this writing, the author is not certain as to whether this project will consist of one comprehensive evaluation or a series of projects.

Technology has come to play a central role in teaching and learning over the past 15 years. During this period, educators and other researchers have evaluated many aspects of teaching and learning with technology. This paper will address two questions:

1. What criticisms and obstacles may have impeded past research?
2. What are the implications of these obstacles for the study proposed under the NCLB Act of 2001?

Each of these questions are important in light of the fact that considerable time and money have been set aside in an endeavor to answer the question decisively. Countless hours and dollars have already been devoted to this subject and one finds little difficulty in locating an "expert" on the topic. However, since the research has yet to provide satisfying results, it seems reasonable to consider why this is the case and what past research suggests about future research in learning and technology?

Literature Review

The astronomical growth of personal computing has brought space-age technology to the classroom. The computer has found its way into every corner of education. From college to kindergarten, educational technology has become the rule rather than the exception in a relatively short span of time. Research into the effectiveness of this technology has been conducted on all fronts from both federal and state government, universities and colleges, and even local educational agencies. Given the emphasis that educational technology research has received over the past decade, a large body of information exists. However, educational technology research conducted since 1990 has been wide-ranging and has attempted to cover a diverse spectrum. At times, the findings have been contradictory and subject to dispute. Kirstie Bellman succinctly argues that, "… the difficulty with educational technology is how to get past the hyperbole and develop the right technology with the right classroom and pedagological practices that will ensure that it is supportive and not destructive for learners and for educators" (2001, Lines 2-5). Before spending more research dollars, we should consider what we have learned from past experience and what, if anything, it tells us about the future. The next section of this paper outlines two problems with past research: breadth of focus and methodology.

Research Criticisms

Research in educational technology encompasses a broad range of categories, sub-categories, and topics which all compete for scarce attention and even scarcer funding. It is this broad range of interests that make rigorous research in this area even more problematic. Because educational technology is at once, a learning issue, a teaching issue, an administrative issue, a social issue, and a political issue, a useful and effective body of research will necessitate the study of all the critical areas of educational technology and this challenge is nothing short of enormous.

One aspect of educational technology research that has received strong criticism has been methodology. Critics have complained about, among other things: a lack of scientific rigor, an over reliance on anecdotal evidence, and technological bias. Waetjen (in Wicklein, 1992) asserts that, "Die-hards claim that research isn't needed and instead offer up dozens of anecdotal accounts of students who have benefited from taking courses in technology education…Only research results will be convincing." (p. 4) While Waetjen was referring specifically to technology education; a minor part of the educational technology landscape, Reyna was addressing the broader issue of educational technology when she criticized a reliance on tradition, superstition, and a reliance on unfounded beliefs (Reyna, 2002).

Feuer and Towne (2002) describe three more problems with previous educational technology research. Researcher bias is a problem because scholars who are closely involved in the environment and frequently even the educational lives of the other participants have conducted a great deal of research (2002). Proximity between researcher and participant has been generally unavoidable and not always undesirable, but it is an area that must be addressed. Patton (1990) suggests that, "getting close to a program through firsthand experience permits the evaluator to access personal knowledge and direct experience as resources to aid in understanding and interpreting the program being evaluated" (pg. 205). However, if the researcher fails to consider her own experiences and background, her participation may influence the findings. This participation or influence would have serious consequences for the validity of a quantitative study and the trustworthiness of a qualitative study.

The second problem described by Feuer and Towne is one of description versus prediction. Educational technology research, and indeed educational research in general has produced research products which are descriptive in nature. The results do not predict future events, behaviors, or changes but merely describe what has occurred in a given situation in the past (2002). Just because a research project is carefully designed, conducted, and reported doesn't make it relevant or useful to a practitioner outside of the research environment. Good educational technology research must have some utilitarian value to practitioners in "the field," particularly if it is supposed to describe and predict how technology facilitates learning in the classroom.

The third criticism involves the diverse and decentralized structure of public schools in the United States. Local control creates a situation where a number of independent local programs may be referred to by the same title or other descriptor but have no relationship whatsoever with other programs of the same name (Feuer & Towne, 2002). This creates a situation where information is either, not generalizable to other populations, or it is accepted as relevant because of similar titles and terminology when, in fact, it is completely unrelated to the current program or programs of interest. The democratic and geographic nature of our federal, state, and local institutions makes it extremely difficult to generalize many findings in educational research. What works for a small rural single school district in Arkansas is not likely to have much relevance for an urban district that may have 100 different schools and vice versa. I think that this is probably the most significant difficulty in conducting research related to educational practices in this country. Our continued preference for local control makes comparison between schools extremely problematic.

Methods

To illustrate the vast body of educational technology research conducted in the past few years, the author of this paper conducted a survey of common educational technology research areas. Using target areas described in the "Enhancing Education Through Technology Act of 2001," the researcher conducted a search of the Educational Resources Information Center (ERIC) database (http://www.askeric.org/) (No Child Left Behind Act, 2001). While the ERIC database does not provide a complete list of all research conducted in the past 12 years, it does offer a reasonably extensive cross-section of data. The current search was conducted by combining the terms 'educational' and 'technology' with each of the following terms or phrases: teacher training, technology integration, assessment and evaluation, and finally, standards and frameworks. The keyword search method utilized the Boolean operator 'AND' and was restricted to the years 1990 through 2002.

Results

The search results in the table below illustrate the breadth of research in the field of educational technology during the 1990s. The search terms, assessment and evaluation, yielded the smallest number of documents for the 12-year time period. However, the 2,329 documents produced by this search still represented an average of 3.73 new articles, reports, and presentations every week from 1990 through the end of 2001.

Search Terms	Results
Educational AND technology ONLY	30,342 documents
Educational AND technology AND teacher training	2,539 documents
Educational AND technology AND integration	5,308 documents
Educational AND technology AND assessment AND evaluation	2,329 documents
Educational AND technology AND standards	2,699 documents
Search conducted: March 11, 2002. http://www.askeric.org	

The original or primary search terms, 'educational' and 'technology' provided the greatest number of results in the ERIC database search. It is assumed that this search yielded all the documents represented by the secondary search terms as well as other educational technology terminology not searched for this report. The ERIC search yielded a total of 30,342 individual documents for the same period from 1990 through 2001. It would take a very diligent researcher to keep up with the approximately 48.65 new educational technology documents that were created every week. The volume alone is enough to perplex and discourage even the most committed educational technology researcher. Given the vast array of research areas which fall under the collective heading of educational technology, it is not difficult to see why research may appear to be insufficient and lacking in meaning and relevance. Unfortunately this is a problem for which there appears to be no clear or easy solution. By nature and definition, the field of educational technology does and will continue to encompass diverse areas of interest as demonstrated by the ERIC search. The task will continue to seem overwhelming and the best opportunity to improve research quality is through more focused, scientifically based research.

Discussion

Given the vast body of research that has occurred since 1990, what direction should future researchers take when examining the effectiveness of educational technology? Melmed (1995) provides a typical example of a broad-based initiative to study the effectiveness of educational technology. In 1995, the U.S. Department of Education requested assistance from the Rand Corporation in responding to the GOALS 2000:Educate America Act of 1994. Melmed served as chair of a 2-day workshop: Workshop on Technology-Supported Student Learning: Outcomes, Effectiveness and Cost. The workshop goals were wide-ranging and diverse. Many of the research questions were similar to the same ones framed in the current research climate.

Unfortunately this example is also an indicator of why little has changed. A two-day seminar that featured 14 presentations was supposed to answer questions and improve education in this country. Again, the 14 presentations were, in general, descriptions of programs and projects deemed successful by their presenters. While many of these may have been valuable in the original research context, there is little reason to suspect that much impact was felt by those not involved in the initial project.

Feuer & Towne (2002) have suggested six principles to guide future research in education that are worthy of mention.

1. Pose Significant Questions That Can Be Investigated Empirically
2. Link Research to Theory
3. Use Methods That Permit Direct Investigation of Question
4. Provide Coherent Chain of Rigorous Reasoning
5. Replicate and Generalize
6. Transparency and Scholarly Debate

These ideas are nothing new to researchers in other discipline areas and are not even novel to educational researchers. However, in educational research most of these principles have not been used systematically or coherently. Given the lofty goals of the NCLB Act of 2001, strict adherence to these basic principles of research will be crucial to determining what educational technology practices and programs are effective and what programs should be abandoned to the scrap heap of experience.

Valid and relevant research requires a thoughtful and systematic approach. The pervasive nature of technology in teaching and learning necessitates research for understanding in a broad area including: teacher training, technology integration, technical literacy for students, and access. Despite the fact that some of these areas are not technically interrelated, none can be ignored. The critical need will be to prioritize focus areas to maximize opportunity for real and useful research-based results.

In order to realized the lofty goals set forth in the "No Child Left Behind" Act of 2001, educators, administrators, and politicians will need to reach some consensus regarding priorities for study. However, this will be a tremendous challenge because, regardless of the technological advancements available to students and educators, the fundamental question remains one at the heart of all educational reform: What is the purpose of public education in this country and what are appropriate goals for realizing that purpose? Any research and reform efforts that fail to honestly address this question are likely to face the same problems and shortcomings of previous research.

References

Bellman, K. (March, 2001). Out of the classroom and into the fire. Paper presented at Project Kaleidoscope 2001 Change Agents Roundtable, Irving, Texas. Retrieved March 10, 2002 from http://www.pkal.org/events/car2001/bellman.html

Feuer, M. & Towne, L. (February, 2002). The Logic and the Basic Principles of Scientific Based Research. Paper submitted to the Scientifically Based Research Seminar. U.S. Department of Education. Washington, DC. Retrieved March 10, 2002 from http://www.ed.gov/offices/OESE/esea/research/feuer-towne-paper.html

Improving America's Schools Act of 1994, § 3114 (1995) Retrieved March 11, 2002, from http://www.ed.gov/legislation/ESEA/toc.html

Melmed, A. (Ed.) (November, 1995). The Costs and Effectiveness of Educational Technology: Proceedings of a Workshop. (Office of Educational Technology Report No. DRU-1205-CTI) Rand Corporation: Santa Monica, CA. (ERIC Document Reproduction Service No. ED392409)

No Child Left Behind Act of 2001, Part D § 2401 (2002) Retrieved March 11, 2002 from http://www.ed.gov/legislation/ESEA02/index.html

Patton, M. (1990). Qualitative Evaluation and Research Methods. Newbury Park, CA: SAGE Publications.

Reyna, V. (February, 2002). What Is Scientifically Based Evidence? What Is Its Logic? Presentation at the Scientifically Based Research Seminar. U.S. Department of Education. Washington, DC. Retrieved March 10, 2002 from http://www.ed.gov/offices/OESE/esea/research/reyna.html

Trotter, A. (2002, February 6). Department study to examine effectiveness of technology. Education Week. Retrieved March 4, 2002, from http://www.edweek.org/

Wicklein, R.C. (December, 1992). Critical Issues and Problems in Technology Education. Paper presented at the annual meeting of the American Vocational Association, St. Louis, MO, (ERIC Document Reproduction Service No. ED354341)

Accessible Adult Learning in the Health Professions:
Interactive Uses of Distance Technology

Abstract: This paper describes a study of students' perceptions of the impact of accessibility and interactivity on successful distance education in the Health Professions. The study utilized both quantitative and qualitative data to determine how students perceived issues of accessibility and interactivity affecting their success in distance courses. Our research found that both accessibility and interactivity are crucial to students' success in and satisfaction with distance education courses. In fact, issues of accessibility and interactivity are interconnected to such an extent that they can work together to either support or detract from students' success. Students, instructors, staff, departments and the university administration must work together as a team to create the most readily accessible and interactive distance education possible.

I. Introduction

In our post-industrial information society, knowledge accumulates quickly and needs to be disseminated quickly, and at frequent intervals, to those who need it. As a result, education can never end. Life-long learning must be encouraged and facilitated to allow for on-going professional development and connections with global learning forums. This process benefits both the learners and the communities they serve. This is particularly true in the health professions.

Research has shown that potential students in the health professions often fall through the gaps in traditional learning environments. For example, rural learners, adult learners, and disabled learners often find it impossible to leave their homes to seek further education. They are often located too far from a learning institution, or are unable to take the time to leave jobs or dependents to seek further education. Those people who do not have the opportunity to access education at a distance to up-date their knowledge and skill sets and further their career goals, are at a disadvantage.

Distance education, increasingly offered via the Internet, provides a solution to this need. The ability to access the technology utilized in distance education is a key component in delivering a successful on-line educational programme but barriers to access remain. As recently as 1996 Angus Reid reported that only 39% of women, compared to 61 percent of men, had Internet access. (Joseph, 54, originally cited in Menzies, 1998) Many rural dwellers still do not have access to high-speed Internet, while disabled students are isolated by web interfaces that do not recognize their particular needs.

The challenge for educators is to retain quality in education whilst extending accessibility to students who would otherwise remain at arms length from their programmes. There has been a tendency to assume that education in the health professions must necessarily be on-site to deal with the challenge of linking theoretical knowledge with the practical development of competence. Efforts have been undertaken bydistance education instructors to promote the interactivity encouraged in the live classroom in the virtual classroom. Experts agree that the best way to accomplish this goal is to make the virtual classroom experience highly collaborative and to promote discussions between students as well as between students and the instructor. This has been one of the key challenges in providing successful education in the health professions.

A review of the most current literature on issues of accessibility and interactivity in health professions distance education confirms the importance of these two key themes in creating a successful programme. While the literature is generally positive about distance education, the purpose of research in this area is to present solutions to recurrent difficulties encountered by many programmes. Some researchers are looking towards educating instructors in new pedagogical techniques suitable for distance education, others are involved in developing and testing computer-based systems that will assist student learning at a distance. Some researchers are also beginning to turn to their students for perspectives, advice and insight about their perceived success and satisfaction with distance learning (Cartwright, DeBourgh, Draude & Brace, Lesh et al., Mamary, Nelson, Thiele).

The ideal health professions course provides plenty of opportunity for students to communicate, cooperate and collaborative with one another. Interactivity between students, and between the instructor and students , promotes community and connection within the course creating support-systems which facilitate learning. (Geer, Liaw & Huang) Group work mimics the real-world experience of health professionals who must often work in teams to understand and cope with the workings of many complex systems including the human mind and body, the administration and management of staff and patients, and the moral and ethical dilemmas they inevitably encounter. (Niederhauser, Spector & Davidson, Orrill, Lankard Brown). Thiele notes that "the current and future health care environment demands a collaborative approach to work. Modeling this expectation in the nursing curriculum provides essential preparation for the multi-disciplinary partnerships that are a requisite for providing quality care, now and in the future" (Thiele, 202).

Despite the advantages the technology has to offer, accessing a virtual course rather than attending a live class is often fraught with difficulties mostly caused by the technology, specifically low-level computer literacy. Some students are afraid of the technology and/or lack the technological skills they need to access and complete the course. This problem can be exacerbated

BEST COPY AVAILABLE

by the lack of the instructors' technological skills or the lack of technological support for both instructors and students from the institution. In some cases, the inability of the institution to supply the necessary technology, to upgrade old systems, or to provide technicians who are capable of setting up complex systems due to financial constraints, affects the access students and instructors have to distance education possibilities. (OLT, Muirhead, Terpstra in *Distance Learning*). Administrators, technical-support providers, and library personnel all need to be trained to assist distance education students. Faculty need to be supplied with access to technological and pedagogical professional development. (OLT, Muirhead, Sykes Berry & Mullaly-Quijas in *Distance Learning*, Franklin in *Distance Learning*) They also need to offer their courses using a variety of learning technologies to facilitate accessibility. (Lankard Brown, Cragg & Doucette in *Distance Learning*) Furthermore, students need to assist themselves by taking computer and orientation sessions before beginning a course to assure they have the requisite skills necessary. Students also need to be willing to problem-solve with the technology in the same way as they problem-solve issues that they face in their daily professional lives (Clarke).

According to the literature, achieving student success and satisfaction with accessibility and interactivity are key components in attaining overall success and satisfaction with distance learning. Studies show that good pedagogy that promotes collaborative learning and communicates expectations clearly to students can enable students to enjoy and succeed in a course despite the technological difficulties they may encounter. (DeBourgh) Ideally, though, the smooth working of technological systems and support services facilitates the ability of students to interact with the course, the instructor, and other students and thus to obtain the maximum benefits of the health professions programmes offered by distance.

II. Specifics of the Dalhousie Health Professions Study:

Five departments within the Health Professions Faculty at Dalhousie University, Nova Scotia, Canada (all offering a varying number of distance education courses and programmes at the undergraduate and graduate level) collaborated to determine their students' perceived satisfaction with the accessibility and interactivity of their distance education.

This Project was conducted in concert with the following internal partners at Dalhousie Univesity: Office of Instructional Development and Technology, Atlantic Health Promotion Research Centre, and the Academic Computing Services. The following external partners were involved: Office of Learning Technologies of Human Resources Development Canada, and the Workers' Compensation Board of Nova Scotia.

ii. Key Themes

Accessibility:
The different ways in which the technology of
distance education is available to learners.

More specifically, ***accessibility*** refers to the students' ability to gain easy access to the course, to be able to access support systems to aid with technological difficulties, and to have access to a variety of ways to interact with the university administration, the course, and the learning process.

Interactivity:
The inter-play and exchange in which individuals and
groups (learner-learner, instructor-learner) influence each other.

More specifically, ***interactivity*** referred to the receptivity of students and faculty to the use of different technologies (chat-rooms, discussion boards, teleconferencing, email) and methods (social rapport building activities, course design, the nature of the communication in a course) to communicate with one another. The term interactivity also referred to students' and faculty's perception of these technologies in enhancing or detracting from their opportunity for discussions and collaborations and the usefulness of these interactions in their learning process.

iii. Student Demographics

In the Faculty of Health Professions at Dalhousie University, the demographics of the adult distance learning were in accordance with those generally described in the literature. Based on survey data, the majority of students were:

- female
- between the ages of 25 and 55
- employed full-time while maintaining part-time student status
- accessing academic courses most often during the evening
- responsible for caring for dependents at home

A significant number of students were rural dwellers.

3. Methodology

i. The Objectives of the Project were:

I. To analyze technology and learning needs identified by adults at the beginning of distance education courses in four Schools and the Disability Management Programme in Dalhousie's Faculty of Health Professions during the 1999/2000 and 2001-2002 academic year;

II. To trace and analyze the progress of learning though distance education throughout course delivery over two years in the four Schools and Disability Management Programme; and

III. To analyze summative evaluation data, and synthesize and disseminate findings on interactive uses of distance technology in a range of entry level, graduate, and continuing education in four different health professions.

These objectives formed the basis for the development of a multi-methods study gathering both quantitative data via surveys and qualitative data via focus groups. A Survey was developed, piloted and redesigned to capture student perspectives on accessibility and interactivity in their distance learning experience in five departments of the Faculty of Health Professions. The Surveys were conducted via email, however students were assured of confidentiality. Survey #2 had a higher response rate likely due to the fact that a pre-survey message was sent reminding students about the survey. Focus Groups were held throughout the two year project. All Focus Groups were conducted by teleconference interviews by an external research group. The final survey questionnaire is described in Appendix A. Table II identifies the data collection process and Table III details the dates the methods were employed and the numbers of participants involved.

4. Results

I. Surveys

1. Students' Technological Confidence

Technological Skill	% of Students 'very confident'
email	73%
keyboarding	72%
word-processing	70%
Internet applications	22%
use of on-line library sources	17%
Trouble-Shooting	14%

2. Availability of Modes of Distance Education

Mode of Distance Education	% of Students Perceiving Mode 'very available'
Internet/Web-Based	71%
Teleconferencing	28%
Videoconferencing	2%

3. Helpfulness of Various Methods in Preparation for Course

Method of Preparation for Distance Education	% of Students Perceiving Method of Preparation 'very useful'
Instructors	43%
Manuals/Literature	31%
Friends/Family	25%
Workshops	16%

4. Opportunity and Helpfulness of Student to Student Interaction

Nature of Student to Student Communication	% of Students Perceiving 'lots of opportunity' for Student to Student Communication	% of Students Perceiving Student to Student Communication 'very helpful'
Exchange of Personal Information with Other Students	65%	53%
Communication About Non-Course Content	34%	32%
Participation in Planned or Spontaneous Activities Allowing Student to Share Ideas	48%	54%

5. Promotion of Interactivity via Designed Activities

Participants in Communication	% of Students Perceiving 'lots Opportunity' for Communication in Designed Activity	% of Students Perceiving Communication in Designed Activity 'very helpful'
Communication Between Student & Instructor	77%	73%
Communication Between Student, Instructor and Other Students	77%	75%
Small Group Work with Other Students	49%	43%

II. Statistical Inferences from Survey Data

Factor Analysis tests performed on Survey #2 resulted in some generalizations and collapsing of data. Collapsing these questions allowed us to see to what extent the demographics are determinant of variations in response to the questions on accessibility and interactivity. After the results of Survey #2 were gathered, questions relating to accessibility were not collapsible. Questions relating to interactivity were generalized.

With regard to 'technological confidence' and 'interactivity there was no statistical difference in probability values in responses between demographics, thus generalized conclusions could be reached. No significant difference was demonstrated in interactivity between number of courses, age group, urban vs. rural dweller, and between those having dependents vs. those without dependents. However, a statistical difference was shown between full-time employed survey participants and those other-wise employed or unemployed. Full-time employed participants exhibited less confidence with the technology than the other group.

No statistical inference could be made with regard to sex due to the high number of female participants and the comparatively low number of male participants.

III. The Focus Groups

Students in the Focus Groups (Focus Groups #1,2,3) believed that having computer skills was the most important skill/experience in contributing to their confidence in distance learning. Most students hadacquired their skills by trial and error either at work or at school, although a few mentioned technical support and course work. They believed that technical challenges inhibited their access to distance education, followed by scheduling difficulties when teleconferences, for example, conflicted with work or family responsibilities. They also mentioned, secondarily, that the being able to work independently and to participate in a well-organized course helped their confidence with distance education.

The students found instructors most helpful in studying by distance, providing flexible hours and deadlines, although they resented instructors who they did not feel were fully committed to distance education or who were inexperienced with distance learning. They also mentioned the support of departmental staff and technical support as being helpful to them. They were frustrated by the administrative and library barriers to studying by distance, such as dealing with the Registrars Office, double-billing, the unavailability of on-line registration, no on-line access to marks and access to materials. They asked for improvements in these areas as well as for more technological assistance. They also stressed the need for well-organized professors who would give more feedback.

Students reported that all distance modalities had their strengths and weaknesses. They found discussion board communication most successful, although turn-around time could be lengthy in this mode. Teleconferencing and chat-rooms were praised for the immediacy of communication but complaints were made about scheduling such interactions and the inability of some students to keep up with the flow of the discussion. Instructors varied greatly in their ability to encourage interactivity and the nature of such interactivity, but most students felt that interactivity was encouraged by instructors through such methods as grading participation, questioning students or requiring students to post questions, or by discussing case studies or relevant web sites.

Most students felt the need for and managed to obtain some amount of informal interaction either on-line or via the phone or in-person where possible. The need to substitute some form of interaction for in-class interaction was high, but there was still often feelings of disconnectedness and loneliness amongst students. Still, students reflected that they were pleased that they had access to courses via distance.

Faculty and Staff Focus Group (Focus Groups #4,5) results supported the findings of the Student Focus Groups. They also raised issues that are specific to their perspective but which nevertheless affect the accessibility or interactivity of distance education. For example, although the departmental staff are willing and able to assist students with difficulties, this role takes up a lot of their time. For the most part, staff had been able to learn the technologies either through trial and error or via workshops to assist students but were as frustrated as the students, if not more so, by the lack of systematic administrative procedures to deal with distance education students. Faculty equally noted the ad hoc manner in which they have managed to learn the distance education technology and have adapted their classroom pedagogy for distance learning. Faculty noted the lack of university support in both contexts. Furthermore, they noted the excessive amount of time a web-based course takes to formulate and run and the lack of support or recognition such teaching work receives.

5. Recommendations for Change:

WHAT STUDENTS CAN DO:

- Students need to provide themselves with baseline technologies wherever possible and take workshops to up-date their technological knowledge
- Students need to consciously understand their learning styles to understand how they work best and where problems may arise for them
- Students should attend live orientations where possible, but definitely on-line orientations to the course and to the technology
- Students should be willing to commit themselves /be open to the collaborative learning process that the best on-line learning necessitates
- Students have to be prepared to work independently, manage their time, motivate themselves to get the work done
- Students should adapt technologies to suit their learning needs - ie. Taping teleconferences, printing discussions, forming partnerships with other students

WHAT INSTRUCTORS CAN DO:

- Provide orientation sessions for students - either live or on-line - technical/introductory to class - to other students and instructor
- Provide clear and detailed syllabus with course requirements and assignment instructions at the outset of the course
- assign groups on basis of time-zone, schedule, availability
- Faculty need to provide multiple weekly on-line meetings to facilitate full-time workers schedules and time-zone differences
- Commit themselves to the extra time an on-line course will take
- provide participation marks/mandatory participation to encourage student interaction on line and build community which will assist in the learning process
- make chat-room groups small so that discussion is more manageable - less threads to follow
- check up on students who have been absent/silent for too long

University Administrative Support For Faculty

- Provide professional development - in technology & pedagogy - for faculty developing on-line courses. Provide an on-line course for faculty in transforming courses into on-line courses. (This way faculty experience the on-line course from a student point-of-view, and they can learn the technology as they learn how to transform their course.)

- Provide more tech support to faculty developing on-line courses and increase faculty awareness of support systems already established on campus

- Provide a University Co-ordinator for distance learning where one person is in charge of distance learning policies and procedures and can oversee professional development of faculty in new technologies and new pedagogical approaches.

- Provide recognition for the amount of extra time an on-line course takes to prepare and conduct by faculty members, increase recognition for teaching achievement within the university

7. Future Partnerships and Catalysts for Future Research in Health Professions Distance Education

Engaging in this project has allowed members to realize that distance education has become a very legitimate method of offering academic course work in the health professions. Being part of the OLT group, including presentations to parties interested in implementing some kind of distance training, has shown that distance technology is a relevant approach to reaching persons who may not have been able to access particular courses in the past. Moreover, it is clear that the changes proposed by this project are very sustainable.

Beyond the study of accessibility and interactivity for student success and satisfaction with distance education within specific departments, other areas for further research in distance education in the health professions include:

1. A study of the gender/rural issue.

2. A study of how students research on-line in the health professions.

3. A study of how health professions students learn in a distance education environment.

4. A study of how health professions faculty adapt their pedagogy from the in-class to on- line environment.

The Project has found that issues of accessibility and interactivity are crucial to students' success in and satisfaction with distance education courses.

References and Bibliography

Brown, Bettina Lankard. (2000). *Web-Based Training. ERIC Digest No. 218.*

Burge, Elizabeth J. (1999). *Keeping Our Balance in Times of Techno-Turbulence*.

Carey, Stephen. (1999). The Use of WebCT for a Highly Interactive Virtual Graduate Seminar. *Computer Assisted Language Learning, 12*(4), 371-380.

Carr-Chellman, Alison; Duchastel, Philip. (2000). The Ideal Online Course. *British Journal of Educational Technology, 31*(3), 229-241.

Cartwright, Juliana. (2000). Lessons Learned: Using Asynchronous Computer-Mediated Conferencing To Facilitate Group Discussion. *Journal of Nursing Education, 39*(2), 87-90.

Clarke, Alan. (1999). *How To Create Effective Information and Communication Technology Learning Programmes. A Guide.* Leicester, United Kingdom: National Institute of Adult Continuing Education.

Damarin, S. K. (1998). Would You Rather Be a Goddess or a Cyborg? In G. E. C. Associates (Ed.), *The feminist teacher anthology: Pedagogies and classroom strategies*. Danvers, MA: Teachers College, Columbia University.

DeBourgh, Gregory A. (1999, February 28-March 4, 1999). *Technology Is the Tool, Teaching Is the Task: Student Satisfaction in Distance Learning.* Paper presented at the SITE 99, San Antonio, TX.

DeBra, Paul and John Leggett (eds) (1999, October 24-30,1999). WebNet World Conference on the WWW and Internet 99. Proceedings of WebNet 99 – Honolulu, Hawaii, October 24-30, 1999. Volumes 1 & 2.

Distance Learning '99. Annual Conference on Distance Teaching and Learning. (August 4-6, 1999). Paper presented at the Distance Learning '99. Annual Conference on Distance Teaching and Learning, Madison, Wisconsin.

Draude, Barbara; Brace, Sylvia. (1999, March 28-30, 1999). *Assessing the Impact of Technology on Teaching and Learning: Student Perspectives.* Paper presented at the Mid -South Instructional Technology Conference, Murfreesboro, TN.

Fetzer, Susan J. (2000). A Pilot Study to Investigate the Impact of Interactional Television on Student Evaluation of Faculty Effectiveness. *Research Briefs*. 39(2), 91-93.

Geer, Ruth. (2000, February 8-12). *Drivers for Successful Student Learning through Collaborative Interactivity in Internet Based Courses.* Paper presented at the Society for Information Technology & Teacher Education International Conference, San Diego, California.

Iwasiw, Carroll, Mary-Anne Andrusyszyn, Anne Moen, Truls Ostbye, Lynn Davie, Turid Stovring, Irene Buckland-Foster (2000). Graduate Education in Nursing Leadership Through Distance Technologies: The Canada-Norway Connection. *Journal of Nursing Education*. 39(2), 81-86.

Joseph, Gillian M. (1999). Reaching and Teaching Women on the Web: The Challenge of Barriers and Bottom Lines. *Canadian Journal of University Continuing Education, 25*(1), 45-62.

Lauzon, Al. (1991). Enhancing Accessibility to Meaningful Learning Opportunities: A Pilot Project in Online Education at the University of Guelph. *Research in Distance Education*. 3(4), 2-5.

Lesh, Steven G ; Guffey, J Stephen; Rampp, Lary C. (2000). *Changes in Student Attitudes Regarding a Web-Based Health Profession Course.*

Lia-Hoagberg, Betty and Marilee Miller. (1999). A Partnership Model of Distance Education: Students' Perceptions of Connectedness and Professionalization. *Journal of Professional Nursing. 15(2), 116-122.*

Liaw, Shu-sheng; Huang, Hsiu-mei. (2000). Enhancing Interactivity in Web-based Instruction: A Review of the Literature. *Educational Technology, 40*(3), 41-45.

Mamary, Edward M ; Charles, Patricia. (2000). On-Site to On-Line: Barriers to the Use of Computers for Continuing Education. *Journal of Continuing Education in the Health Professions, 20*(3), 171-175.

Marsden, Lorna. (2000). Lifelong Learning: Crossing Generations and Cultures. *Education Canada, 40*(2), 4-7.

Mates, Barbara T. (2000). *Adaptive Technology for the Internet: Making Electronic Resources Accessible to All.* Chicago, IL: ALA Editions, American Library Association.

Muirhead, Brent (2000). Enhancing Social Interaction in Computer-Mediated Distance Education. A pre-discussion paper for the IFETS discussion list online moderated by Dr. Brent Muirhead .

Nelson, Lin M. (1999). *Increasing Retention of Adult Learners in Telecourses through the Incorporation of Learning-Centered Instructional Strategies and the Use of Multiple Modalities for Content Delivery and Interaction.*, Nova Southeastern University.

Niederhauser, Victoria P ; Bigley, Mary Beth; Hale, Janet; Harper, Doreen. (1999). Cybercases: An Innovation in Internet Education. *Journal of Nursing Education, 38*(9), 415-422.

Orrill, Chandra Hawley. (2000). *Designing a PBL Experience for Online Delivery in a Six-Week Course.* Paper presented at the Annual Meeting of the American Educational Research Association, New Orleans, LA.

Price, Bob. (1997). Defining Quality Student Feedback in Distance Learning. *Journal of Advanced Nursing*. 26, 154-160.

Rouse, Deborah. (1999). Creating an Interactive Multimedia Computer-Assisted Instruction Program. *Computers in Nursing*. 17(4), 171-176.

Schnorr, Donna; Hazari, Sunil. (1999). Leveraging Student Feedback To Improve Teaching in Web-Based Courses. *T.H.E. Journal, 26*(11), 30-38.

Seemann, Eric A ; Buboltz, Walter C, Jr ; Wilkinson, Lamar. (2000, February 8-12). *Then and Now: Technology and the Changing Face of Higher Education*. Paper presented at the SITE 2000, San Diego, California.

Spector, J Michael; Davidsen, Pal I. (1999, April 19-23). *Transparency and Interaction in System Dynamics Based Learning Environments*. Paper presented at the Annual Meeting of the American Educational Research Association, Montreal, Quebec.

Stoicheva, Mila. (2000). The Digital Divide and Its Implications for the Language Arts. ERIC Digest D153. 4.

Technologies, Office of Learning. (1999). *Professional Development and Learning Technologies: Needs, Issues, Trends and Activities = Le perfectionnement professionnel et les technologies d'apprentissage: Besoins, problemes, tendances et activites*. Hull, Quebec: Human Resources Development Canada.

Thiele, Joan E ; Allen, Carol; Stucky, Mary. (1999). Effects of Web-Based Instruction on Learning Behaviors of Undergraduate and Graduate Students. *Nursing and Health Care Perspectives, 20*(4), 199-203.

Trentin, Guglielmo. (2000). The Quality-Interactivity Relationship in Distance Education. *Educational Technology, 40*(1), 17-27.

Tu, Chih-Hsiung. (2000, February 8-12). *Strategies To Increase Interaction in Online Social Learning Environments*. Paper presented at the Society for Information Technology & Teacher Education International Conference, San Diego, California.

Williams, John W. (1999). *The Chat Room as an Integral Part of the Virtual Classroom in Distance Learning Program Design for Adult Learners*.

Coaching the transition to e-learning: re-thinking instructional design

Chris Trevitt
Centre for Educational Development and Academic Methods
The Australian National University

> 'There is not a simple "experiment" that involves pitting distance and on-campus education against one another to determine which is "better". The question basically is what is the best way to deliver different facets of an educational program. In many instances the answer will likely involve a mixed combination of synchronous and asynchronous experiences for both on- and off-campus programs.'
>
> 'The innovation opportunities of distributed learning involve both delivery and learning methodology. At present, technology appears to be driving many adaptations, and not many research faculty are involved in educational research and development. Educational objectives would be advanced if this trend were reversed and problems were formulated before a technological solution was sought and more funding were available to support the needed educational research.'
>
> (US Council of Graduate Schools, Policy Statement on 'Distance Graduate Education: opportunities and challenges for the 21st century': 1998, p18.)

Introduction

This paper reviews the experiences of a collaborative approach to the intense educational development involved in the transition to a successful technology -facilitated off-campus study program. Drawing on a history of many years of collaboration between the ANU educational development centre (CEDAM) and the Legal Workshop (LW) group in the Faculty of Law, the project spanned a 12-month academic year development period in 2001. The study program is a Graduate Diploma in Legal Practice (GDLP), taken by more than 150 students per year from all over Australia as well as overseas, many of whom are employed in a wide range of work environments. There are some 15 separate courses of study.

The institutional context is highly research intensive and gives emphasis to an on-campus education. Recently, however, the University has begun actively exploring distributed and flexible approaches in niche settings (such as that represented by the GDLP) which permit it to better meet changing national and student needs. This paper highlights some of the lessons learned from the experience of undertaking one particular program level change, and in supporting academic and other staff during the transition to a technology-facilitated curriculum.

The project plan: purpose and expected outcomes

The project was multifaceted. One purpose was to evaluate the experience of re-developing GDLP courses within a *WebCT* environment and, in particular, to comment on the specific mix of different types of staff (and, to some extent, student) support that experience suggested was required. The project was set up as a cooperative undertaking between the Faculty of Law and CEDAM, and was intended to provide feedback on six areas of broad interest within the broader University:

- Academic leadership and management: program and project level
- Curriculum design and course development
- Student and staff support
- Quality enhancement and quality assurance
- Technology infrastructure
- Library and student administration

Questions of interest associated with *Curriculum design and course development* included:

- what particular staff-student and student-student interactions are valued by students and support their learning? (eg what role is played by student-student discussion, peer support, cohort groups, technology mediated lecturing, role modelling, etc)
- what are some of the ways of meeting examination and student assessment requirements in technology-enabled flexible courses?
- what role is played by team- or group-work in the course design and development process and how is this best facilitated?

Some observations and findings addressing each of these questions are presented below, following a brief description of the overall structure of the project.

Project structure

Late in 2000 a project officer (learning design support trainee consultant) was appointed to a hybrid position comprising both workplace and study responsibilities. In part, the position description drew on ideas articulated by Laurillard (1993) and Walker et al., 1995) and read as follows:

> The position would suit a recent graduate who has some familiarity with the concept of instructional design...
>
> The intention is *not* so much to provide an instructional design service for areas, rather it is to facilitate areas' capacities to re-think teaching practice and re-invigorate course provision in ways which draw on instructional design concepts *and* reinforce the ethos of a research-led institution. The aim is to move beyond classical instructional design models *and* exploit opportunities opened up by new technologies. It is expected that a component of the study program will investigate the extent to which this aim is achieved, and what factors influenced the outcome.

By far the main responsibility (and most time consuming component of the workload) involved one-on-one consulting with instructors in LW who were redesigning and redeveloping courses for access by students off-campus through *WebCT*. A key principle informing the advice to instructors, is that of *alignment* of curriculum goals, student activities and assessment, explained by Biggs (1999). The project officer was required to undertake an 'online' postgraduate study program in order to gain first-hand experience of a student perspective in such an environment. The assumption was that this would assist in yielding realistic and high value consulting advice.

In addition to consulting and coaching activities for course development, there were two other significant areas of activity: program-level support, and project management. Program level support comprised periodic peer review workshops involving all LW instructors and, along with the project officer and myself. Project management involved an informal steering group comprised of the Director, LW, and myself. Project management also required substantial CEDAM-based professional support in the form of 'consultant debriefing' throughout the year, most of which I undertook. This provided a structure and impetus for continuous reflection and improvement. It yielded substantial insights into many strengths and weaknesses of both the teaching innovations being trialled by LW instructors, and our own CEDAM strategies for managing and supporting the consulting process. The more substantive 'learnings' were 'logged' in the form of a set of project-level notes compiled on a needs basis throughout the year by both the project officer and myself. These notes subsequently formed the basis for much of the internal ANU project report, which detailed a response under each of the six broad areas of interest identified above (Trevitt, 2002).

Curriculum design and educational development: some observations and findings

- *what particular staff-student and student-student interactions are valued by students and support their learning? (eg what role is played by student-student discussion, peer support, cohort groups, technology mediated lecturing, role modelling, etc)*

Technology-mediated discussions are a central feature in a number of GDLP courses. Both voice (teleconference) and text (electronic discussion boards) is used extensively.

BEST COPY AVAILABLE

Telephone interviews have been used for a number of years. These represent an authentic setting for graduate lawyers wanting to be certified to practise. Mock exercises are run requiring students to give advice to instructors acting as 'clients', and are assessable. They also provide instructors with an early opportunity to learn of any student concerns and help allay fears, correct any misconceptions about course expectations, etc, and enables students to seek any early reassurance required.

Asynchronous discussions (eg using the *WebCT* Discussion Board Tool) rather than chat room type exchanges (which require two or more people to be online at the same time) have been used very successfully. Creating a clear and relevant context (and purpose) motivated students to engage in discussion and helped ensure success. The importance of issuing specific and unambiguous instructions cannot be overemphasised. Students are not necessarily adept at picking up all the nuances about instructor expectations at the best of times, let alone when they are located remotely 'at the end of a wire'.

The two boxes below illustrate different examples of the way in which technology -enabled discussions can be employed.

In the *Skills Development* course being conducted in 2002 instructions to students read, in part, as follows.

Skills Development

Participate via the Discussion Board in sharing your reflections with other students

Post to your group's Discussion Board at least five times on five different topics (not including the compulsory topic one tutorial activity)

- I'm looking for insightful postings that demonstrate a creative approach to problem-solving in the skills area involved. I'm looking for energy in your continued professional development and a mentor approach to learning where your new found knowledge and practical experience enhances the whole profession as you share your reflections with others.
- 250 words is the recommended length.
- topics remain open for a week from Sunday night until Sunday night.

A turn as group leader (or e-moderator) summarising your group's postings for the week and posting that summary to the Main Discussion Board by midnight Tuesday of the week following the topic.

- Click below for some ideas on e-moderating:
  http://www.e-moderators.com/moderators/artonlinehost.html
- I'm looking for a 500 word reflective posting from the group leader that picks out the main threads of the group's postings and enunciates this clearly. The leader should identify common themes and weave the threads together into a posting offering a practical solution to dilemmas others have posed and some constructive critical analysis where appropriate.
- Click on calender to find out in which week you are the leader.

These instructions give students a general overview of expectations. They help set the scene, and communicate the key criteria for success. Other, more specific instructions were subsequently issued to guide the weekly discussion on each topic.

In a second course, *Civil Practice*, the use of technology -enabled discussions demonstrates a somewhat more complex – but still very workable - approach to this sort of application of *Problem-Based Learning* principles to promote student learning. This example highlights the powerful motivation associated with authentic assessment activities that have been carefully aligned with course learning objectives. In 2001, exchanges associated with this mock legal case yielded 634 messages from 23 students and one instructor during a period of approximately 8 weeks.

Civil Practice

Students in the *Civil Practice* course were arranged into groups of 3 or 4 and asked to act for the Plaintiff or Defendant in a mock case. There were 3 pairs of Plaintiff-Defendant groups. Students used different discussion groups for different purposes. For example, group members developed their case and communicated with one another using a private Defendant or Plaintiff group. (Only group members can access postings to group discussions designated as 'private'). All students acting for the Plaintiff (Defendant) were eligible to communicate with one another using a general Plaintiff (Defendant) discussion forum. In addition, they had access to discussion forums known as *The Locker Room* or *The Court Registry*. Copies of descriptions of the purpose and function of these two discussion areas offered by the lecturer in charge are given below.

The Locker Room	The Court Registry
The Locker Room is where we discuss team issues. There are a number of different elements to working effectively in teams. There will be three formal discussion periods in the locker room. One starts now (June 8). The next will be at about 10 July and the final in the last week (July 23) of the course. Your participation in all three form part of your assessment.	The Court Registry is where you need to file your documents which form part of the case file. It is NOT where any discussions take place. When your group has a document which must be sent to the other side (ie your assessable case file documents) they should be posted in here. Your opposing team will then collect the document from here and prepare their response. By the relevant date, the response shall also have been filed. Like a normal Court, documents must be filed on time. The deadline is 6pm on the day the document is due. If the document is not filed on time, the entire group gets ZERO for the item (but must still complete it so the case can continue). For this to work, everyone must take responsibility and ensure the deadlines are met.

- *what are some of the ways of meeting examination and student assessment requirements in technology-enabled flexible courses ?*

In the *Civil Practice* example above, it is clearly impossible for one instructor to read and judge the worth of each discussion contribution for assessment purposes. Instead, for the final assessment at the end of the mock case, students were asked to look back over their respective contributions and determine which four were the most important. They were then asked to write a brief account of the value of the contribution made by these four postings to the overall outcome of the 'case'. This account was then submitted for assessment. This leads to both a manageable load for the instructor and an obligation on students to develop valuable self-analysis and reflective skills.

A major review workshop held toward the end of the project addressed assessment issues. Early successes and practical options for the future identified by instructors included:

- Can we make greater use of the *WebCT* quiz tool by, for example, allocating students so many hours for an exam preview period starting as soon as they access and download the questions, and requiring answers to be submitted by the end of the designated period? This approach has the advantage that it would not require students to stay logged on while addressing themselves to the questions.
- Can we make more extensive use of the proven 1:1 telephone interview system? Students like the telephone communication – it offers opportunities for:
    - better instructor-student interaction and more immediate feedback than occurs when marking written work
    - students to enhance their performance skills in interviewing, negotiation, advocacy
    - students to raise other concerns on a needs basis – eg admission, job search, etc

  While sometimes seen as time-consuming for instructors telephone interviews may not be much worse than traditional marking.
- Project work involving team and group work encourages student interaction skills, and is valued by employers. Students work together and produce a group report that attracts a single shared mark. In order to minimise the

BEST COPY AVAILABLE

perennial 'freeloader' problem they are asked to submit individual critiques on this product (eg in the form of a succinct 'internal' memo to a 'boss' in a fictitious firm). This has the additional benefit that it encourages individuals to reflect on the group process. When designed well, group work has the potential to both broaden the skills learned and save marking time.

- *what role is played by team- or group-work in the course design and development process and how is this best facilitated?*

Prior to the commencement of this project, instructors who were rethinking curricula and undertaking course development did not necessarily work in a group or team-based fashion. Usually, courses have been taught by one (sometimes two) instructors and, subject to meeting Law profession requirements and expectations, course development proceeded within the relatively private domain of the relevant individual(s).

Our experience indicates that, with the transition to a technology -mediated study program, the curriculum design and development process increasingly involved more and more people. Structured and semi-structured discussion and dialogue has played a central role in the rethinking process. Discussion between a range of different players: between different instructors; between instructors and CEDAM consultants; between instructors and support staff responsible for management of student administration data; and between instructors, technical staff and CEDAM consultants. The systematic use of discussion and dialogue in this way is in accord with others' experiences and widely reported in the literature (eg. Schon, 1990; Laurillard, 1993; Brockbank and McGill, 1998). Schon's concept of reflection-in action, in particular, has informed the dialogue and underpinned much of the interaction between CEDAM consultants and LW participants.

Toward the end of the project the consolidation of team-based approaches to support the process of course design and development appears to be happening in an increasingly explicit and autonomous fashion (ie independent of any CEDAM input). Embryonic, self-organising groups of 2 or 3 individuals, for example, have embarked on at least two different course designs and development initiatives in the latter part of 2001. Team approaches may prove to be a key component of the emerging 'course development culture' within LW as experience mounts with the iterative process of rethinking associated with technology -mediated course design, development and provision

> 'The common interest in *WebCT* has given us a context in which to talk more about our individuals courses and identify group issues. A good atmosphere is developing involving showing what you can do and sharing options, with people readily adapting approaches from someone else's course and applying it to their own. Inevitably, approaches are put together in different ways in different courses – in ways suited to each context.' (Director, LW, 2002)

Some additional observations and findings

The experience of this project has also demonstrated that:

- a strategic leadership commitment is required from those responsible for managing degree and study programs in order to achieve such a sustained effort

> 'You can't get whole programs to change without this level of commitment. Individual courses can be changed in a comparatively straightforward way. Whole-of-program change of this sort needs a different approach – for example, the one described here.' (Director, LW, 2002)

- a campus commitment to strengthening technological infrastructure (eg installing *WebCT*) is an essential prerequisite – and an ideal trigger - for the sort of course and curriculum design rethinking (and associated course development initiatives) described here
- the transition to technology -enabled off-campus study leads to a substantial shift in instructor focus from curriculum content to process
- off-campus students need explicit support structures and communications. Students need an induction into program and course expectations: an overview of what the course is about, what they need to do and when, and what comprises the assessment.

BEST COPY AVAILABLE

- appropriate means for acquiring student feedback can involve use of telephone interviews and/or use of web-based open ended questions centred around: What worked well? What needs improvement? Answers to these questions can then be logged and managed in a small database.
- a distributed approach to the educational development (coaching) support can be highly effective (eg through an individual coach/consultant based in CEDAM but with specific area-based responsibilities – in this case Legal Workshop). Such support can be achieved with a junior position, where it proves possible to attract, identify and appoint an appropriate individual.
- a 'coach the coach' approach to support for the project officer within CEDAM appears to be essential in order to minimise the opportunities for the day-to-day 'rough and tumble' of the job to get out of hand. It also enables the capture of valuable 'institutional learning' outcomes

> 'We could not have achieved our current level of success in the transition to web-based delivery without this kind of support. It allowed us to help staff through the intellectual and cultural change, and saved us from foisting unworkable courses on students.' (Director, LW, 2002)

A wide range of ongoing issues remain. Those concerning the rethinking of curriculum include:
- determining practical and timely ways to keep abreast of new and successful teaching approaches being developed in the context of web-enabled off-campus course delivery
- how to assist instructors to find time for the continued ongoing course design and redesign, and student activity planning work
- the desire to streamline the assignment submission process using *WebCT* tools
- identifying what additional skills instructors can/should develop either individually or as a team in order to continue to strengthen the program

Concluding discussion

The project experience described here is in broad accord with that articulated in the opening quote by the US Council of Graduate Schools. The shared approach to project leadership involving both 'top-down' and 'bottom-up' strategies accords with Johnson's (1997) recommendations about the requirements for effective educational change. Quality of the student learning experience was maintained by:
- developing and engaging in a group or peer 'review' process of curriculum redesign and teaching review;
- acquiring, interpreting and acting on student feedback in a timely way; and
- using external facilitation by educational development staff to support these two processes.

A sustained commitment to an evidence-based approach to course redesign and redevelopment was achieved. Cyclically acquiring, interpreting and acting on student feedback enabled the transition to a successful technology-enabled curriculum to be achieved over just three or four iterations of course design, development and implementation. Given the magnitude of the conceptual change demanded of teachers undertaking such ventures, we suggest this is a very reasonable number of re-development cycles.

Provocatively, our experience suggests that the use of an internal consultant working as a 'coach' (and supported by an appropriate 'coach the coach' process) is a cost-effective means to support the demands to rethink curriculum. At first glance, this is a counter-intuitive outcome. However, when we consider what is now known about the nature of 'deep' learning (eg Biggs, 1999), and the central role played by conversation and dialogue in achieving conceptual change, and the importance of conceptual change to the curriculum rethinking process, then this is not necessarily an unexpected outcome after all. Perhaps the real issue concerns the extent to which it proves necessary (or not) to continue to provide external consulting support now the transition is mostly complete. Equally important is the question of how flexible a course should be: When is a course in danger of becoming too many things to too many people? At this stage it is still too early to offer an evidence-based opinion on these important points.

References

Biggs, J. (1999) Teaching for quality learning at university. Buckingham: Society for Research in Higher Education and Open University Press.

Brockbank, A. and I. McGill, (1998) Facilitating reflective learning in higher education. Open University Press.

Johnson, S. (1997) Educational development units: aiming for a balanced approach to supporting teaching. Higher Education Research and Development, 16: 331-342.

Laurillard, D. (1993) Rethinking university teaching: a framework for the effective use of educational technology. London: Routledge.

Schon, D. (1990) The reflective practitioner: how professionals think in action. San Francisco: Jossey-Bass.

Trevitt, A.C.F. (2002) The Law, IT and Education (LITE) project: a report on 2001 activities and outcomes. CEDAM Report. pp37.

USA Council of Graduate Schools (1998) Distance graduate education: opportunities and challenges for the 21st century'. http://www.cgsnet.org/pdf/DistanceGraduateEducation.pdf

Walker, R., Lewis, R. and Laskey, L. (1997) Flying in the face of instructional design: rationale for the case study. *Australian Educational Researcher*.

Acknowledgments

The foresight, commitment and continued support of the Pro Vice-Chancellor (Academic) Professor Robin Stanton in supporting this work is appreciated. It is a pleasure to acknowledge too, the constant good nature and high level of tolerance exhibited by Aliya Steed (the project officer), Gary Tamsitt (Director, Legal Workshop) and all the instructors and staff of Legal Workshop, and Margot Pearson (Director of CEDAM during the lifetime of the project).

Advanced Interactive Web Technologies in Industry Training

Tania Vassileva
Department of Electronics
Technical University of Sofia,
Bulgaria
tkv@vmei.acad.bg

Ilario Astinov
Ingenatic Gmbh
Germany
Ilario.Astinov@ingenatic.com

Dimitar Bojkov
Department of Software Engineering
Technical University of Sofia,
Bulgaria
dbb@vmei.acad.bg

Vassiliy Tchoumatchenko
Department of Electronics
Technical University of Sofia
Bulgaria
vpt@vmei.acad.bg

Ulrich Scholten
Ingenatic Gmbh
Germany
Ulrih.Sholten@ingenatic.com

Ivan Furnadziev
Technical University of Sofia,
Bulgaria
ihf@vmei.acad,bg

Abstract: Today, faced with the problems of global competition, increasing costs, and complex production engineering, a company can only be successfully managed if the employees are motivated and highly qualified. To cope with this demand the new educational scheme for cost-effective retraining, lifelong learning and distance education at the workplace should be introduced. This paper describes the developed Web based Intelligent Training System used in the Bosch WebTr@iner product range. It details how Java simulation, virtual reality modeling and animation can be used in a complementary approach to teaching complex industrial processes and systems in a cost-effective, rapid and interesting way on the global scale.

Introduction

Over the last decade, a dramatically increased rate of change in business has been observed. Companies are struggling to keep pace with new competitors that are introducing products at an incredible rate. The technological innovations and cycle are becoming shorter and the current technology will be obsolete and replaced by new advanced technology within a few years. But this increased rate of product introduction and the shorter technological cycles has created a huge problem. First of all there is demand for a higher level of knowledge to cope with the "scientification" of industrial branches based on advanced technologies, which should be provided for greater number of employees. This demand is even stronger in correlation with the fact that technology is getting younger simultaneously as workforce is growing older and globally dispersed.

Specifically, companies are being challenged with how to enable employees and the channel to sell and support the products that are flying off the assembly line. As a consequence of this fast development, there is no doubt, that retraining and lifelong learning of engineers, technicians and workers from industry is becoming a necessity (Schmockel, 1998). To maintain their innovative forces in the future, highly qualified experts with a multidisciplinary background, experimental skills and social attitude must be educated (Donovan, 1999).

The ever-growing importance of knowledge and greater numbers of people being educated and trained at the high level has increased the responsibility of educational institutions. Governments and industry are under tremendous pressure to convey more and more knowledge and skills at ever-faster rates to growing number of persons in need of education and training. But the costs involves for such rapidly growing demand is reaching proportions, which can no longer be financed even by the industrialized nations with conventional educational and training methods.

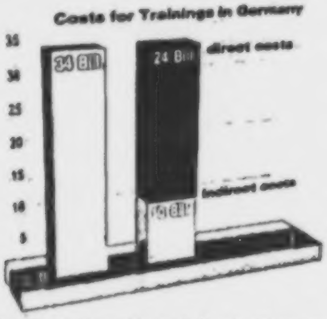


Figure 1: Costs for training in Germany

The diagram of Fig. 1 (see Hyperwave, 2000) shows how the total expenditure for training in Germany compares to the direct and indirect costs of training. Of the billions spent in this area, on average only about a fifth is spent on costs that directly relate to the training course. In fact, it is indirect costs (travelling and accommodation expenses for example) that make up the rest of the outlay. Often, the hidden cost of temporarily replacing staff is overlooked. Worse, staff may not actually be replaced during the time they are absent for training. The business is, therefore, operating in a much less efficient way.

What these estimates show is that traditional methods for training are not proving cost-effective. Although the diagram is for a specific country, it is highly probable that the situation is the same in practically any location.

To face the above-mentioned topics and develop new paradigms for learning, the contents, methods and forms have to be changed to fulfil the growing personal needs for a higher level of knowledge in new specialization and skills. To cope with this demand the new educational scheme for cost-effective retraining, lifelong learning and distance education at the workplace should be introduced.

The e-Learning tools accessible via Internet/WWW technologies create a very good environment to solve this complex task. By providing a solution that overcomes the challenges of proximity and time, e-Learning is a vital component in succeeding in business today. Wolz (see Wolz et al., 1997) have investigated the use of computer-mediate communications in educational environment. Maurer (Maurer and Dietinger, 2000) have described how modern WWW systems support teaching and learning.

Considering these facts, it is particularly in the automation sector that tailor-made vocational and specialized training has advanced to become one of the decisive criteria for success. And this is where Bosch AT-didactics comes in with its unique training program (Bosch AT-Didactic, 1999).

The paper describes the structure of the developed Web based Intelligent Tutorial System (ITS), used in Bosch WebTr@iner product line. It details how Java simulation, virtual reality modeling (VRML) and animation can be used in a complementary approach to teaching complex industrial processes and systems in a cost-effective, rapid and interesting way on the global scale. The target audience, for which the WBT is designed, is sales personnel and technicians. Through the WBT they should gain a better understanding of the advantages of the range, which should contribute to improving the sales for the sales personnel and technical knowledge for the technicians.

BEST COPY AVAILABLE

Learning Objectives

It has been the authors' ambition to design Web based courses in accordance with the model for "independent learning", with a particular emphasis on the interaction with the course material. The Web based trainers should guarantee opportunity for:

- Life-long, independently responsible learning;
- Motivated learning;
- Self-determination/autonomous learning (learning time, learning methods, learning tempo and possibly even subject matter have to be determined to a grate extend individually)
- Training on Demand (Learning will no longer take place only in the classroom or the laboratory. The training will go to the trainee, to his workplace, his office in the company or privately at home.)

Experience has shown that the effective development of training concepts and materials require a clarification of various learning objectives. It is useful to distinguish the different groups of goals since it is important that each group be matched with the appropriate didactical procedure (IWL Martens, 1999). We distinguish between learning objectives, in which experiments and hands-on experience are of prime importance, other learning objectives for which a visualized and clear presentation is decisive, or learning objectives that depends on video or films to reach the feeling of the learner.

Multimedia program is designed to reach the following learning objectives:

- Developing positive attitudes towards personal effectiveness;
- Recognizing the possibilities of influencing difficult situations;
- Accepting difficulties as challenges;

The learners have to be trained with extensive hands-on experiments to strengthen further understanding of theory. The idea is to illustrate all theoretical concepts with examples selected from real-world applications, in order for learners to benefit from the practical experience and to help them understand links between theory and practice. The experience side of e-learning should address factors including:

- Engagement: How will we get the learner fully engaged?
- Curiosity: How will we harness the power of curiosity and exploration?
- Simulation and Practice: More powerful simulation and practice opportunities?
- Action Learning: Simulators that trigger action learning and align with workplace challenges?
- Intensity: How can we create high intensity, memorable learning experiences?
- Assessment and Feedback: Help the learner to gain a better sense of their knowledge gaps?

In using interactive media the learner is required to repeatedly solve complex tasks and thus is actively involved and at the same moment is demonstrating mastering of material. Further, the results of short follow-up tests should show to what extend the learner is personally affected by the content of the presented material. Self-evaluation will make progress visible to the learner, and help to decide when to proceed in the material.

The learning methodology, implemented in the WebTr@iner, is designed to maximise the impact of modern multimedia technologies and human-computer interaction to achieve high quality training, which is attractive to the student. The approach used aims to place the onus of learning on the students' own initiative. Based on his/her own knowledge and experience, the student is able to choose the appropriate route through the course material, and in turn this improves his/her motivation during the learning process. This requires the course material to be structured into essentially independent modules, freely accessible in whichever sequence is desired.

WebTr@iner Series

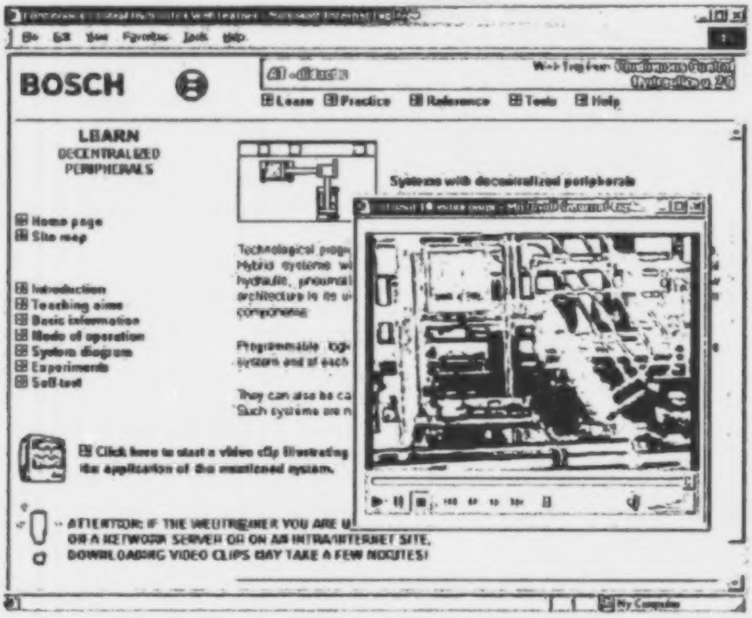
The WebTr@iner series consists of several educational courses, which have been developed in Web technology. All modules are directly accessible by the WWW browser. The network version may be directly run on a Web server, so networked learning and distance learning via Internet and training servers has become reality. The WebTr@iner is suitable for autodidactic learners who want to familiarize with a subject as well as for trainers aiming at lively multimedia-supported classes.

Several e-Learning tools are available: Hydraulics-Basics; Hydraulics-HS2, Electro Hydraulics; Pneumatics-Basics; Pneumatics-Controls, Continuous Control Hydraulics. All systems are modular in concept and can therefore be directly adapted to specific requirements. They can be extended and combined with each other at any time and in accordance with the learners' wishes. By personalization of course content based on the personal skill of a targeted individual Role Based Training is ensured.

Above all, effective learning is based upon the quality of the training and the training system as well as upon practical exercises. The varied design of the WebTr@iner series including quality images, graphics and sound-videos ensures an interesting training course and facilitates knowledge transfer. Trainers comprise an intuitive user-friendly interface, a convenient navigation system; a modular architecture; a proper ratio of text material and animations.

An environment for *learning by doing* on the basis of developed interactive tools and *learning by discovering* based on the simulation of real systems are provided. The developed Web trainers offer a virtual classroom experience that combines the benefits of traditional classroom training with the flexibility of e-**Learning** in order to increase learning with high moment of teaching value.

WebTr@iner Structure



Click here to start a video clip illustrating the application of the mentioned system.

ATTENTION: IF THE WEBTR@INER YOU ARE U
ON A NETWORK SERVER OR ON AN INTRA/INTERNET SITE,
DOWNLOADING VIDEO CLIPS MAY TAKE A FEW MINUTES!

Figure 2: Basic information page of the WebTr@iner

All tutorials have a common structure (Fig. 2) build around the aim to offer a learner-centred environment, in which the learners are actively involved in the learning process. Generally the WebTr@iner structure has **Learning**, **Practice** and **Test** sections. Advanced Web technologies and methods, which encourage learners participation are used to the maximum extend in all sections.

A video clip shows practical application of the considered component or system in industry or real life.

Mode of operation is illustrated by 3D animated model. Animation is a particularly valuable technique when it illustrates phenomena, properties, and any topics, which cannot be effectively described by static published lecture notes. High degree of animation and interaction are of crucial importance to the presentation. Interactive animations provide insight into the inside of component and illustrate its functionality.

After the consumption of the individualized training unit, the trainee gets the chance to practice the newly obtained knowledge. A **virtual reality** play model is provided to visualise the functions and flow characteristics of hydraulic or pneumatic components. Virtual reality models of components are a good opportunity to bring more transparency into dynamic processes occurring into the component during its operation.

BEST COPY AVAILABLE

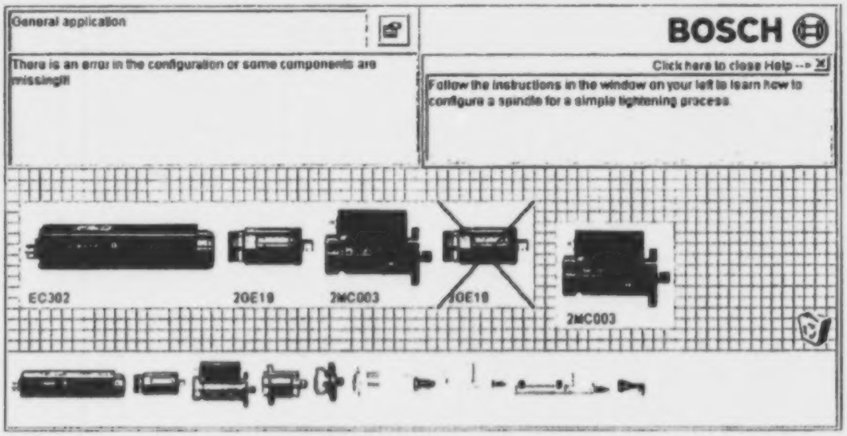
Practical training via **interactive simulators** can contribute considerably to an easier and deeper understanding of the learning material. In systems simulations, the trainee may apply the newly gained theoretical knowledge to entirely risk free practical solutions and trace the interaction of components. **Guided experiments** are also provided in which learners should follow step-by-step instructions of virtual tutor. Correctness of learners' actions is checked at every step.

The evaluation of the gained knowledge and assessment of the level of understanding are the natural accompanying measures of the self-learning process. **Tests** are a special kind of interactive learning. The test questions are designed in a way to illustrate as clearly as possible what the learners are expected to learn and which aspects are more important than others.

Interactive Tools

A better understanding of the physical, electrical, and mechanical properties is strongly desirable, because of the increasing complexity of today's industrial applications. This is not possible without hands on experience. For this reason practical training is very important. The skills obtained through problem solving are a strong contribution to the introduction of learners to the behavioural patterns of today's industry.

Assembly Unit



General application

There is an error in the configuration or some components are missing!!

Follow the instructions in the window on your left to learn how to configure a spindle for a simple tightening process.

Figure 3 Java based interactive assembly tool

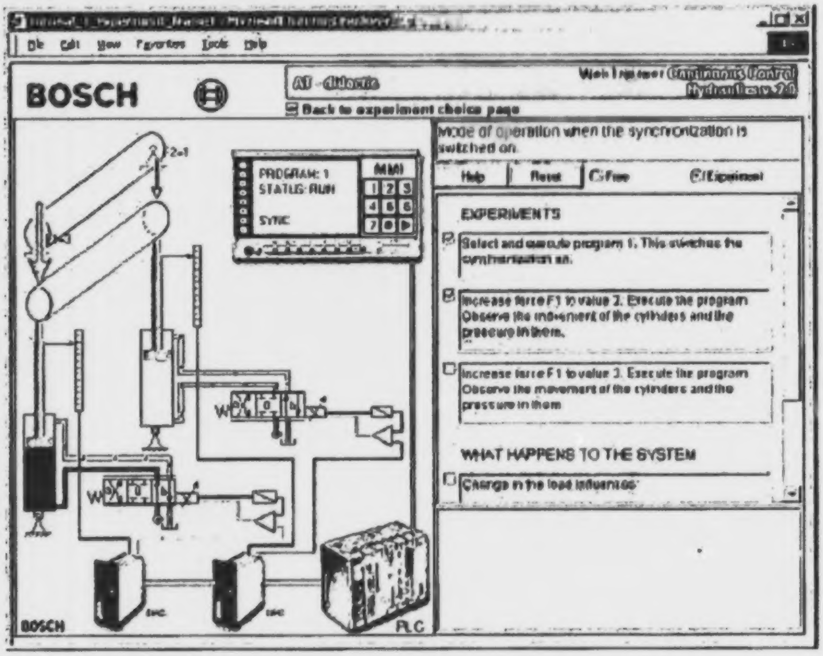
The assembly unit is developed as a general-purpose interactive tool for assembling different systems from the predefined set of components. Users can interactively choose every one of components and move it to the right place in the system, which should be assembled. Checking facilities and context sensitive on line help are provides as well.

The tool has three regimes called "show me", "guide me" and "try me". The first shows the right way of assembling the system being on consideration as well as sequences of user actions that should be done for obtaining such result. These sequences include choosing appropriate component for placement, moving it to the right position and placing there, choosing the next one etc. The second regime like an intelligent "virtual tutor" guides users step by step during assembling. In this regime incorrect actions are prevented and the user can start placement of the next component only if the previous one has been placed to the right position in the system. The wrong component and the wrong position are disabled for using. The third regime allows for free placement of every component at every position in the system. The Check facility is intended to show users correctness of their actions. All obtained errors are marked on the screen and an appropriate report is provided to the user. Fig. 3 shows the user interface of the interactive assembly tool and the result from checking of the current system configuration.

BEST COPY AVAILABLE

System Simulators

Technological progress has led to new approaches to complex production processes. Hybrid systems with open system architecture have replaced traditional hydraulic, pneumatic and electric systems. They link and control all system components. Such systems are mainly used in high technology environments. Their proper operation need appropriate maintenance staff, which should have a firm understanding of the whole system.



Mode of operation when the synchronization is switched on.

☑ Select and execute program 1. This switches the synchronisation on.

☑ Increase force F1 to value 2. Execute the program. Observe the movement of the cylinders and the pressure in them.

☐ Increase force F1 to value 3. Execute the program. Observe the movement of the cylinders and the pressure in them.

☐ Change in the load influences:

Figure 4: Java based system simulator

It is very important learners to have opportunity to obtain hands-on experience working with the system. It is not common practice in industry to stop technological process and to use production system for education. This is also very risky, because using product equipment by unqualified learners can easily lead to personnel hazards and material damages. For this reason interactive simulators are very useful for training. They provide the learners with an easier and better understanding of complex problems using simulation to animate various properties, operational principles and phenomena.

Fig. 4 shows an interactive Java based simulator of one Bosch continuous control hydraulic system with decentralized peripherals. Programmable logic controls (PLC) ensure predefined functionality of the whole system and each individual component. The system can perform different operations depending on the program incorporated. By clicking on the man-machinery interface (MMI) unit users can change the program and observe the signal sequences, interactions between different components in an automated system, sensors reaction and corresponding action of the robot and other equipment in the production line. All dynamic processes are visualised by changing colours for signal sequence, sensors and different fluid pressures. Animations are used for a products flow on the product line, robot hand movement and cylinder rod movement for current forming operation. Changing the program will change the PLS command and the same equipment will perform quite different operations. For educational purposes the main component of the system appears in the screen in the same manner as in real production process.

BEST COPY AVAILABLE

Intelligent "Virtual Tutor"

In the previous section the so-called "free experiment mode" of the interactive simulator was considered. "Guided experiment mode" is also provided. To increase teaching value in the tutorial an intelligent "virtual tutor" is used in guided experiments. The idea is to stress learners' attention on important topics, on specific features of the system, on critical operations or on required sequence of operations, which should be performed for guaranteeing error-free mode.

There are two experiments per tutorial, which force learners to follow step-by-step instruction to complete the experimental task. This "virtual tutor" not only guides learners, but at every stage checks if they have properly performed the task. If not, the next step is disabled. On line help is also provided on request.

Fig. 4 illustrates the free and experimental modes of the simulator. In free mode all the controls are accessible. During the experimental mode all controls are disabled except the particular one needed for that task.

After successfully completing the guided experiment the learners are requested to answer two questions in order the "virtual tutor" to check if they have understood the system's mode of operation. Learners obtain on-line feedback of correctness of their answers.

By becoming an active part of the learning process, the learner is involved in a self-organised discovery process. Thus he/she can learn not only the basic properties and processes, but also acquire a better and deeper understanding of the analysed subject.

3D Virtual Reality Models

Virtual Reality Modelling Language (VRML) is used for 3D representation and simulation of dynamic technological processes. The created virtual environment gives the user opportunities to play and experiment risky-free with complex machinery, to take a look inside the different components, to learn about their controls and adjustment procedures.

Most of the 3D models have at least two different representations, each one with a different level of details. Depending of the proximity of the user to the component, a more or less detailed model is visualized. Cross-sectional models help for better understanding of how the components work Components can be rotated and examined from any direction; the paradigm of "Walk" and "Fly" is used to navigate in a complex environment. A mathematical model is used for calculations of output pressure and flow rate according input values and user presets and adjustments at run-time. This permits complete hydraulic/pneumatic schemes to be composed and simulated by linking together inputs and outputs of different components.

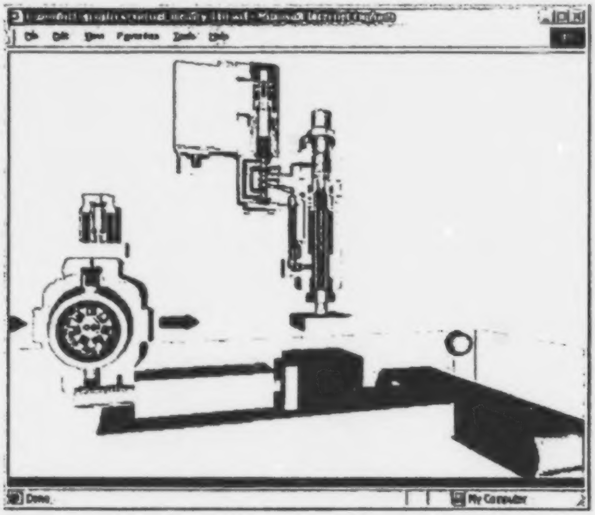


Figure 5: VRML 3D model of the decentralised hydraulic peripheral system

BEST COPY AVAILABLE

Fig. 5 illustrates an automated system composed of hydraulic press, robot application and a transfer system. The changes of flow rate and pressure in a continuous controlled hydraulic system with a **variable displacement pump,** 4/3 Direct Control Valve (DCV) and a double acting hydraulic cylinder are examined. The model helps to illustrate the relationship between needed press power and displaced volume by the hydraulic pump.

A program, simulating a Programmable Logic Controller (PLC), drives the action sequences from the press, robot and the transfer system. The VRML model and the Java-based PLC Simulator are linked via the External Authoring Interface (EAI).

This approach allows for the creation of free-programmable virtual environment. It can be used for simulation of different technological processes only by changing the program, interpreted by the PLC Simulator.

Conclusions

Training and enhancing the skill and expertise of personnel is imperative. But the complexities of today's fast paced business environment make effective training and continuous learning a challenge at best. That is where **e-Learning** will provide its benefit.

This paper describes an intelligent interactive **e-Learning** system for teaching hydraulics and pneumatics. In addition to theory, it includes:

- Video clips illustrating the basic application of the system;
- Many animated pictures showing components' mode of operation;
- Virtual 3D play models of the basic components;
- Interactive assembly unit, for system assembly from predefined set of components;
- Interactive system simulator demonstrating different modes of operation;
- Intelligent "virtual tutor" guided experiments
- Self-tests.

The main advantages of the proposed intelligent WebTr@iner can be summarised as follows:

- The teaching method used illustrates complex processes in an easy, clear and attractive manner;
- It takes into account the different levels of knowledge of students starting the course;
- As an Intelligent Tutorial System it reacts to the students' capabilities and mistakes;
- It is quickly accessible, easy to update and distribute;
- Widespread geographical areas will not cause a logistical problem.
- It provides a time and cost effective training of users;
- WebTr@iner is available in various languages;

The implementation of the Intelligent Training Courses and modules on the Internet/WWW allows the sales personnel and technicians to work autonomously at any time and at any site. Together with the didactic department of Bosch Automation a system was developed to easily train staff worldwide. The ITS approach offers scope of application in training curricula that similarly require complex and global solutions i.e. corporate management or sales training as well as electrical and mechanical engineering. Distance education through network offers tremendous opportunities not only for continuing education but also for education in general to break the barriers of place and time that otherwise limit access to teaching.

References

Bosch AT-Didactic, (1999). Solutions in Didactics for Automation, *Sauth Africa -Geman Conference & Exhibition on Human Resources Development and Qualification*, pp. 34-38

Donoval, D. (1999). CAL/CBT modules – Comprehensive Learning Tools, *Conference on Computer Aided Engineering Education, CAEE'*99, Sofia, Bulgaria, pp. 23-31

Hyperwave (2000). Knowlegde Management based e-Learning http://www.hyperwave.com/e/products/els_elearning.html

IWL Martens GmbH, (1999), Personality Development with Multimedia, *Sauth Africa -Geman Conference & Exhibition on Human Resources Development and Qualification*, pp. 6-8

Maurer, H. (2000). How Modern WWW Systems Support Teaching and Learning, http://www.iicm.edu/gentle.htm

Schomockel, H., Falter, T. and Beinvogl, W., The view of Siemens on Training, Collaborative Projects, Continuing Education, *2^{nd} European Workshop on Microelectronics Education*, Kliwer Acad. Publ. 1998, p.3

Wolz,. U., Palme, J., Anderson at all., 1997, Computer-Mediated Communication in Collaborative Educational Settings, *ITiCSE'97 Working Group Reports and Supplemental Proceedings © 1997* ACM 1-58113-012-0/97/0010, http://www.dsv.su.se/~jpalme/distance-education/iticse-cmo-in-education.html

An Evaluation Framework for the Development Process of an Online Curriculum

Karen Belfer
Simon Fraser University
2400 City Centre, 10153 King George Hwy, Surrey, BC, Canada V3T 2W1
karen_belfer@sfu.ca

Ron Wakkary
Simon Fraser University
2400 City Centre, 10153 King George Hwy, Surrey, BC, Canada V3T 2W1
ron_wakkary@sfu.ca

Abstract. The aim of this paper is to demonstrate how an evaluation framework was developed and implemented in order to support goals of an e-learning university. The paper will discuss the aim of assessment to support institution-wide e-learning goals, the benefits and challenges of this approach to assessing the development of content for e-learning, a description of the evaluation framework and the assessment tool GUIDE (Guided Instructional Design Evaluation), and the results based on implementation for the development of graduate and undergraduate programs.

1.0 Introduction

We introduced an evaluation framework to support assessment of the development process for e-learning content. The aims of the framework are: a) implementation guidelines for the development process that based on best practices in pedagogy; b) the strengthening of participants' ability to evaluate their own and others development efforts; c) creation of effective assessment practices; d) dissemination of information including information about our collective development strengths and weaknesses.

The larger aims of the evaluation framework were to emphasize the development of learning and support staff, ensure formative assessment and feedback to continually improve our processes and procedures, and to support an institution-wide mission and goals for learning, resulting in design strategies to accomplish these goals.

2.0 Supporting Institutional Goals

In the case of Technical University of British Columbia (TechBC), the assessment of the development process is strategically shaped by the need to support institutional goals of effective learning, learner-centered learning, and the effective use of technology.

"As an evaluator you assess what is important, thus influencing educational processes and products, and moving these closer to a prescribed level of quality. In any organization, quality is ensured by strategic assessment practices that acknowledge, through the factors that are examined, the mission and goals of the organization." (Orden, 1982:23)

The mission of the academic program can best be described as creating an accessible and effective learning environment. The use of evaluation of the development process strives to achieve and support the mission and goals of the institution within the curriculum and its delivery.

2.1 Effective Learning

Learning effectiveness is a key composite measurement of institutional, program, and module/course level assessment results. For example, at TechBC, following scalability factors discussed by Tony Bates (Bates, 1995), the development clusters, and the assessment phases of the development were seen to be central supporting tools of assessment in relation to delivery models, and instructional design.

The renewed emphasis of the learning environment and the role of instructional design in e-learning require support of assessment methods. The assessment of the development process supports and ultimately validates effective learning activities and delivery environments.

2.2 Learner Centered

Policy directions of the use of evaluation models aimed to re-enforce good assessment practices helped achieve the goal of learner-centeredness as described by Patricia Cross, "...students and their learning should become the focus of everything that we do. From the instruction that we provide, to the intellectual climate that we create, to the policy decisions that we make..." (Cross, 1998).

2.3 Effective Use of Educational Technology

Effective use of the technology in learning is best achieved by ensuring the application of the technology is considered to be interwoven with learning goals, learning and instructional design strategies, resources and logistics. The assessment of the development process and in particular the Quality Circles support this approach and aid in ensuring its successful implementation, becoming a critical component in support of technology and learning goals.

3.0 Benefits & Challenges

3.1 Effective curriculum implementation

In relation to curriculum planning, the goals of TechBC, are to be interdisciplinary in learning strategies and knowledge sharing, and to provide a quality consistent learning environment that nurtures the use of educational technology and is learner centered, regardless of the discipline. Cross-program implementation of the development process supported the curriculum planning goals.

TechBC was faced with a need to look for efficient, scalable methods of developing large numbers of courses – often in new formats and using new technologies – while continuing to meet high pedagogical standards. Some institutions have approaches that are rich in the support and implementation, but too rigid or not applicable in large-scale production (Leacock, et al, 2001).

Scalability in the development process is achievable through the embedding of learning technology. The process of embedding learning technology is not insignificant (Laurillard, et al., 1993). One reason for this is the considerable range of skills that need to be acquired if embedding is to be carried out in a professional way (Phelps et al., 1999).

Early research into the requirements for the design tool showed that there was clear need for support in the process of designing or redesigning courses, in order to take advantage of the opportunities provided by learning technology. For effective use of technology practitioners should be given training, professional development and continuing support.

The reality of having faculty with different skill sets, all knowledgeable in the use of technology, but a wide range of expertise in educational technology, curriculum knowledge, and course development needs to be addressed. Defined development processes, project management and an integrated assessment framework aids substantially in identifying the skill gaps of the people undertaking the task (Conole and Oliver, 1998).

3.2 Effective Management

The delivery of the academic programs aimed to be portable and scalable. Central to the issue of scalability is the need for assessment to support a learning practice that is understood in discrete elements (subject knowledge, pedagogical expertise, multimedia skills, assessment techniques), and understood as a team effort [CVCP, 2000]. At TechBC, inter-disciplinary cluster groups made up of faculty and support staff in assessment, instructional design, media development, research and project management ensured a high level of quality and effectiveness was achieved in the academic programs.

The assessment structures embedded in the development process support these outcomes and are integral to them. This approach to development allows for greater portability and scalability of the online curriculum.

3.3 Cost-effectiveness

Effective resource management is critical to the successful implementation of online learning. From an academic planning perspective, in order to support successful resource management, the components of intended learning environment must be fully formalized.

If the formative approach to assessment improves the quality of delivery, this ensures less cost at revision time.

4.0 Evaluation of the Development Process

There is literature that reflects on the use and goals of putting together an assessment strategy in the development phases of the project. Most of the time the guiding principle is formative (Calder, 1994); monitoring the development of the product at each phase to ensure quality and achievement of the objectives. In other cases the guiding principle is accountability. Yet, the most common approach is summative, measuring the final product against specific criteria.

Bates (1997) defined the following criteria as determinant factors of quality of an online course: a) content, b) media production, c) instructional design, d) project management, and e) delivery (Bates, 1997).

Most institutions concentrate their assessment efforts on the assessment of the course delivery, using learners' comments as the most common approach for accounting of quality in online courses, and as information required for revisions.

Course delivery has shown to have great dependencies on the quality of the development. The relationship lies in the idea that the quality of the delivery depends on the foundational development work put into the course -- the quality of the content itself, the value of the media production selected, and the skill of the content experts as an instructional designer and project manager. In addition to the support of resources and clear processes, quality development relies on an assessment framework to identify gaps and insufficiencies. It is clear in an elearning context, that reliability and quality of the outcome must be assured prior to delivery to learners, and not during.

Specifically, the purpose of assess the course/module development process are:

- To introduce a process for formative review and assessment of the development of the program and the course/modules.
- To implement guidelines for the development process that entrench good pedagogical practices.
- To invoke effective assessment practices.
- To effect management guidelines to ensure quality, fairness and validity, and serve the university's philosophy of innovation.
- To assess effective use of resources and identify skill gaps.

4.1 Stages of the development process:

The development process has five phases: 1) Planning phase, 2) Specification phase, 3) Design phase, 4) Production phase, and 5) Post- production phase.

Each phase has specified deliverables (Belfer and Nesbit, 2001). Institutionally, these phases are coordinated and initiated through an academic workflow process that ensures effective strategic goal setting, design, resource allocation, and implementation of all academic projects.

I. Planning (occurs prior to development cycle)

The purpose of this phase is to plan all or part of an academic program by specifying the program marketing strategy, student characteristics, modules, module objectives, and the pre and co-requisite relations between modules. It also includes creating a plan, assigning roles and responsibilities, such as project manager, membership for the different development clusters, and timelines.

II. Specification (2 weeks)

The outcome of the specification phase is information such as, course name, credit weight, course description, unit names, sequence of units, unit learning objectives, and brief descriptions of learning objects and activities planned for each unit.

The specification phase is very important in the development cycle. During this phase the high level instructional design is specified.

Developers concentrate most of their time doing research to determine the scope of the development, the level of the content, existing textbooks, learning objects, and educational technology options. Upon completion the developers expectations and/or requirements are measured against the existing delivery and evaluations models.

All the specifications are revised by a peer group responsible for contrasting specifications against program goals and system capabilities, and a determination is made at that time on whether the development is to proceed.

III. Design (4 weeks)

The purpose of this phase is to create and publish a prototype of the course in the online learning environment. A unit is regarded as approximately one week of learning time. The prototype includes learning objectives and outlines of web presentations, assessments and learning activities. An instrument called Guide (Guided Instructional Design Evaluation) is used in this phase to assess objectives, delivery model, assessment activities, learning activities, workload, teamwork, learning resources, and the level and quality of the content and web presentation.

IV. Production (8 weeks)

The purpose of this phase is to complete course development by creating learning objects and completing all course authoring and editing tasks. This phase is carried out by the course development team together with educational technology support. GUIDE is used in this phase to assess media elements, and to re-assess learning resources and the level and quality of content.

V. Post-Production (2 weeks)

The purpose of this phase is to ensure the material reads well for the web, outline recommendations for future development of the course, and develop the course delivery plan (e.g. instructors' notes).

4.2 Assessment Process

Table 1 describes the objectives and both formative and summative assessment procedures that would be applied at each stage of the module development process.

4.2 Design Phase: Quality Circles

Quality Circles was one of the most successful parts of the assessment process for meeting its objectives and building on the formative aspect of assessment. Approximately two months into the development cycle. A team that consisted of experts in instructional design, assessment, module content areas, and representatives from the academic planning and academic operations areas (Quality Circle Team) would review a prototype unit.

The Quality Circle team uses Guide to evaluate these prototype units against pre-defined criteria that addressed the learning objectives, assessment strategies, application of delivery models, learning activities, web presentations, interactivity, learner workload, content, balance between team-based and individual work, and match between the resources available for development and the needs of the module. Representatives from the Quality Circle team then meet with the developers to provide feedback.

In many occasions developers commented on the value of the process. Being timely feedback, the opportunity to share ideas, and cluster and interdisciplinary collaboration the key elements that motivated this comments. In a short period of time a great amount of data is gathered, analyzed and synthesize to provide developers with substantial feedback their at a critical juncture in the development process (Leacock, et al, 2001)

Table 1. Module Development Evaluation Process

	a) Planning Phase:	b) Specification Phase:	c) Design Phase: Quality Circles	d.1) Production Phase:	d.2) Production Phase: Editing	e.1) Post-Production Phase: Show & Tell	e.2) Post-Production Phase: Roll up	e.3) Post-Production Phase: Status
Goal:	- Determine the quality and value of the programs. - Ensure consistency across program areas.	- Meets objectives of program design - Resource Planning	- Meets objectives of quality of the Instructional design. - Content expertise - Development performance - Content quality assurance - Instructional design quality assurance	- Content expertise - Development performance - Content quality assurance - Instructional design quality assurance (media production)	- Readability - Consistency	Accountability	Summative report	On-going: Status of the course/ module
Use:	Accountability.	Provide feedback to the course/module developers to improve the course/module development process and the quality of the end product	Provide feedback to the course/module developers to improve the course/module development process and the quality of the end product	Provide feedback to the course/module , developers to improve the course/module development process and the quality of the end product	Provide feedback to the course/module developers to improve the quality of the end product	Provide feedback to the course/module developers to improve the quality of the end product	Record	Course production Coordinator
By Whom:	Curriculum Academic and Assessment Planning Group (CAAP)	DAP?	- Instructional design and content: Quality Circle team (Assessment Coordinator, Development Cluster Leader, Instructional Designer, Educational Analyst, Course Development Researcher, Dean of Academic Planning) - Project management. - Content Quality: Cluster Manager	- Instructional design media production: Quality Circle team (Assessment Coordinator, Development Cluster Leader, Instructional Designer, Educational Analyst, Dean of Academic Planning Media Developer) - Project management: Tracey Leacock - Content Quality: Cluster Manager	Online editors	CAAP and peers	Assessment coordinator	ET&L production and delivery team
Role:	Summative	Formative	Formative	Formative	Formative	Summative	Summative	Summative
Milestone Stage:	N/A	Last task of the specification phase, before the design phase starts.	Last task of the design phase, before the production phase starts.	Middle of the production phase.	Middle of the production phase.	End of the production Cycle	End of the development cycle	End of the development cycle
Data Collection:	N/A	Specification document Part I(see Appendix 1). Module names, module object ives, learners workload, teaching and lab resources, etc.	- Complete Specification document. Module names, module objectives, unit names, unit objectives, unit learning activities (assessments, web presentation, in class activities, online activities) learners' workload, teaching and lab resources, etc. - Sample of one unit on the CMS.	Information on the Course Management System (CMS).	Information on the CMS.	Information on the CMS.	- Primary Trait Analysis (PTA's) - Reports form Quality Circles - Report form online editors - Post mortem of development	Editing - Copyrights clearance - Media Production or acquisition - Delivery components

	a) Planning Phase:	b) Specification Phase:	c) Design Phase: Quality Circles	d.1) Production Phase:	d.2) Production Phase: Editing	e.1) Post-Production Phase: Show & Tell	e.2) Post-Production Phase: Roll up	e.3) Post-Production Phase: Status
Elements to be Assessed:	- Coherence. - Meeting the academic program objectives	- Course outlines - Learner workload - Lab, teaching and learner resources - Delivery Model (choice, balance)	- Instructional design (objectives, delivery model, assessment activities, learning activities, learning resources) - Project management: Management of time, human resources, communication, and standards. - Content: Expertise and quality.	-Instructional design (media production, objectives, learning resources) - Project management: Management of time, human resources, communication, standards. -Content: Expertise and quality.	Content	Content and overall structure of the end product.	Overall assessment process. Structure of the development process	Readiness for delivery
Questions Asked:		- Are the objectives been met? (Program, content level, integration) - Appropriate choice of, learning resources? - Reasonable workload? - Appropriateness of the delivery model?	- What is working? - What needs to be improved? - How can it be improved?	- What is working? - What needs to be improved? - How can it be improved?	- What is working? - What needs to be improved? - How can it be improved?	- What is working? - What needs to be improved? - How can it be improved?	N/A	N/A
End Product:	Program Plan	- Where needed: List of comments and recommendations for the developers addressing the elements being assessed.	- List of comments and recommendations for the developers addressing all elements being assessed.	- List of comments and recommendations for the developers addressing all elements being assessed.	- List of comments and recommendations for the developers addressing all elements being assessed.	N/A	Final Report	Status Report
Implementation Process:	N/A	- Extraordinary meeting	- The Quality Circles team will use the PTA to asses each course/module. - The learning staff responsible and the cluster manager will (self/peer) Asses the course too. - 1.5-hour session with each cluster.	- The Quality Circles team will use the PTA to Asses each course/module. - The learning staff responsible and the cluster manager will (self/peer) Asses the course too. - 1.5-hour session with each cluster.	N/A	N/A	N/A	N/A
Instrument for Assessment:	N/A	N/A	PTA: GUIDE (Generally Useful Instructional Design Evaluation) - Quality Circles	PTA: GUIDE (Generally Useful Instructional Design Evaluation) - Quality Circles	To be generated	N/A	N/A	

4.3 The Instrument: GUIDE

GUIDE (GUided Instructional Design Evaluation) was created in response to the need for an efficient, reliable and comprehensive instrument capable of supporting the formative assessment of all courses offered (Belfer and Nesbit, 2001).

Drawing from literature on instructional design (Diamond, 1998; Dick & Carey, 1996) a set of rubric-based items applicable to TechBC's modular learning structures and delivery models were created. The development and resulting format of the instrument is similar to the Primary Trait Analysis (PTAs) described by Walvoord and Anderson (1998). PTAs are constructed by identifying components or traits of the products to be assessed then creating a scale for each component and annotating each level of the scale with a descriptive rubric.

Several instructional design components expected to be present in TechBC courses were identified and few items for each component were determined. Table 2 shows the components and the number of items created for each component.

Table 2. Instructional Design Components Assessed by GUIDE.

Component	Number of Items	Component	Number of Items
Learning Objectives	4	Learning Resources	4
Delivery Model	3	Teamwork	4
Assessment Activity	5	Workload	3
Learning Activities	3	Media Elements	9
Content	8	Resources	4
Web Presentation	7	Support for Development	10
Editing	5	**Total**	**68**

For example, the Learning Objectives trait component was broken down into 4 items: Taxonomic Level, Clarity, Fit with Assessments, and Fit with Activities. Table 3 shows the item for Learning Objective Clarity.

Table 3. The Learning Objectives Clarity Item.

Objectives	Strong	Satisfactory	Weak	Absent	Score
Clarity: Objectives are clearly defined.	The objectives are clearly defined.	The objectives are somewhat clearly defined.	The objectives are not clearly defined.	The way the learning objectives are written does not provide information about the expected outcomes. **Or** No learning objectives are specified.	

5.0 Results

The formative assessment structures focused on product and process review, not performance evaluation. By structuring the review to focus on the deliverables, we reduced the anxiety and defensiveness that can be associated with personal evaluations. Instead, the emphasis was on working together to create the best modules possible, and the outcomes have supported this approach.

The most rewarding part of this process was seeing a marked improvement in understanding of instructional design concepts amongst developers over the course of the development cycle. Feedback that showed how these concepts apply to the work each person was doing provided developers with tools for current and future development projects (Leacock, et al, 2001).

The summative assessment structures mainly relay on accountability measures that help keep the developers on schedule with expected milestones and inform the community of the accomplishments obtained.

The development process is based on a cluster approach that enriches the products by providing developers with venues for collaboration and sharing. An emphasis on the development of learning and support staff, formative assessment and constructive feedback enable us to continually improve our processes and procedures to achieve our goals. It has created an institution-wide acceptance of the mission, goals and design strategies required to accomplish these goals.

6.0 References

Bates, A. W. (1997). *Restructuring the university for technological change*. The Carnegie Foundation for the Advancement of Teaching: What Kind Of University?

Belfer, K., Nesbit J. (2001) *GUIDE: An Instrument for evaluating quality of instructional design in mixed-mode university courses.* World Conference in Multimedia Hypermedia and Telecommunications (Ed-Media) Tampere, Findland, June 25- 31.

Calder, Judith (1994) *Programme Evaluation and Quality: A Comprehensive Guide to Setting up an Evaluation System.* Kogan Page.

Conole, G. and Oliver, M. (1998), "A pedagogical framework for embedding C&IT into the curriculum", ALT-J, Vol. 6, No. 2, pp. 4-16.

Laurillard, D., Swift, B. and Darby, J. (1993) "Academics' use of courseware materials: a survey", ALT-J, Vol.1, No. 1, pp.4-14.

Leacock, T., Farhangi, H., Mansell, A., Belfer, K. (2001) *Infinite Possibilities, finite resources: The TechBC course development process.* Paper presented at the Computers and Advanced Technology in Education Conference, Banff. June 2001.

Orden , A. (1982) *Evaluación Educativa*. Buenos Aires. Docencia.

Phelps,J., Oliver, M., Bailey, P. and Jenkins, A. (1999) The Development of a generic Framework for Accrediting Professional Development in C&IT, EFFECTS Report No.2, University of North London.

Lessons from An Action Research on Project-based Learning in a Web-based Learning Environment

Chien-hsing Wang
Graduate School of Education
National Changhua University of Education
Taiwan, R.O.C.
chwang@cc.ncue.edu.tw

Abstract : This study investigated issues on the project-based learning (PBL) approach with web technology. Action research methodology was employed for the investigation. Data included online discussions, an online questionnaire, and the transcripts of face-to-face interactions. Content analysis was used for data analysis. The findings showed that students required more scaffolds to become active learners and assume their learning responsibility. Their abilities of searching information, usingtechnology, and keyboarding also influenced their learning and participation. In addition, a powerful, stable, learner-centered system was needed to implement project-based learning effectively. Finally, the instructor's skills in dealing with emotional issues are important to successful online learning.

Introduction

Project-based learning has a potential to overcome inert knowledge. With PBL, learners have opportunities to foster their skills of inquiry, critical thinking and reflections by involving themselves in an authentic, complex learning context. Consequently, PBL serves precisely the need of connecting knowledge to the contexts of its application. However, to implement PBL requires a resource-based learning environment that augments collaboration, communication, reflection and authentic assessment. Web technology enables educators to create such a rich resource-based learning environment. Therefore, he paper intended to discuss critical issue in implementing PBL in a web-based learning environment from a teacher-researcher perspective. First, the rationale for the course and research design is presented, then, the research results and finally the reflection on teaching based on literature.

Rationale

It is a necessity for educators to arrange the kind of present experiences that live fruitfully and creatively in subsequent experiences according to Dewey (1953). Educators have the responsibility of being aware that environments can shape student's actual experience and recognizing what surroundings are conducive to learning experiences leading to growth. School education must give each present experience a worthwhile meaning, and should be an ever-present process if knowledge application in the real world is expected.

Students are motivated to deepen their understanding of key concepts and sharpen their skills if they perceive the apparent connection between what they learn in school and its potential uses of that knowledge in real world situations (Steinberg, 2000). One goal of project-based learning (PBL) is for students to learn, and be able to use formal knowledge in an authentic and complex setting (Barron, Schwartz, Vye, Moore, Petrosino, Zech, Bransford, & the Cognition and Technology Group at Vanderbilt., 1998). PBL is intended to combat the inert knowledge and to enhance learning by engaging students in authentic, real world task as that in professional situations (Guzdial, 1998; Laffey, Tupper, Musser, & Wedman, 1998; Poell, Van Der Krogt, & Warmerdam, 1998; Schwartz, Brophy, Lin, & Bransford, 1999; Steinberg, 2000). However, PBL also challenges students and teachers and overwhelms the cognitive support structures found in contemporary education (Laffey et al., 1998).

Web-based instruction is an application of a repertoire of cognitively oriented instructional strategies implemented within a constructivist and collaborative learning environment, utilizing the attributes and resources of the Web (Relan & Gillani, 1997). According to Relan & Gillani, the assumptions of WBI are as follows: (a) the learner has access to the Web at all times and is allowed to explore it in a self-determined or guided sequence, (b) WBI would function best in a constructivist environment, (c) teachers as a facilitator for finding, assessing, and making meanings from the information discovered from a variety of media, and (4) learning occurs in an interdisciplinary fashion without regard to the attainment of learning objectives within a fixed time frame. Therefore, this study was to implement PBL in a web-based learning environment on the course of Introduction of Education.

Research Design

Course Design

Based on the aforementioned rationale, the course design for this study was anchored in the issue of network-café, which was a nation-wide hot issue at the time. Each group conducted a self-directed project to present their perspective on the issue based on the knowledge domain they chose (ex. parenting, educational psychology, etc.). The first three weeks were devoted to the introduction of the course, the web-based learning environment, and the Software of Netmeeting in face-to-face classroom settings. The following five weeks were online roundtable meetings on the issue of network-café focusing on specific topics (e.g. family relationship). There were students-teacher online group meeting during the 9th and 10th week. In the week of midterm, the software of Media Master Recorder was taught to two representatives of each group in a face-to-face setting for their project purpose. Students submitted their project in a written format at midterm and critiqued peer's work online. Then, they were asked for revising their work based on both their peers' and the teacher researcher's feedback. Finally, they submitted their project in the format of oral presentation clip with text for the grade. A face-to-face self-evaluation meeting was held in the last week. An online questionnaire was administered after the final meeting during the same week and the following one.

Subjects, Data Collection and Data Analysis

Forty-six students participated in this study. Most were freshmen majoring in Special Education except for two freshmen majoring in Guidance & Counseling, two graduates in Special Education and one graduate from Science Education. Data collection included student-teacher interactions via online synchronous discussion and e-mail, face-to-face meetings, online roundtable meetings, online asynchronous discussions, the online questionnaire, and the transcript of self-evaluation meeting. Content analysis was used for data analysis. The framework of "teaching presence" by Anderson, Rourke, Garrison, & Archer (2001) was used as a reference to analyze the data mentioned above.

Results

The results showed that the teacher researcher made efforts on scaffold student learning by teaching them how to learn. The pattern of teacher researcher's teaching is outlined as follows: asking students to articulate what they learned from their reading, to explain the relevance of their reading to group project or the anchored issue, and to request a practical action plan for their proposed ideas or solutions. In addition, the teacher researcher facilitated discourse by presenting probing questions: clarification, explanation, challenging, and making meaningful connection.

Although the teacher researcher put efforts on facilitating discourse by using probing questions, students expected more direct instruction. Their learning motivation was declined because they were not goal-driven for their project. Neither did they obtain more comprehension about the issue of network-café, nor did they deepen their understanding of the subject matter of their study. They felt overwhelmed by their project because of lacking domain knowledge. They did not know how to delineate their project and find useful resources. They were also tired of discussing the same issue for the whole semester without any in-depth deliberation. They suggested that a variety of issues should be included in the course and believed they would have done better if more lectures were given in traditional face-to-face settings.

Students preferred face-to-face interaction rather than online interaction. They felt the sense of *reality* via face-to-face interaction. One student pointed out that none of them had experience on web-based learning and were not ready to be an active learner. They expected lectures and answers from the teacher. He suggested to devote a half of the class time to the lectures in the traditional classroom setting to serve as a transition. The majority of those who voted for face-to-face class meeting agreed with him.

The results also revealed that most of their group discussions were held in a face-to-face setting. Their participation in online asynchronous discussion was declining from the beginning to the end of the semester. Convenience was a factor. It was more convenient for them to discuss face-to-face because most of them took the same other courses. They met each other quite often. They further identified two major reasons for their avoiding online interaction: lack of keyboarding skills and the stability of the university network system. In fact, both students and the teacher researcher were overwhelmed by the technical problems of the web-based learning environment.

Most students were frustrated by insufficient computer skills that made their learning more time consuming. In fact, their learning time was doubled in comparison with those courses taught in the traditional setting. The time was spent in acquiring computer skills rather than learning domain knowledge. However, the intimacy of peer rapport was enhanced because they often worked out technical problems together.

Reflections

Balance between Structured Instruction and Empowerment Learning

PBL requires the balance between structuring learning and empowering individual in their learning. Deep learning does not occur with PBL if "doing" of a project takes precedent over "doing with understanding" because students do not have a driving question that fosters focused inquiry (Barron et al. 1998). Students' learning outcome of this study corresponded to the assertion by Barron et al. Students needed scaffold to transit from a teacher-centered approach to a learner-centered approach. Teachers should provide instructional scaffolding in encouraging goal-driven and meta-cognitive processing if project-based learning is considered (Barron et al. 1998; Laffey et al., 1998; Land & Greene, 2000).

Requirement of Domain Knowledge, System Knowledge, and Meta-cognition

Students participated in this study encountered serious difficulty of finding valuable information for their project because of lacking domain knowledge, system knowledge and meta-cognition. Traditional teacher-directed education creates a fundamental problem for project-based learning that emphasizes exploration and learner-centered thinking (Hill & Hannafin, 1997). Simply providing access to information does not guarantee effective learning (Land & Greene, 2000). Scaffolding students in fostering divergent thinking, multiple perspective building, critical thinking and problem solving is needed to help them adapt project-based learning. (Hill & Hannafin, 1997). The interplay between meta-cognition and domain knowledge are critical to the success in project-based learning.

Strategies for Leading to Active Learning and Reflection

Learning-community is critical to online learning (Palloff & Pratt, 2001; Poell et al., 1998; White &Weight, 2000). Interacting with instructors and their peers is essential if they are to master the concepts and skills associate with their profession (Ferry, Kiggins, Hoban, & Lockyer, 2000). The teacher researcher recognized the importance of online discourse and made efforts on facilitating discourse by probing questions. Unfortunately, the students did not have the sense of learning community and their participation was declined. According to Wang & Bonk (2001), online discussion is fostered by significant task structuring, controversial topics, student ownership, instructor modeling of system use, and role play. It also requires students to share thoughts, and analyze and critique others' thoughts (Wang & Bonk, 2001). Reflecting on the course design, the learning activities included the above elements by Wang & Bonk (2001). However, online discussion died for lack student active learning and effective self-reflection. Land & Greene (2000) assert that a learner-generated "need to know" is critical for purposeful knowledge-building. Students' active learning is critical to online learning (Harasim, Hiltz, Teles & Turoff, 1997; Palloff & Pratt, 2001; Simonson, Smaldino, Albright & Zvack, 2000). It is important to balance action and reflection, as well as facilitator intervention in project-based learning (Poell et al., 1998). The missing puzzle was what practical strategies would lead students to active learning and reflection.

Support of Learner-Centered Technology

Technology must provide scaffolds for a learner-centered approach requiring context-driven and individualized learning skills that not well cultivated in current educational system. Technological scaffolding for authentic inquiry must legitimately support and be aligned with both the teachers' interests in assessing student work, and the students' needs for support of the fluid and dynamic aspects of inquiry (Laffey et al., 1998). It is critical whether the assessment practices correspond to the goals and philosophies of project-based learning (Schwartz et al., 1999). Researchers have proposed models for technological support in project-based learning (e.g. Guzdial, 1998; Hill & Hannafin, 2001; Laffey et al., 1998; Schwartz et al., 1999).

Implementing PBL became cumbersome and impossible without the support of learning-centered technology. The web-based learning environment used for this study tended to be a teacher-centered design in comparison with the above models. The teacher researcher could not implement some online learning activities to get more student involvement (e.g. peer evaluation, sharing useful online resources etc.) because of the technology limitation. Consequently, a powerful learner-centered technology is a necessity to implement project-based learning on the Web.

Skills for Handling Emotional Issue

Establishing social organizations that promote participation is important to PBL (Barron et al., 1998). Palloff & Pratt (2001) emphasized the importance of creating a social context for participants to share their lives with each other to promote the intimate friendship in web-based learning. The "Café of Mood" was originally designed as a social organization by the teacher researcher. Unfortunately, the "Café of Mood" did not function as expected but became a discouragement to the teacher researcher because students posted their complaints on it. Some students indicated that they were too busy to participate in course discussion, but spent lots of time posting many complaints on the "Café of Mood." Such online student behaviors frustrated and disappointed the teacher researcher. The frustration, disappointment and discouragement impacted the student-teacher relationship negatively. This was an unexpected consequence.

A web-based PBL as a learner-centered approach is an educational paradigm shift for both the instructor and the students. The challenge for both teachers and students is to re-think their roles and responsibilities in the learning process (Anderson et al., 2001; Gersh, 2001; Hanna, Glowacki-Dudka, Conceição-Runlee, 2000; Kochtanek & Hein, 2000; Lawlor, 2000; Palloff & Pratt, 2001; Wang & Bonk, 2001). The change of teacher's role is both an emotional and a pedagogical challenge (Shrivastava, 1999). The paradigm shift arouses student resistance of change (Huba & Freed, 2000). Therefore, the teacher researcher needs skills to handle such emotional problems.

Conclusion

Teachers need help to be a coach and a facilitator. Students need support for taking self-directed projects, not just carrying out tasks assigned by the teacher. Both of them require new skills, approaches, resources and support systems while engaging in project-based inquiry (Laffey et al., 1998). Teachers require practical knowledge to balance empowering student learning on structured instruction. They also require practicable strategies that lead students to become active and self-reflection learners. They must scaffold students to acquire domain knowledge, system knowledge, and meta-cognition that are critical to the effective learning in web-based, project-based learning. A powerful learner-centered technology can support both teachers and students to effectively handle the challenge of the paradigm shift from teacher-centered to learner-centered. Finally, teachers should increase the level of tolerance to students' negative emotion and have skills for handling such emotional issues.

References

Anderson, T., Rourke, L., Garrison, D. R., & Archer, W. (2001). Assess teaching presence in a computer conferencing context. *Journal of Asynchronous Learning Networks, 5*(2), 1-17.

Barron, B. J. S., Schwartz, D. L., Vye, N. J., Moore, A. Petrosino, A., Zech, L., Bransford, J. D., & the Cognition and Technology Group at Vanderbilt. (1998). Doing with understanding: Lessons from research on problem- and project-based learning. *The Journal of the Learning Science, 7*(3&4), 271-311.

Dewey, J. (1953). *Experience and education.* New York: Macmillian.

Ferry, B., Kiggins, J., Hoban, G.., & Lockyer, L. (2000). Using computer-mediated communication to form a knowledge-building community with beginning teachers. *Educational Technology & Society, 3*(3), 496-505.

Gersh, S. O. (2001). Technology's role in creating the shared learning environment. *Multimedia Schools, 8*(5), 48-51.

Guzdial, M. (1998). Technological support for project-based learning. *Association for Supervision and Curriculum Development. Yearbook*, Alexandria, pg. 47, 25 pgs.

Hanna, D. E., Glowacki-Dudka, M., Conceição-Runlee, S. (2000). *147 practical tips for teaching online groups: Essentials of web-based education.* Madison, Wisconsin: Atwood.

Harasim, L., Hiltz, S. R., Teles, L., & Turoff, M. (1997). *Learning networks: A field guide to teaching and learning online.* Cambridge, Massachusetts: The MIT Press.

Hill, J. R., & Hannafin, M. J. (1997). Cognitive strategies and learning from the World Wide Web. *Educational Technology, Research and Development, 45*(4), 37-64.

Hill, J. R., & Hannafin, M. J. (2001). Teaching and learning in digital environments: The resurgence of resource-based learning. *Educational Technology, Research and Development, 49*(3), 37-52.

Huba, M. E., & Freed, J. E. (2000). *Learner-centered assessment on college campuses: Shifting the focus from teaching to learning.* Boston: Allyn & Bacon.

Kochtanek, T. R., & Hein, K. K. (2000). Creating and nurturing distributed asynchronous learning environments. *Online Information Review, 24*(4), 280-293.

Laffey, J., Tupper, T., Musser, D., & Wedman, J. (1998). A computer-mediated support system for project-based learning. *Educational Technology, Research and Development, 46*(1), 73-86.

Land, S. M., & Greene, B. A. (2000). Project-based learning with the World Wide Web: A qualitative study of resource integration. *Educational Technology, Research and Development, 48*(1), 45-68.

Lawlor, M. (2000). Online instruction strategies require close examination. *Signal, 54*(5), 29-32.

Palloff, R. M., & Pratt, K. (2001). *Lessons from the cyberspace classroom: The realities of online teaching.* San Francisco: Jossey-basess.

Poell, R., Van Der Krogt, F. J., & Warmerdam, J. H. M. (1998). Project-based learning in professional organizations. *Adult Education Quarterly, 49*(1), 28-42.

Relan, A., & Gillani, B. B.(1997) .Web-based instruction and the traditional classroom: similarities and differences. In B. H. Khan(Ed.) , *Web-based instruction* (pp.41-46). New Jersey: Englewood Cliffs.

Schwartz, D. L., Brophy, S., Lin, X., & Bransford, J. D. (1999). Software for managing complex learning: Examples from an educational psychology course. *Educational Technology, Research and Development, 47*(2), 39-59.

Shrivastava, P. (1999). Management classes as online learning communities. *Journal of Management Education, 23*(6), 691-702.

Simonson, M., Smaldino, S., Albright, M., & Zvacek, S. (2000). *Teaching and learning at a distance: Foundations of distance education.* Upper Daddle River, NJ: Prentice Hall.

Steinberg, A. (2000). Community-connected learning. *School Administrator, 57*(7), 40-44.

Wang, F., & Bonk, C. J. (2001). A design framework for electronic cognitive apprenticeship. *Journal of Asynchronous Learning Networks, 5*(2), 131-151.

White, K. W., Weight, B. H. (2000). *The online teaching guide: A handbook of attitudes, strategies, and techniques for the virtual classroom.* Boston: Allyn and Bacon.

The Design of an Integrated System for Web-based Distance Education

Hongxue Wang and Pete Holt
Centre for Computing and Information Systems
Athabasca University
1 University Drive, Athabasca, AB T9S 3A3
Canada
{harrisw, holt}@athabascau.ca

ABSTRACT

This paper details the design of an integrated system for Web-based distance education (ISWBDE. At the highest level, this system can be dissected into two sub-systems: an integrated course authoring system (ICAS) and an integrated course delivery system (ICDS). The integrated course authoring system (ICAS) is designed to help with, or automate the creation and management of curriculum, learning objects, and courses, whereas the integrated course delivery system (ICDS) is designed to generate personalized courses for individual students, to provide an integrated online learning environment on students' computers, an integrated tutoring environment for tutors and an integrated coordinating environment for course coordinators. The focus of this paper will be on the design of the whole system rather than the implementation, since we don't have enough space for those details.

1. INTRODUCTION

Distance education is an effective way "to remove barriers that traditionally restrict access to and success in university-level studies, and to increase equality of educational opportunity" (Athabasca University, 2002), and the World Wide Web is the most effective way to get people connected across almost any distance. Thus, Web-based distance education has become so far the best form of distance education, and is becoming a fast growing market worldwide.

As usual, Web-based distance education involves two phases: course development and course delivery. In the course development phase, an academic program including a detailed curriculum must be proposed, evaluated and fully developed according to the overall commitment and available resources of the institution as well as the current educational market. There are also other issues involved in program curriculum development and management such as credential and compatibility with programs offered in other institutions. Given a fully developed program, professors or subject matter experts can then plan, design and author each course in the program curriculum. The first thing in writing a particular course is obviously to define what a course is, or what should be included in a course package. This must be done at the beginning of a course development.

In the delivery phase of developed courses, it is generally required that instructors, tutors and students should work together in order to achieve certain designated teaching and learning goals. The detailed tasks for instructors, tutors and students to carry out in course delivery phase may be essentially different, however. So the first thing that must be done before a course can be offered or even developed is to decide what the instructor should do, what the tutors should do, and what the students should do, and most importantly, how.

In Web-based distance education neither of these two phases is an easy task. Therefore, it is important for institutions that offer web-based courses to provide course developers with some tools to automate the development of Web-based courses or as assistance, and to provide instructors, tutors and students some tools to accomplish their teaching and learning tasks over the World Wide Web.

In this paper we present the design of an integrated system for Web-based distance education that provides educators with support in both Web-based course development and delivery, and provides students with an integrated software environment to learn, to communicate with instructors, and to collaborate with others in both peer-to-peer and group mode. We will also recommend and describe certain important strategies and techniques necessary for the implementation. We will also explain the rational of each proposed functional module and recommended strategy and techniques for the implementation.

1.1 The integrated system as a whole

The whole integrated system we are developing is intended for upgrading or enhancing our existing course development and delivery system by providing instructors with an integrated system for course development and authoring, and providing instructors with an integrated teaching environment to teach, and providing students with an integrated system to accomplish their designated learning tasks, and to achieve the desired result. Accordingly, the whole system can be divided into two subsystems: an integrated course authoring system (ICAS), and an integrated course delivery system (ICDS). These two subsystems overlap at course server that takes input from the course authoring sub-system (ICAS), and makes output to the course delivery sub-system (ICDS).

In the following section we will describe details of these three parts of the integrated system for web-based distance education: the course authoring subsystem, the course delivery system and the course server that joins the above two subsystems together. We do not use the term e-learning here because we consider what we are doing now is closely relevant to the entire distance education system, of which learning is only a part.

2. The Design of Integrated Course Authoring System

In this section, we first detail the design of an integrated course authoring system, then outline some technical details on how the system should be implemented. The structure of the system is shown in Figure 1.

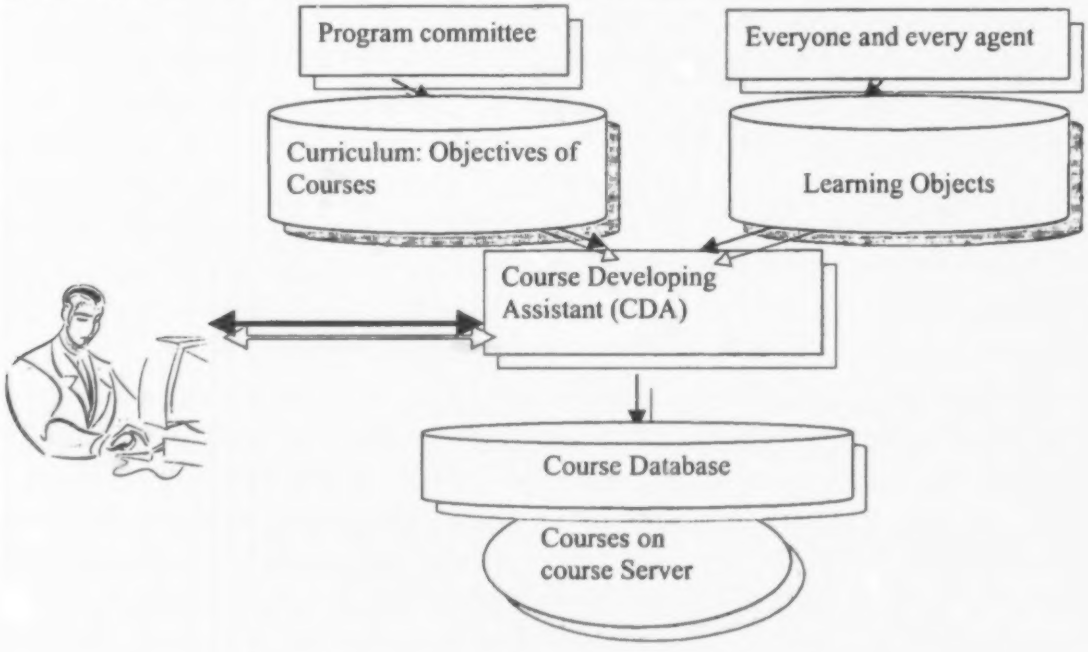


Figure 1: Structure of the integrated course authoring system

BEST COPY AVAILABLE

The ICAS system is based on two essential databases: a database of course or program objectives set up by the program committee and maintained by the program coordinator based on IEEE or ACM curriculum, a database of learning objects developed by a variety of people and software agents. A course is an association of course objectives with learning objects, and should be organised in accordance with certain widely agreed pedagogical approaches.

Therefore, the course developing assistant (CDA) should be design to help professors to: find out the right coverage of a course, create a list of units, then sections for each unit, and for each section generate a list of section objectives and then choose appropriate learning objects from the learning objects database. The CDA should also be able to automatically generate course study guide and all other files as well as data sets in the course database.

3. The Design of Integrated Course Delivery System

The integrated course delivery system consists of three parts for instructors/coordinators, tutors and students respectively. The relationships between these three systems are shown in Figure 2.

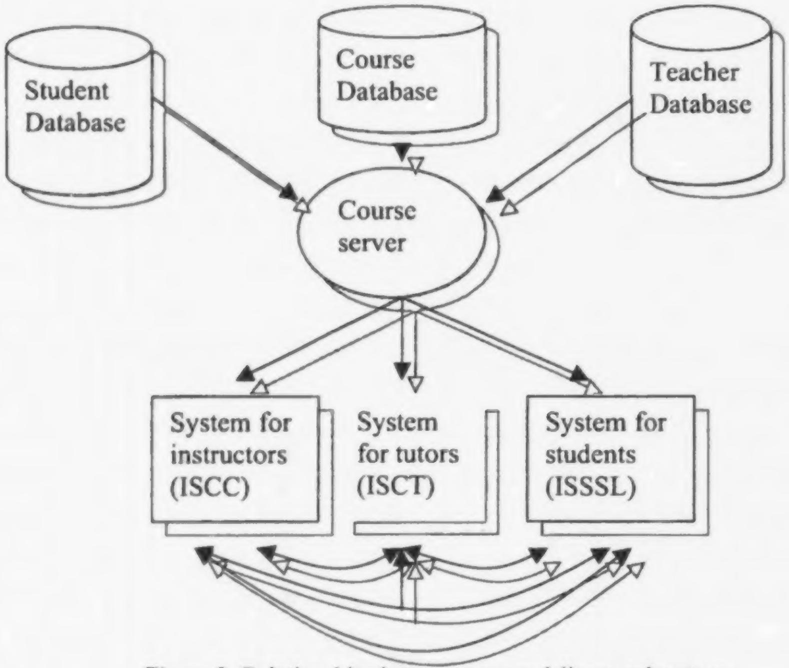


Figure 2: Relationships between course delivery subsystems

It should be noted that within our integrated course delivery system the three subsystems can interact with each other in both peer-to-peer and group fashion.

3.1 ISCC: INTEGRATED SYSTEM FOR COURSE COORDINATORS AND TUTORS

In Web-based distance education there is no face-to-face real-time instruction. As such, course coordinators often play roles of both coordinators and instructors in traditional universities. These roles include, but not limited to, *a.* assess students' qualification for course registration and make decisions accordingly; *b.* answer all hard questions and queries from students and even tutors; *c.* control the quality of teaching and learning by discovering and preventing plagiarisms, ensuring satisfactory performance of both tutors and students, continuously improving and quality and accuracy of course material including quizzes, assignments and exam questions.

To help course coordinators in accomplishing their jobs, our integrated system for course coordinators include the following modules:

1. ***Course presentation module***
   This module is essential to our integrated system. With this module not only course material marked in XML can be parsed and rendered with whatever output devices available on the user's computer. Learning objects including simulation and other course-specific programs can also be rendered in an effective way.

   In terms of network-related system performance and security, there is nothing to worry about, although some programs and simulation images will be of big size and can be more capable of doing things on client machines than traditional applets. The main reason is that most course materials such as course-related programs and images will be packed in the course package and downloaded by students only once, such as when a student has decided to start the course work. Later in the process of taking the course some updates or patches may be necessary for downloading from the course server, but that will not happen so often.

2. ***Course maintenance module***
   This module is responsible for assisting course coordinators to find inconsistency in course material, validate hyperlinks, identify and locate mistakes in the course material, and when capable automatically update course material based on coordinators' instruction and received messages.

3. ***Course messaging module***
   This module is similar to general email client such as Netscape messenger or Microsoft Outlook, but built into our integrated system for course coordinators (as we shall see shortly similar course messaging module is also built into integrated systems for tutors and students). The big advantage of developing and using such a built-in or specialized messaging module is that messages can be shared and manipulated by other modules easily. Also, some software agents can be easily built and deployed within such a specialized messaging module. Among these possible agents, an automatic question answering agent or FAQ agent will be most helpful since answering hard questions from students and tutors is an important duty of course coordinators.

4. ***Course conference module***
   While messages posted using the above messaging module are read and kept by the recipients and maybe the senders, messages posted at the course conference will be stored in a central server, and accessible to all course participants including coordinators, tutors and students. As usual, these messages will be threaded, and processed by some software agents for further actions such as course update, question answering. Although course conference is a place of open discussion about the course mainly for students, course coordinators do need to pay their attention to some hard questions. Technically speaking, the simple way to help course coordinators in this is to build a software agent into the conference module. What the agent is supposed to do is help identify those hard questions and send them to tutors or the course coordinator via the course messaging module, where some automatic question answering agents have already built.

5. ***Students assessment module***
   This module assesses both registered students and potential students who are seeking for professors' approval. The purposes of assessing a student registered in the course are: to identify potential plagiarism by checking the inconsistency among the results of quizzes, assignments and exams; to decide student's final grade; to evaluate the quality of the course by doing various statistics on student learning records. If the coordinator is also tutoring the course, assignment grading and management function should also be activated.

   To assess the qualification of a potential student, this module will simply communicate with the student seeking for missing information about his/her background knowledge and work experience, then compare with the course prerequisites. The assessment, and the data used in this assessment will be kept in a different database initially, but can be migrated to database for registered students.

6. ***Tutors assessment module***

As usual, a course coordinator is also the person, if not the only one, who is responsible for assessing and monitoring the performance of course tutors. The assessment is based on students' evaluation, statistics over messages in the course messaging and conference module.

7. *Task scheduling and monitoring module*

It can be easily imagine that course coordinators will have lots things to do. It is sometime very hard to decide when to do what without missing certain deadlines. The task scheduling and monitoring module is designed to identify questions to answer, emails to reply, and other tasks a course coordinator should complete and schedule these tasks for the coordinator, and monitor the progress of accomplishment.

The structure of ISCC including the relationships between the modules mentioned above is illustrated in Figure 3.

The integrated system is designed for use in a centre or department, and there is no such an integrated system at the university level yet. Therefore, until then messages from university registry and student administration regarding students, either in the course or merely interested in taking the course, will be sent to course coordinator at a regular email address, and be filtered and copied to a specific local file folder to which ISCC can access. These messages will then be processed by a parser for further decisions. Since students and tutors are all using their version of integrated systems, messages from tutors and students can be easily handled within the integrated course delivery system (ICDS).

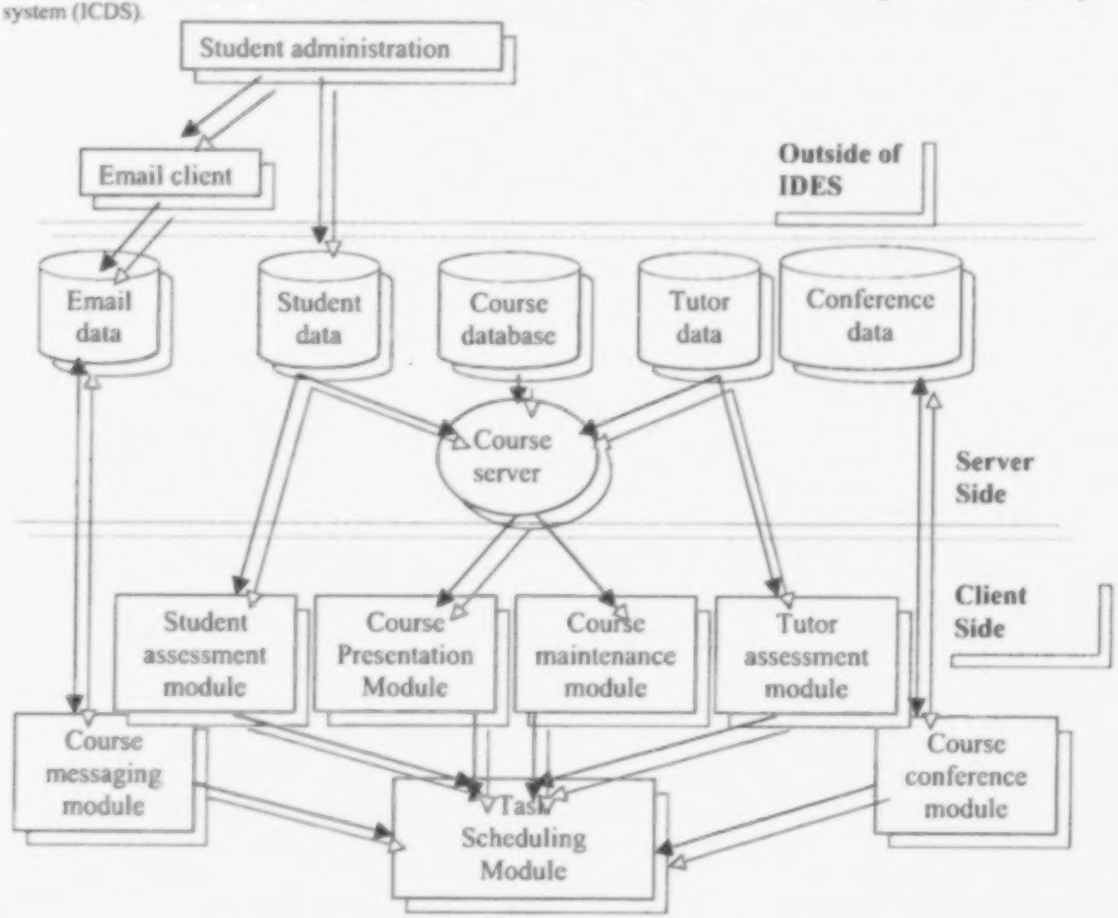

Student administration
Email client
Outside of IDES
Email data
Student data
Course database
Tutor data
Conference data
Course server
Server Side
Client Side
Student assessment module
Course Presentation Module
Course maintenance module
Tutor assessment module
Course messaging module
Task Scheduling Module
Course conference module

Figure 3: Structure of integrated system for course coordinators

The integrated system for course tutor also includes a course presentation module, a course-messaging module, a course conference module, student assessment module and a task scheduling and monitoring module. The function and the design of the first three modules are similar to that of ISCC. The function of student assessment module for tutors, however, is different from the module for course coordinators. Course tutors are responsible for marking student assignments while the course coordinator is generally not unless s/he is also tutoring the course. Therefore, the course assessment module for tutors needs to be able to help tutors in managing and marking student assignments. These may include, for example, retrieving student assignments from somewhere, or accepting student submission of assignments, reminding tutors to mark assignments, and record the marks. The plagiarism detection facility can also be built into ISCT for tutors.

3.2 ISSSL: INTEGRATED SYSTEM TO SUPPORT STUDENT LEARNING

The ISSSL is designed to bear the following features to support students learning:

- Be able to present a variety of learning objects to student.
- Presented course material should be personalized
- Learning progress can be self monitored by a student.
- If needed, a virtual lab can be provided to students to accomplish their learning task.
- Allow a student to communicate with course coordinators, tutors and other students, and the communication can be traced and followed up.
- Allow both peer-to-peer and group collaboration, etc.

Based on modules we have discussed so far in the two previous subsections, some of these features can naturally provided within some of the modules it can share with ISCC and ISCT. These modules are: course presentation module, course messaging module and course conference module. While the courses presentation module will focus on XML for creating and processing specialized educational tag sets, it will also include players for 3D and multimedia presentations. Likewise the messaging module will give students the option of email, instant messaging, whiteboard, and chat). For students two new modules have to be provided within ISSSL: a module that can help students to schedule their learning tasks and monitor the learning progress and a module for identifying and selecting suitable peer collaborators. The design for integrated system to support student learning is shown in Figure 3 on the last page of the paper.

4. Discussions

We have presented in this paper the design of a specialized integrated system for Web-based distance education presents. Compared with systems based on general-purpose Web browsers, one of the advantages of a specialized system is that we shall be able to present all kinds of course material to students including programs for simulation and virtual lab and other sophisticate functions. One more function may be possible is to implement a online exam module within ISCC and ISSSL by utilizing video camera connected to student computers.

5. ACKNOWLEDGEMENT

This research is funded by DALE (Distributed Adaptive Learning Environment) project at Athabasca University.

REFERENCES

[1] Athabasca University, http://www.athabascau.ca

[2] Vladimir Uskov, http://www.iasted.org/conferences/2002/cancun/chair-355.htm

[3] Scorm, http://www.adlnet.org/Scorm/scorm/

[4] Edward W. Felten and Michael A. Schneider, Timing attacks on Web Privacy, In Proceedings of 7th ACM Conference on Computer and Communication Security, page 25-32, ACM Press, 2000.

[5] Owston, R.D.: The World Wide Web: A Technology to Enhance Teaching and Learning. Educational Researcher, 6(2), 27-33, 1997.

[6] Blackboard products: http://products.blackboard.com/

[7] WebCT, http://www.webct.com/products

[8] IMS specification, IMS Global Learning Consortium, http://www.imsglobal.org/specifications.html

[9] CanCore, CanCore Consortium: http://www.cancore.ca/

[10] The MHEC Interactive Courseware Committee, Interactive Courseware Conceptual Framework, http://www1.umn.edu/mhec/ici/framework.htm

[11] Janette R. Hill and Arjan Raven, Online Learning Communities: If You Build Them, Will They Stay? http://it.coe.uga.edu/itforum/paper46/paper46.htm

[12] Introduction to catalyst tools, http://depts.washington.edu/catalyst/tools/#overview

[13] Pedagogic Models - Theories of Learning, http://www.staffs.ac.uk/COSE/cose10/pedmodel.html

[14] UMUC, Three Models of Distance Education, http://www.umuc.edu/ide/modltext.html

[15] Kotz, D. & Gray, R. (1999). Mobile Agents and the Future of the Internet, ACM Operating Systems Review, 33(3), August 1999, Pages 7-13.

[16] GroveNetworks, http://www.groove.net/

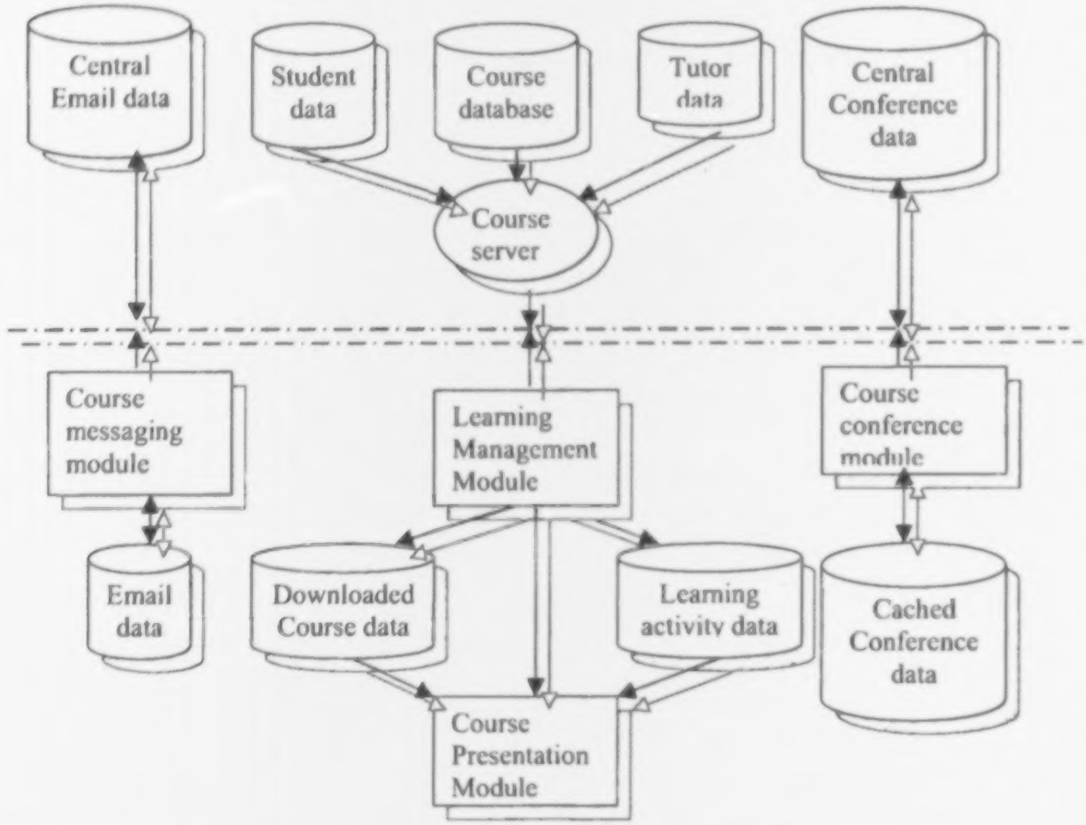

Central Email data
Student data
Course database
Tutor data
Central Conference data
Course server
Course messaging module
Learning Management Module
Course conference module
Email data
Downloaded Course data
Learning activity data
Cached Conference data
Course Presentation Module

Figure 4: Structure of Integrated System to Support Student Learning

The Study of Learning Progress for Distance Education Students in Taiwan

Sheng-mei (Jenny) Wang, Ph.D.
Assistant Professor, Department of Applied Foreign Languages
National Huwei Institute of Technology, Taiwan
wang170@yahoo.com

ABSTRACT: The purpose of this descriptive study was to identify factors related to dropout/retention for distance education students in order to identify variables which might promote participation through completion. The major focus of the study was to document the distance education students' learning progress and to identify variables that relate to their decisions for dropping out or staying in the program. The participants in the study were undergraduate students who originally enrolled in the distance education undergraduate program at the National Open University of Taiwan. The instrument used in this research was a mailed questionnaire for investigating the factors of dropout or retention for distance education students. The key factors which related to dropout or retention decisions for undergraduate distance education students found for this study are as follows. (1) demographic variables, (2) goal commitment, (3) social integration, and (4) academic integration.

Introduction

Over the past few decades, the number of programs and schools offering distance education as a cost-effective and as an educationally-efficient learning system in higher education has increased rapidly in many developed and developing economies. The need to keep up with technological advances, job training or retraining, and below par literacy skills are among the many reasons that adults need more education and return to school. Mature adults need an educational system that has the flexibility and diversity to provide advanced education for everyone (Huang, 1997). Fortunately, distance education is the most obvious and efficient solution. Distance education reaches across geographic boundaries and provides opportunities for higher education and technician level training to those unable pursue traditional programs (Sherritt, 1996). It provides flexible access for the traditional student and an educational "second chance" for adults who were previously denied opportunities (Rumble, 1986; Van Enckevort, 1986; Garland, 1992).

However, many of the recent distance education studies do not adequately address the learning experience of distance education students in a higher education while they have focused on student outcomes, such as academic achievement and intention to enroll in other distance education courses. Glatter and Wedell (1971) state that the dropout rate in distance education classes is much higher than would be expected in full-time courses and could reach 70 percent. According to Kember (1995), Rumble (1982), Wichit Srisa-An (1984), and Fleming (1982), the dropout rates in some distance education schools are higher than expected. In the distance education university in Venezuela, the dropout rate was 79%; at the Open University of Thailand, 62% of the students were no longer enrolled after two years; in Pakistan's distance teaching university, the dropout rate was 99.5%

as early as the first semester. These examples show that distance education institutions generally lose half or more of their enrolling students.

This lack of retention is also the situation at the National Open University (NOU) of Taiwan. It is recorded that only about 5% of the students who completed the registering process at the NOU obtained a degree. Therefore, this study aims to identify the significant characteristics of distance education students who have dropped-out or continuously and successfully progressed in the distance education program at the NOU of Taiwan. The major focus of this study was to identify the factors which might relate to the students' decisions for dropping out or staying in the distance education program, and to gain a better understanding of students' perceptions of their current academic setting.

Statement of the Problem

The problems can be summarized into three central questions. First, who is the distance education student? How do students' characteristics relate to their decisions of dropout or retention? Second, what are students' reasons for dropout or retention in the program? How do the variables in terms of *external attribution, emotional encouragement, and motivation* relate to the students' decisions of dropout or retention? Third, what are the students' perceptions of their academic setting in terms of interaction with the instructors/institution and the imp ression of their current program? How do these perceptions relate to their decisions of dropout or retention?

Literature Review

Studies (Drummond, 1989; MacKinnon-Slaney, 1994; Sheath, 1965; Tinto, 1975; Bean & Metzner, 1985, 1987; Kember, et al., 1992 & 1994) have indicated that the factors of support and encouragement (such as family support and encouragement), external attribution (such as insufficient time, financial difficulties), and motivation (Entwistle & Ramsden, 1983; Wlodkowski, 1985a & 1985b; Knowles, 1984; Maslow, 1970; Kember, et al., 1992 & 1994) were related to the student's learning experience.

Many of the factors of dropout and retention research in distance education include demographic characteristics of the individual learner over which the educational institution has little or no control. However, for the institution, it is significant to consider these individual characteristics. Several studies (Fjortoft, 1996) identify the reasons which lie behind student dropout as an important task in order to provide trends to an institution. In fact, student dropout is usually costly to the institution and the individual (Metzner & Bean, 1987). Furthermore, a high dropout rate also suggests a failure to solve a larger social issue, the equality of educational provision (Belawati, 1998).

An interactive process between the individual and the institution may also relate to students' dropout rate in higher education (Tinto, 1973; Bean, 1985; Metzner & Bean, 1987). Cable television is currently being used as the delivery media at the NOU. Researchers Ritchie and Newby (1989) found that in a television classroom environment, students experienced less involvement, less ability to ask questions, and less overall enjoyment in the learning experience than did students in a traditional classroom setting.

Methodology

Research Design

A descriptive survey method was used to collect data. The study used a mailed questionnaire to gather data from distance education students at the NOU of Taiwan related to their enrollment decisions of dropout or retention. The questionnaire was designed to answer the research questions and consisted of closed-ended questions.

Subject Selection

From the target/accessible population (N = 10,133) who first entered as full-time freshman four years ago at all of the distance education centers in mainland Taiwan , a proportional stratified random sample of the NOU distance education students from eleven distance learning centers was selected to arrive a representative sample size at a total sample (n) of 375, as recommend by Krejcie and Morgan (1970).

Return Rate

The overall response rate for this study was 81.07% after 3 follow-up mailings followed by the initial mailing.

Findings

Research Question #1

The responses to the first research question, "How do the selected demographic characteristics relate to students' decisions of dropout or retention?" were analyzed using the point-biserial correlation coefficient or phi coefficient (ø)/Cramer's V statistic based upon the type of variables to be correlated.

The results of the point-biserial correlation coefficient indicated that there were statistically significant relationships with the enrollment status for the categories of number of semesters, grade performance, age, and salary. The results of phi coefficient (ø)/Cramer's V statistic indicated that there were significant relationships with enrollment status based on gender, sponsorship, occupation, and education.

Research Question #2

The responses to the second research question, "How do the factors of External Attribution (Insufficient Time, Events Hinder Study, Distractions, and Potential Dropout) relate to the students' decisions of dropout or retention?" were analyzed using the point-biserial correlation coefficient. The results indicated that a significant relationship existed between the enrollment status and *External Attribution* (r= -.257, p= .000), which included subscales of *Events Hinder Study* (r=-.346, p=.000), *Potential Dropout* (-.215, p=.000), and *Insufficient Time* (-.140, p=.000) at the .01 level. The external attribution means negative social integration and is sub-divided into four subscales in the instrument.

Research Question #3

The responses to the third research question, "How do the factors of Emotional Encouragement (Enrollment Encouragement, Study Encouragement, and Family Support) relate to the students' decisions of dropout or retention decisions?" were analyzed using the point-biserial correlation coefficient. The results of the point-biserial correlation coefficient indicated that no significant relationship existed between the factors of Emotional Encouragement (Enrollment Encouragement, Study Encouragement, and Family Support) and the students' decisions of dropout or retention.

Research Question #4

The responses to the fourth research question, "How do extrinsic and intrinsic motivation factors relate to students' dropout or retention decisions?" were analyzed using the point-biserial correlation coefficient. The results of the point-biserial correlation coefficient indicated that no significant relationships existed between extrinsic motivation and students' enrollment status as dropout or retention decisions. However, there was a significant relationship between students' enrollment status and intrinsic motivation (r=.186, p=.001) at the .01 level. It indicated that as participants had more intrinsic motivation, they were more likely to stay enrolled or complete the program compared to those with less intrinsic motivation. However, it was only a low relationship between intrinsic motivation and enrollment decisions of dropout or retention.

Research Question #5

The responses to the fifth research question, "What are the students' perceptions of their interaction with the instructor/institution and their perceptions of their current program? How do these perceptions relate to their dropout or retention decisions?" were analyzed using the point-biserial correlation coefficient. The results of the point-biserial correlation coefficient indicated there was a significant correlation with enrollment status based on Negative Impression of the Program (r= -.183, p= .000) and Positive Interaction(r= .207, p=.000) at the .01 level. The results indicated that participants who expressed more dissatisfaction with the program and its support tended to dropout from the program more frequently than those who expressed less dissatisfaction with the program. In addition, the results also indicated that the participants who gave more positive feedback tended to stay enrolled or complete the program more frequently than those who did not give positive feedback. The positive feedback referred to course materials, tutoring, assignment marking and administration.

Conclusions, and Recommendations

Conclusions

Based on the results of the present study, the researcher identified the key factors related to dropout or retention decisions for undergraduate distance education students:

1. Demographic Variables: age, number of semesters, grade performance, salary, gender, occupation, education, sponsorship.
2. Goal Commitment: intrinsic motivation
3. Social Integration: insufficient time, events hinder study, potential dropout
4. Academic Integration/incompatibility: positive interaction with instructors/institution, negative impression of the program

Theses four factors are related to dropout or retention decisions for the undergraduate distance education students. Among these factors, the students' grades and academic integration are more under the control and can be managed to some extent by an institution.

Recommendations

Based on the findings of this study, the researcher makes the following recommendations that might be taken by the institution to improve the distance learning environment. Finally, recommendations for future research in the area of distance education are addressed.

Recommendations for institutions:

1. The institution should offer flexibility within units and wide choice of units to form a course in order to maximize intrinsic motivation students.
2. As suggested by Landtroop (1998), students' grades can be influenced by each professor's teaching/learning philosophy and the instructor/student interaction. Therefore, the institution should create some constructive ways to involve the students in learning and encourage instructors to interact with the students.
3. Every distance learning center should have enough staffs to assist students. The employment of counselors is also recommended. Counselors should be able to assist students in integrating study demands with work, family, and social obligations.

Recommendations for future research:

1. Conduct qualitative studies to confirm and clarify findings.
    a. Interview individuals from the various distance learning centers.
    b. Interview students who have decided to no longer enroll in the program in order to glean information about possible factors associated with student dropout.
    c. Interview students who have completed the program or stay enrolled in order to obtain information about possible factors associated with student retention.
    d. Interview faculty who have experience with teaching and interacting with distance education students.
2. Investigate the current policies and practice of the National Open University that impact student's learning.
3. Research must continually explore the relationship and factors associated with dropout or retention. Establishing a longitudinal study and monitoring students' learning progress over time is suggested. The factors related to stop-out should also be studied. What were the factors leading to their dropout? What intervention could be provided?
4. The timing of dropout requires more investigation in distance education. For example, factors contributing to early dropout (dropout soon after enrolling) versus later dropout should be explored. What were the factors leading to dropout?

References

Bean, J. P. (1985). A conceptual model of nontraditional undergraduate student attrition. *Review of Educational Research*, 55(4), 485-540.

Bean, JP. and Metzner, B.S. (1985). A conceptual model of nontraditional undergraduate student attrition. *Review of Educational Research*, 55(4), 485-540.

Belawati, T. (1998). Increasing student persistence in Indonesian post-secondary distance education. *Distance Education*, 19(1), 81-108.

Drummond, R. (1989). Predictors of academic self-concept of older adults. *Psychological Reports*. 65(3), Dec. 771-774.

Entwistle, N.J., & Ramsden, P. (1983). *Understanding Student Learning*. London: Croom Helm.

Fjortoft, N.F. (1996). Persistence in a distance learning program: A case in pharmaceutical education. *The American Journal of Distance Education*, 10(3), 49-59.

Fleming, A. (1982). The Allama Iqbal Open University. In D. Kember (1995), *Open learning courses for adults*. New Jersey: Englewood Cliffs.

Garland, M.R. (1993). Student perceptions of the situational, institutional, dispositional, and epistemological barriers to persistence. *Distance Education*, 14(2), 181-198.

Glatter, R. & Weddell, E.G. (1971). *Study by Correspondence*. London: Longman.

Hunag, J. (1997). *Distance Education: A key strategy for lifelong learning in Chinese Taipei*. ERIC Document ED 411 890.

Kember, D. (1995). *Open Learning Courses for Adults: A model of student progress*. NJ: Englewood Cliffs.

Kember, D., Lai, T., Murpgy, D., Siaw, I, & Yuen, K. S. (1992). Student program in distance education: Identification on explanatory constructs. *British Journal of Educational Psychology*, 62, 285-298.

Kember, D., Lai, T., Murpgy, D., Siaw, I, & Yuen, K. S. (1994). Student progress in distance education courses: A replication study. *Adult Education Quarterly*, 45, 286-301.

Knowles, M. (1970). *The Modern Practice of Adult Education: Andragogy versus Pedagogy*. New York: Association Press.

Knowles, M. S. and Associates (1984). *Andragogy in Action: Applying Modern Principles of Adult Learning*. San Francisco: Jossey-Bass.

Krejcie, R. V. & Morgan, D. M. (1970). Determining sample size for research activities. *Educational and Psychological Measurement*, 30, 607-610.

Landtroop, D.W. (1998). Persistence in Master-Level, Theological, Distance Education: A case analysis. Unpublished Ph.D. dissertation: The University of Georgia.

Maslow, A. H. (1970). *Motivation and Personality* (2nd ed.). New York: Haper & Row.

McKinnon-Slaney, F. (1994). The adult persistence in Learning Model: A road map to counseling services for adult learners. *Journal of Counseling & Development*, 72(3), Jan. 269-275.

Metzner, B.S. & Bean, J. P. (1987). The estimation of a conceptual model of nontraditional undergraduate student attrition. *Research in Higher Education*, 27(1), 15-38.

Ritchie, H. & Newby, T. J. (1989). Classroom lecture/discussion vs. live televised instruction: A comparison of effects on student performance, attitude, and interaction. *The American Journal Of Distance Education*, 3(3), 36-45.

Rumble, G. (1982). The Univerdad Nacional Abierta, Venezuela. In *"Open learning courses for adults"*. D. Kember (1995), New Jersey: Englewood Cliffs.

Rumble, G. (1986). *The Planning and Management of Distance Education*. London: Croom Helm.

Sheath, H. C. (1965). *External studies, the first ten years 1955-1964*. Armidale: The University of New England.

Tinto, V. (1973). *Dropout from Higher Education: A theoretical synthesis of recent research.* Washington, DC: Office of Education. ERIC Document ED 078 802.

Tinto, V. (1975). Dropout from higher education: A theoretical synthesis of recent research. *Review of Educational Research*, 45, 89-125.

Van Enckevort, G. (1986). Distance education for adult students: From old to new barriers for participation?, In "Distance education and the adult learner: Innovations in distance education". G. Van Enckevort, K. Harry, P. Morin & H.G. Schutze (Eds.) (1), 55-67. Heerlen, the Netherlands: Dutch Open University.

Wichit Srisa-An (1984). Evaluation of higher distance education results. The case of Sukhothai Thammathirat Open University of Thailand. *Evaluation of Higher Distance Education Results*. Madrid: Univeristy Nacional de Education a Distancia.

Wlodkowski, R. J. (1985a). How to plan motivational strategies for adult instruction. *Performance & Instruction Journal*, November, 1-6.

Wlodkowski, R. J. (1985b). *Enhancing Adult Motivation to Learn*. San Francisco: Jossey-Bass.

A Framework for Managing Personal Knowledge Activity in Education

Toyohide Watanabe
Department of Information Engineering,
Graduate School of Engineering, Nagoya University
Furo-cho, Chikusa-ku, Nagoya 464-8603, Japan
Phone: +81-52-789-4409, Fax: +81-52-789-3808
E-Mail: *watanabe @ nuie.nagoya-u.ac.jp*

Abstract *In educational environment, it is desirable to support the mechanism by which persons can participate in their interesting communities without any troubles and also promote their learning activities increasingly or successfully. In particular, now that web-based educational environments have been successively organized under a virtualized communication network or a logical interaction space the architectural framework must be investigated. In this paper, we address an architectural framework of handling knowledge in the education from a viewpoint of personal activity. Our objective is to design the support environment of personal activity in the education, based on the seamless transition mechanism among individual educational environments. In order to make the viewpoint of our investigation clear we introduce a three-layers model for educational support architecture. Three layers are educational environment, support system and person role, from the top layer to the bottom layer. The lower layer is organized so as to contain the functional features in the upper layer, as basic and composite facilities for the construction.*

Introduction

The computer systems coupled with information networks take important roles to establish the infrastructure for information society from a logical point of view, in comparison with the infrastructure for our social life-lines to be supported traditionally by architecture or civil engineering. So, the knowledge infrastructure environment grows up without any doubt as our information-oriented society to be desirably expanded in the 21st century. Our daily activities are more or less dependent on the utilization/adaptation of our heuristically-experienced or traditionally-accumulated knowledge, and the effectually computer-supported mechanisms must be investigated to establish such knowledge infrastructure environments[1].

The computer support for educational activity is one of important subjects, and until today various research subjects have been investigated eagerly and progressively. Many of these traditionally investigated subjects unfortunately were disjoint from other research viewpoints with a view to establishing globally or cooperatively integrated educational environment. This historical trend may be dependent on the large desirability and dream of educational application for computer power. The discussions or considerations of educational activity or knowledge growing process should be sufficiently exchanged or attacked. Concerning with knowledge growing process, I.Nonaka, et al. proposed an aggregated model (e.g. SECI model) for knowledge management[2,3]. Although SECI model is not always appropriate to investigate educational activities of persons, at least the framework is very interesting in our discussion. Also, we have already discussed an architecture for handling knowledge in education with a view to designing uniformly integrated educational support system[4-6]. However, our conventional research project did not focus on the educational support framework for personal activity because our research view was dependent on the educational support mechanism in the organization, like SECI model.

In this paper, we discuss the constructive framework of handling knowledge in the education from a viewpoint of personal activity, but not with respect to complementary trainings or exercises in the organization. Our objective is to design the support environment of personal activity in the education, based on the seamless transition mechanism among individual educational environments. In order to make this modeling viewpoint clear, we introduce three-layers model for educational support architecture. Three-layers model arranges analytically our knowledge activity with respect to three measurements: educational environment, support system and person role. We address our modeling mechanism

BEST COPY AVAILABLE

successfully, based on the correspondence between upper and lower layers with a view to making it explicit that educational activities defined in the environment should be interpretatively implemented as the behaviors of individual persons.

Framework

The effective environment of knowledge management in the education must support various behaviors of individuals smartly without any operational differences because the personal activities are too strongly dependent on the personality and progressiveness of individuals but are not uniformly controlled under the organization. Of course, it is very difficult to attain this requirement sufficiently since ordinarily we are not always assisted well to our educational activities by man-to-man or by one-to-one relationship, but in many cases act in ourselves or are supported together by one-to-many relationship. Our educational support architecture is illustrated conceptually in Figure 1. This architecture is composed of three layers: educational environment, support system and person role. In three layers, different modeling views are correspondingly mapped from the upper layer to the lower layer so that the modeling characteristics in the upper layer should be constructed interpretatively by the corresponding characteristics in the lower layer.

The educational environment points out distinguishable categories in our educational activities: private learning, group learning, group lecture and private lesson. These distinguishable categories are observed from our practically experienced education systems: the private learning is corresponding to our self-learning such as pre-learning and post-learning for school lectures; the group learning does to the discussions, meetings, exercises, etc.; the group lecture does to school lecture, public seminar, etc.; and the private lesson does to man-to-man lesson, private coaching, etc. Of course, these categorized activities are functionally established by means of any educational support systems such as CAL (Computer Assisted Learning) for private learning, CSCL (Computer Supported Collaborative Learning) for group learning, CAI (Computer Assisted Instruction) for group lecture and ITS (Intelligent Tutoring System) for private lesson. These educational support systems have been developed with a view to being apt respectively to individual education systems, which are currently organized as social structures/mechanisms. Of course, these support systems must be applicable to various types of users, who take roles to keep effectually instructional and conversational interactions. The person role makes the interactive- or functional-tasks of persons, who take plays actively or passively according to their situations and objectives in individual educational environments, explicit.

The functionality in the educational environment is interpretatively mapped into educational behaviors of persons and the educational environment is explicitly defined as the practical paradigm. The person roles can be looked upon as the features of users in the educational support systems, and student, teacher, tutor, coordinator, speaker, etc. are effectual roles. The educational environment in the top layer is individually categorized by characteristics of educational support systems and the categorized educational support systems are characterized by the roles of participated persons as actors. So, it is important for the educational environment to organize seamless activity fields in accordance with person roles and also construct the functionality of making seamless activities possible among person roles. Of course, the person role is variant for individuals: the same person may take different roles in accordance with the objectives/motivations for the educational activities.

Support View for Educational Activity

In the educational environment, the educational styles which we can distinguish in the real world are categorized into the private learning, group learning, group lecture and private lesson. These educational styles are distinguished in accordance with two factors: the number of students and the number of teachers. The number of students is 1 or n ($n>=2$), and the number of teachers is 0 or 1, respectively. Figure 2 locates such educational styles into two-dimensional space with respect to these two factors. Of course, we often observe the educational activity in which the teacher is a basic composite actor even on the group learning: in particular, in the large-scale group discussion which has not been associated with leaders, the teacher takes an important role as an advisor or a coordinator. Figure 2 does not define the categorization for our educational activities of persons, but arranges the constructive relationship among different educational styles.

As for these educational styles, today the typical educational support systems, which are currently usable or proposed, are classified into four types of system configurations such as CAL, CSCL, CAI and ITS. These support systems are correspondingly consistent to four styles of educational activities. Figure 3 shows such a corresponding relationship between educational styles and educational support systems. In Figure 3, it is strongly drawn that CSCL and ITS related respectively to the group learning and private lesson are not strictly constrained by two factors: number of students and number of teachers. CSCL and ITS are depicted so as to be expanded to the partitioned domain "group lecture" (which is defined by many students and a teacher), assigned to CAI. In CSCL, the presentation process in the symposium or congress is similar to that in the group lecture in many cases. Similarly, ITS is extensible to the domain of CAI in case that one tutor teaches or discusses a few students together at once or one by one. At least, students are timely located to one of four types of educational support systems, according to their educational activities and pre-assigned schedules of learning. Thus, it is important that the seamless transition mechanism among different educational support systems should be implemented. Of course, these educational support systems are not adaptable to only students, but also must be applicable to persons such as teachers, advisers, instructors, etc., related closely to students. Table 1 arranges person roles for this discussion about extended support activities. Figure 3 shows the improved interaction among individuals in each educational style: in comparison with Figure 2, the interactive relationships among composite elements are complex in CSCL and ITS. Namely, this improvement insists that individual educational support systems should provide adaptable facilities to different classes of persons in accordance with person roles, which have to be done in the educational activities.

Seamless Activities among Educational Styles

Figure 4 illustrates different classes of persons in each educational support system. Here, we must pay an attention that the person role in each educational support system is pre-assigned when the transitive movement from the private learning to another is occurred: for example, a person takes a role of university student in one case, and in another case he takes a play of tutor for students in an elementary school. Additionally, all educational activities are started on the private learning as the origin. This is because the private learning is looked upon as the pre-education for various educational activities. In Figure 4, persons who participate in the group learning are categorized into three types according to the size or scale of meeting: small-size, large-size and symposium-like meetings. Also, in such meeting categories persons are classified into students, coordinators and speakers. Namely, three kinds of meetings are distinguished by the construct among these composite actors: the small-size meeting is organized only by students; the large-size meeting is controlled by the coordinator so as to carry on the discussion in the well direction or promote active information exchanges; and in the symposium-like meeting speakers (or presenters) newly participate with the help of coordinator.

Figure 4 shows the transitional relationship among different educational activities attended with person roles. Ideally, it is hopeful that the environment should support various styles of educational activities by the cooperative mechanism among different functions. The educational environment which can support the seamless sequence among various actions and reactions powerfully is better. We investigate the seamless activities in Figure 4 with respect to person roles. Figure 5 shows various types of transitive processes among different support systems. The private learning is interpretatively looked upon as the pre-stage for another educational activity, and when one objective or successive behavior of personal plan is scheduled, a sequence of actions must be determined with person role, which was assigned in the private learning. In various educational styles, persons prepare their learning subjects to participate in pre-assigned meetings/parties. The person roles for participation are very changeable in accordance with occasional motivations. In this case, the private learning is a very simple and fundamental stage, and also is regarded as the pre-learning and post-learning phases for another educational style. Thus, the educational support system must always work cooperatively with each other so as to integrate various facilities and share data storage (or knowledge resources) accumulated by individual activities.

Conclusion

In this paper, we addressed an architectural framework for educational activities of persons. In particular, we proposed three-layers model, which is composed of educational environment, support system and person role. Our idea is to integrate them adjustably under the corresponding relationships among layers, and transform interpretatively the concepts in the upper layer to those in the lower layer. Concerning with this approach, our objective is to investigate knowledge handling mechanism from a viewpoint of person activity. The effectual results discussed in this paper are as follows:

1)framework of seamless personal activities among educational environments;
2)framework to be supported practically by computers.

Of course, currently these frameworks are not always sufficiently investigated: in particular, the integration of individual frameworks should be addressed strongly. Also, we should establish the educational knowledge handling paradigm and implement effectual educational support environment and functionality-oriented mechanism on our Internet world[7].

As our next step for managing personal knowledge activity, we should investigate the total architectural framework which makes the interactive structure among various types of knowledge operations clear[8].

Acknowledgement

We would like to thank our research members in the Lab. for their eager discussion and cooperation.

References

[1] P.M.Senge: " The Fifth Disciplines: The Art of Practice of The Learning Organization", *The Spieler Agency*(1990).
[2] I.Nonaka, K.Umemoto and D.Senno: "From Information Processing to Knowledge Creation", *Technology in Society*, Vol.18, No.2, pp.203-218(1996).
[3] I.Nonaka and H.Takeuchi: "The Knowledge-Creating Company", *Oxford University Press*(1995).
[4] T.Watanabe: "Education Support Paradigm as Knowledge Management", *Proc.of ED-MEDIA'01*, pp.2007-2008(2001).
[5] T.Watanabe: "Architecture of Education Support System, Based on Knowledge Management Paradigm", *Proc.of WebNet'01*, pp.1320-1321(2001).
[6] T.Watanabe: "Knowledge Management Architecture of Integrated Education Support", *Proc.of ICCE'01*, pp.1138-1141(2001).
[7] P.Klint and C.Verhoef: "Enabling the Creation of Knowledge about Software Assets", *J.of Data & Knowledge Engineering*, Vol.41, pp.141-158(2002).
[8] T.Watanabe: "A Knowledge Handling Model in Educational Activity", *Proc.of E-Learn'02*(2002).

Table 1: Person role in support system

	CAL (private learning)	CSCL (group learning)	CAI (group lecture)	ITS (private lesson)
student(self)	•	•	•	•
student(other)		•	•	●
speaker		●		
coordinator		●		
teacher			•	
tutor				•

[Note] • : elements in inherent frame, ● : elements in extended frame

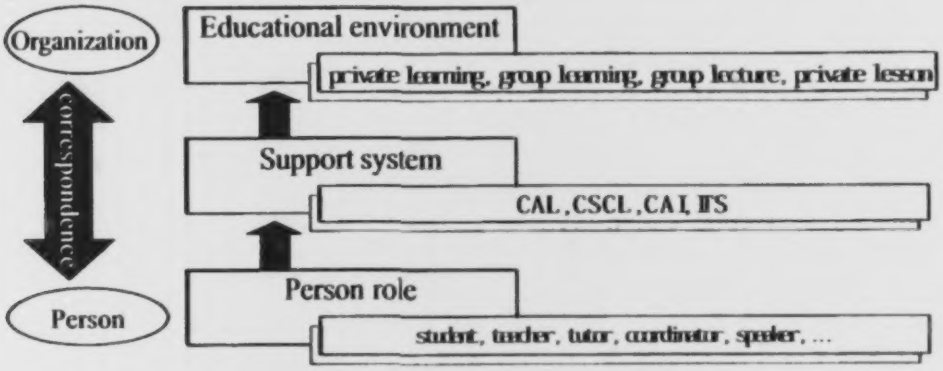

Organization
Educational environment
private learning, group learning, group lecture, private lesson
correspondence
Support system
CAL, CSCL, CAI, ITS
Person role
Person
student, teacher, tutor, coordinator, speaker, ...

Figure 1: Educational support architecture

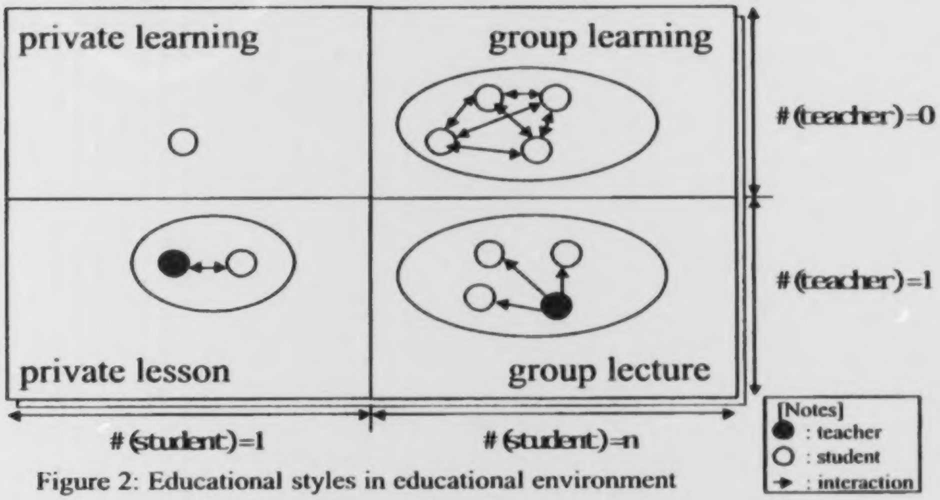

private learning
group learning
#(teacher)=0
#(teacher)=1
private lesson
group lecture
#(student)=1
#(student)=n
[Notes]
● : teacher
○ : student
→ : interaction

Figure 2: Educational styles in educational environment

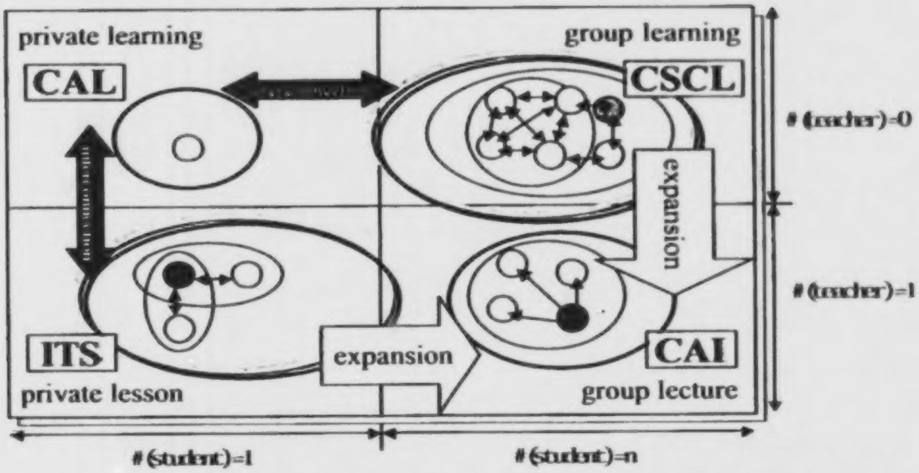

private learning
group learning
CAL
CSCL
#(teacher)=0
expansion
#(teacher)=1
ITS
expansion
CAI
private lesson
group lecture
#(student)=1
#(student)=n

Figure 3: Educational styles and educational support systems

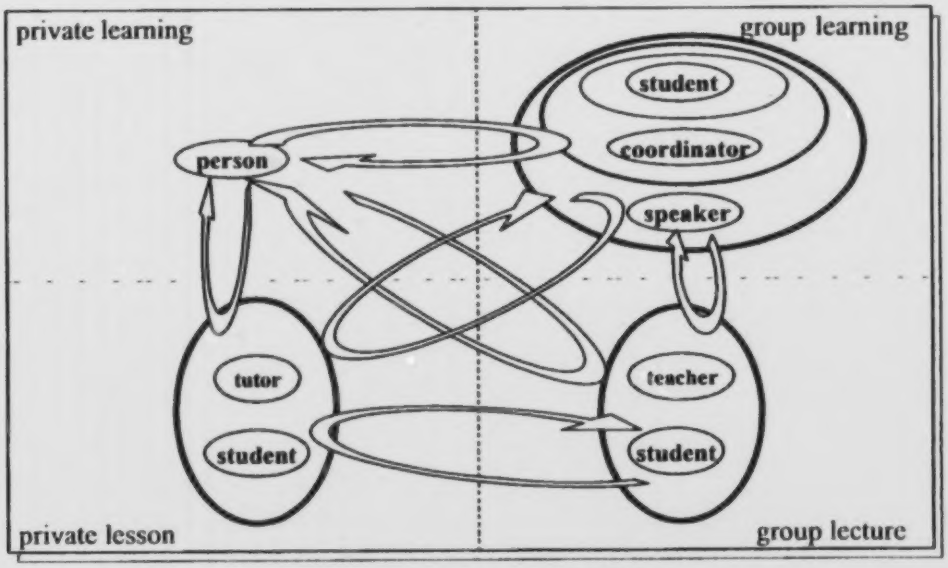
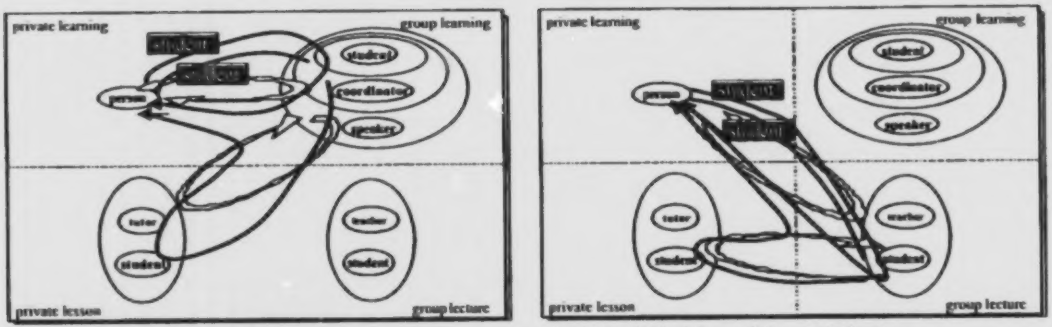

private learning
group learning
student
coordinator
person
speaker
tutor
teacher
student
student
private lesson
group lecture

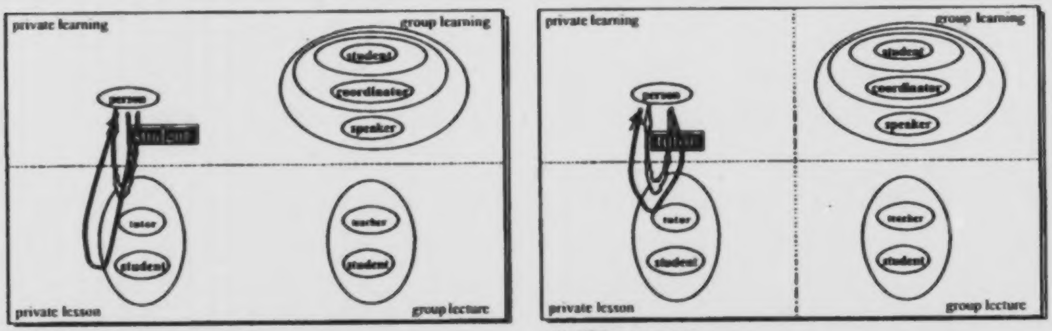
Figure 4: Transitive relationship

BEST COPY AVAILABLE


private learning
group learning
student
student
person
student
coordinator
speaker
tutor
student
teacher
student
private lesson
group lecture
private learning
group learning
person
student
student
student
coordinator
speaker
tutor
student
teacher
student
private lesson
group lecture

a) CSCL with/without ITS, as student

b) CAI with/without ITS, as student


private learning
group learning
person
student
student
coordinator
speaker
tutor
student
teacher
student
private lesson
group lecture
private learning
group learning
person
tutor
student
coordinator
speaker
tutor
student
teacher
student
private lesson
group lecture

c) ITS, as student

d) ITS, as tutor

Figure 5: Transition among individual environments (1/2)

BEST COPY AVAILABLE

Transcultural learning in Internet-based learning environments – European methods and experiences

Peter J. Weber
University of Hamburg (Germany)
Institute for International and Comparative Education
weber@erzwiss.uni-hamburg.de

Abstract: This paper deals with a survey on three case studies of various arrangements for intercultural learning via the Internet in Europe. On the one hand the empirical research is based on theoretical reflections about intercultural competence needed in a multicultural society on the other hand it is grounded in the pedagogical discussion of media competence. The main goal of the research is to determine the sustainability of Internet-based learning arrangements and a virtual mobility for campus based students.

1. Introduction

With the technical development of the World Wide Web in the early 1990's, the Internet was theoretically accessible for everyone, at least in the industrial nations. Without a doubt, the traditional electronic media could never have triggered such a development as has the fusion of computer, telecommunication and electronic media (Willke 1997). This can be largely traced back to the optimization and redesigning of communication processes which present a possibility for businesses to respond to the higher demands regarding costs, quality and flexibility in the international marketplace. According to OECD estimates, 30% of the volume in the areas of communication, finance and smaller trade and 20% in education, public health and government will be influenced by the electronic trade (OECD 1999, 9).

A general increase of Internet users can be counted on worldwide. Virtual contact situations will be thus influenced especially by the giants of intercultural and media competence. An intercultural competence in virtual contact situations can contribute to both a globalized and regionalized society, permitting peaceful co-existence since they lead to a large degree to the dismantling of prejudices and stereotypes. Yet the interaction between intercultural and media key competencies is rarely considered, let alone the subject of social competence, which can be regarded as decisive in global as well as regional contact situations in the Internet. This contribution will deal next with the relationship between intercultural competence and internet based virtual mobility situations, in order to enrich consciously the very technically oriented discussion with one further aspect. Based on the mutual influence between Internet and intercultural competence, the influence of a social competence through virtual mobility will be discussed through the demonstration of three case studies. Due to the paradigmatic character of the chosen case studies, this can be of definite importance for the development of a 'global social competence' via virtual mobility.

2. Transcultural competence and virtual mobility

Just how far the Internet poses a chance for intercultural learning depends very much on how far the Net lends itself to learning processes. The question is which new opportunities the Internet-based learning environments for virtual mobility offer for the development of intercultural competence for learners of different anthropological backgrounds. With that, two central problems are raised:

- How should the target size of a transcultural competence be designed in relationship to the development of a virtual world?
- Which Internet learning environments should be chosen from the existing multitude in order to arrive at lasting design criterion?

One possible target size lies in the connection of the effects of the new media with a differentiated understanding of society. Today, a meeting of cultures is let loose from a central nation state through the new media. This is due to the continually progressive supplementation of the national electronic and printed media through new international media, which obey other principles altogether (Schröder/Zimmer 1995). If media in the nation states is on the whole only planned for its lnguistic region, global media of international communities orientates itself toward its multilingual users[1]. At the same time, technical development makes the integration and interactive design of various media possible. At this point the process of community creation becomes increasingly important since social actors can join forces with one another or with many others out of common interest. This process will be made easier in the international context through the Internet. And with it, a substantial importance of the new media could be in making possible the formation of transnational societies which themselves consist of many sub-societies. The new media therefore has the ultimate effect of being identity-founding. These transnational societies unite people of different cultures; for example, through trade, immigration and emigration or through common activities in the Internet by virtual mobility. This doesn't mean that the state and the related concept of the international society become obsolete or that the artificial particalization of the society must increase (Kleger 1997). This transnational space is at the same time transcultural, requiring a corresponding competence from the social actors which can no longer be fixed to an intercultural understanding. It must concern itself with a transcultural competence which allows the social actors to deal with many cultures of the transnational society, since with the multitude of contact possibilities, not all specific cultural competencies can be conveyed. Objectives for a virtual mobility can therefore be culture-overlapping fundamental competences, to which a transcultural social competence belongs, consisting of sociability, communicative flexibility and sensitivity.
To the solution of the second initial problem – which Internet learning environments should be drawn upon for the analysis of intercultural learning via virtual mobilty in the Net – a categorization lends itself which has been obtained from the analysis of world-wide collaborative learning environments for presence universities. It is concerned with learning environments which work by sensitization through explanation and training (Type 1), through consensus creation (Type 2) and through knowledge construction (Type 3) (see Ribold/Weber, 1998). For Type 1, case study CCED (Cross Cultural Explorations and Dialogue) has been chosen, whereby it should be mentioned that since winter 1998, this training with online-communication has been expanded with accompanying video conferencing. At the time of the interviews, this feature hadn't yet been predicted. DEMETER (Distance Education Methods in Teacher Education and research) was chosen for Type 2 and HALÜBO (Hamburg/Lüneburg/Bochum) for Type3.
(There will be a hands-on demonstration of the three leraning environments during the presentation.)

3. Analysis

The data collection in winter 1997/98 for the three case studies works with a combination of qualitative and quantitative methods. In order to receive specific information about the environments within a university system, the data, which is analyzed here, has been taken from the data pool of the German universities about the three projects. There were three collection methods in total. A questionnaire was distributed before and after the courses so that distinctive personality characteristics of the learners of the environments could be identified. A qualitative analysis of the communication environments, such as message boards, ensued from a look at the intercultural or rather, transcultural learning process which included the comparison of the categorization according to the Software Typology of Baumgartner and Payr (1994). With regard to the enduring effects of the study results, interviews with experts were conducted in connection with a workshop.

The main objectives of the study are as follows: the study should indicate effects of the technical and pedagogic variations of Internet learning environments. It should also indicate the typical changes in distinctive personality characteristics in regard to the target size of a transcultural competence. The study should finally determine general construction criterion of Internet learning environments with regard to pedagogic constructivism.

---

[1] In this contribution, we will address the tendency toward globalization through the Internet only, not that of regionalization, which exists as well. The analysis of the language usage of websites indicates that the 'globalization language' English does not play the dominant role as was supposed. Websites are mostly bilingual, in a national language plus English: this points out the further creation of regional and local virtual space, in which the intercultural and media competences remain indeed as equally important as in the global space (Databank Consulting 1997).

4. Results [2]

The results of the exploratory study conducted before the start and at the end of the courses (with 173 students who had rather weak international and technical knowledge beforehand) can be divided into three areas: efficacy of the learning environment on the learner, typical distinctive personality characteristics and their changes after the courses and finally, the potential for innovation of the Internet learning environments of these three types. In the following, the results regarding the distinctive personality characteristics will be introduced by way of examples. These characteristics constitute the core of the study since it is through them that the question of which learning environment best supports the development of transcultural competence will be investigated. Transcultural competence was set within a sub-construction of the question which consists of 16 dimensions and 41 variables. The variables were adapted from the personality research for transcultural inquiry. The analysis pursued Latent class analyses (LCA), in order to procure typical answer patterns (Rost, 1990, 1996).

Figure 1 shows an example of 4 typical answer patterns in the dimension sociability, as appearing before and after the Internet courses. The largest group before the course is the "hesitant" type who, although having only minor anxiety towards other cultures, is quite hesitant in establishing and maintaining contact themselves. Less hesitant is the second type before the course (the "sociable" type), who also demonstrates strengths in establishing contact. The evidence for mistrust towards people from other cultures is rather ambivalent, existing only at the beginning. The "sociable" type reappears again after the course and in this case, comprised over 60% of the students. A learning effect had taken place as the sociable group is by far the biggest; even when the individual LCA types don't have to be composed of the same people.

The hesitant type no longer appears after the courses; rather a more active type with noticeably little anxiety regarding foreign cultures. A general finding is that the Internet courses led to increased sociability for most participants. This result is repeated for nearly all 16 dimensions of the measured distinctive personality characteristics. After the courses there was a general gravitation by all the types toward the categories of transcultural competences and at the same time towards a higher positive response niveau. One can therefore assume an overall positive influence of the Internet learning environments on transcultural learning success.

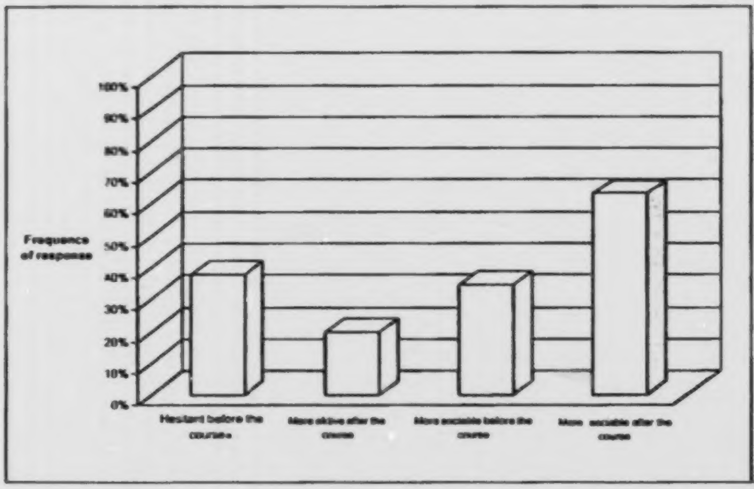


Figure 1: Sociability dimension

The point of departure for a look at the changes in the differentiations after the three Internet courses is the classes or types of the LCA analysis, as described above. According to these types and with the help of cross-tabulation, it will be investigated in which typical response pattern differenentiations occur after the course. Within the first dimension, hardly any differentiations in the strengths can be found in the discrete examinations of the courses for the categorization of the types 'Hesitant' and 'Sociable'. All three courses in this dimension more or less reach the objective of increasing sociability in the participants after the course. This can be explained by the design of the courses, in which all three included a phase of direct contact with the help of the medium of Internet (e-mail, chat, etc.). Two special features result through the technical construction stipulations of the Internet. Firstly, independent of the pedagogic design, it is apparent that the participants are more sociable in intercultural situations through the inclusion of electronic communication possibilities which they themselves specify. Secondly, it became obvious that limits to the technical implementation of problem oriented environments exist due to their enhanced complexity which can lead to undesirable learning results despite the allowance for communicative target categories.

---

[2] Some preliminary results were published in: P. Marquet, A. Jaillet, S. Mathey, E. Nissen (eds.) (1999). *Actes d'IN-TELE 98*, Berlin: Peter Lang,.

5. Discussion

On the whole, all three learning environment types studied proved capable of initiating a learning process centered especially in the area of social competence, going beyond culture toward a sociable, open and considerate learner. Within the framework of the exploratory character of the study, it can be suggested that the Internet is well suited to the construction of transnational societies since, through the development of social competence, the process of community creation will be supported. People of very different nations and cultures band together out of common interest. This bond can also be understood in terms of the perceptions of one's own subjectivity which are part of identity and culture developmental processes. In this way, culture can be understood as a complex bundle of subjectivities (experiences, values, norms, ideas, attitudes, dialects, etc.) and objectivities (activities, behavior, language, artifacts) which assist everyday orienteering and life mastery (Roth 1996, 260). With regard to Max Weber (1972), community creation can now be seen as the more subjective process, whereby individuals come to a group formation out of subjective reasons, in contrast to society creation in which the rather objective motivations play a role. For the future multicultural community, it is exactly the process of community creation which may possess the greatest creative potential. And with it one great importance of the new media for the world society could be that the new media actually has the effect of being identity-founding in a world of international and multicultural communities where it is possible to form international communities of various actors (organizations, individuals, businesses, etc.) consisting of many sub-communities. All these communities will cohere out of common interests and, from the start, need in no way, for example, follow the majority of any nation state.

It is also to be borne in mind that the best learning effect could be a result of a combination of the three types since a comprehensive transcultural competence cannot be provided by just one type of the Internet learning environments. This would be conceivable in serial modularity, although it would be problematic in the European university system which is neither institutionally nor organizationally very flexible. The teletutoring structure should therefore greatly influence the virtual and partially virtual universities of the future (Geyken/Mandl/Reiter 1998). At the same time, only few universities are likely to prevail as truly virtual institutions (single model) such as the University of Phoenix. They are rather likely to become more Add-on or More-Quality models (dual mode), which perform parts of their services virtually (Krempel, 1997).

6. Conclusion

In the future there will surely be more people who will have tertiary educational experience in a virtual space, even without being explicitly prepared for it by an educational institution. Therefore the existing concepts of multicultural education must automatically be questioned as to whether their concepts are adequate enough to prepare people for increasingly enmeshed cultures within corresponding learning processes. This doesn't mean that the area of tertiary experiences should obscure the other experience areas, but it should be prognostically assumed that it will play a larger role in hypermodern societies than in postmodern ones (Telepolis 1997).

Of much greater importance is that the ephemeral life-models of postmodernity - just as in hypermodernity – will retain their validity. It will be impossible for the individual to be prepared for the life-long challenges in the rapidly changing social roles, structures and duties. The decisive factor should be world-wide technical and trans-cultural competence since they make the individual citizen flexible in the specific creation of private and professional life-plans. As they are primarily coupled with the new media, they should also be striven for within its frameworks. The results of the studies, introduced here by way of example, advocate that virtual international Internet learning environments lead to a change in the learner's social competence with a view to a global social competence and virtual mobility Hence, it is to be in future even more intensively investigated how multicultural education concepts concerning the new media can be complemented.

References

Baumgartner, P./Payr, S. (1994). *Lernen mit Software*, Österreichischer Studienverlag.

Databank Consulting (1997): *Evolution of the Internet and the WWW in Europe*. http://www2.echo.lu/mlis/en/ document/evolution.html.

Geyken, A/Mandl, H/Reiter/W. (1998): Selbstgesteuertes Lernen mit Tele-Tutoring. Schwarzer, R (Hrsg.): *MultiMedia und TeleLearning*, Frankfurt/New York (Campus), 163-180.

Kleger, H. (1997). Bausteine transnationaler Demokratie, Kleger, H. (Hrsg.): *Transnationale Bürgerschaft*, Campus, 287-335.

Krempel, S. (1997). *Das virtuelle College – die Zukunft für die Universitäten*. http://www.heise.de/bin/tp/issue/tp.htm?artikelnr=2612&mode=html.

OECD (1999): *The Economic and Social Impact of Electronic Commerce*, Paris: OECD.

Ribold, M./Weber; P. J. (1998), First Steps towards Structures in the Use of Internet Tools in Distance Learning Environments, *Internet as a vehicle for Teaching*, Cluj-Napoca, 68-79.

Rost, J. (1990), *LACORD. Latent Class Analysis for Ordinal Variables*, 1990, Institut für die Pädagogik der Naturwissenschaften an der Universität Kiel.

Rost, J. (1996). *Lehrbuch Testtheorie, Testkonstruktion*, Bern: Huber.

Roth, J. (1996). Interkulturelle Kommunikation als universitäres Lehrfach. Zu einem neuen Münchner Studiengang. Roth, K (Hrsg.): *Mit der Differenz leben. Europäische Ethnologie und Interkulturelle Kommunikation*, Münster et al.: Waxmann, 253-269.

Schröder, H./Zimmer, D. (1995). Begegnung der Kulturen im Netzwerk? Neue Medien und Transkulturalität. *Zeitschrift für Kulturaustausch* 1995/3, 356-364.

Telepolis (Die Zeitschrift der Netzkultur) (1997): *Die große Müdigkeit. Europa im Dornröschenschlaf*, Nr. 3 September 1997.

Weber, M. (1972). *Wirtschaft und Gesellschaft*, Tübingen.

Willke, H (1997). Informationstechnische Vernetzung als Infrastrukturaufgabe – Welche Rolle spielt die Politik? Werle, R./Lang, C. (eds.): *Modell Internet?*, Frankfurt/Main/New York: Campus Verlag, 115-13

Presenting Complex e-Learning Content on the Web: A Didactical Reference Model

Franz Weitl, Christian Süß, Rudolf Kammerl, Burkhard Freitag
University of Passau
{weitl,suess,freitag}@fmi.uni-passau.de, kammer01@fsuni.rz.uni-passau.de}

Abstract: Education can profit significantly from hypermedia und e-technologies. However, in our experience the majority of students having the choice of learning on the computer or from a printed script or book prefer the latter when it comes to "challenging" formal domains. For online learning material to be successful its structure and presentation have to reflect the characteristics of hypermedia and the web. This paper presents a *model* of the *didactical structure* of online learning content based on methods of instructional design. The model specifically addresses two major problems of the medium web for learning: *loss of overview* due to low information density of the medium and *short attention spans* due to fast fatigue of perception. The model serves as a framework which guides the author in structuring even abstract and complex content such that it can be efficiently learned on the web. The model is the basis of how 12 German universities structure their content in the joint project WWR (Wissenswerkstatt Rechensysteme – Knowledge Factory for Computing Systems) which aims at providing a pool of 150 XML-based online learning modules in technical computer science.

1. Introduction

In our experience from current e-learning projects [NE02, LA02, WWR02] e-learning needs to take different learning styles into account to be successful. Thus in all of these projects we decided to publish the course material in at least two formats: (1) as a web- based e-learning course, (2) as a traditional printed script. However, internal evaluations have shown that the majority of students prefer the print medium, when it comes to "challenging" complex or abstract subjects which are typically taught in higher maths and computer science education.

This observation is not just coincidental. We identified two major disadvantages of the medium web for learning formal material:

- Relatively low information density: the amount of information which can be presented on the screen is limited as compared to print media. This leads to a quick **loss of overview**, when the presented material is complex.
- Non-optimal learning environment: research results show, that the perception tires out quickly when the recipient has to grasp a large amount of new information on the screen [KS89]. As a result, authors of online material have to cope with particularly **short attention spans**.

To tackle these problems we developed a didactically motivated information model for e-learning modules. Our model has proven useful for (1) the story board-based **specification** of e-learning modules, in particular the definition of forms, (2) the **implementation** of modules, specifically the enhancement of XML languages in terms of didactical structures, (3) the development of an appropriate **presentation** framework supporting the learner's orientation and navigation. [WSK02, SFB99].

The rest of the paper is organized as follows: In section 2 we discuss the scientific background of our model, section 3 presents our model in detail, section 4 discusses related work and section 5 concludes with a summary of our achievements.

2. Prerequisites and Foundations

The model presented in this paper is based on the didactical framework of Instructional Design (ID) [M94]. The focus is on the analysis and design phase of ID (i.e. preparing the learning content and planning the instructional method and media) rather than on the other processes of ID.

Prerequisites of the reference model

The model concentrates on the structure and optimal presentation of learning material on the web with minimum requirements regarding the technical and social learning environment. The basic assumptions are as follows:

Domain: Our goal is to provide online modules which accompany university lectures in technical subjects (such as maths, computer science). The domain to be taught is well structured. Scientifically founded expert models exist and are taught to the students. A collection of objectives is given (e.g. based on examination regulations) or can easily be defined.

Target Group: The target group is relatively homogeneous and their profile (characteristics, pre-knowledge) well known. Our model does not (yet) address the personalized presentation of course material with respect to different individual profiles.

Learning Situation: The main purpose of the learning modules considered here is the support of self-motivated study and unsupervised revision before exams. It is further assumed that the individual study is the primary learning form. Students may of course build learning communities on their own initiative. However, group work and communication processes are not specifically addressed in our model. In this sense our model could be seen as a part of a larger complete model [SFB99, K01].

Medium: On the technical side the minimum requirement is a standalone standard PC. A permanent internet connection, special tools or learning environments may be useful for certain modules, but are not imposed by our model.

Instruction Models

Several learning theories have been discussed in the literature as a basis for the instructional method: The major strands are **Behaviourism**, **Cognitivism**, and **Constructivism** [GCR96, M94, D92].

The constructivist learning theory is a modern approach for designing learning material as it stresses the **active individual exploration** of the domain to be studied. However, we have chosen the cognitive approach as the basis for the structural model:

- The focus is on lectures based on scientifically founded complex expert models. It is mandatory that students understand the subject in detail and on a rather formal level. The course leads the students to a high level of mastery of **predefined** objectives.
- The learner needs to receive sufficient guidance by the predefined structure and presentation of the course material since we assume unsupervised study as the main purpose.
- Even cognitively designed web material does not necessarily limit individual, active exploration when presented in conjunction with free navigation support, search facilities and integration of runtime systems (such as web-interfaces to databases, applets simulating algorithms…).

Structural requirements for online material

We have selected and categorised the guidelines from software ergonomics and media didactics related to the identified major problems of web based learning [KS88, M93, Mea96, MDC84, B97]:

Loss of overview:

1) *First present the overview then the details.*
2) *Restrict yourself to significant information.*
3) *Offer orientation opportunities to the user.*

Short attention spans:

4) Make the (re-)start of learning easy: *provide contextual information.*
5) Keep in mind, the learner will get tired quickly: *don't present too much at once.*
6) However, try to prevent the user from getting tired quickly: *activate the learner regularly.*

Why are these guidelines difficult to meet? In conjunction with formal content they lead to the following contradictive requirements:

- *Formal precision and completeness of the material vs. lower attentiveness of the recipient on the web.* Higher education often requires completeness of the material regarding formal definitions, arguments, proofs. However, when presented on the web in the wrong way certain formal material may constitute an unnecessary obstacle for the recipient's overview and flow of learning.
- *Fine-granular structure of material vs. avoiding loss of overview.* Due to the low information density the chunks of information presented on the web need to be relatively small. This leads to a fine-granular and deeper hierarchical structure as compared to print material and makes it harder for the student to keep the overall overview.

Material which is structured according to our model will automatically fulfil the guidelines stated above and thus also solve the stated contradictions.

3. Didactical Structures of Online Material – Information Model

Next, we present the model of didactical structures of courseware. The main emphasis is on the micro-structure level of *learning resources* (in contrast to macro-structures such us curricula, courses) [AD01].

Hierarchical sequential organisation

Basic entities of our model are the learning module and the learning unit.
Learning modules present instructions for learning an expert model in a single, self-contained and complete area of a certain domain. They can be (re-)used in several different courses/curricula. In our model we assume that a learning module requires 2 to 10 hours of study. Learning modules are described by metadata and organised in **sections** which represent the hierarchy of topics to be taught in the module.
A **learning unit** is a special type of section. It represents all the material and instructions required for one single learning session. The required study time is suggested to be 45 minutes.
Learning units lead the learner from one level of expertise to the next in one or more **learning steps**. Learning steps constitute one part of the learning unit's complex internal structure which is presented in the following sections.

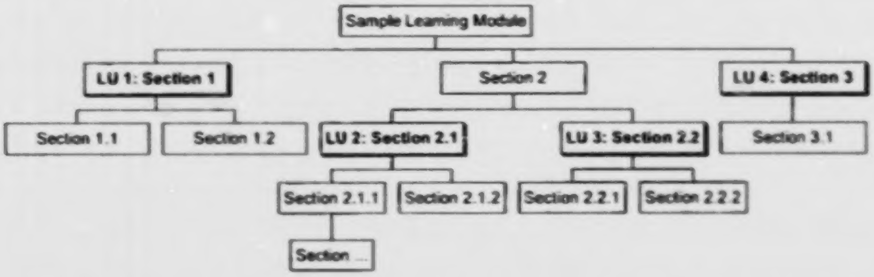


Figure 1: *Hierarchical sequential organisation of a learning module in sections and learning units*

We organise a learning module hierarchically in sections according to the logic of the instructions to be presented, **and** sequentially according to the identified learning units [R99]. The logic of instruction corresponds to the skills of the target group identified in the analysis of situated items.
Note: We do not assume that there is only one possible hierarchical, sequential organisation of a module. Different organisations may be defined manually or automatically according to the learner's prerequisites, amount of study time and individual objectives. However, for a given instance of a learning module we suggest an ordered tree as the appropriate organisation.

Horizontal Micro Structures – Information Model of Learning Unit

In this section we present the horizontal organisation of learning units due to a sequential order of didactical units in contrast to the vertical organisation discussed in the next section.

A learning unit consists of two basic concepts: didactical metadata and didactical units.
Didactical metadata contains helpful information about a learning unit to support the learner in finding the appropriate learning unit, getting started with learning and navigate efficiently through the presented material according to individual objectives. On the authoring side, didactical metadata serves as an abstract specification of the learning unit stating its objectives and relationships to other learning material, the user profile, and the external learning environment.
Didactical units represent the instructional content to be worked through by the learner. They implement the instructional design of the learning unit. Didactical units are ordered sequentially within a learning unit.

Content units in our context are chunks of information of any granularity and any type. Didactical units and their substructures **are** content units and may **contain** further sub-units at a lower level of granularity.

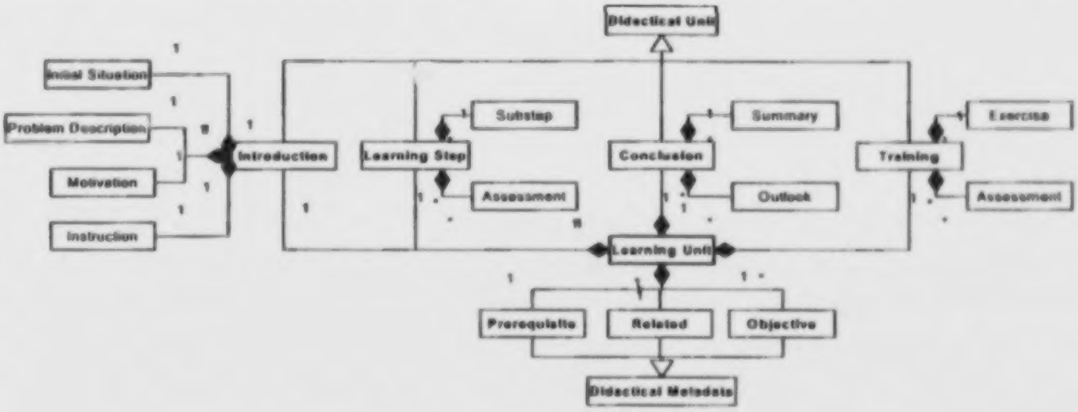

Didactical Unit
Initial Situation
Problem Description
Motivation
Instruction
Introduction
Learning Step
Substep
Assessment
Conclusion
Summary
Outlook
Training
Exercise
Assessment
Learning Unit
Prerequisite
Related
Objective
Didactical Metadata
1
n
1..*

Figure 2: Information model of a learning unit

Didactical Metadata

We propose three categories of didactical metadata supporting the orientation of the learner.

- **prerequisites**: requirements concerning the learners profile (knowledge of certain material and keywords, level of mastery of previous objectives).
- **objectives**: learning targets of the current learning unit according to Bloom's taxonomy (knowledge, comprehension, application, analysis, synthesis, evaluation) [B56].
- **related** material: references to material which is in any sense related to the content of the current learning unit or the process of working through it. The target of these references can be internal (within the current learning module) or external (e.g. other web sites), online (URLs) or offline (e.g. books), content (web sites, books) or software (tools, simulators, programming environments) or physical elements (e.g. tools for conducting an experiment).

  Categories of related material are resources (references or tools necessary or helpful to work through the current learning unit), continuations (possibilities to continue the study besides the immediately following learning unit), extensions (references to material which extend the content of the current learning unit, and generally related material (study material with similar content, objectives or focus).

Objectives play a central role in the didactical design of learning units. According to the general model of instructional design we suggest to specify the objectives of a learning unit first before specifying its didactical units. When specifying didactical units the objectives are linked to the relevant content units or test questions within the learning unit. Thus a bipartite graph as depicted in figure 3 is defined between content units and associated objectives [G89].

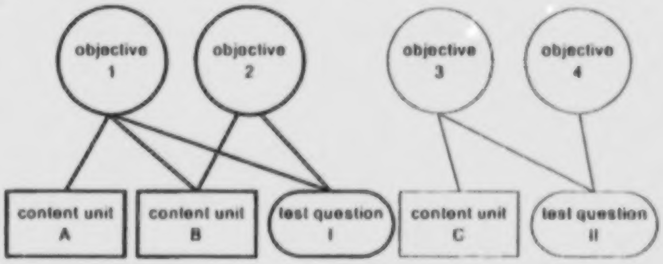

objective 1
objective 2
objective 3
objective 4
content unit A
content unit B
test question I
content unit C
test question II

Figure 3: Bipartite graph of objectives and units of contents / test questions

Regarding the manifold functions of objectives we refer to the discipline of instructional design [M94] and add the following:

BEST COPY AVAILABLE

- Objectives - when associated with content units - can serve as an additional, goal oriented navigation structure.
- They serve as an indirect association mechanism between different content units as well as between content and test questions. Content units associated with the same objective are similar according to this objective. This is particularly useful in relating test questions to relevant content. In figure 3 the relevant text passages for test question I are content unit A and B. If the learner has problems in answering this question the test system can direct him/her to the related material.
- As stated previously, objectives can be interpreted as an abstract specification of the learning unit. The association between objectives and content to some degree enables the formal verification of a given implementation. In figure 3 objective 4 is not associated with any content unit, thus there is obviously no course material present which could enable the learner to achieve objective 4. A processor examining the associations between objectives and content can automatically identify these possible structural problems.

Didactical Units

Didactical units implement the instructions of a learning unit w.r.t. its objectives. They contain

- **overview information** presented in the introduction and conclusion.
- **detailed information** about the concepts to be studied as presented in the learning steps.
- **exercises** and **test** questions presented in the training section.

The aim of the **introduction** is to (1) **get** the learner **started** by stating the textual context of the current learning unit within the module (initial situation), (2) **activate** the learner by defining the problems to be solved within the current learning unit (problem description), (3) **motivate** the learner (motivation), and (4) **guide** the learner by giving specific instructions of how to work with the following material (instruction).

Learning steps present the details of the concepts to be learned. We suggest to divide the material of a learning unit into 3 or 4 learning steps each about 10 to 15 minutes in length as this is about the average attention span for picking up new information on the screen [KS89]. A learning step is divided into a small number of substeps. After working through the substeps the user is directed to an assessment screen containing a small number of relatively simple self test questions. These questions activate the learner and provide regular and immediate feedback regarding the learning progress.

The **conclusion** puts the details presented in the learning steps into an overall context of the learning unit by (1) **repeating** the essence of the concepts studied in the previous learning steps (summary), and (2) **motivating** the learner to continue studying the following learning unit (outlook).

The **training** part plays a central role in learning. Its aims are:

- Building up a high level of mastery of the defined objectives through active reproduction and application of the concepts studied in the learning steps (exercise).
- Self-test and feedback regarding the degree of mastery of the objectives (assessment).

It may be desirable that some exercises such as formal proofs, programming or software design are done offline or using specialized tools. While these exercises can be listed in the exercise section of a learning unit the execution, submission, assessment and feedback is out of the scope of the model.

Current e-learning and CBT systems provide a large variety of tools and information models for computer based online/offline training and assessment [QTI02]. We do not suggest yet an another information model but assume, that one of the existing formats is adopted according to local requirements (installed e-learning platform and assessment tools). The entities exercise and assessment in our information model serve as an abstract placeholder for one of these local information models.

Presentational Design

Presentational design adds annotations to the didactically structured material such that the material can be optimally presented as web-pages with respect to the special limitations (low information density) and advantages of the medium web (linking, interactivity).

Presentation Units

The concepts presented so far were merely motivated by the didactical function of the content. Presentation units are motivated by the characteristics of the medium web. A **presentation unit** represents the content of one single web page. Its size should be small enough to avoid scrolling [B97].

Ideally, presentation units can be defined along didactical structures such as introduction, substep, or summary. However, it might be appropriate that a complex substep spans several presentation units or that several small substeps are covered by a single presentation unit.

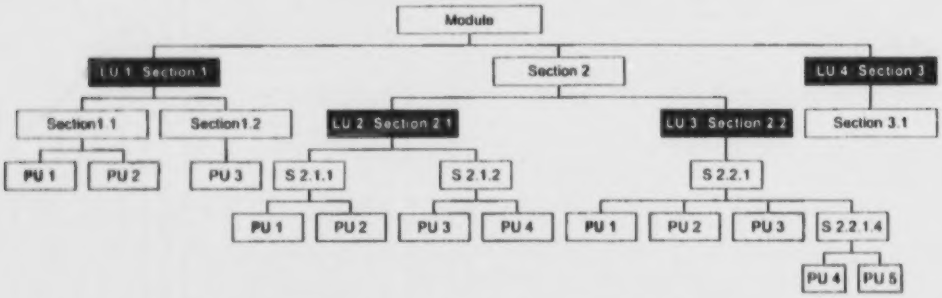

Module
LU 1 Section 1
Section 2
LU 4 Section 3
Section1.1
Section1.2
LU 2 Section 2.1
LU 3 Section 2.2
Section 3.1
PU 1
PU 2
PU 3
S 2.1.1
S 2.1.2
S 2.2.1
PU 1
PU 2
PU 3
PU 4
PU 1
PU 2
PU 3
S 2.2.1.4
PU 4
PU 5

***Figure 4**: Hierarchical sequential structure of a learning module after definition of presentation units*

The module is organised as an ordered tree having presentation units as leaf nodes. Sequential orders are defined at the level of learning units and at the level of presentation units within learning units. This two-level sequential order serves as an ideal address base. Every page within the learning module can be identified by two numbers: the number of the learning unit and the number of the presentation unit within the learning unit. This is useful for the **orientation** of the learner ("Where am I?") and for precise **communication** for example in giving feedback ("Don't understand definition in LU 3 / PU 5").

Vertical Micro Structures – Presentation Levels

Besides the didactical function of content we identify two subsidiary structural dimensions: (1) **importance** of content regarding the objectives to be achieved, and (2) **difficulty** of material for the average learner.
Related to these dimensions we can define three distinct *presentation levels* as follows:

- Content units, which are important and relevant regarding one or more objectives, belong to the presentation level **basic**.
- Content units, which are less important or relevant **and** can be assumed to be known or self explanatory for the majority of the target group (low difficulty), belong to the presentation level **help**.
- A content unit is assigned the presentation level **extension** if it is less important **and** difficult to understand for the majority of the target group (e.g. due to its high level of abstraction and formality).

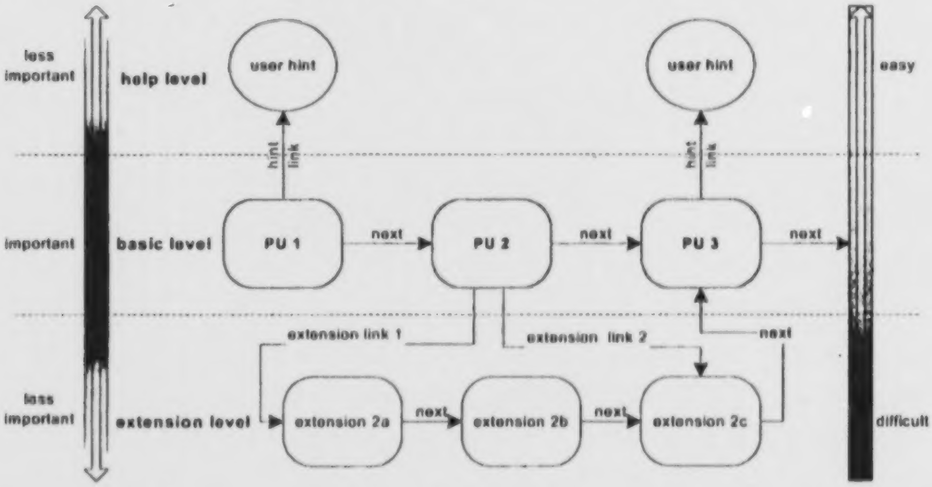

less important
help level
user hint
user hint
easy
hint link
hint link
important
basic level
PU 1
next
PU 2
next
PU 3
next
extension link 1
extension link 2
next
less important
extension level
extension 2a
next
extension 2b
next
extension 2c
difficult

***Figure 5:** Vertical micro structure of a learning module organised by presentation levels*

BEST COPY AVAILABLE

By revising the material and assigning presentation levels to content units the following is achieved:

- The content of the basic presentation level is concise and highly focussed on current objectives.
- The novice user can access additional information at the help level on demand.
- The experienced or specifically interested user is offered additional opportunities in deepening his / her knowledge by pursuing extension links.

4. Related work

Pedagogical theories and models proposed in the literature are manifold [K01]. As a result existing formal models of courseware take up a rather abstract point of view in order to be valid for all kinds of learning situations and didactical strategies.

The CAMELEON project aims at providing reusable modules for online/offline course materials encoded in TeachML [WL01]. TeachML identifies several didactical units (such as examples, figures with explanation, exercises) and structures such as (courses, chapters, learning paths, ...). However, an underlying didactical model or design strategy is not visible. As a result TeachML gives little assistance in *how* to use the provided elements in order to develop learning material which can optimally be presented and studied on the web.

The "life long learning" project aims at meeting the needs of different target groups by offering several learning trails through the same online course specified in the XML language L3-XML [SLK00]. L3-XML introduces the notion of a learning unit (LU). Similar to our approach each LU contains objectives and all information necessary to achieve them. However, in L3-XML a LU is a recursive element in order to specify the hierarchy of topics presented in a course rather than a precise didactically motivated information model for a single learning session.

The EML [K01] provides a framework for the complete XML-based description of all objects, roles and activities involved in the teaching/learning process of a unit-of-study. EML is an XML-binding of a pedagogical meta model and thus stays abstract regarding the specific instructional / pedagogical model to be adopted when implementing a unit-of-study. Our specific didactical model can serve as a possible instantiation of the EML meta model for cognitively organised instructional material. It can be integrated into EML (and other existing mark-up languages) by using subtyping as suggested in [K01] and already successfully implemented on the basis of LMML [SFB99, WSK02].

5. Conclusion

We presented a reference model for structuring online modules in formal and abstract domains such that the learning content can be optimally presented according to the characteristics of the medium web. We have shown how to tackle two problems inherent to web based material – loss of overview and short attention spans – by satisfying the following structural requirements: (1) *first present the overview then the details* (introduction), (2) *restrict yourself to significant information* (presentation levels), (3) *offer orientation opportunities* (two level sequential order of learning units and presentation units), (4) *provide contextual information* (introduction, summary, objectives associated to each presentation unit), (5) *Don't present too much at once* (small learning units, learning steps and presentation units), and (6) *regularly activate the learner* (each learning step of 10-15 min ends with a self-test).

Our approach is different and innovative as compared to other approaches because

- we identify the didactical components of courseware on the microstructure level and suggest precise qualitative and quantitative guidelines based on research results.
- we distinguish three presentation levels as an additional dimension of structuring online material, which help to focus on essential information while maintaining the formal completeness of the material.
- we do not only introduce didactical metadata such as objectives as useful concepts in organising and managing learning material, but also suggest association of objectives and learning content/exercises to provide a goal-orientated navigation facility and to define indirect associations between single content units of the learning module.

An XML-Binding of our model is currently integrated as a possible didactical component into the LMML and WWR-ML frameworks [SFB99, Dea02].

6. References

[AD01] Advanced Distributed Learning Initiative, Sharable Content Object Reference Model (SCORM) Version 1.2, The SCORM Content Aggregation Model, 2001

[B56] Bloom, B.S.: Taxonomy of educational objectives: The classification of educational goals, Handbook I, cognitive domain. New York, 1956

[B97] S.-P. Ballstaedt: Wissensvermittlung: Die Gestaltung von Lernmaterial. Weinheim, 1997

[D92] W. Dick: An Instructional Designer's View of Constructivism. In: Constructivism and the Technology of Instruction: A Conversation, Hillsdale, 1992

[Dea02] C. Dettlaff-Günther et al.: Teachware aspects and their description particulary through XML. In: proceedings of the *ED-MEDIA*, Denver, 2002.

[G89] A. Gibbons: Algorithmic graph theory, Cambridge University Press, Cambridge, 1989

[GCR96] J.G. Greeno, A.M. Collings, L.B. Resnick: Cognition and Learning. In: Handbook of Educational Psychology, New York, 1996

[K01] R. Koper: Modeling units of study from a pedagogical perspective: the pedagogical meta-model behind EML, Open University of the Netherlands, 2001

[KS88] J.M. Keller, K. Suzuki: Use of the ARCS motivation model in courseware design. In: Instructional designs for microcomputer courseware. Hillsdale, NJ, 1988

[KS89] H. Küffner, C. Seidel. Computerlernen und Autorensysteme, Verlag für angewandte Psychologie, Stuttgart, 1989

[LA02] LAMP-Project: Teaching Initiative Augsburg Munich Passau, http://www.lamp-bayern.de, April 2002

[M93] R.E. Mayer: Problem-solving principles: Principles form the behavioral and cognitive sciences. In: Instructional message design, Educational Technology Publications, 1993

[M94] M. D. Merrill: Instructional Design Theory, New York, 1994

[MDC84] R.E. Mayer, J.L. Dyck, L.K. Cook: Techniques that help readers build mental models from scientific text. In: Journal of Educational Psychology, 76, 1984

[Mea96] R.E. Mayer et al.: When less is more: Meaningful learning from visual and verbal summaries of science textbook lessons. In: Journal of Educational Psychology, 88 (1), 1996

[NE02] Nelli-Project: Web-based Teaching Network for Teacher Education in Computer Science, http://www.nelli-bayern.de/, April 2002

[QTI02] IMS Learning Consortium, Inc. IMS Question & Test Interoperability Specification, http://www.imsproject.org/question/, March 2002

[R99] C.M. Reigeluth: The elaboration theory: Guidance for scope and sequence decisions. In: Instructiona-design theories and models. A new paradigm of instructional theory, 1999

[SFB99] C. Süß, B. Freitag, P. Brössler: Metamodeling for Web-Based Teachware Management. In: Proc. Intl. WWWCM'99 Workshop on the World-Wide Web and Conceptual Modeling in conjunction with ER'99, Paris, 1999

[SLK00] S. Seehusen, C. Lecon, C. Kaben: Specification of Learning Trails in Virtual Courses, Frontiers In Education Conference, Kansas City, 2000.

[WL01] F. Wehner, A. Lorz: Developing Modular and Adaptable Courseware Using TeachML. In: Proceedings of ED-MEDIA, Finland, 2001

[WWR02] WWR-Project, part of the bmb+f program „new media in higher education", www.wwr-project.de, March 2002

[WSK02] F. Weitl, C. Süß, R. Kammerl: Didaktische Strukturierung von Online-Inhalten, IFIS-Report 2002/01, Universität Passau, 2002

Is *e*Learning Effective?
A Review of Literature from 1993-2001

Robert R. Whelan[1] and Dr. Jan L. Plass[2]
Steinhardt School of Education
Educational Communications and Technologies,
Consortium for Research and Evaluation of Advanced Technologies in Education,
New York University,
239 Greene St, Ste. 324, NYC, NY, USA
rrw216@nyu.edu[1] & jan.plass@nyu.edu[2]

Abstract: The past 8 years of growth of the Internet and computing have brought unprecedented change in the U.S. education system. Between 1993 and 1999, the percentage of schools with access to the Web grew from 35% to 95%. and classrooms with Web access increased from 3% to 65%. By fall 2000, the ratio of students to instructional computers was 5 to 1, as compared with 20 to 1 in 1994. During this time, the nation has invested over $38 billion to bring educational technology and Web connectivity to America's schools. But despite this boom, inadequate resources have been devoted to establishing empirically whether or not, and how, the Web is an effective instructional tool. This paper discusses a literature review of over 300 research articles in Web-based learning between 1993 and 2002. The conclusion is reached that empirical research into Web-based learning is severely wanting. A research agenda is proposed based on trends and themes emerging from the papers we reviewed.

The past 8 years of growth of the Internet and computing have brought unprecedented change in the U.S. education system. Between 1993 and 1999, the percentage of schools with access to the Web grew from 35% to 95%. During the same period, classrooms with Web access increased from 3% to 65%. By fall 2000, the ratio of students to instructional computers was 5 to 1, as compared with 20 to 1 in 1994. During this time, the nation has invested over $38 billion to bring educational technology and Web connectivity to America's schools rising from a mere $46 million of funding in 1995, to over $3 billion this year through a range of federal programs. There is every indication that these levels of investment will continue.

Now, a decade after the introduction of this technology, industry estimates suggest that over 500 Million people worldwide are using the Internet (Nua Internet Surveys, 2002). At the same time, a large number of corporations, institutions of higher education, government organizations and non-profit organizations are beginning to embrace the Web for the delivery of training and instruction, naming it "the next major killer app".

Given this high number of individuals with Internet access and the growing interest in using the Web for instruction, the question arises as to what research has been carried out on the effectiveness of Web-based delivery of instruction.

Research Objective

In the review of the literature for this article we will focus on three questions:

(1) How is the Web currently used for instruction, as reflected in the literature?

(2) What types of empirical inquiries are employed to study the use of the Web for teaching and learning?

(3) What evidence for the effectiveness of the Web for teaching and learning is reported?

Method

The literature reviewed for this article included academic journals and conference proceedings in the field of education, educational psychology, and instructional technology. We reviewed a total of over 400 articles from over two dozen journals and conference proceedings. In a first pass, we reviewed the titles of the articles that appeared in each publication since the establishment of the Web in 1993 through they year 2001. We filtered out articles that could clearly be identified as not concerning the Web. In a second pass, we selected articles to be included in the review based on the contributions they made to the discussion of our three research questions.

Findings

Of the papers that we identified as related to the use of the Web for learning and instruction, the vast majority (63%) was of a non-empirical nature. These non-empirical papers were either conceptual articles, discussing design guidelines and theories, prescriptions for the use of the Web in learning and instruction, and taxonomies for Web-based instructional materials (36%), described software, projects, tools, and models (26%), or reviewed the existing literature on Web-based learning (1%).

The majority of articles originated from practitioners of various subject-matter areas who reported on their use of the Web for learning and instruction, rather than from educational or psychological researchers. The most common subject matter used as instructional content for WBI systems included multimedia, Web, computer science, and sciences (especially biology, chemistry, and engineering), which, taken together, accounted for over a third of the subject areas being taught. Mathematics, non-science subjects such as literature or public policy, languages, and music were the subjects taught in just under a third of the WBI research we reviewed. Examples of the less frequent subjects taught by WBI systems included operations management, nanoscience, drug prevention and civics studies. Humanist or esoteric subjects such as philosophy, religion and poetry were notably absent from our sample, although no research was identified which analyzed the differential effects of WBI across different subject areas or topics.

The vast majority of developmental research papers we reviewed described WBI systems which utilized some form of communication systems. Most researchers now emphasize the important role that the Web plays in supporting communication and collaboration among learning teams through email, synchronous or asynchronous chat tools, or in some cases, more advanced conferencing or whiteboard tools and they developed WBI systems built largely around these communication functions.

Most researchers engaged in exploratory or descriptive research, the typical example of which are program evaluations and exploratory survey studies. We found only a very limited number of articles describing naturalistic inquiries and case studies, which is surprising considering the ill-structured nature of the field of Web-based learning and the apparent need for hypothesis-generating research. The low number of explanatory research on causal relationships we found may reflect the fact that the theoretical basis of the use of the Web as an instructional medium is as of yet underdeveloped. The experimental/quasi-experimental studies that we found focused on comparison of Web-based delivery of entire courses with other, traditional delivery formats, or on specific strategies of Web-based instruction, such as computer-mediated communication.

The effectiveness of the Web in instruction was often found to be expressed simply in terms of the *enthusiasm* it generates, the motivation to learn, explore and to participate - on the part of "innovative" teachers as well as learners. The effectiveness of the Web in instruction was also found to be expressed in terms of its much touted "promise": increased access to learning; more personalized learning; more individualized learning; stimulation of collaboration and cooperation of all participants at all levels; empowerment of learners; increased accountability; increased currency (up-to-date) of content; increased efficiency and effectiveness of education; reduced costs; reduced learner time to competence; and rapid adoption of new information and new programs. Our review found many such discussions of these promises, but little meaningful research, evidence or discussion of these promises' relationships to actual gains in academic performance or overall intellectual growth. This "promise" conveys rather, a complete transformation in how the time devoted to learning is spent. Whether or not this brings about improvements in learning performance is usually not addressed.

The effectiveness of the Web in instruction was also discussed in terms of the many diverse functions and functionality of Web-based learning environments, tools and toolsets. From chat, e-mail, images and sound, file sharing, to Web-conferencing, application sharing, electronic whiteboards, and more recent broadband interactive multimedia tools, the Internet has offered a seemingly compelling high-tech toolkit that, though dizzying in variety, is *presumed* to boost learning and instruction. Many researchers would write as though the mere *bundling* of a wide range of tools was pedagogically beneficial in an of itself – the large number of papers written *by* computer scientists *about* computers, multimedia or the Web testifies to this.

Although the research papers we reviewed tended on the whole to be enthusiastic and encouraging about the use of WBI, around 10% of the papers sounded a cautionary – and in some cases, a critical – note about WBI. This wariness showed itself as arguments for the need for a stronger theoretical basis for WBI and a more developed program of fundamental research in WBI, to criticism of the commercialization of WBLEs. Other concerns included the argument that heightened interactivity and visually rich learning resources may not actually aid learning but rather distract, or that hypermedia authoring systems often do not provide functionalities required for true constructivism. Moreover, students still expect to emulate the traditional lecture paradigm online and do not exploit the unique characteristics of WBLEs. Researchers comment that WBLE design takes time, money, and specialized skills and there are usually few shortcuts.

Indications of Future Research Efforts

A wide range of potential research avenues are described by researchers in varying degrees of formalism. By compiling these indications, a glimpse of an overall research framework emerges.

The most frequent research focus in the developmental research papers involved aspects of the complex relationships between, knowledge, mental models and conceptual structures on one hand, and hypermedia navigation and interface design on the other. Much needed research on the theoretical basis for WBI design, development, delivery, evaluation, and learner assessment was also cited frequently in the research we reviewed. Studies of learner collaboration and patterns of learner interaction in WBLEs were also cited frequently, as was research into the relationships between individual differences in/or learning styles with WBLEs. Research into authoring tools and delivery systems, as well as research into learning strategies in WBLEs were commonly mentioned. Authentic, meaningful Web-based learning tasks, the use of authentic technologies and their translation into design principles was another topic requiring further research. More exotic applications of the Web such as immersion and virtuality were also seen as fruitful research areas. Standards and interoperability, learner control, metacognition and complex thinking in WBLEs, as well as cognitive tools, specialized digital learning tools, and teaching tools for specific subjects, were also cited as areas for further research.

Title: Tools of the Web-Based Learning Trade

Introduction

Tools have been integral to all advances of humans since the beginning of time (Rosenberg, 1976). Tools of the agricultural age were the ploughs, the industrial age was the metal implements, and the information age is the computer. These tools helped in the advances of mankind by improving productivity as well as changing the nature of the tasks. Rosenberg (1976) suggests that the fundamental unit of change in all tool effects is how each individual learns to use the tools, improves the use of the tool, and invents new tools resulting in economic development over time. Following that same thinking to the information age focuses our attention on the computer as THE tool of our day. Computer tools have become a part of everyday life today and has become the key to work, play, and learning activities. We use computer tools like databases, spreadsheets, and the World-Wide-Web in most activities today.

The focus of this paper is web-based learning environments and the tools that can support learning. This paper argues that the tools of web-based learning should be the tools that support problem solving and not the tools of course management.

We begin with a theoretical foundation of tool effects on humans, overview of research on how computer tools affect learning and how this information should influence the web-based learning environment, and conclude with two examples of computer tools used in web-based learning.

Theory - The *Effect Of* and *Effect With* Tools

Pea (1985) presented two components of tool effects on humans. First, he suggested that as humans use tools for their activities the tool leaves a cognitive residue on the person using it. This cognitive residue was termed the "*effect of*" computer tools. Salomon et al. (1989) presented findings that showed how learners internalized prompts from a reading partner to improve their reading and monitoring/understanding skills. As learners were given prompts to attend to the main points of the reading, they were able to improve their understanding of the material and were able to transfer the skills to other reading activities. Here the *effect of* the tool was the students' display of the monitoring skills prompted by the reading partner.

Second, humans solving problems with tools is described as the *effect with* tools (Pea, 1985). The *effect with* tools is a complex phenomena where humans can off-load working memory intensive mental activity to a computer tool and concentrate on higher-order thinking and the tool provides an affordance to the activity. Off-loading is a simpler concept where users can overcome limitations of working memory by allowing a spreadsheet to do calculations while they concentrate on higher order activities like hypothesis testing (Salomon, 1990; Salomon et al. 1991). Affordances on the other hand are complex interactions that are affected by the tools, the prior knowledge of the users, and the types of activity where the tool is being used (Gibson, 1966; Greeno, 1994). For example, Zhang (1997) showed that users are affected by the presentation modes and think that one type of Tic-Tac-Toe presentation is more complex than others. Similar findings were report by Kozma & Russell (1997) where younger novice learners were more affected by representations of problems than experts.

The combination of the *effect with* and *effect of* tools has very important implications for the design of web-based learning environments. The computer tools can and do have lasting impacts on the knowledge structures of learners, and these experiences have the potential to affect their future work and learning activities. The research supporting this theoretical framework is described next.

Research - A Summary

The *effect of* computer tools have been studied in the areas of reading (Salomon et al. 1989), writing (Salomon, 1993), mathematics (Adams & Shrum, 1990; Dixon, 1997), science (Roth, 1995), and many others. The findings of these studies are mixed. Wijekumar & Jonassen (2002) presented findings showing how the *effect of* long term computer tool use was evident in experts' problem schemas, approach to problem solving, and the solutions as well.

The *effect with* computer tools also has some very relevant findings. Wijekumar & Jonassen (2002) report how experts interacted with the computer tool to off-load some mental activities like calculations, graphing, and statistical analysis, while they concentrated on identifying the possible factors that explain the results as well as comparing the results from different types of analysis. Roth et al. (1996) however showed that younger learners had difficulty in using the tools because they lacked the prior knowledge and knowledge of the tool's use to effectively accept the affordances provided by the tool.

In summary, research has shown that computer tools do leave a cognitive residue on its users in their problem schemas and knowledge structures. It is also becoming evident that the tools interact with the users providing very complex affordances which are dependent on the prior knowledge and experiences of the users. Based on the research reviewed the following are critical aspects of computer tool use in educational settings.

1. The tool(s) will leave a cognitive residue on the learners
2. The tool(s) should provide the scaffolds and support the learning process as it relates to the goals and objectives of the learning environment and tasks.
3. The tool should also be introduced to help the learners learn and as an assessment tool. It should not be assumed that learners have the domain knowledge and/or tool skills to use the tool effectively.

Given the state of theory and research on computer tools in human activities do we have the right tools in our web-based learning environments?

Web-Based Learning - The Tools

The current rage in web-based learning environments is the use of course design and management systems that are sometimes also referred to as learning management systems. Examples of these products include WebCT, BlackBoard, etc. These environments provide a general framework to allow designers and professors to create on-line courses which contain notes, multiple choice tests, essay tests, links to web sites, chat rooms, bulletin boards, and email. While these are some tools for creating web-based learning environments, they are frequently the only tools available to designers, professors, and learners. A review of any journal on web-based learning and/or papers on the topic shows a variety of topics on comparing web-based courses with in-class courses, studying the discussion contents of bulletin board postings, and analyzing interactions of learners using the same.

Reading these papers makes one want to believe that learning can occur through reading notes, conversations (bulletin board and chat), and/or multiple choice tests only! Tools have been shown to leave a lasting imprint on the knowledge structures of learners and this impact affects future problem solving as well. If students were reading notes, posting comments, and taking tests, what types of knowledge structures can they be expected to have? Are they using the tools that are appropriate for the task? How are they using them? What scaffolds are being used with the tools?

In light of the research and theory discussed in this paper it should be obvious that these web course management tools do not address these concerns and they are not and should not be the only tools of the trade for a web-based learning environment. To be an effective environment for learning it is critical to address the following factors:

1. The right tool for problem solving must be used by the learner
2. The correct scaffolds and help for using the tool should be available to the learner
3. The assessment of the learning should include the use the tool.

Next we present two examples of how tools can be integrated into web-based learning environments to facilitate learning.

Examples of Effective Use of Tools in Web-Based Learning Environments

Case 1

A graduate level course on management economics requires students to analyze data on employee performance to recommend a reward program for a company. As part of the case students on the web are required to read the literature on performance factors as well as incentive and rewards programs. The next step is to provide the student with a statistical analysis tool to perform the analysis themselves.

As part of the course design a Filemaker Pro database was linked to the case study and instructions and guidance was given on the use of the tool. The student was also able to keep open two windows, the first with the database/analysis tool and the second which contained instructions and feedback based on their responses from the analysis.

The important points in this example is that the users had access to a real tool which was used as part of their problem solving activity. They also responded to questions in the second window which was written using a CGI-SCRIPT so that they could submit answers to the system and get automatic feedback on their answers as well as possible next steps. This combination provided the students with the correct tools as well as the scaffolding necessary to use the tools.

Case 2

An undergraduate level course on distributed programming provided a comprehensive enterprise level development environment linked to the course. This environment used open source software Ant, Tomcat, Jboss, XML, and HTML, which was structured so that learners could build, deploy, and test their enterprise application using Java™ in a controlled setting with scaffolds. For example, the learners were given written guidelines and a tutorial on creating, testing, and deploying servlets and linking the servlets to web pages. The students used the pilot environment to develop their solutions using multiple levels of input from the system as well as the instructor, and colleagues. The users had access to the complete sets of instructions, examples of deployed servlets, hints, and access to logs. The environment was set up with secure access from anywhere using a Secure Shell Application and Protocol.

Implications for Designers of Web-Based Learning Environments

The examples presented here were designed to showcase how computer tools can and must be incorporated into web-based learning environments to support the most realistic problem solving environment. The choice of tools depends on the tasks and objectives of the course.

The current array of web-based course management tools are not sufficient to develop a learning environment that supports the construction of problem solving and other complex skills. It should be the designer and/or creators responsibility to identify the tools required and choose the interfaces as well as the implementations that will seamlessly provide access to those tools.

The access methods described in this paper required programming expertise in web related programming and markup languages like html, xml, CGI scripts - Perl, and understanding of the hardware requirements for supporting the course content, layout, and delivery. Building scaffolds adds another level of complexity by requiring a complex thought process on how novices learn, identifying the types of hints they will need, and designing the interface that will provide the scaffold and not be too intrusive in the learning process.

Conclusion

As shown in the examples, the tools of web-based learning should be chosen based on the goals of the course and individual objectives. If a student in a web-based course is learning to create an incentive plan for employees of a company, then they should be given access to the tools that facilitate the tasks that support the objectives. If a student is learning to create a web-based bookstore then they should have the tools and resources necessary to create programs, test them and showcase them. These and many other examples in human services, Physics, Mathematics, and Law will be presented at the conference to showcase how we can improve the cognitive residue of our web-based learning environments and change the nature of the tasks by allowing the learners to off-load mental work to the tool and accept the affordances provided by the tools. These should be the tools of the web-based learning trade.

References

Adams, D.D. & Shrum, J.W. (1990). The Effects of Microcomputer-Based Laboratory Exercises on the Acquisition of Line Graph Construction and Interpretation Skills by High School Biology Students. Journal of Research in Science Teaching, Vol. 27, No. 6, pp. 777-787.

Carter, G., Westbrook, S.L. & Thompkins, C.D. (1999). Examining Science Tools as Mediators of Students' Learning about Circuits. Journal of Research in Science Teaching, Vol. 36, No. 1, pp. 89-105.

Dixon, J.K. (1997). Computer Use and Visualization in Students' Construction of Reflection and Rotation Concepts. School Science and Mathematics. Vol 97(7), 352-358.

Gibson, J.J. (1966). The senses considered as perceptual systems. Boston, MA: Houghton Mifflin.

Greeno, J.(1994). Gibson's Affordances. Psychological Review, Vol. 101, No.2, 336-342.

Hutchins, E.(1995). How a Cockpit Remembers Its Speeds. Cognitive Science, 19, 265-288.

Jonassen, D.H. (2000). Computers as Mindtools for Schools: Engaging Critical Thinking (2nd Ed.). Upper Saddle River, NJ: Prentice Hall.

Kelly, G.J. & Crawford, T. (1996). Students' Interaction with Computer Representations: Analysis of Discourse in Laboratory Groups. Journal of Research in Science Teaching, Vol. 33, No. 7, pp. 693-707.

Kozma, R.B. & Russell, J. (1997). Multimedia and Understanding: Expert and Novice Responses to Different Representations of Chemical Phenomena. Journal of Research in Science Teaching, Vol. 34, No. 9, pp. 949-968.

Lindström, B., Marton, F., Ottosson, T. & Laurillard,D. (1993). Computer Simulation as a Tool for Developing Intuitive and Conceptual Understanding in Mechanics. Computers in Human Behavior, Vol. 9, pp. 263-281.

Mayes, R.L. (1995). The Application of a Computer Algebra System as a Tool in College Algebra. School Science and Mathematics. Vol. 95(2), pp. 61-67.

Pea, R.D. (1985). Beyond Amplification: Using the Computer to Reorganize Mental Functioning. Educational Psychologist, Vol. 20, No.4, 167-182.

Peck, K.L. (2001). Our biggest challenge: proving the power of technologies in educational settings. In R. Branch and M. Fitzgerald (Eds.), Educational Media and Technology Yearbook, vol. 26. Englewood, CO: Libraries Unlimited Incorporated.

Rosenberg, N. (1976). Perspective on Technology. Cambridge University Press: Cambridge, England.

Roth, W.M. (1995). Affordances of Computers in Teacher-Student Interactions: The Case of Interactive Physics. Journal of Research in Science Teaching, Vol. 32, No. 4, pp. 329-347.

Roth, W.M., Woszczyna, C. & Smith, G. (1996). Affordances and Constraints of Computers in Science Education. Journal of Research in Science Teaching, Vol. 33, No. 9, pp. 995-1017.

Salomon, G. (1988). AI in Reverse: Computer Tools that Turn Cognitive. Journal of Educational Computing Research, Vol. 4(2), pp. 123-139.

Salomon, G., Globerson, T., & Guterman, E. (1989). The computer as a zone of proximal development: Internalizing reading-related metacognitions from a reading partner. Journal of Educational Psychology, 81, pp. 620-627.

Salomon, G. (1990). Cognitive Effects With and Of Computer Technology. Communication Research, Vol. 17, No.1, February, pp. 26-44.

Salomon, G., Perkins, D.N. & Globerson, T. (1991). Partners in Cognition: Extending Human Intelligence with Intelligent Technologies. Educational Researcher, Vol. 20, No. 3, pp.2-9.

Salomon, G. (1993). On the nature of pedagogic computer tools. The case of the writing partner: In S.P.LaJoie & S.J. Derry (Eds.) Computers as cognitive tools. Hillsdale, New Jersey: Lawrence Erlbaum Associates.

Wijekumar, K. J. & Jonassen, D.H. (2002). Experts, Computers, and Ill-Structured Problem Solving. Paper presented at the American Educational Research Association Conference, New Orleans, LA.

Williamson, V.M. & Abraham, M.R. (1995). The Effects of Computer Animation on the Particulate Mental Models of College Chemistry Students. Journal of Research in Science Teaching, Vol. 32, No. 5, pp. 521-534.

Zhang, J. (1997). The Nature of External Representations in Problem Solving. Cognitive Science, Vol. 21 (2), 1997. 179-217.

Integration of e-Learning and Knowledge Management

Darrell Woelk
Elastic Knowledge
United States
dwoelk@elasticknowledge.com

Shailesh Agarwal, Ph.D
Docent Inc.
United States
sagarwal@docent.com

Abstract: e-Learning technology today is used primarily to handcraft training courses about carefully selected topics for delivery to employees registered for those courses. On the other hand, knowledge management technology is used to rapidly capture, organize and deliver large amounts of corporate knowledge. This paper investigates the integration of e-learning and knowledge management technology to improve the capture, organization and delivery of both traditional training courses and large amounts of corporate knowledge. First, a model is proposed for the phases of knowledge management. That model is then enhanced with concepts and technology from e-learning. The model is then used to illustrate four real world scenarios that add increasing amounts of knowledge management to an e-learning environment. Analysis of these four scenarios will help to better understand the practical relationship between knowledge management and e-learning.

1. Phases of Knowledge Management

One way of understanding the impact of knowledge management on a corporation or government organization is to look at the knowledge management lifecycle and the flow of knowledge in the organization. Nonaka and Takenuchi (Nonaka & Takenuchi 1995) have investigated the relationship between tacit knowledge and explicit knowledge and have described four phases of knowledge conversion: Socialization, Externalization, Combination and Internalization. The goal of the implementation of knowledge management in an organization is to increase the amount of tacit knowledge that an individual has available to apply to solving business problems. This suggests that there is a fifth phase, Application, which is the application of knowledge that has been exchanged through the other phases (Frappaolo & Toms 1997). These five phases are described below and illustrated in (Fig. 1).

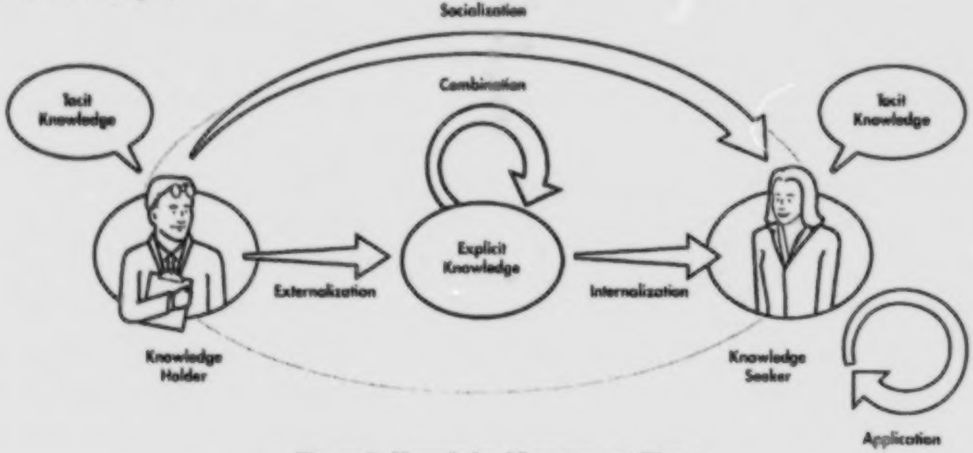


Figure 1: Knowledge Management Phases

BEST COPY AVAILABLE

- **Socialization:** Transfer tacit knowledge from one person to another person
- **Externalization:** Translate tacit knowledge into explicit knowledge in a repository
- **Combination:** Combine different bodies of explicit knowledge to create new explicit knowledge
- **Internalization:** Extract the explicit knowledge from a repository that is relevant to a particular person's need and deliver it to that person where it is translated into tacit knowledge
- **Application:** Apply tacit knowledge to a business problem

2. e-Learning Enhancements to Knowledge Management

e-Learning technology has been evolving separately from knowledge management technology. There have been recent investigations into the integration of these technologies (Barron 2000) (Allee 2000). e-Learning technology will enhance the effectiveness of each of the five phases of knowledge management as shown below. A sixth phase, Feedback, has also been added.

- **Socialization:** Competency and skills measurements help identify the people with specific interests, skills and knowledge in the organization.
- **Externalization:** Knowledge is captured by the system with the intent of teaching that knowledge to other people. This improves the knowledge capture process.
- **Combination:** Knowledge about products and processes of the business is organized to make learning the knowledge more effective and efficient. Pedagogical techniques are embedded in the knowledge.
- **Internalization:** Competency and skills measurements help identify which people lack the knowledge to do their job effectively and provide them with online training. e-Learning will insure that a person has learned the knowledge using assessments and alternative learning methods, if necessary.
- **Application:** People can be provided with on demand performance support by getting just the training that they need at the time that they need it to complete a business task.
- **Feedback:** Assessments provide feedback concerning how well a person has learned and how well they have applied what they learned to a business problem.

(Fig. 2) is a modified and more detailed version of (Fig. 1) that represents the knowledge management phases with e-learning enhancements. In (Fig. 2), a Knowledge Holder can either transfer tacit knowledge to a Knowledge Seeker through socialization or create explicit knowledge and store it in a knowledge repository. The Knowledge Organizer in (Fig. 2) is a person (or software program) who relates the created knowledge to other knowledge in the repository or further refines the created knowledge. The Instructional Designer is a person (or software program) who organizes the learning of the knowledge by adding pre-assessments, additional learning aids, and post-assessments. The Knowledge Seeker then learns the explicit knowledge through an online guided learning experience. The Knowledge Seeker then uses the knowledge gained through socialization or internalization to make decisions and perform tasks in the enterprise. The performance of the Knowledge Seeker on these decisions and tasks is measured and returned to the knowledge repository as feedback that can be used to help determine if the skills have been learned and to suggest additional e-learning experiences.

The implementation of these knowledge management phases with e-learning enhancements will require new advancements in technology. The application of new technologies such as semantic web services, competency ontologies, business process integration and intelligent software agents within an enterprise is discussed in (Woelk 2002). The application of these technologies across multiple corporations, educational institutions and community organizations in support of performance-based lifelong learning is discussed in (Woelk & Lefrere 2002).

3. Business Scenarios

This section illustrates the integration of knowledge management and e-learning through the use of a series of four business scenarios. The scenarios represent the addition of increasing amounts of knowledge management concepts and technology to an e-learning environment.

BEST COPY AVAILABLE

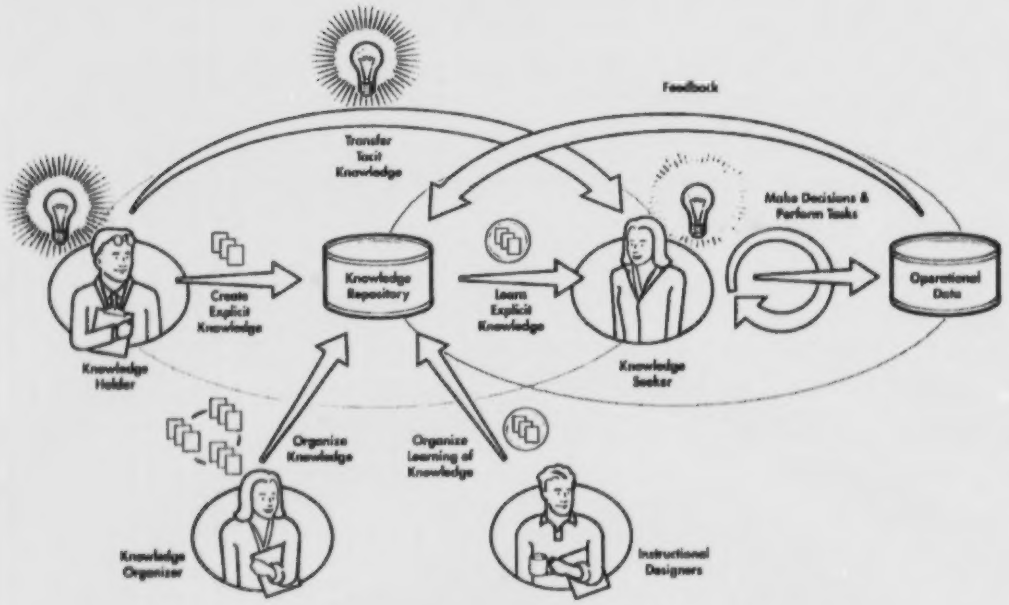

Feedback
Transfer
Tacit
Knowledge
Make Decisions &
Perform Tasks
Knowledge
Repository
Operational
Data
Create
Explicit
Knowledge
Learn
Explicit
Knowledge
Knowledge
Holder
Knowledge
Seeker
Organize
Knowledge
Organize
Learning of
Knowledge
Knowledge
Organizer
Instructional
Designers

Figure 2: Knowledge Management Phases with e-Learning Enhancements

The first three scenarios concentrate on increasing the effectiveness of the performance of employees in meeting the objectives of the company. This requires that an employee receive the *right knowledge* at the *right time* and *just enough* knowledge that they need to execute effectively. The *right knowledge* that an employee needs is determined by their role in the company and the products and processes in which they are participating. The *right time* to receive that is knowledge is when they need it for a specific task. *Just enough* knowledge is whatever they need and nothing more. The fourth scenario concentrates on the ability of a large publisher, such to meet the future demands for the publishing of large amounts of digital information.

3.1. Business Scenario 1: Traditional e-Learning

Scenario 1 is shown in (Fig. 3). A large company has 1000 worldwide salespeople who sell 100 products. There are 1000 engineers and marketing people who create and release 5 new products (or product enhancements) per month. There are 5 instructional designers who collectively build 2.5 online courses per month that are used to train salespeople on new and modified products. These are simple 2 hour courses that concentrate on information transfer rather than skill development. Instructional designers will typically talk to engineers and marketing people to find existing online content or to learn enough to create the learning content themselves. Learning objects (Longmire 2000) are created that may be stored in a Learning Object Repository so that they can be reused in other courses. This helps when new courses are created for existing products but does not help much when courses are created for new products.

The company encounters the following problems with Scenario 1:

- There is content that the instructional designers don't know about that could be used in courses.
- There is content that the instructional designers know about but they can't find. Even if they find content, it might be incorrect.
- Instructional designers don't have time to talk to all of the engineers and marketing people so they produce fewer courses.
- The 5 instructional designers can only build a total of 2.5 courses per month so some products introduced each month no not have a training course.

BEST COPY AVAILABLE

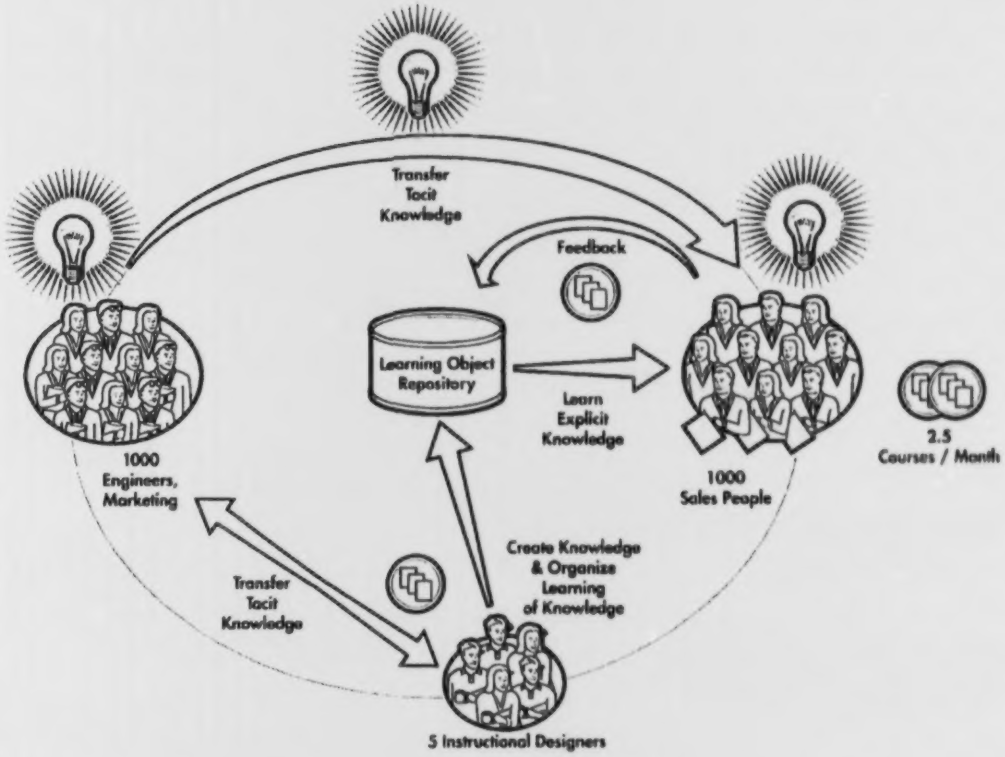

Transfer
Tacit
Knowledge
Feedback
Learning Object
Repository
Learn
Explicit
Knowledge
1000
Engineers,
Marketing
1000
Sales People
2.5
Courses / Month
Create Knowledge
& Organize
Learning
of Knowledge
Transfer
Tacit
Knowledge
5 Instructional Designers

Figure 3: Scenario 1: Traditional e-Learning

3.2. Business Scenario 2: e-Learning Based on Enterprise Content

Scenario 2 is shown in (Fig. 4). In this scenario, the company uses a Content Management System to create, store and update the content about new products from the 1000 engineering and marketing people. This increases the effectiveness of the instructional designers because they can build learning objects by finding and reusing the content created by engineering and marketing. By building learning objects in this manner, the content of the learning objects can automatically be updated when the content in the Content Management System is updated. These improvements will enable the 5 instructional designers to create a total of 5 courses per month.

However, the company encounters the following problems with Scenario 2:

- Courses are created using smaller, reusable learning objects, but entire courses, not individual learning objects, are delivered to sales people.
- People in the company are creating knowledge about the products that is not being embedded in the courses. Email messages, memos, sales call notes, audio messages, meeting notes, product recalls, customer support problem reports, personnel and strategy changes at customer companies, etc. all contain knowledge that would make the sales person more effective.
- Sales people either never know that this knowledge exists or they spend valuable time interacting directly with engineering, marketing and other sales people to find the knowledge. Even then, they might interact with the wrong person and get the wrong information.

BEST COPY AVAILABLE

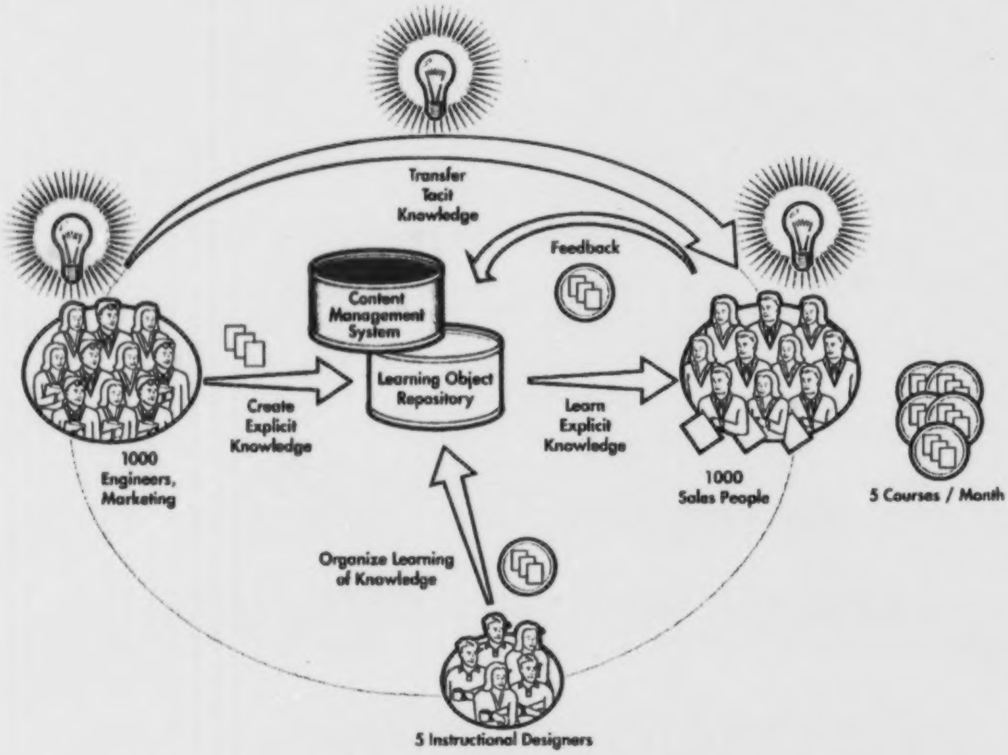

Transfer Tacit Knowledge
Feedback
Content Management System
Learning Object Repository
Create Explicit Knowledge
Learn Explicit Knowledge
1000 Engineers, Marketing
1000 Sales People
5 Courses / Month
Organize Learning of Knowledge
5 Instructional Designers

Figure 4: Scenario 2: e-Learning Based on Enterprise Content

3.3. Business Scenario 3: e-Learning Based on Enterprise Knowledge

Scenario 3 is shown in (Fig. 5). In this scenario, e-learning in the company leverages not only the content in the Content Management System, but also the knowledge that has been captured in a Knowledge Management System. This knowledge includes email messages, memos, sales call notes, audio messages, meeting notes, product recalls, customer support problem reports, personnel and strategy changes at customer companies that were mentioned in the previous section. But the knowledge also includes information on the roles, skills, expertise and performance of individual employees that will simplify the transfer of tacit knowledge and explicit knowledge to the sales person. This knowledge will enable the sales person to find the right learning objects and to contact the right people for tacit knowledge that is needed to be effective. The key to finding the right content and the right people from the multiple information sources in (Fig. 5) is an ontology containing a metadata representation of the concepts, relationships and processes of the enterprise. Progress is being made in the standardization of ontology representations (World Wide Web Consortium 2002). An enterprise ontology can provide a gateway to multiple information sources that can be navigated by people and software agents (Lenat 1995) (Woelk & Tomlinson 1994).

In this scenario, knowledge will be delivered through a variety of presentation devices including web browsers, PDA's and cell phones. This enables the sales person to receive the knowledge when it is needed regardless of where they are and what they are doing. e-Learning will be delivered as small, focused learning objects to fit the format of the presentation devices.

(Fig. 5) shows that the role of the Instructional Designer is still to organize the learning of the knowledge. But the Instructional Designers will be more efficient because the authoring systems will be more intelligent and the knowledge will be better organized. This organization of the knowledge will be the responsibility of Knowledge

BEST COPY AVAILABLE

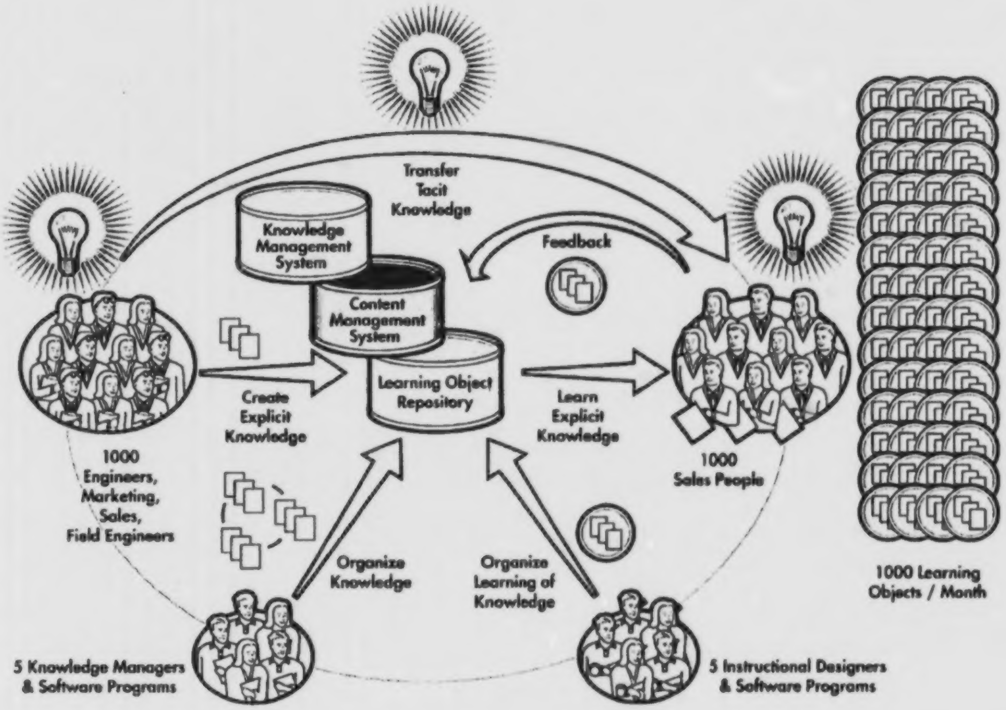

Transfer Tacit Knowledge
Knowledge Management System
Content Management System
Learning Object Repository
Feedback
Create Explicit Knowledge
Learn Explicit Knowledge
1000 Engineers, Marketing, Sales, Field Engineers
1000 Sales People
Organize Knowledge
Organize Learning of Knowledge
1000 Learning Objects / Month
5 Knowledge Managers & Software Programs
5 Instructional Designers & Software Programs

Figure 5: Scenario 3: e-Learning Based on Enterprise Content and Knowledge

Managers and automated software programs. In this scenario, 5 Knowledge Managers and 5 Instructional Designers will be able to create 1000 learning objects per month.

3.4. Business Scenario 4: Digital Publishing

Scenario 4 is shown in (Fig. 6). A large publishing company has 1000 independent authors who contribute content and knowledge to be published to a mass audience of millions of people and institutions. The contributions are in the form of knowledge objects that may be either full books, training courses or smaller pieces of knowledge. The publishing company has Knowledge Editors who organize and correlate the contributions to make them easy to find. The publishing company also has 5 Instructional Designers who may further organize some of the knowledge in order to publish it as e-learning. These authors, knowledge managers and instructional designers will be able to publish a total of 1000 learning objects per month.

This is similar to Scenario 3 except that there are additional issues:

- Knowledge is being transferred across multiple companies and individuals rather than within a single company. This includes thousands of authors and millions of readers.
- The traditional security issues of authentication, authorization, integrity, confidentiality, audit and accountability must be dealt with in a geographically distributed environment.
- The issue of digital rights management must be solved:
  - Ownership of content
  - Rights to use that content in specified contexts
  - Appropriate payment for the use of those rights
  - Security and protection required to enforce those rights
  -

BEST COPY AVAILABLE

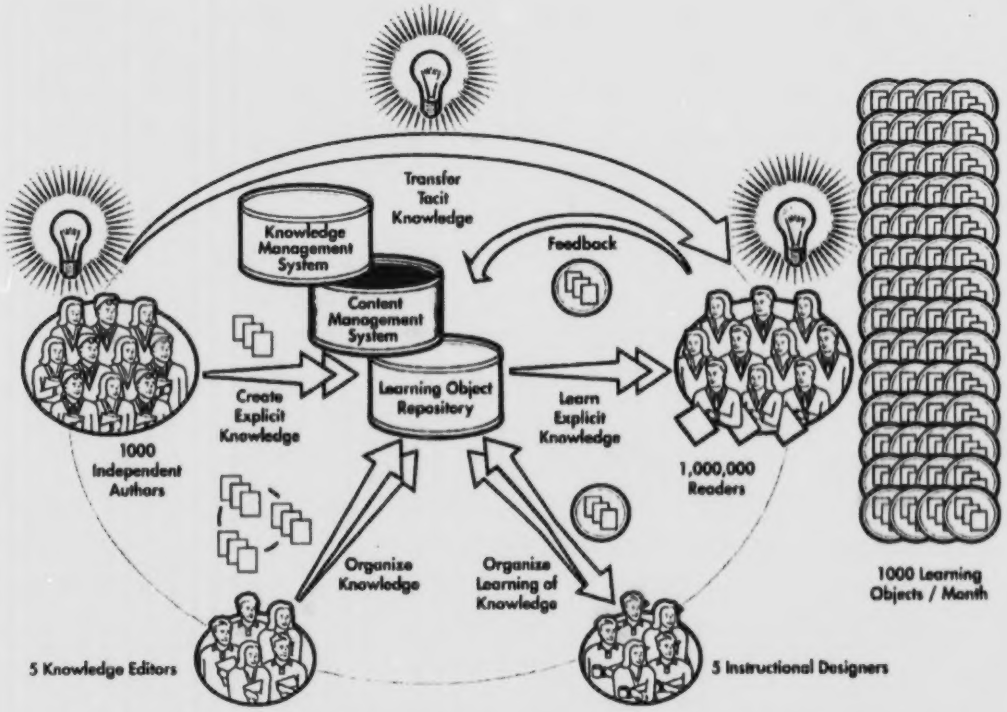

Transfer
Tacit
Knowledge
Knowledge
Management
System
Feedback
Content
Management
System
Learning Object
Repository
Create
Explicit
Knowledge
Learn
Explicit
Knowledge
1000
Independent
Authors
1,000,000
Readers
Organize
Knowledge
Organize
Learning of
Knowledge
1000 Learning
Objects / Month
5 Knowledge Editors
5 Instructional Designers

Figure 6: Scenario 4: e-Learning Based on Content and Knowledge from Independent Authors

- Information about the knowledge that readers already have will be used to identify the knowledge that they wish or need to acquire. This information will exist in a broad number of places such as university records systems, military training histories, company training histories and corporate ERP and HR systems.

4. Conclusions

This paper has illustrated how e-learning techniques and technology can be used to enhance knowledge management in an enterprise and provide the benefits of both. First, a model was presented for the integration of e-learning and knowledge management. The model was then applied to some real world scenarios to illustrate the benefits of this integration. These scenarios also provide a roadmap for the evolution of new systems that will provide both the efficient capture of knowledge and the efficient delivery of knowledge.

References

Nonaka, I. and H. Takeuchi (1995). *The Knowledge-Creating Company*, Oxford Univ. Press, NY.

Frappaolo, C. and W. Toms (1997). "Knowledge Management: From Terra Incognito to Terra Firma", The Delphi Group, http://www.delphigroup.com/articles/1997/11071997KMThoughtMgmt.html.

Barron, T. (2000). "A Smarter Frankenstein: The Merging of E-Learning and Knowledge Management", ASTD Learning Circuits, http://www.learningcircuits.org/aug2000/barron.html.

Allee, V. (2000). "eLearning is Not Knowledge Management", http://www.linezine.com/2.1/features/vaenkm.htm.

Longmire, W. (2000). "A Primer on Learning Objects", ASTD Learning Circuits, http://www.learningcircuits.org/mar2000/barron.html.

World Wide Web Consortium Web Ontology Group. (2002). http://www.w3.org/2001/sw/WebOnt.

BEST COPY AVAILABLE

Lenat, D. (1995). "CYC: A Large-Scale Investment in Knowledge Infrastructure", Nov. 1995, Vol. 38 No. 11, Communications of the ACM.

Woelk, D. and C. Tomlinson. (1994). "The InfoSleuth Project: Intelligent Search Management via Semantic Agents", Second International World Wide Web Conference.

Woelk, D. (2002) "E-Learning, Semantic Web Services and Competency Ontologies", Proceedings of ED-MEDIA World Conference on Educational Multimedia, Hypermedia and Telecommunications, Denver, Colorado. June 2002.

Woelk, D and P. Lefrere (2002) "Technology for Performance-Based LifelongLearning", to appear in the International Conference on Computers in Education (ICCE 2002), Auckland, New Zealand. December, 2002.

XML Based Course Websites

Michael Wollowski
Computer Science and Software Engineering Department
Rose-Hulman Institute of Technology
United States of America
wollowski@rose-hulman.edu

Abstract: XML, the extensible markup language is a quickly evolving technology that presents a viable alternative to courseware products and promises to ease the burden of web authors who edit their course pages directly. XML uses tags to label kinds of contents rather than format information. The use of XML enables faculty to focus on providing contents, leaving the task of rendering contents to experts who provide a single stylesheet used for formatting purposes. This stylesheet has to be edited once, saving time and effort and ensuring consistent appearance of course pages that reference it. However, the major benefit of XML is the ability to provide pinpoint search engines. Additionally, web-based editors can be provided to make editing pages easier.

Introduction

The *Extensible Mark-up Language (XML)* is a promising new technology for creating, maintaining, and searching course pages. XML shows the most promise when it comes to searching for information. Furthermore, the use of XML reduces the overhead of editing web-pages by separating form and contents. Content providers have to do just that, provide the contents. Similar web-pages are rendered by a common stylesheet. It only has to be edited once. A common stylesheet ensures uniform appearance of web-pages that are of the same kind. This in turn provides for ease of navigation and recognition of location.

When it comes to course web-sites, there are largely two alternatives: to edit and maintain them directly or to use courseware products such as (WebCT 2002) or (Blackboard 2002). The benefits of direct editing are complete control over appearance and contents; the major drawback is a lot of work formatting contents. The benefits of courseware products are ease of use and integration with other academic systems, such as the Banner; a drawback is that formatting and functionality are as provided. We propose a third option which is slowly become a viable alternative: the use of XML. We will show in this paper that XML shares most of the benefits of the two current alternatives: ease of contents creation and maintenance as well as complete control over appearance and contents. A major added benefit of XML is the ability to furnish very precise search engines, enabling users such as students, prospective students, or prospective employers to quickly locate relevant information.

Industry started using XML a while ago, chiefly to unify information between companies and their suppliers (Goldfarb & Prescod 2000). We show an application of this technology that demonstrates its benefits for academic use. We will briefly explain the main components of XML and in the process show how XML separates form and contents. We will demonstrate how common information can be placed into separate files, greatly aiding in the maintenance and consistency of course sites. We will show how to is to provide web-based editors as well as search engines for course pages. Finally, we will report on the status of the project.

Separation of Form and Contents

XML is three technologies in one. It consists of *XML* proper, which is a language for labeling contents. There are *Document Type Definitions (DTDs)*, which are used to specify kinds of documents. Among others, DTDs specify the labels to be used in XML documents. Finally, there are languages to render XML documents. Typically, web-authors use either the *Extensible Stylesheet Language (XSL)* or *Cascading Stylesheets (CSS)*. Since XSL is more powerful when it comes to the way final documents can be composed, we chose XSL over CSS. At this point, only Internet Explorer 5.5 and higher support XSL. Most other browsers support only CSS.

In what follows, we present an example of an XML document containing a course description of one of our courses. We want to show how XML supports the separation of form and contents. The challenges of dealing with larger documents such as syllabi will be addressed in the conclusions. Figure 1 shows an XML file containing course description information for CSSE 100, one of our courses. In general, white space does not matter and should be used to enhance readability. XML *tags* are identified by opening and closing angle brackets. A closing tag is identified by a forward slash preceding its name. An opening and closing tag form an *element*. To aid in readability, we boldface the tags in this write-up.

The second line indicates that this document is of the type as specified in the *course_description.dtd* document. The third line asks web-browsers to use the *course_description.xsl* document to render this document. The contents proper is nested inside of the **course_description** element. There, we find information on the course **id**, its **title**, number of **credits**, and a brief catalog course **description**.

```
<?xml version="1.0"?>
<!DOCTYPE course_description SYSTEM "course_description.dtd">
<?xml-stylesheet type="text/xsl" href="course_description.xsl"?>

<course_description>
      <id>
            CSSE100
      </id>
      <title>
            Introduction to Programming and Problem Solving
      </title>
      <credits>
            2
      </credits>
      <description>
            An introduction to general methods of problem
            solving, structured algorithm design, object-oriented
            techniques, and elementary computer programming.
      </description>
</course_description>
```

Figure 1: XML document for a sample course description

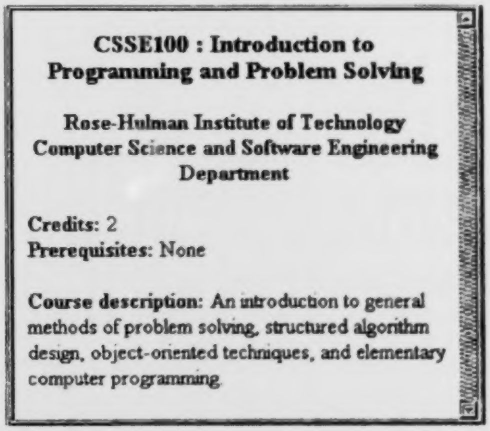
Element names are chosen by the author of the DTD. A web-author has the option of using an existing DTD or to design their own. A key principle of XML is that element names are used to indicate kinds of contents. Notice that there is no formatting information present. This is in contrast to HTML, where tags are used to format contents. This is the primary difference between XML and HTML. We will now explore the ramifications of this difference.

Since in XML, elements are used to indicate kinds of contents, content providers do not have to be concerned about formatting. This of course greatly simplifies the life of the typical academic web-author, who lacks time to memorize HTML formatting tags and who oftentimes spends considerable effort fiddling with HTML tags to obtain a halfway decent looking web-page. While authors who prefer to edit their documents with plain text editors still have to memorize XML elements, we will show in the section on "Ease of Editing" how even this can be circumvented.

In order to render an XML document, XML elements have to be translated into HTML formatting tags. We decided to use XSL over CSS, because of its wider range of transformations. XSL stylesheets are rather complex and can be lengthy. We will not present a stylesheet here, but refer the interest reader to (Wollowski 2002) which contains the stylesheet used to render the XML document from figure 1. The result is displayed in figure 2.

XSL stylesheets are complex. They should be edited by someone familiar with them. Alternatively, it may be advisable for contents providers to adopt a DTD and stylesheet from other organizations rather than editing their own.

There are several benefits to a well-designed stylesheet. (i) If all pages of a given kind reference the same stylesheet, then they all appear the same. This greatly aids users in finding information across courses. (iii) If changes to the appearance of course pages have to be made, only one document has to be edited. (iii) Content providers only have to reference a stylesheet. This leaves the worry over appearance to specialist versed in web-design. Since every HTML based web-page has to be concerned with form in addition to contents, not having to worry about appearance offers a significant time savings.



CSSE100 : Introduction to Programming and Problem Solving

Rose-Hulman Institute of Technology
Computer Science and Software Engineering Department

Credits: 2
Prerequisites: None

Course description: An introduction to general methods of problem solving, structured algorithm design, object-oriented techniques, and elementary computer programming.

Figure 2: Sample XML document as rendered by our stylesheet

A further benefit of XML is the ability to take information common to documents and place it into a separate file. For example, the document of figure 2 contains information about the department and institution. Notice that they are not part of the file displayed in figure 1. Since this information is common to all course description pages, we placed it into a separate file which is displayed in figure 3.

```
<?xml version="1.0"?>
<!DOCTYPE course_description SYSTEM "course_description.dtd">

<departmental_information>
        <institution>
                Rose-Hulman Institute of Technology
        </institution>
        <department>
                Computer Science and Software Engineering Department
        </department>
        <term>
                Fall
        </term>
        <year>
                2002
        </year>
</departmental_information>
```

Figure 3: XML document containing departmental information

In our experience, one of the most time consuming and menial tasks is the updating of web-pages between terms as this requires changing term specific information. By referencing files with common information, only one (or few) documents have to be changed, with obvious benefits for sanity and consistency.

Notice that the file from figure 3 contains information that is not displayed on the course description page. The additional information is used for syllabi pages.

BEST COPY AVAILABLE

An often overlooked aspect of XML are Document Type Definitions (DTDs). DTDs serve to specify XML documents. As such they can be regarded as specifying classes of XML documents. A contents provider should consult the DTD for the kind of document that they plan to author, in order to learn about the available element names, the order in which they should appear in the document, and whether they are necessary or not. XML documents are currently not validated against their associated DTDs, hence a lot of authors do not create DTDs. However, there is an important reason why one should prepare DTDs. Stylesheets are used to render XML documents. In order to properly render an XML document, the stylesheet should have formatting directives for all elements to be expected in an XML document. The author of a stylesheet should consult the DTD for the type of document they wish to render. As such, a DTD serves as much to document a stylesheet as it serves to document an XML page.

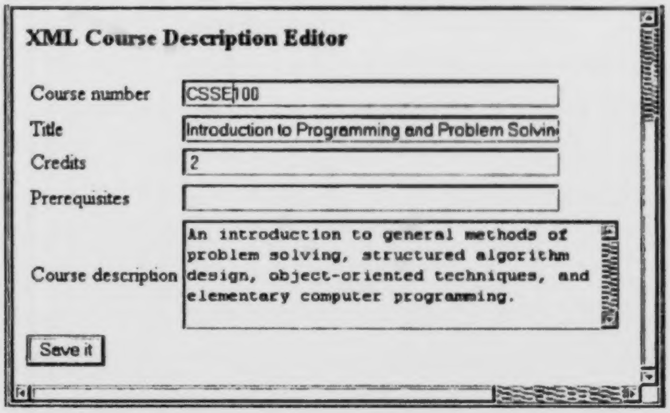
Another important reason for providing DTDs, is that they enable the automatic generation of XML editors, a point that will be revisited in the following section.

Ease of Editing

There are several ways in which content providers may edit XML documents. The most straightforward way is by using a regular text editor. In this case, authors have to memorize element names as well as the structure imposed by the DTD, or they have to have the DTD handy. Due to the semantic nature of the elements, memorizing element names is not too much of a chore.

For web authors who prefer the use of text editors, we provided a template for a sample course document. Naturally, a document of an existing course could be copied, but it may not contain all elements.

For web authors who are not willing to use text editors, we provide a forms based web-page which prompts users for information to be placed into given elements. Figure 4 contains a screenshot of the editor for our course description pages. When using this editor, authors do not have to look up the DTD or memorize element names. We set up the editor so that certain elements come with default information which can either be accepted or edited. An example of such default information is the prefix for course numbers. The editor, which is password protected, can be used to generate new documents or to modify existing documents.



XML Course Description Editor

Course number: CSSE100

Title: Introduction to Programming and Problem Solvin

Credits: 2

Prerequisites:

Course description: An introduction to general methods of problem solving, structured algorithm design, object-oriented techniques, and elementary computer programming.

Figure 4: Interface to editor for course description pages

Since XML documents are only concerned about contents, it is feasible to provide a form field for each XML element. Right now, the fields are hard coded into the editor. We are currently working on ways to automate the editor so that it dynamically generates form fields based on a DTD.

One of the concerns when using XML are last minute additions to a document which fall outside of any given XML element. In general, the contents are rendered. However, there will likely not be any formatting. In order to format such additions, the stylesheet would need to be modified or expanded, with appropriate modifications of the corresponding DTD. This is a very time consuming effort and such

BEST COPY AVAILABLE

changes should probably be made only in consultation with the department. To enable authors to make last minute additions to an XML page, we provide them with the ability to use regular HTML tags.

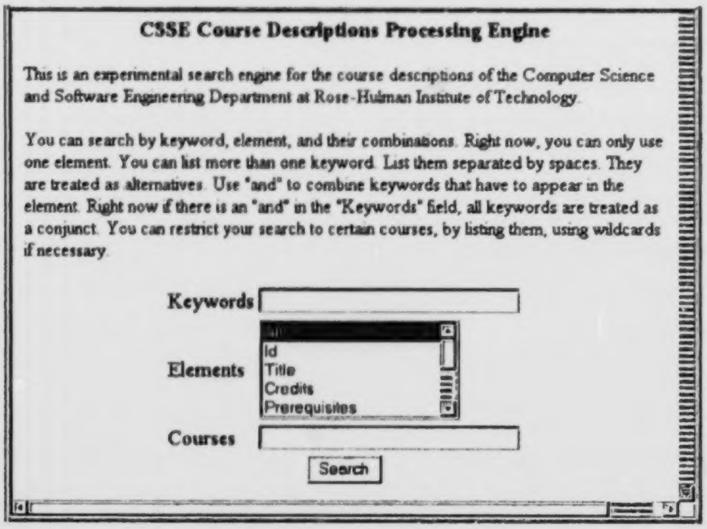
In XML documents, each element must be closed by its corresponding tag. This means that when including HTML tags into an XML document, matching end tags must be present. As such, HTML code has to conform to the original specification of HTML, something that current browsers do not enforce.

If authors follow this simple rule, our stylesheet can render inline HTML code properly. We edited a stylesheet that can render HTML documents, and reference it from the stylesheet for the course description pages. This is another case where XSL shines. With XSL, one can include additional stylesheets into a particular stylesheet.

Another benefit of XSL is that stylesheets can be set up to process missing information. For example, the XML document of figure 1 does not contain information on the prerequisites for that course, yet the web-page from figure 2 states that there are none. This information was purposefully placed there by the stylesheet. Knowing about this ability of a particular stylesheet, web authors can further reduce their work.

Pinpoint Searching

A major benefit of XML is the possibility for vastly improved web-search. Due to the semantic nature of XML elements, search can be restricted to elements, thereby pinpointing searches. XML searching is an acknowledged research problem and we are only beginning to explore the exact benefits of searching XML files. Figure 5 contains a screenshot of the search engine for our course description pages.



CSSE Course Descriptions Processing Engine

This is an experimental search engine for the course descriptions of the Computer Science and Software Engineering Department at Rose-Hulman Institute of Technology.

You can search by keyword, element, and their combinations. Right now, you can only use one element. You can list more than one keyword. List them separated by spaces. They are treated as alternatives. Use "and" to combine keywords that have to appear in the element. Right now if there is an "and" in the "Keywords" field, all keywords are treated as a conjunct. You can restrict your search to certain courses, by listing them, using wildcards if necessary.

Figure 5: Interface to search engine for course description pages

There are a variety of searches that can be performed with it: (i) One can search for one or more keywords inside of one or more selected elements. The keywords can be treated as a conjunct by including the keyword "and" in the search term. Alternatively the keywords are treated as a disjunct. (ii) One can search for keywords in entire documents. (iii) One can browse pages by element, by leaving out keywords. In this latter case, information of the selected element is displayed for each of the documents accessible to the search engine. In the "courses" textbox, one can restrict the search to the documents specified.

The type of search engine made possible by XML is advantageous for many kinds of users. Consider searching the course description pages. If a student has taken a certain course, they can search the prerequisites fields with that course's number to see which other courses they can now take. Prospective students may search course descriptions for reference to certain programming languages.

BEST COPY AVAILABLE

Given information on which courses a students has taken, prospective employers can search syllabi for a whole host of interesting information. For example, they may be interested in the programming languages to which a student was exposed, or the kinds of projects in which they participated, or the kinds of books they were supposed to study. As such, XML is more than a search engine. We like to refer to XML based search engines as *information processing engines.*

Our search engine is custom tailored to the XML document (as specified in the DTD.) Next to the editor, a customized search engine is the second piece of software that can be automatically generated from a DTD. At this point, our search engine is very primitive. There are many open issue that need to be addressed. We are working on some of them.

Multiple formats

The existence of a single stylesheet for documents of a given type ensures a uniform appearance of those documents. However, sometimes instructors prefer a certain appearance over another. For example, some instructors prefer a navigation bar at the top of a web-site, while others prefer to locate it at the left-hand side. While violating the principle of uniformity, those wishes can be adapted by providing stylesheets which implement those ideas. To go one step further, we are currently working on a way to enable students to select the stylesheet that most suits their web-surfing habits.

Conclusions

Using a sample course description, we have shown how to harness the power of XML to provide tools for convenient editing and maintenance of course description pages. Due to the separation of form and contents in XML, it is very natural to obtain a uniform appearance of departmental course pages. Last but not least, we have shown how to easily generate precision search engines, which are useful for current and prospective students as well as prospective employers.

During the presentation we will demonstrate the software for editing and searching syllabi. We will also report on faculty feedback when it comes to editing pages and student feedback in regards to ease of search. At this point, we want to gain more experience with our chosen set-up. In order to be scaleable, further work has to be done on the design of the search engine. We are currently working on this problem and will give a status report at the meeting.

Realistically, XML presents an exciting avenue for those departments that have not moved to courseware products. However, even departments that have adopted courseware products way wish to investigate the benefits of XML technology. The current lack of integration with systems such as Banner does not pose a problem, as course pages are fairly independent of information stored in Banner type systems. In our department, we have several pieces of software aimed at providing some of the functionality provided by courseware sites, giving us the power to tailor them to our needs.

For those interested in learning more about XML, I found the following books very useful (Harold & Means 2001, Williamson 2001).

References

Blackboard (2002). http://www.blackboard.com/

Goldfarb, C.F., Prescod, P. (2000). *The XML Handbook*, 2nd Ed. Prentice Hall.

Harold, E.R., Means, W.S. (2001). *XML in a Nutshell.* O'Reilly.

WebCT (2002). http://www.webct.com/

Williamson, H. (2001). *XML: The Complete Reference.* Osborne.

Wollowski, M. (2002). http://www.cs.rose-hulman.edu/~wollowsk/xml/dept/course_description.xsl

Factors Limiting the Proliferation of E-learning within Small to Medium Sized Enterprises

Dan Wood, NTP Information Solutions Ltd, Sheffield, United Kingdomdwood@ntp.co.uk

Jason Watson, School of Engineering, The University of Huddersfield, United Kingdom j.a.watson@hud.ac.uk

Abstract: In today's cut-throat economic climate companies have to look more than ever for new ways of operating efficiently. When a company looks for ways of reducing its fixed expenditure it is inevitable that long-term investments, such as the budget allocated for training, will come under scrutiny first. So, as companies become leaner, and budgets become tighter, the money allocated for training becomes tighter. At the same time there is pressure to maintain a well trained workforce and good on-going training programmes are essential to the recruitment of well qualified staff. As a consequence, trainers and managers of companies are looking increasingly towards employing E-learning to fulfill the need for alternatives to more traditional methods of instruction. However, despite the unprecedented success of E-learning technology within big business, the take-up within small to medium sized enterprises (SMEs) has been somewhat less meteoric. This paper explores the factors inhibiting the utilization of E-learning technology by SMEs, and the innovations the E-learning industry has implemented to overcome them. Particular focus is given to the issues surrounding payment for online leaning content. Conclusions include recommendations for future E-learning developments aimed at SMEs.

Introduction

The World Wide Web has provided methods of supplying tailored, measured and assessable learning material throughout the globe in ways which were unimaginable just a few years ago. The Internet has made distance learning a serious alternative to classroom based training. However, the industry uptake of E-learning technology has been somewhat disappointing – although E-learning technologies have a foothold with key market leaders, notable examples being Cisco, Dell and Microsoft, uptake within the small to medium sized enterprises (SME) sector has been slow.

This paper investigates reasons, both environmental and cultural which may be preventing the smooth integration of E-learning technology, and also aims to investigate the technologies which may increase the lacklustre proliferation of E-learning at the lower end of the financial spectrum, focusing on the integration of modern and innovative e-commerce technologies.

The SME Market

According to the European Commission Information Society Directorate-General an SME is a business which employs less than 250 individuals, and has an annual turnover of less than 40 Million ECU or an annual balance sheet total of 27 Million ECU (European Commission 2002). In the USA the definition is slightly different: 'up to 300 employees, total assets of up to $15 million, and total annual sales of up to $15 million' (IFC 2002).

98% of the 3.7 Million businesses trading in the UK are SMEs (by EU definition) (Small Business Service 2000). In the UK; SMEs account for 51.1% of all turnover and employ 55.1% of all those employed.

In Canada; 6 out of 10 employees work for SMEs (Canadian FIB 2002 - Slide 4). The same statistics also state that 58% of all Canadian SMEs prefer an informal approach to staff training, whereas only 33% have a structured training system (Canadian FIB 2002 - Slide 4). Formalised classroom based training is often beyond the financial reach of smaller businesses, and the only realistic cheaper alternative currently available is computer based training (CBT). In the next section, reasons which may account for such a high percentage of SMEs rejecting formalised training are explored.

Factors Inhibiting the Growth of the E-learning Industry in the SME Sector

Legacy Computer/Training Systems

Larger industries have been implementing E-learning solutions for many years, with some significant successes. The focus in many large companies is not the integration of computer based learning CBL into their infrastructure, but rather the amalgamation of many individual, unrelated systems. British Airways have accomplished this, not inconsiderable task with some success. Their 60,000 employees now share a unified training system (Department of Trade and Industry report 2001) which gives all employees access to the same recourses throughout the company. The SME CBL market is not as mature as that of larger businesses, so proper planning of systems as they are integrated should be a consideration to avoid situations such as those prevalent in the E-learning systems of companies such as BA a few years ago.

Utilising modern E-learning software on legacy PCs may pose a major problem for SMEs, in response to this; CD-ROM based CBT is often inherently 'platform specific', that is to say it is designed to run on one specific operating system or type of computer. Many companies now develop content designed to run in any web-browser, on virtually any PC capable of supporting this kind of rudimentary software. As with CD-ROM based applications; there are, however, pitfalls in this approach – in order to deliver interactive learning content incorporating complex multimedia several 'plug-ins' and supplementary applications may be required (for example: Online Expert 2002), for instance 'Flash', 'Real-Player' and 'Acrobat Reader'. Although implementing these multimedia features expands the range and possible interactivity of learning content, implementing them increases the system requirements of the host computer, and makes use of 'thin clients' such as hand-held computers more difficult. An example of a system, which requires the user to install several components in order to function properly, is the system run by 'Online Expert'. This system also requires an up to date version of 'Microsoft Internet Explorer' browser to be installed, further limiting use of the system by those users who do not use Microsoft technology.

Perceived Ineffectuality

One of the major obstacles to the expansion of E-learning techniques into the SME market is the perceived ineffectuality of the learning material. Technology improvements and innovations in the E-learning sector in recent years have led to dramatic increases of the quality and effectiveness of online learning and computer based training; including levels of interactivity and multimedia content which were impossible just a few years ago. Tests have shown however, that negative preconceptions still exist regarding the effectuality of CBL (Dewhurst Et Al 2000). The same research also indicates that most negative preconceptions about CBL are reversed once effective, modern learning content has been sampled. These prejudices do still exist, and overcoming them is one of the greatest limiting factors on the success of E-learning. The level of interactivity and multimedia content of learning material delivered online has scope for even greater improvement due to the enhancements in streaming technologies, and the increased use of 'broad-band' Internet connections. All these innovations should help to convince sceptical SMEs that there will be an acceptable return on investment provided by E-learning systems.

Large training providers tend to deliver their online learning content through a Learning Management System (LMS). An LMS is a control application that facilitates the administration of learners, and the learning material they have access to; allowing a supervisor to track a student's progress through a course. An effective LMS will usually facilitate the measurement of system performance, providing feedback to a company regarding the usage by staff, and assessment results. An LMS can also ensure that trainees have completed the amount of training and achieved the level of skill required to comply with relevant standards.

Computer Anxiety

Within certain industrial sectors, computer anxiety is still a defining factor in the selection of a training methodology. Anxiety can be predicted and pre-empted within the workplace; certain social groups are more prone to suffering excessive fear or mistrust of computer systems. These groups may be predicted from general demographic information (Mikkelsen Et Al, 2002), and although these problems may be overcome with additional training, many companies may see this as unnecessary expense and be unwilling to embrace computer based learning for this reason alone. (Sun HC 2000) CBL needs a prerequisite of computer proficiency to be attained before it can become effective. To an individual who has, for instance, never had cause to use a mouse; beginning a computer course would be impossible without some human teaching intervention. Several training solutions have been instigated to address this; in Europe, ECDL (European Computer Driving License) courses are available from many training vendors. These low cost courses provide an introduction to computing for users with little or no experience with IT systems (ECDL Tutors (2002).

Perceived High Cost

Perceived high cost is one of the prevailing factors which influence the SME market's continuing rejection of E-learning culture; this is a problem particularly prevalent with learning content which is delivered via the World Wide Web. Online delivery of learning content is fine for 'wired' companies with permanent or 'always on' Internet connections, but for many SMEs the Internet is still a seemingly expensive luxury. This problem recedes with every year that passes, as more and more individuals and businesses are connected to the Internet through free services, or services that use a flat fee system, rather than charging 'per-use'. A greater problem is the lack of Internet access for individual employees within SMEs. In the UK this could pose a substantial obstacle to individual usage of online Elearning systems. Corporate paranoia over security breaches and employee misuse of the internet in the UK have led to this situation, improvements in security systems and staff monitoring are slowly remedying it.

The method of purchasing online training materials may be a contributing factor in the continued failure of the E-learning industry to penetrate SME sector. In general, companies wishing to offer their employees online or computer based learning must either design it in-house, commission bespoke software or purchase an 'off the peg' solution from an existing training provider. Generally the cost is the main inhibiting factor regarding systems designed to meet a specific companies' needs. Generalised 'off the peg' solutions are fine for 'general' training needs, but many companies require training on relatively exclusive systems and skills.

One solution to this particular problem is the modularisation of learning content. Several companies offer training solutions involving a process of selection of several modules from their catalogue, ultimately creating a customised learning experience without the added cost of creating whole courses for a specific company or application. This approach can save money by reducing the overall cost of a customised training solution, but may inspire doubts in customers who may feel that they do not receive a training solution truly designed to meet their needs.

Perceived Lack of Structure and Guidance

In the absence of a formal 'teacher', motivation of learners can become a problem. The environment within which learning takes place is an important factor, as the workplace is not usually a location associated with formalised learning, students may find it hard to concentrate. Without a tutor to structure learning, define deadlines and monitor student progress, motivation may be lost. An LMS can incorporate features which can replicate some of the functions of a tutor and is a highly effective way of deploying modularised Elearning content over the World Wide Web (JJ Kuisma & JA Watson 2002), providing a framework for assessment and tracking of individuals learning in ways that even classroom learning cannot match; it is possible to assess, not only what a student reads, but also how fast and at what time.

An extension of modularisation is 'intelligent tutoring' (JJ Kuisma & JA Watson 2002). Basic modularised training consists of a content designer, be that a tutor or student supervisor, creating a learning path, through a series of modules. These separate modules form the 'lessons' in the online course, a students path through these modules is often linear and static. There are several obvious problems with this; students may require further tuition on certain concepts within the subject, but not on others. Because the path through the course is pre-set, a student must seek other means to fulfil his or her learning requirements. Intelligent tutoring offers an effective solution to this problem; the learning path is dynamic; once a student has embarked on a module, his/her path through it is not statically defined. This makes several exciting learning concepts possible; if for instance a module is assessed regularly throughout it's course; for instance once every two 'pages' of learning content, a student's answers will alter the path they take through the learning content. For instance, if the student gets questions on a particular concept incorrect, he/she may be directed through an extra module clarifying the subject (A Patel Et Al 2000).

This system may also provide more challenging systems of 'in-course' assessment, if an end of section test is failed and must be re-taken, an intelligent tutoring system could provide an entirely different set of questions (covering the same subject of course) drawn from a central 'pool' of questions on the module. This way, it would not be possible to simply learn the answers to the questions a student answers incorrectly; actual understanding of the subject matter would be necessary to pass the module.

Commitment/Payment

There are several issues regarding the payment method when purchasing online E-learning material, which smaller companies may find daunting. Many E-learning providers require a large initial outlay; customers often have to purchase entire courses or series of courses at once. Some companies offer more SME friendly systems – whereby smaller modules of learning content are purchased (obviously for a smaller price). However, these systems usually require a commitment of a large 'initial set-up' fee or, at best; an account with the training company. This kind of commitment requires great confidence in return on investment, E-learning concepts and the companies providing them. This confidence is often not forthcoming in SMEs.

One method of payment for E-learning content focussing on recognised qualifications is to create a system whereby the 'lessons' are free, but the assessment required to obtain the qualification is chargeable. Thus SMEs may sample the learning content, without any obligation, but once the training is completed may decide to purchase the accredited qualification.

A LMS may also provide a mechanism for 'pay-per-use' charging of learning content. The problems outlined above, regarding the purchase of learning content can be made even more complicated with the introduction of non-linear learning paths (as in intelligent tutoring systems). The LMS can sidestep most of these payment problems relatively easily – the LMS may track all actions a student takes while moving through a course. This information could not only be used for monitoring of an individuals learning, but also their chargeable usage of the system. Some companies are beginning to utilise pay-per-use systems such as these, but the concept is still, largely speaking, in its infancy. In general, companies still require registration of an account to access and use learning content; this is a handicap when dealing with small companies for which this system may represent a daunting commitment.

In order for a pay-per-use system such as the one described above to be truly effective, a commitment free way of transferring relatively small amounts of money would have to be implemented. Unfortunately credit cards are not suitable for this purpose. Since the introduction of 'Diner's Club' (the world's first universal credit card) in 1951, the credit card transaction model has remained largely unchanged. The general model of an online credit-card transaction is very similar. Generally a customer locates the products he/she wishes to purchase and places an order, supplying a credit card number and various personal details for verification. Once the merchant receives the order, it contacts the credit card issuer to verify the customer is authorised to remove the funds. In order to complete a transaction, the following information is supplied by the merchant: Merchant ID, Valid card number, Expiration date, Credit-card limit and Card usage. Either; the transaction is refused, in which case the customer is informed and the sale is cancelled, or the transaction is approved, the funds are transferred electronically to the merchant and the goods are dispatched to the customer (Lamond 1996).

The main flaw with credit card transactions is cost. Mainly thanks to the increase of fraud, online and otherwise, coupled with the administrative tasks required to perform a credit card transaction, the effective 'cost' to a merchant has increased. The money required recovering stolen or misplaced funds, and the lost funds themselves contribute to this overhead. This situation effectively means that it is only economically practical to make credit cards transactions above a certain monetary amount. In the offline world this is not a major problem. Smaller purchases (of a few pounds or a matter of pence), i.e. a bus ticket or a newspaper, can easily be purchased with cash. However, because of the overhead on credit and debit cards it is currently impractical to purchase items such as these remotely through the Internet or over the phone.

Generally, e-commerce websites are centred on the sale of items and services of a value of at least £10.00 (GBP). Although websites do sell items below this price, they usually do so alongside more expensive products, rarely does a seller specialise in extremely small goods. The monopolisation of the online shopping community by credit card based payment systems has proved to be the stumbling block to the sale of small scale intellectual property e.g. online newspapers, sports scores or in this case; E-learning material. To attempt to facilitate the purchase of low value items, several systems have been devised. Unfortunately, mainly due to poor industry collaboration and low retailer uptake, the systems have not been adopted widely by consumers and consequently many have failed.

Many recent notable systems have relied on a subscription based approach to the purchase of goods. A user purchases 'electronic cash' via credit card, in a large enough denomination to make a credit card purchase financially viable e.g. £15.00, then uses this electronic cash in much smaller units to make purchases at participating vendors. The accepted terminology for such small purchases is Micropayment (M Liskov 2001). In principal this model is a viable method of making Micropayments remotely or online. A similar system to the one described above was implemented by Digicash. The system was developed by the renowned Dr. David Chaum and, in its infancy, was billed as the future of electronic payment systems. Unfortunately Digicash filed for bankruptcy in 1998, and in early 1999 was acquired by eCash Solutions, who discontinued the project (McCullagh 2002). One flaw of this product, which may discourage a merchant from taking it up, is the requirement of subscription and initial deposit. This removes the possibility of 'impulse buying' for non-subscribed users. Also, consumers may be unwilling to deposit relatively large amounts of cash with a company who may only have one or two merchant partners. Effectively a customer could be left with an 'e-wallet' full of 'e-cash' and nowhere to spend it.

This unwillingness to support new and un-established services by both consumers, and the retail industry as a whole has brought about the birth of many innovative methods of utilising existing Micropayment systems. For example, telephone users are effectively already equipped with a fully functional Micropayment system: Calls costing a small amount are paid for as part of larger bill, at a regular interval. The Orange network has already implemented a mobile telephone based Micropayment system in Denmark, with promising results. This could be extended to an E-learning system, for instance by utilising the chargeable Short Message Service (SMS) (used to purchase mobile telephone 'ringtones' and graphics by hundreds of vendors in the UK alone) to pay for learning content as and when it is required.

Purely online payment systems have also attracted the attention of some major IT companies in the last couple of years: most notably Millicent. This is a Micropayment system implemented by Digital Equipment Corp, now owned by Compaq. The system went live in June 1999 in Japan, with wallets starting at 1000 yen and payments as small as 5 yen (approximately £0.025 at launch time). The system was also given a trial in the USA. Compaq claim MilliCent's trial run went "extremely well." The trial had 10,000 users buying small pieces of content from more than 45 vendors, including the Oxford University Press, which sold dictionary lookups; and the University of California at Berkeley, which sold individual book chapters (Mitchell 1998). About 84 percent of the transactions were for less than 25 cents, and 73 percent were for less than 5 cents. The median transaction was for 2 cents, but, thanks to a few people who spent a few dollars at a time, the mean average was 30 cents (Mitchell 1998). Despite these early promising reports, development of the system is currently suspended indefinitely (Compaq 2002). Compaq spokesmen claim that this is due to the company's focused nature, and a desire to remain largely in the business of the supply of hi-tech hardware. Compaq are planning to license the software to a third party to complete the development (Mitchell 1998).

Conclusions

Uptake of Elearning by SMEs has been slow and this is mainly due to the cost efficiency of an E-learning solution being tied to economies of scale. SMEs have fewer staff and less money to spend on training than larger companies and often find paying for the development of a bespoke E-learning solution too expensive to swallow. The E-learning industry is responding to this by developing generic products aimed at specific SME markets. However, these products are still perceived as expensive at the point of sale. In addition, the generic content of such material does not always match a SME that may have more specific requirements. One solution to this problem may be to examine pay-per-view as a payment option that would make the pill of training expenditure a little easier to swallow.

Commitment free pay-per-view online payment for E-learning content is still in its infancy. Until a form of E-Cash is devised which is globally accepted and achieves a reasonable level of consumer uptake – the truly 'no strings attached' approach to Elearning payment may not be viable. When a suitable system is finally developed, E-learning will become a much more financially viable option for SMEs and the general public, revolutionising the industry in the same way that 'pay-as-you-go' technology did for the mobile telephone industry in the UK. For now, account based 'pay-per-use' LMS based systems may yet provide a convenient and useable interim solution.

In addition to overcoming the financial hurdle of implementing an Elearning solution companies, SMEs especially, need to measure their return on investment. Many of the quality issues to do with E-learning may be overcome with the deployment of an advanced LMS. Several companies already offer Learning Management Systems, of varying levels of depth and effectiveness, and as these systems become more prevalent and standardised they could hold the key to the SME friendly E-learning systems of the future. The measuring and monitoring features incorporated within LMS' should also help to inspire confidence with respect to motivation of learners.

References

'ECDL FAQ' – ECDL Tutors (2002) - http://www.ecdltutors.com/faqs/faqs.htm

'Job characteristics and computer anxiety in the production industry' - Aslaug Mikkelsen a, Torvald Ogaard b, Preben H.Lindoe a ,Odd Einar Olsen b. (2002) - Computers in Human Behavior 18 223-239.

'Independent student learning aided by computers: an acceptable alternative to lectures?' - David G. Dewhurst, Hamish A. Macleod, Tracey A.M. Norris (2000) - Computers in Human Behavior 35 (2000) 223-241.

'Scheduling and Monitoring Dynamic Learning Objects on the Web' – JJ Kuisma, JA Watson (2002) - EDMEDIA 2002 (Accepted, Pending Publication).

'Intelligent Tutoring Tools for Cognitive Skill Acquisition in Life Long Learning' - Ashok Patel, Kinshuk, David Russell (2000) - Educational Technology & Society 3(1)
ISSN 1436-4522.

'Amortised E-Cash' – Moses Liskov (2001) – Submitted as partial fulfillment for the degree of Master of Science in Computer Science at the Massachusetts Institute of technology.

'On-line flexible and conventional learning: A comparative study of a student's experiences' – Sun Hea Choi (2000) - School of Computing, Napier University -
http://www.cogs.susx.ac.uk/lab/hct/hctw2000/papers/choi.pdf

'Definition of an SME' - European Commission (2002) - Information Society Directorate-General -
http://europa.eu.int/ISPO/ecommerce/sme/definition.html

'SME Definitions' – IFC 2002 - http://www.ifc.org/sme/html/sme_definitions.html

'Small and Mediumsized Enterprise (SME) Statistics for the UK' – Small Business Service (2000) - http://www.sbs.gov.uk/press/news44.pdf

'The Future Of Corporate Learning' – Department of Trade and Industry report 2001 (UK)

'Online Expert – Website' 2002 - http://www.onlineexpert.com/elearning/gettingstarted/sysreq.php

'Credit Card Transactions – Real World and Online' – Keith Lamond - 1996- http://www.virtualschool.edu/mon/ElectronicProperty/klamond/Intro.htm

'Digging Those Digicash Blues' – Declan McCullagh - 2002, Wired News - http://www.wired.com/news/ebiz/0,1272,44507,00.html

'Millicent' – Compaq Digital Products and Services - 2002 - http://www.millicent.com/home.html

'Compaq to License Digital Cash Technology' – Dan Mitchell – 1998 - CNET News - http://news.com.com/2100-1017-219482.html?legacy=cnet

'2002 Canadian SME Overview' – Canadian Federation of Independent Business – http://www.cfib.ca/research/reports/sme2002_e_files/frame.htm

On-line Learning Courses: A review and usability attributes

Panagiotis Zaharias
PhD student, Department of Informatics
Athens University of Economics & Business
76 Patission Str.
10434 Athens Greece
pz@aueb.gr

Konstantina Vassilopoulou
Department of Management Science and Technology
Athens University of Economics & Business
47A Evelpidon & 33 Lefkados Str.
11362 Athens Greece
kv@aueb.gr

Angeliki Poulymenakou
Department of Informatics
Athens University of Economics & Business
76 Patission Str.
10434 Athens Greece
akp@aueb.gr

ABSTRACT

While electronic learning environments provide exciting possibilities for supporting learners, the design of the user-interface is as yet little understood. The purpose of this paper is to investigate the importance of specific usability attributes for on-line learning courses. To realize this authors first content the need for designing learner-centered interfaces. A review of related papers on usability methods used and learning theories is presented. The results of a usability study evaluating the use of a Virtual Learning Environment providing Distance Learning for Post-Graduate studies in three Greek Universities using WebCT, a well-known elearning delivery platform, are presented. Finally, the review and the results of the study point towards specific usability attributes that need to be considered while designing usable learner-centered interfaces.

Keywords

On-line learning course, usability, learning theories, learner-centered interface, usability techniques, usability attributes.

1. INTRODUCTION

As information and communications technologies become more and more pervasive, expectations for educational computing are becoming greater and greater. Advances in electronic and web-based technologies offer online learning courses for learners (either students in educational settings or young professionals in organizational contexts) the opportunity to become skillful and acquire knowledge. There is an expectation that these technological advancements will make education and training available to a much wider audience of learners with diverse backgrounds and ages.

Given the importance of online educational computing for learning, *the need for evaluation of these technologies* becomes crucial (Jones et al., 1999). Squires (1999) points out clearly the need for *integration of usability and learning* as "*workers in HCI and educational computing areas rarely speak to each other or take note of each others' work: the educational computing literature is littered with naive and simplistic interpretations of interface design issues, and many writers in the HCI literature appear to be unaware of the significant developments that have been made in theories of learning*". Squires and Preece (1999) further argue that scholars have not considered the implications of usability features of an educational package in order to achieve educational goals: being educationally *beneficial*. Along the same vein Cronje (2001) asserts that "*although learning on the Internet is becoming more and more usual, it would seem that most of it still takes the form of virtual lectures*".

It is important in such environments to understand how usability contributes (or not) to educational goals (Jones et al., 1999). To this end, this paper argues that there is a need for usability scholars to consider the way in which usability and learning (special emphasis on user interfaces of on-line learning courses), interact. It is therefore, the aim of this paper to examine specific usability attributes that need to be considered.

To address this issue the paper is divided into 3 sections.

2. THE IMPORTANCE OF USABILITY FOR ON-LINE LEARNING COURSESS

The authors content that while designing on-line learning courses one needs to consider the usability of a web user interface. In this paper it is argued that usability of an on-line course's user interface can significantly affect learning.

In order to address the issue of usability one needs first to define the context of use of an on-line course. Increase in the diversity of learners, technological advancements and radical changes in learning tasks (learner interaction with a learning/training environment is often an one-time event); present significant challenges and render the possibility of defining the context of use of online learning courses. It is of great importance to point out that unlike users of a traditional software product return time and again and gradually learn the interface, the instructional interface must make sense quickly since the user is unlikely to use the environment for an extended period of time.

Thus a good starting point would be to pose the following questions: What is the role of usability in the context of modern educational software design? Which usability attributes affect on-line learning?

To answer the first question these authors provide a review of learning theories and usability techniques and how these are used to improve the user interface of on-line learning courses. The results of this review will be used to conduct a usability study aiming at identifying usability attributes that affect users in on-line learning, thus answering the second question.

2.1 Applying Learning Theories

Chalmers (2000) links learning theories as well as instructional theories in order to present potential user interface improvements for research and development of computer-assisted instruction interfaces. This author suggests allowing quantification of observable results into the screen, use table of contents and the ability to link a chapter with the other chapter can be applications of behaviorism and cognitive learning theory respectively that can lead to learning.

Norman and Spohrer (1996) combine constructivism and problem-based learning with learner-centered approach: places the learner at the center of the interface design. Using constructivism theory learners are motivated to seek out new knowledge when they confront real problems at hand. The goal is active exploration, construction and learning and not the passivity of the lecture attendance and textbook reading. Norman and Spohrer (1996) assert that while this philosophy is not new the current applications are. The ideas of active exploration and construction of meaning as well as the motivation to solve real problems in authentic contexts are here for ages. These authors focus their analysis on three dimensions of instruction: engagement, effectiveness and viability. Engagement is tightly associated with motivation and the provision of rapid compelling interaction and feedback help make learners motivated and engaged. Effectiveness is a major concern because after all, learning as such is the most critical issue. Viability includes the issue of scalability, the technological infrastructure (authoring tools, design tools, component software standards etc) as well as the social and cultural one (integration into existing learning/training activities etc).

While learning theories can be applied to design on-line courses still the question remains (Dringus, 1995b): How does an instructor know that the course interface provides full potential for students to access and utilize the information that is being presented? Evaluations of online learning courses should include learners' perceptions about the course interface as well.

Application of learning theories onto the design of online learning courses' user interfaces cannot give answers to usability scholars. In fact Chalmers (2000) stresses we neither know *"...if we can generalize learning theories from the classroom to the computer lab"* nor *"...if we can generalize instructional theories from the text to a software tutorial"*. Further research needs to be conducted before these conclusions can be drawn.

Systematic evaluation of the efficacy of various media integrations and the usability of the interface and its functional components is missing. To this end, the next section reviews current usability evaluation techniques as they have been applied on on-line learning courses.

2.2 Applying Usability Evaluation Techniques

Parlangeli et al. (1999) conducted three studies: a heuristic evaluation, a usability test, learning assessment; regarding the evaluation of the multimedia course. The results of the usability test (using ten people) revealed many usability problems similar to those identified by the heuristic evaluation. The perceived low-level usability resulted by both studies have had a common denominator: scantly usable hypertextual structure. Additionally Parlangeli et al. conducted a third study focused on learning assessment. To evaluate the effects of learning using the multimedia course, given that this course evaluated as a poorly usable system, the learning performance of three homogeneous groups of students performing the same tasks although working with different tools was considered. These tools (a CD, a book and printed materials of the CD) were allotted to each student group. When the learning phase was completed, the students were given a multiple-choice test to assess their performance. There was no significant difference in the learning performance among the three groups of students.

Evaluating learning may move usability practitioners outside their comfort zone. In order for usability evaluation techniques to be more effective, they need to familiarize themselves with the evaluation frameworks and methods from instructional design (Lohr, 2000). Also essential are acquaintance with educational testing research (Rovai, 2000), learning styles (Terrell and Dringus 2000; Kolb 1984), and the rudiments of learning theory (Lin and Hsieh, 2001).

Web design heuristics that have grown up around e-commerce can also be used to evaluate online learning courses. Dringus (1995b) proposes that usability heuristics suggested by Shneiderman (1987) and Nielsen (1993) can be applied to evaluate on-line course interfaces. However, these heuristics should be used with caution since many assumptions about the users of e-commerce do not apply to on-line learners. The challenge for most types of on-line learning is that established sets of heuristics do not exist. Pedagogical guidelines typically have to be developed that will be combined with the aforementioned heuristics.

Towards this direction Squires and Preece (1999) realized that simple application of these heuristics could not be effective because they fail to address the specific challenges of learner centered interface design as well as the issue of integration of usability and learning. Thus, these authors proposed an adaptation of Nielsen's (1993) heuristics, taking into account socio-constructivism tenets (Phillips, 1995; Soloway et al., 1996). The proposed set of "learning with software" heuristics contains the following:

- Match between designer and learner models
- Navigational fidelity
- Appropriate levels of learner control
- Prevention of peripheral cognitive errors
- Understandable and meaningful symbolic representations
- Support personally significant approaches to learning
- Strategies for cognitive error recognition, diagnosis and recovery
- Match with the curriculum

These authors do not claim that this is a final set of heuristics. Rather it is an initial attempt towards integration of usability and learning that needs further discussion and elaboration.

Finally, established sets of principles of what works for on-line learning, based on research findings or industry best practices, do not yet exist. The usability standards and tests that have proven their worthiness for e-commerce and other applications need to be transformed before being applied to on-line learning tools and applications. However, some preliminary attempts towards this direction have been made and will be further discussed.

Relevant to *navigational fidelity* is the work conducted by Parlangeli et al. (1999). The working hypothesis was that the level of usability of an online course could affect the learning performance. The results indicated that students' knowledge related to the content of the course under evaluation was not higher after the use of the system. More specifically, students provided low ratings to the navigation of the multimedia course. Parlangeli et al. (1999) concluded that the complex structure of the multimedia course indeed affected students' performance.

Addressing the heuristic of *understandable and meaningful symbolic representations* Cronje (2000) investigated the issue of "what extent can some of the methods used by educators be replicated over the internet". To this end this author poses the question: How do adult learners respond to internet-based role-play exercises and youthful methaphors? The challenge was to design a virtual learning environment by using metaphors applying theoretical foundations of constructivism. The results revealed that using metaphors can lead to successful and motivational learning and physical attributes of a classroom can be metaphorically recreated in cyberspace.

Terrell and Dringus (1998) focus their interest on awareness, which is "a combination of visual and conceptual cues given to the learner that increases a learner's immediate sense of presence of others in an online class". While investigating the question of "how awareness can be effectively conveyed online" they propose that awareness metaphors can be conveyed in a number of several ways: number of learners and their locations, CVs, online tours, syllabi and readings, study hall, orientation room, research labs, help center etc.

Learning styles issue is a crucial factor while *supporting personally significant approaches to learning*. Terrell and Dringus (2000) investigated the effect of learning styles on student success in an online learning environment. Kolb's learning theory was the basic theory and the Learning Style Inventory (LSI) the main instrument for assessing the learning styles of the participants in the experiment. The results indicated that students that fit with *Accommodator* learning style dropped from the online program at higher rates.

Checklists

The use of checklists date back to the early days of educational software. Squires and Preece (1999) reported several problems evaluators have found with the use of checklists as predictive evaluation tools. Some of them deal with the focus on technical rather than educational issues. McDougall and Squires (1995) content that these problems are symptomatic of the failure to adopt a situated perspective on the use of educational software. Several attempts have been made to provide a more holistic approach of the use of educational software but they resulted in very extensive checklists, which are tedious to apply (Squires and Preece, 1999). Additionally, an analysis of two well-known checklists (one developed by the National Council for

Educational Technology for evaluating CD-ROMs and the American Microsift Evaluators Guide) reveals the lack of attention to usability and the lack of integration between the two issues (Jones et al., 1999).

2.3 Summary

Despite the efforts of scholars from educational research streams and usability the problem still remains. Dringus (1995b) proposes heuristics without further adaptation to the context of learning environments. Squires and Preece (1999) propose such an adaptation but there is a clear need for further elaboration and empirical validation. Parlangeli et al. (1999), conduct their studies by using usability evaluation methods (Nielsen's heuristics, User evaluation of Interactive Computers System Questionnaire) that were developed to address the needs of a user as a computer user and not as a learner. Notess (2001) stresses that the afore-mentioned methods need additional consideration under the light of on-line learning courses and learning environments.

It can be concluded that educational computing literature seems to deploy naïve and simplistic interpretations of interface design issues. An instructional interface comprises of elements that assist the learner in the task of learning. Online courses and other online learning applications, tools and technologies have to be usable.

Under the auspices of SIG, CHI (2001) it has been reported that: (a) very little quality control and usability testing has been going into the designing of courses and the design of e-learning technologies, typically due to time constraints and low perceived importance of usability, (b) there is a need to focus on how to develop useful and usable tools and environments since so far we are focused more on the technology and not on the pedagogy, and (c) there is very little thought at the decision-making level to usability issues.

The review of learning theories and usability techniques provided evidence regarding the importance of usability while designing online courses. The aim of the next section is to identity which usability attributes affect on-line learning.

3. LEARNERS' REACTIONS TO AN ONLINE COURSE

In order to better understand the users' reaction towards web-based learning a study was carried out. This study relies upon a funded[1] project called "XEXO". This is an abbreviation in Greek, which means a space for Education and Training with no limits. The main objective of the project was to develop a virtual space for lifelong learning. This space is targeted to professionals; even post graduate students who seek additional educational and training opportunities.

3.1 Objectives of the study

One of the objectives of this study was to generate users' reactions while using an online learning course that provides Distance Learning. This course supported three Post-Graduate Masters in three Greek Universities: Athens University of Economics and Business, Technical University of Crete and University of Macedonia. To meet students' needs a Virtual Classroom environment was developed using a well-known e-learning delivery platform, WebCT, and computer based tools.

3.2 Implementation of the Web-based Course

The web-based course comprised of six major topics: Knowledge Management, E-Commerce, Activity Based Costing, Business Process Modeling, Statistical Process Control, and Total Quality Management Each university developed two topics. This integrated web-based course was titled *Organizational Transformation* and was equivalent to 42-hour traditional university graduate-level course. The course aimed at developing students' understanding of the emerging issues concerning the aforementioned topics.

A Virtual Learning Environment (VLE) was developed to support the course using WebCT's Computer Mediated Communication (CMC) and World Wide Web (WWW) Tools. The web-based course ran for 12 weeks. The whole learning environment and the learning content were developed in English. The users were full-time students having English as a second language. Each university assigned one tutor for the scientific coordination and guidance of the course and one administrator for the technical and administrative issues.

Lecture notes and slides were pre-prepared, edited and uploaded into the WebCT environment. Lecture notes were developed as plain text with hyper-links (HTML files). Slides were downloadable as Power Point presentations. Students were supposed to preview the on-line educational material and initiate discussions and questions regarding the course if they felt it was appropriate. Associated information on schedule, assignments, exercises and group-work was also available on-line.

3.3 Questionnaire Design

A questionnaire was designed to collect data regarding users' reactions while using the on-line course. In order to design the questionnaire the results of the literature review presented earlier were used.

---

[1] See acknowledgement

The questionnaire consisted of three parts. The first part dealt with demographics questions. The questions related to the user's frequency of use of PC, the Internet, and the e-mail. The second part dealt with the users perception regarding the use of the system. The questions related to the usability of the online course. The user was supposed to answer regarding the importance of each specific usability item using a scale from "1" being least important to "5" being most important.

3.4 Results

It is not the aim of this paper to report all the results of this study. Attention will be paid to the usability attributes that the users rated as highly important while using an online course. To aid the reader the results of the study are divided in three sections: three sections of the questionnaire.

Users Familiarity with the Technology

The results have shown us that the vast majority of students who participated in the experiment were familiar with the use of PCs, Internet and the use of email while they are not really familiar with the use of collaborative tools and most of them prefer the natural, face-to-face way of communication (Table 1).

Use of PC and Internet	
Use of PC on a daily basis	85.37%
Use of PC Few times a week	12.20%
Use of Internet regularly	85.37%
Use of Internet rarely	14.63%
Type of communication methods preferred	
Face-to-face	73.17%
Telephone	17.07%
E-mail	9.76%

Table 1: Familiarity with the Technology

Questions referring to web-based courses' usability

Participants were asked to evaluate the importance of usability attributes of the user interface of an online course. To aid the reader specific usability attributes were enlisted while there was space for free-form comments as well. The results in Figure 1 present the frequencies that the usability attribute was rated as "1" that being most important. It can be derived from the results depicted in Figure 1 that the majority of the respondents were satisfied from the material and variety of content provided. Almost half of them think that navigational fidelity is important. Most of the participants were satisfied with the environment: WebCT. Students felt that they receive good directions allowing them to find their way in the web site. This is obvious since navigation through the web pages of the course is rated as the most important requirement for an online learning course. In terms of activities the students require in order to better attend their distant course they consider the ease of use of the system and the capacity to directly communicate with their instructor as the most important factors.

Free-form comments

Students were asked to propose usability attributes that they consider as significantly useful in a web-based course.

Functionalities	**Frequency**
On-line help and learning performance evaluation	39.47%
Support the use of multimedia files	23.68%
Accessibility	15.79%
Enhancing awareness	10.53%
Efficient searching facility	10.53%

Table 2: Users' Comments

The authors reviewed their answers searching for key words. The results reveal the importance of five additional usability attributes: Support the use of more multimedia files, on-line help and learning performance evaluation, accessibility, enhancing awareness and efficient searching facility (Table 2).

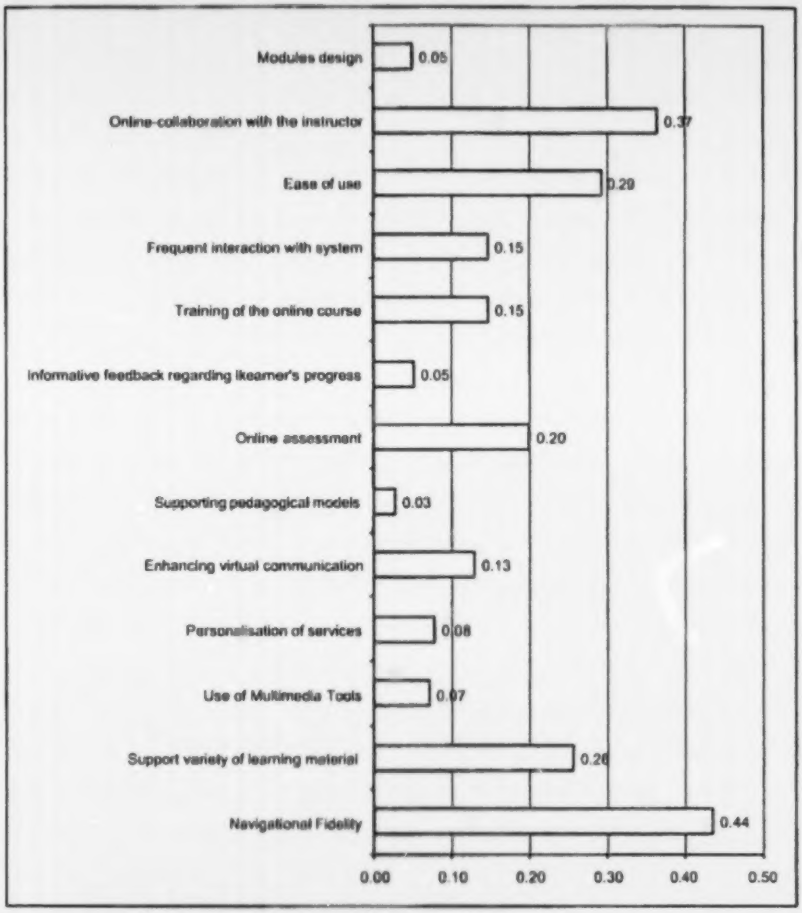


Figure 1: Most important usability attributes

4. CONCLUSIONS

Technological progress allows for further flexibility and power and places the learner in the center of the learning process (Lohr, 2000). In this paper it is argued that designing the interface between a learning environment and the learner is an increasingly critical part of the development of online courses.

First a literature review was presented. The results of the review point towards the direction that scholars currently address the needs of the software environment rather than learning environment where the user and the task are fundamentally different. Current usability techniques as well as learning theories should consider different usability attributes while designing online courses. Learners use these environments to build their expertise. Their interactions with the on-line learning environments may not produce visible results.

Based on these observations this paper examined specific usability attributes that are important to the users while designing online learning courses. To address this issue the results of an experimental study were presented. The results pointed towards five additional usability attributes that need to be addressed by usability researchers and practitioners.

The authors do not mean to say that only these usability attributes should be considered. The results of this study simply provides some light to the continuous efforts towards integrating usability and learning. Understanding which usability attributes should be considered by the designer is an important step towards this integration.

Finally, while there is an abundance of online courses currently available (e.g. Cronje, 2001) still they have not addressed which specific usability attributes an online course should have. Furthermore, the outcome of the learning experience is often not reflected in the interface but on the learner's mind (Lohr, 2000). To this end this paper presented the results of an ongoing effort towards investigating and understanding specific usability attributes that reside on the learner's mind and how these can be communicated to the designer.

ACKNOWLEDGMENTS

The European Commission and the Greek General Secretariat of Research and Technology have funded this work. The authors wish to acknowledge these bodies for their support. The authors would also wish to acknowledge: Prof. Vassilis Moustakis from Technical University of Crete, as a scientific coordinator of the project, Prof. Konstantinos Tarabanis, as a scientific coordinator from University of Macedonia, and Kyriaki Fytraki and Thanasis Giouvanakis as technical administrators from Technical University of Crete and University of Macedonia respectively.

REFERENCES

[1] Chalmers P.A., User interface improvements in computer-assisted instruction, the challenge, *Computers in Human Behavior* **16** 507-517 (2000).

[2] Cronje, J. C. Metaphors and models in Internet-based learning. *Computers &Education*, **37** (2001), 241-256.

[3] Dringus,L., An Iterative Usability Evaluation Procedure for Interactive Online Courses. *Journal of Interactive Instruction Development*, **7(4)**, 10-14 (1995a).

[4] Dringus,L., Interface Issues Associated with Using the Internet As a Link to Online Courses. *Journal of Interactive Instruction Development 16-20* (1995b).

[5] Jones, A., Scanlon, E., Tosunoglu, C., Morris, E, Ross, S., Butcher, P., Greenberg, J., Contexts for evaluating educational software, *Interacting with Computers* **11 (5)** 499-516, (1999).

[6] Kolb, D. *Experiential Learning: Experience as the success of Learning and Development*. Prentice Hall. Englewood Cliffs, New Jersey, (1984).

[7] Lohr.L.L, Designing the instructional interface, *Computers in Human Behavior* **16** 161-182 (2000).

[8] Nielsen, J. *Usability Engineering*. Boston, MA: Academic Press, 1993.

[9] Norman, D., Spohrer, J., Learner Centered Education, Communication of the ACM, **39 (4)** 24-27, (1996).

[10] Notess, M. *Usability, User Experience, and Learner Experience*, 2001 Available at http://www.elearnmag.org/

[11] McDougall, A. and Squires, D. A Critical Examination of the Checklist Approach in Software Selection, *Journal Educational Computer Research*, **12 (3)**, 263-274, (1995).

[12] Parlangeli, O., Marchigianni, E. and Bagnara, S. Multimedia System in Distance Education: Effects on Usability, *Interacting with Computers*, **12**, 37-49, (1999).

[13] Phillips, D. C. The Good, The Bad, The Ugly: The many Faces of Constructivism, *Educational Researcher*, **24 (7)**, 5-12, (1995).

[14] Rowai, A. P. Online and Traditional assessments: What Is the Difference, *Internet and Higher Education*, **3**, 141-151, (2000).

[15] Shneiderman, B. *Designing the user interface Strategies for effective Human-Computer Interaction*. 3rd Edition. Addison Wesley, (1998).

[16] Soloway, E., Jackson, S. L., Klein, C., Quintana, C., Reed, J., Spitulnik, J., Stratford, S. J., Studer, S., Eng, J., and Scala, N. Learning Theory in Practice: Case Studies in Learner-centred Design, In *Proceedings of Computer Human Interaction CHI '96*, ACM Press, 189-196 (1996).

[17] Squires, D., Usability and Educational Software Design: Special Issue of Interacting with Computers, *Interacting with Computers* **11 (5)** 463-466, (1999).

[18] Squires, D., Preece, J., Predicting quality in educational software: Evaluating for learning, usability and the synergy between them, *Interacting with Computers* **11 (5)** 467-483 (1999).

[19] Terrell, S. R. and Dringus, L An Investigation of the Effect of Learning Style on Student Success in Online Learning Environment. *Journal of Education Technology Systems*, **28 (3)**, 231-238, (2000).

Accessible Multimedia for the Web

Nicholas Zaparyniuk
Department of Educational Psychology
3-105 Education North
University of Alberta
Canada, T6G 2G5
nickzap@ualberta.ca

Jillianne Code
Instructional Media and Design
Grant MacEwan College
Canada, T5J 4S2
codej@macewan.ca

Introduction

The World Wide Web has evolved from a primary text based medium into an integrated net of media. With this change comes the responsibility of the author to ensure that all aspects of the communication on their site are accessible. This communication whether by video, audio, or animation, in its ability to relay information to the audience, is something that should not be discriminate in its delivery.

With the Internet taking a dominant role in corporate training, education, retail, and customer based product exploration; all have to ensure that the media they do deliver is accessible to the widest audience. The technologies capability to enhance, promote, and engage the customer or the learning experience, contributes to the success of the author's intended message. The audience includes those with disabilities.

Whether users have a visual, auditory, physical, or developmental disability, accessible multimedia can enhance and promote the message delivery through the chosen medium. Current Web multimedia technologies of use on the Internet are enhanced and made accessible with some simple modifications and alterations. This paper outlines some of the multimedia technologies currently available on the Web and the means to make them more accessible.

Web Audio and Video Captioning

Captioning is synchronized text that is used as an alternative format to deliver audio content (WGBH, 1992). The goal for multimedia authors should be to provide captions for all audio, including that contained in video and animations. Typically, captions are displayed through a client-side media player.

Designed by the WGBH Educational Foundation in Boston, a public broadcasting company, captioning was originally designed for people who are deaf or hard of hearing (Microsoft, 2002). Like other enabling technologies, captioning and its ability to relay information, can now be seen as an asset to those without hearing difficulties. It's applications for those wanting to learn a second language, learning to read, communication in noisy environments, and people using equipment with poor audio quality, showcases the delivery formats wide application base (Microsoft, 2002). This application base can now be delivered on the Web.

The ability to transfer this alternative audio format for Web based audio and video allows everyone the ability to learn and accept the message of the page author. Through the work of the World Wide Web Consortium (W3C) Synchronized Multimedia Integration Language (SMIL) and various media player contributors, captioning on the Web is a reality (W3C, 1998).

Captioning audio and video in Realmedia. Incorporating closed and open captioning in real player is achieved in several ways. Real Networks, being one of the first organizations to capitalize on the benefits and potential of SMIL and XML, has created their own subset language called RealText (RealNetworks, 2000). RealText is a mark-up language similar to HTML and can be programmed using any standard text editor. This language, which is fully supported through the Realmedia player, allows multimedia developers to incorporate synchronized text, audio, and video without taking away user control. Since the text caption is a separate file within the media presentation, the captioning can be turned on an off by the users and is readily edited.

Captioning audio and video in Windows Media format. Not unlike Real Networks Real media, Microsoft's Windows media will also support SMIL functionality. Through their own XML subset language called SAMI, which stands for Synchronized Accessible Multimedia Interchange, Windows Media player and Encarta products can interpret and playback captions in up to 8 different languages (Microsoft, 2001). SAMI is written in a plain text editor and saved in the same directory as the Windows Media file. Through the Windows Media player closed captions can be turned on an off by the users and edited easily apart from the other media files.

Captioning audio and video in QuickTime. Apple's QuickTime player also supports captioning through the use of QuickTime Text. QuickTime Text is a simple tag-based syntax that reads in text captions and synchronizes them to an audio or video file (Apple, 2002). The text is then imported as a separate track embedded in the QuickTime movie. Closed captioning can be enabled and disabled by turning text tracks on or off, or by incorporating interactive QuickTime elements through software such as Livestage (Totally Hip, 2002) or SimpleCaption (Baird, 2002).

The authoring tools that are available to caption these media elements can be as simplistic as a simple text editor to the multifaceted functionality of Livestage. One tool that allows the author to caption video and audio and save the caption text file in all supported above formats, namely SMIL, SAMI, and QuickTime Text, is MAGpie. MAGpie, or the Media Access Generator, which was created by the National Center for Accessible Media (NCAM), allows authors to create captions for Web based audio and video (NCAM, 1996). This tool is free and available for Macintosh and Windows based computers.

Macromedia Flash

Flash is one of the fastest growing Web media formats. It's ability to supply small file sizes, interactivity, and its scalability has made it a very attractive media element to incorporate into a Website. The problem with this media format, like other Web browser plug-in formats, is that they are not readily accessible to assistive technology. The interactive elements, text and animations that are contained in the media leave the user unable to navigate or access the information within. These problems, however, have been addressed as an add-on extension for Flash 5 and in Flash MX (Macromedia, 2002).

With Flash MX and the Flash 6 Web browser plug-in, developers can now add descriptive text to Flash based animations, forms, movies, and content that is readily accessible to operating system and application-based screen readers (Macromedia, 2002). Macromedia's support for accessibility also extends through the use of the Microsoft Active Accessibility Application Programming Interface (API), which enables the software program to expose information about their content and user interface to assertive technologies (Macromedia, 2002). This is utilized by the application and it's Web plug-in. Some of the specific accessible elements that are incorporated into Flash are (Macromedia, 2002):

- Text based descriptions of Flash elements, which can be read by a screen reader application for those with visual impairments.
- Scalable vector text and graphics, which can be magnified without a loss of quality, for those with visual and auditory impairments.
- Content controls that allow the user to control the playback of content
- Customized colour control for those with colour blindness.
- The ability to synchronize audio with visual elements.
- Mouse free navigation controls
- An Accessibility window in Flash MX to help in accessible Flash creation.

The ability to provide accessible Flash content can also be utilized in previous versions of Flash through the use of the Flash 6 browser plug-in. These older versions of the technology enable the author to utilize long description tags, alt tags, and alternative text for the published movie as long as the audience is using an appropriate screen readers that support Flash (Clark, 2002).

PowerPoint for the Web

Using presentation media presents a challenge to users who are blind, deaf or hard of hearing. More often than not the audio is unusable or the presentation itself is not readable by screen readers (WebAIM, 2002B). There are several techniques that can be used to assist these users in accessing the meaning of media content. These techniques mainly involve creating text equivalents for the graphical data and also creating accessible HTML versions. The four techniques below can all be used to render PowerPoint information accessible to those with disabilities.

Provide the Source File. Probably the best and easiest way for you to ensure that your presentation can be viewed is to provide the users with the source file or the actual PowerPoint file (WebAIM, 2002A). Microsoft has improved its accessibility options within Office 2000 and Office XP and information within the documents outline and description text can be accessed with Office compliant assistive technology.

Saving the Outline Only. You can also save the outline of your PowerPoint presentation as text or rich text and convert that outline to Accessible HTML. With this method you don't get the added benefit of visuals - so if visuals are important to your presentation then you may not want to use this technique (WebAIM, 2002A).

Using the Save as Accessible Plug in. This Power Point Point Accessibility Wizard, which is available free from the Division of Rehabilitation Education Services at University of Illinois, simplifies the task of converting PowerPoint presentations to pure HTML through an easy- to-use user interface (Gunderson, 2002). This plug in converts Power Point Presentations to an HTML format that includes required accessibility information including ALT tags and accessible formatting. Although this tool is still in BETA form it one of the easiest tools to use to make PowerPoint presentations accessible (WEBAIM, 2002A).

Convert Presentations to Video Format. Creating accessible presentation media using Windows Media, QuickTime or Real Media involves captioning or adding audio descriptions. Those with disabilities can then access this extra information contained within the presentation. Conversion of PowerPoint to any of the aforementioned video formats can be accomplished with a variety of tools. Some of the tools available include Real Presenter for Real Media, Microsoft Producer for Windows Media, and QuickTime Pro. Captioning these presentations can then be accomplished using MAGPie (NCAM, 2002), Hi-Caption (HiSoftware, 2002), SAMI (Microsoft, 2002), SMIL (W3C, 1998), RealText (RealNetworks, 2000) or QuickTime Text (Apple, 2002).

Scalable Vector Graphics (SVG)

SVG is an XML (Extensible Mark-up Language) based language that allows images, text and vector graphics to be programmed directly into the Web interface (W3C, 2002). This language allows for the description of two-dimensional objects that can be scaled and manipulated with no loss in resolution of the object. With it's ability to be incorporated directly into the XML coding of the page text equivalents for images, and other descriptive features in the media can be accessed by those who use assistive technologies (W3C, 2002).

Other attributes of this graphics format language is its ability for interactivity, data driven content, and alternative delivery modes and structures for content. This includes directory structures for image equivalents and language alternatives (Adobe, 2002).

Portable Document Format (PDF)

Adobe Portable Document Format (PDF) has become a standard protocol for the distribution of electronic documents via the Web. It's ability to retain the original source documents formatting, fonts, colors, and graphics, regardless of what application platform it was created on, outlines its power on the Web (Adobe, 2002). With the introduction of Acrobat 5.0 and the updated Acrobat reader plug-in, Adobe has included accessibility enhancements to the Portable Document format (PDF) making a very viable option for the distribution of accessible information. With the ability to add tagged information to PDF documents, screen readers can now access PDF text content, logical document structure, and alternative text information for images and graphics (Adobe, 2002). These enhancements allow the reader to follow the intended document organization and reading order while navigating the document.

With accessible PDF documents users can now:

- Follow the logical reading order of the document. This is achieved by defining the structure of the document by using tiles, chapters, headings, and multicoloured text.
- Provide alternative text descriptions for images
- Navigate with embedded links
- Specify document languages to benefit screen readers that may be able to change languages the fly.
- Use windows based screen readers to read the text
- Use keyboard navigation.
- View documents in high contrast mode.
- Zoom in on text and reflow to fit any size view when working with tagged (accessible) Adobe PDF files.

Conclusion

With the use of any Web based information the author is ultimately responsible to ensure that the message is accessible. This includes information that is contained within multimedia. Although these media do possess barriers to those with disabilities through their delivery, alternative delivery methods can ensure that the widest audience receives the message. Various methods, tools and protocols that are currently available, and others in development, can facilitate the creation of these media. These tools however, can only be utilized by those whom are aware of accessibility issues. Through the conscience effort of all that contribute to the World Wide Web, all information can be made accessible.

References

Adobe Inc. (2002A). How To Create Accessible Adobe® PDF Files Booklet. Adobe. Retrieved March, 2002, from the World Wide Web: http://access.adobe.com/booklet.html

Adobe Inc. (2002B). Adobe Acrobat Accessibility Features. Retrieved March, 2002 from the World Wide Web: http://access.adobe.com/features.html

Adobe Inc. (2002C). SVG Zone. Retrieved March, 2002 from the World Wide Web: http://www.adobe.com/svg/viewer/install/

Apple Inc. (2002). QuickTime Text Tracks. Retrieved March, 2002, from the World Wide Web: http://www.apple.com/quicktime/products/tutorials/texttracks.html

Baird, A. (2002) SimpleCaption. Available online: http://members.aol.com/andy8080/SimpleCaption.html

Clark, J. (2002). A list apart: Flash MX: Clarifying the concept. Retrieved April, 2002 from the World Wide Web: http://www.alistapart.com/stories/flash_mx_clarifying/

Gunderson, J. (2002). Microsoft Power Point WWW Publishing Accessibility Wizard. University of Illinois. Retrieved February, 2002, from the World Wide Web: http://www.rehab.uiuc.edu/ppt/index.html

HiSoftware. (2002). Creating accessible multimedia demos with HiSoftware ACCVerify, HiCaption, Microsoft PowerPoint and Microsoft Producer. Retrieved April, 2002 from the World Wide Web: http://www.hisoftware.com/hmcc/hmcc-paper.htm

Macromedia Inc. (2002). Accessibility Macromedia Flash MX Features. Retrieved March, 2002, from the World Wide Web: http://www.macromedia.com/macromedia/accessibility/features/flash/

Microsoft Inc. (2001). Understanding SAMI 1.0. Retrieved March, 2002, from the World Wide Web: http://www.msdn.microsoft.com/library/default.asp?url=/library/en-us/dnacc/html/atg_samiarticle.asp

Microsoft Inc. (2002). Captions and Audio Descriptions for PC Multimedia. Retrieved March, 2002, from the World Wide Web: http://www.msdn.microsoft.com/library/default.asp?url=/library/en-us/dnacc/html/ATG_CCandAudioDesc.asp

NCAM. (1996). Media Access Generator (MAGpie). National Center for Accessible Media. Retrieved March, 2002, from the World Wide Web: http://ncam.wgbh.org/Webaccess/magpie/

RealNetworks Inc. (2000). RealText Authoring Guide. Retrieved March, 2002, from the World Wide Web: http://service.real.com/help/library/guides/realtext/realtext.htm

Snyder, J. (2002). Audio Description -- The Visual Made Aural. National Endowment for the Arts. Retrieved March, 2002, from the World Wide Web: http://arts.endow.gov/artforms/Presenting/Joel.html

Totally Hip Software. (2002). Livestage. Available online: http://www.totallyhip.com/

WebAIM. (2002A). How to Create Accessible PowerPoint Slides on the Web. Retrieved March, 2002 from the World Wide Web: http://webaim.org/howto/powerpoint/

WebAIM. (2002B). WebAIM Training Event Week 1: The user perspective. Retrieved April, 2002 from the World Wide Web: http://webaim.org/training2002/week1/

WGBH Educational Foundation Captioning Center. (1992). Suggested Styles and Conventions for Closed Captioning. Retrieved March, 2002, from the World Wide Web: http://main.wgbh.org/wgbh/pages/captioncenter/ccstyles.html

W3C World Wide Web Consortium. (2001). Scalable Vector Graphics (SVG) 1.0 Specification. Retrieved April, 2002 from the World Wide Web: http://www.w3.org/TR/SVG/intro.html

W3C World Wide Web Consortium. (1998). Synchronized Multimedia. Retrieved March, 2002, from the World Wide Web: http://www.w3.org/AudioVideo/

Panels

E Learning: A Study of Three Types of Electronic Learning Environments

Overview

This panel discussion will consist of a detailed review of three dynamic electronic learning projects of national scope. They are: 1) The National Global Learning Consortium; 2) The National Borderlink Challenge Initiative; and 3) The American Association of University Women Learning Online Initiative.

Importance to the Field

The panel will present information that provides field research from three national projects. One project of the Global Learning Project, the Friendship Through Education Consortium, is a consortium of non-governmental organizations and private groups committed to connecting children from different nations in an effort to bridge cultures and broaden cultural understanding. This Friendship Through Education Consortium connects with and is inclusive of: People to People International; UN's Cyberschoolbus; ePals Classroom Exchange; Global SchoolNet Foundation; Schools Online; Sister Schools international; US Fund for UNICEF; and World Wise Schools Program of the Peace Corps. In addition, Wexford Inc. with The Center for Language Minority Education and Research at California State University Long Beach (CLMER), will report information from their research on the multilingual and multinational projects, Mathematics in Our Lives and Water, Water Everywhere. All of these national and international projects are examples of cyberspace serving as a learning space for cultural interaction by faculty and students from around the world. In particular these projects are exemplary because they demonstrate: students involved in decision-making regarding tough issues of national and international scope; students around the world developing a sense of responsibility and teamwork; teachers and students learning new concepts together in a constructivist learning environment; students learning through topics they chose and that are closely related to their lives; use of telecommunications for the betterment of mankind. In addition these initiatives from the Global Learning Project involve parents as active partners and involve parents as valued members of the global learning team along with teachers and students. Detailed findings from all of the above initiatives will be discussed.

The Borderlink Challenge Initiative is a partnership between the Imperial COE and the San Diego COE with the purpose of improving post-secondary opportunities of students. One particular powerful component of the program is the online AP Coursework. This initiative has provided numerous students in California with the opportunity to access AP courses that without the program would not be realized. The completion rate for this program is extremely high because of the following factors with students: helping each other; having strong study habits; are independent learners and are highly motivated; make use of their coaches; have strong English skills in reading and writing; and keeping up with schedule of course and not getting behind. Information from a smaller sample shows that: 94% accessed coursework from home and school; 83% took course to be more competitive for college entrance; 78% wanted to try something more challenging; and 72% wanted to work more independently. Detailed findings form the report will be discussed.

The third initiative that will be reported is the American Association of University Women (AAUW) Study of Women Learning Online (www.aauw.org/2000/3rdshift.html). Over 500 women and men were surveyed or interviewed for the study. Findings include: online learning is on the rise and 60% of these nontraditional online learners are over 25 years of age and female; the majority of those surveyed had educational goals and aspirations similar to traditional students; majority had anxiety about fulfilling their other roles and having to study, conduct research and write papers; virtual classroom minimizes the discomfort and alienation that these students feel on traditional college campuses populated by 18-22 year olds. The Women in this study give distance learning high marks for family and flexibility as they can be home for their family, cab learn at their own pace and do course work when they can fit it in with their busy schedule. It was also found that the online learning situation decreased the cost of their education saving money and time on commuting and childcare. Women also found that they found new fulfillment from obtaining a degree or gaining useful knowledge for the workforce. Some negative issues were the cost of tuition and equipment and the often difficult course-load. They also found that not all the distance education courses were accredited. With this we have found that we need to expand financial and programs to support part-time students with small course leads. We also must involve more women administrators, teachers, and students in the planning process for online courses. Education is needed for

BEST COPY AVAILABLE

policy makers so they understand the difficulties of working mothers who are seeking to continue their formal education online. Information from this study needs to be broadly disseminated to groups that support women and their needs.

Qualifications of panelists

Sheila Cassidy is the Executive Director of Wexford Inc. a private not for profit organization that specializes in the evaluation of large-scale technology initiatives. Wexford Inc. The WEXFORD Institute assists agencies and individuals to collaborate to solve educational issues, to create equitable and excellent educational opportunities for all learners. WEXFORD is recognized nationally for its work in collaboration, strategic planning, evaluation, and equity. Sheila Cassidy has 25 years experience as an evaluator. She is committed to equity and excellence in education for all students, with a focus on the traditionally underserved, particularly children of color, language minority students and students from low income families. Sheila has been a teacher in Philadelphia, Pennsylvania and Compton, California, as well as an administrator of bilingual programs in Lawndale, California. She completed her doctoral coursework at the University of Southern California in Curriculum Change and Evaluation. She has conducted research and evaluation for local, state, regional and national agencies and programs.
Over the last decade, Sheila has assisted agencies in program development (planning, design, funding, implementation and evaluation). Sheila has authored instructional materials, evaluation and research reports and articles. She co-planned and facilitated the 1997 Distance Education Forum, the 1998 Distributed Education Forum and the 1998 Educators Summit on Evaluation of Technology Integration and Distributed Education, sponsored by the Office of Educational Research and Improvement in the U.S. Department of Education. Sheila is the co-author of "*Developing a Vision for Distance Education in the 21st Century.*"

Selma L. Sax is the Senior Consultant of the SAXTON GROUP, a firm which offers consulting services to business firms and educational institutions throughout the United States. She is currently working with Wexford, Inc.as a Senior Evaluator, Director of Policy Initiatives and Co Director of PT3•L3 "Learning, Linking and Leading", Wexford's 2001 Catalyst Grant funded through the Preparing Tomorrow's Teachers to Use Technology grant program at the United States Department of Education. Mrs. Sax holds a degree in Education from the University of Massachusetts at Boston, did her graduate work at California State University at Los Angeles, and holds both California and Massachusetts teaching credentials. She was a high school teacher, counselor and psychometrist for Los Angeles Unified School district for 9 years and served as a locally elected school board member for eight years, serving as president of the board twice.

In 1997, Governor Wilson appointed Mrs. Sax to the California Education Council for Technology in Learning and reappointed her in 1998 for a second term. She served for over two years as the Chairperson of the Council. More recently, Mrs. Sax worked with Policy Staff for President George W. Bush to help formulate the policy initiatives for the educational technology section which was written as part of the "No Child Left Behind" ESEA Reauthorization legislation in 2001.

Deborah V. Jolly is a Senior Research Scientist with Texas A&M University and directs the College of Education's Governmental Relations Initiative. Dr. Jolly has lead man national and international research efforts in the area of educational technology. She has vast experience in K-12 education, special education, school administration and university research. She has been a private business owner in the high tech field and has held senior management positions with a national regional research laboratory.

Portraying Yourself Online:
A Discussion of Teaching Styles in Online Courses

Dr. Susan M. Colaric, Assistant Professor, Educational Technology (moderator)
Dr. Plummer Alston "Al" Jones, Jr., Associate Professor, Library Science
Dr. Diane D. Kester, Associate Professor, Library Science and Educational Technology
Dr. Sue Steinweg, Visiting Professor, Special Education
East Carolina University, Greenville, NC, USA

Abstract: It is clear that more courses are being offered online each year. With the increase in the number of courses offered, the number of faculty teaching at a distance will also be increasing. Many researchers are discussing concerns that faculty have about online courses, such as incentives, training, technical support, workload, and intellectual property. Yet an additional area of concern may be holding many faculty back. The thought of transferring their teaching style to an online environment may be impossible for some faculty to imagine. This panel discussion will involve four faculty members who currently teach online in various subjects. Each will present information on his/her teaching style, both classroom based and online, and discuss any differences in assignments and assessment.

It is clear that an increasing number of institutions have begun offering distance learning. Among public 4-year institutions, 79 percent reported offering distance education courses in 1997-98, and an additional 12 percent planned to offer such courses within the next 3 years (NCES, 1997). Total enrollment in distance education courses across all postsecondary degree-granting institutions approximately doubled from 1995 to 1997-98, from 754,000 to 1.6 million (NCES, 1999). Institutions cite various reasons for offering distance education courses delivered through the Internet or other audio/video media (interactive or one-way). Among the goals are increasing students' access, increasing enrollments, increasing the institution's access to new audiences, and improving the quality of course offerings (NCES, 1999). In fall 1998, 6 percent of full- and part-time instructional faculty and staff at degree-granting institutions indicated that they taught at least one class or section through a distance education program; however with the increase in courses offered, the number of faculty teaching at a distance will also be increasing.

Many researchers are discussing concerns that faculty have about online courses, such as incentives, training, technical support, workload, and intellectual property. Yet an additional area of concern may be holding many faculty back. The thought of transferring their teaching style to an online environment may be impossible for some faculty to imagine. Grasha (1994) defines teaching style as a "pattern of needs, beliefs and behaviors that faculty display in their classroom". A faculty member's style affects how information is displayed, how student interaction occurs, how classroom tasks are carried out, and how assessment occurs. For instance, a faculty member who categorizes herself as an "Expert" believes that she possesses knowledge and expertise that the students need. Her main concern is with transmitting information and ensuring that students are well prepared (Grasha, 1994). The eighty-three percent of faculty who recently reported using lecture as their primary instructional method (NCES, 2001) would probably fall into this category. In contrast, a faculty member who considers himself to be a "Personal Model" oversees, guides, and directs students by showing how to do things and encouraging students to observe, and then emulate, the instructor's approach (Grasha, 1994). Is one teaching style more appropriate for online learning or should each faculty member be encouraged to express his/her own teaching/learning philosophy online?

This panel discussion will involve four faculty members who currently teach online in various subjects. Each will present information on his/her teaching style, both classroom based and online, discuss any differences in assignments and assessment, and present ideas of how they came to have that teaching style.

BEST COPY AVAILABLE

The discussion will then be opened to the audience to address a number of controversial issues in e-learning in higher education:

- Do faculty members need to change their teaching style when moving to an online classroom?
- How difficult would it be and who would decide what the "correct" online teaching style would be?
- Do the accrediting agencies have a right to dictate how online class interaction occurs?
- Is the academic freedom that a professor exercises in the classroom being jeopardized by the move to an online classroom where the content can be more readily reviewed?

Dr. Colaric's Position statement: I believe that knowledge is built by an individual, is internal to the individual, and is influenced by the culture in which the individual learns. The role of the teacher is to guide learners as they construct their knowledge by providing resources, and challenging students to build an integrated understanding of the material. My goal is to provide a learning environment, either face-to-face or online, in which students are comfortable participating in discussion and where they feel responsible for both their own, and their classmates', learning.

My face-to-face and online courses are fairly similar. Both rely on the assumption that students will obtain basic content information independently and the role of the class is to have students define, describe, and modify that information until it becomes knowledge. So preparation through reading is key and class time is for discussion. I don't consider myself to be a content expert but a facilitator whose role it is to design activities, social interactions, or problem-solving situations that allow students to practice the processes for applying course content. This isn't an easy process! Many, if not most, students are used to reading textbooks and listening to lectures and then recalling what is often disconnected and discrete bits of information. Many students are confused by my classes for the first few weeks. They aren't used to their opinion and experiences "counting" as knowledge and are waiting for me to tell them what to do. In a face-to-face class it isn't unusual for me to announce that I don't answer my own questions and then we wait through long periods of silence until some brave soul speaks up.

In online classes I've developed a number of strategies that assist me in moving students to this student-centered environment. I make very clear that class participation is an integral part of the course grade and provide them with guidelines of exactly what they need to do to earn participation "points". I start the class with an introduction dialogue that introduces the students to each other in order to build a learning community where students come to know each other. All students move through the class at the same pace based on two-week modules; this definitely isn't a self-paced course. And I model appropriate communication strategies throughout the course.

Dr. Jones' Position statement: I believe that content is the most important consideration for a course and that the majority of my time as a teacher should be involved in making sure that it is relevant. I realize all too well that I depend on my technologically savvy colleagues for help in getting the content online. I'm still amazed at the mysterious ftp process and the capabilities of servers to store and distributed the information I create.

My philosophy of teaching students is based on the assumption that students in my classes are true beginners. I assume that they know nothing or very little of the content to be presented. I believe that all students are individuals and I try to take into consideration that their approaches may be vastly different from my own. I try to give my students practical knowledge that can be used as the building blocks to add to the lifelong process of building upon prior knowledge.

My courses are self-paced totally. Students have a deadline when everything must be completed. I am available online through a conference center as well as via e-mail, telephone, and fax to coach them through their assignments and amplify what they are introduced to in their online class materials. I hold physical as well as virtual office hours.

The assignments for all of my classes require the students to apply what they are learning to their own situations. I feel that students need and often do not have hands-on experience. The assignments allow them to get involved in real life situations where the information they are learning can be applied toward solving problems in various library settings. As a confirmed pragmatist, I design my students' assignments to be practical in nature. I want what I present my students, either online or face-to-face, to be applicable to their particular library settings.

I love to teach and see the advantages of teaching students who have busy schedules and lives outside my courses and live in remote areas not readily accessible to ECU's campus. I see online teaching as a means of removing barriers and making the formerly impossible now not only possible, but also readily accessible via the Internet.

Dr. Kester's Position statement: Some have called me a pioneer in moving from face to face teaching to totally online teaching. The content of the first course I delivered over the Internet was an introductory course about the Internet. What better way for students to learn the content than to experience it first hand. That first year, I held a two-hour hands on session to be sure students understood the terms. These terms included telnet and gopher. The students found it difficult to move from the well-equipped computers of the university lab to their own personal computers with dial-up access. That was the last time I held such a preliminary session for a class.

My students have always been non-traditional adults in graduate courses. Knowing the difficulties of juggling work, home, and school, I began each class with a global overview of the expectations of the semester. Assignment deadlines were flexible, except for student presentation dates. I use the same teaching style online, with some modifications. I use general deadlines that are meant to help students move through the course and not get behind. Units cover two to four weeks, providing flexibility during that time.

Over the past six years I have developed eleven different courses for online delivery. Gradually, most of these courses have been turned over to new faculty members, giving them a model to use during their first year of teaching online with the opportunity to revise to suit their own teaching style. Our students live in rural areas with slow Internet service; therefore, I have kept the design of the courses simple - no frames, few graphics, no streaming video. For our audience this has lessened the technology anxieties and allowed students to concentrate on the content. My instructional strategies include pairing, small groups, threaded discussions, and some synchronous chat. Assignments are designed for performance based assessment. Field visits to schools and libraries to gather information are followed by reflection on what was observed. Projects are designed to allow students to prepare for their future (and sometimes current) work setting.

When teaching face to face, I knew each student by sight, but could not always recall their name. Teaching online, I know students by their personalities, their email tags, and their style of writing in our "15 minute break" discussion threads. It is always a thrill to finally meet students at conferences or even on graduation day.

Dr. Steinweg's Position statement: My first experience with online instruction was exciting, frustrating, and arduous! Everyday there was a new challenge. I found that the students were hampered in accessing the content by their lack of technology skills. It seemed that I spent a great deal of time dealing with technology issues. The very structured, content-focused nature of the course design left me feeling that I was keeping records. I couldn't seem to get beyond the mechanics and in some way interact with the students. I felt like I was the grader in a self-paced, programmed instruction manual. Getting the content across was important, but I wanted a way to "talk" with the students.

I was fortunate to be asked to teach two sections of this same online class in the Fall semester. I took the course that had been designed and tried to tweak it to make it fit my style. I wanted to be able to interact with the students. I wanted them to interact with each other. I felt that we all had information and experiences that could add to the understanding of the content.

Teaching style is probably what I am really trying to say. In a face-to-face class, I like to have a lot of classroom interaction. I don't feel comfortable with the role of "dispenser of knowledge". I do feel that it is important that the factual information is presented, but I feel that the students can obtain a lot of that from the text. What I want to do is to get them to apply the facts to real world situations in which they are working. I also want them to see that there isn't always one right way or answer.

Because my topic is about exceptional children, I feel it is important for the students in my class to actually see children who are exceptional learners and to understand that we are talking about people, not just numbers. In my face-to-face classes, I usually use video clips to generate some discussion. I often invite practitioners in the field to come and share information about their work with exceptional learners. Students are required to give group presentations on a topic they have researched.

Trying to transfer some of this into my online class was a challenge. Because our university serves a large rural part of the state, many individuals are accessing the course through modems at home and video can be a problem. This also has an impact on the use of synchronous chats. Fall semester I changed a few things, but I still didn't feel comfortable. Students were beginning to interact minimally on the Discussion Board. But I still had this feeling of isolation in the course.

This semester I am teaching two online sections of the same introductory class and one section of another graduate level special education course that is taken primarily by students seeking a MAT. Another instructor had designed this course and I was teaching it the way that it had been designed. I decided to sign-up for an online class in strategies for online instruction. Teaching two online classes designed by two different people and taking an online class afforded me the opportunity to observe lots of different techniques, some of which addressed the things for which I had been looking.

I learned some ideas to generate conversation and to have students do online presentations. I began to see the interaction among students, and to even see them supporting each other. Rather than having students send all of their assignments to me, I started having them post their work on the discussion board so that classmates could ask questions and offer comments. I started using case studies to get the students to think about real situations with exceptional learners.

I will have to add that I have begun to think that I like teaching online better than face-to-face due to the time it allows for reflection and the multiple opportunities to view the information. In a face-to face class, the conversation is here for a second and then it is gone. Even notes do not completely record what happened. In an online class, the conversation and other information is there to be accessed repeatedly. The student or instructor can view the conversation, think about it, and then respond. This seems to generate higher level thinking.

What I am beginning to see is that I don't have to change my style to teach online. I just have to explore and find ways to use technology that allow me to do what I want to do. My technology skills are limited, but I am learning fast. Observing what other teachers have done online really helps. I can be just as supportive and encouraging online as I can be face-to-face. Trying new things is scary and exhilarating!

References:

Grasha, A.F. (1994). "A matter of style: The teacher as Expert, Formal Authority, Personal Model, Facilitator, and Delegator". *College Teaching (42)*, 142-49.

National Center for Educational Statistics (1999). *Distance Education at Postsecondary Education Institutions: 1997-98*. Online: http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2000013

National Center for Educational Statistics (1997). *Distance Education in Higher Education Institutions*. Online: http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=98062

National Center for Educational Statistics (2001). *The Condition of Education 2000 and 2001: The context of Post Secondary Education*. Online: http://nces.ed.gov/programs/coe/2001/section5/index.html

Panel Presentation

Application Domain: All
Technology: Many are relevant to this issue.
Strategic Focus: Many are relevant to this issue.

Presentation Title: eDropouts: Reducing Attrition in Online Learning

Presentation Description

Instead of, "If we build it will they come?" maybe we should be asking, "If they come will they stay?" The dropout rate in distance learning is generally reported to be higher than that for traditional classroom based learning. Those engaged in online distance learning must grapple with the problem of online learning dropouts. We need to identify innovative approaches and technologies that directly address the causes of attrition.

The reasons dropouts give for discontinuing distance learning are many. Common reasons include:

- Lack of prerequisites (academic preparation)
- Personal or domestic reasons
- Insufficient time available for study
- Job related issues
- Financial issues
- Care of children and or other domestic demands
- Change of plans
- The nature of the courses offered or the teaching methods
- Lack of academic counselling and support
- Isolation (loneliness and lack of interaction)
- Illness
- Unsatisfactory leaning or study conditions
- Lack of motivation and lack of confidence

Many educators and corporate trainers have offered suggestions for reducing attrition in online distance learning. Some of these suggestions include:

- Improved learner preparation
- Time management
- Learner goal setting and self assessment
- Increased interaction (discussion forums, chats, simulations, etc.)
- Mentoring and support
- Hybrid models (mix of face-to-face and online communication)
- Improved content quality

I propose to host a panel of three or four online educators and/or corporate trainers to examine the reasons learners give for dropping out and to explore innovative methods and technologies that may reduce attrition.

Ready to Roll: Go to Market Smarter.

Abstract:
Product shelf-life keeps getting shorter with constant upgrades and new releases rapidly replacing the previous generation. The speed-to-market marching order can only work if everyone across the organization is up to date on the latest product offering. That means getting new product knowledge to the right people right away, from marketing to sales to support staff, to maintain the competitive advantage of rapid product life cycle.

In this panel presentation, Ara Ohanian and representatives from Black and Decker, Toyota and The Hartford will examine how product education can be shaped as a marketing weapon that can sharpen competitive edge, increase sales and build customer loyalty. They will discuss how companies can extend the reach of proprietary business intelligence to create a smarter sales force, and thus quicken market penetration. Citing the importance of training beyond product functionality, the speakers will describe how companies can keep personnel up to speed on current value propositions, market positioning against competitors, and sales strategies. The speakers will discuss how Vuepoint deployed educational tools to maximize knowledge acquisition and management across the organization to achieve speed-to-market sales objectives and product support readiness.

Attendees will learn:

- Critical role of education for product roll-outs
- How compressed speed to product knowledge can generate more sales and increase revenues
- How to rapidly ready the organization for new product roll out and upgrades
- How formal policies and practices for creating, capturing, and sharing proprietary knowledge can help build and reinforce brand awareness and identity

Speaker contact info:
Ara A. Ohanian, Chief Executive Officer and Founder
Vuepoint Corporation
Four Expressway Plaza
2nd Floor, Roslyn Heights, NY 11577
(516) 390-8800

Speaker bio:
Ara Ohanian brings more than 10 years of international corporate training, and knowledge transfer experience to his position as CEO and Founder of Vuepoint Corporation. Prior to founding Vuepoint, Ohanian founded management programs with the late Nobel Laureate Dr. W. Leontief to provide just-in-time training to over 2,500 international executives in more than 10 countries. He also established and ran a successful series of entrepreneurship programs to train citizens of the former Soviet Union for the United States Agency for International Development (USAID) under a contract from Deloitte & Touche.

Ohanian also has extensive sales and marketing experience that began with his position at NCR corporation where he ranked #1 in overall sales for the organization. In addition, he worked in advertising and marketing for Amacon, a UK based company representing brands such as Kellogg and Clorox.

Ohanian received a BA from the City University of New York as well as a French Baccalaureate from the Universite de Lille. He is conversant in more than 5 languages including French, Armenian, Spanish and Russian. A member of the Learning Content Management System (LCMS) Vendor Council, Ohanian also co-founded the eLITE (Electronic Learning Incites Teaching Excellence) Think Tank, an independent educational and research organization dedicated to advancing knowledge and thought leadership in eLearning.

Recent speaking engagements include: Human Resources Technology Conference and Expo, eLearning Executive Leadership Conference, Online Learning Conference and Expo, and Training Director's Forum.

Recent articles about Ara Ohanian:
Ohanian was quoted in the May 2002 issue of CFO Magazine in an article entitled "Web Learning Still a Class Struggle,"which describes how Toyota implemented Vuepoint's eLearning software as an effective management tool to increase productivity, and sharpen competitive advantage with faster speed to market for new products and services
<http://www.parsintl.com/pdf/4539-CFO.pdf>

Ohanian was the subject of an interview with CEOCast.com:
<http://www.vuepoint.com/news/ceocastInterview01.pdf>

July 2001 Training Magazine article:
<http://www.vuepoint.com/news/knowledge_race.pdf>

August 2001 EdVentures.com article:
<http://www.vuepoint.com/news/eduventures0801.pdf>

In August, 20021, Ohanian was nominated for SmartExecutive's eLearning Executive of the Year Award alongside renowned CEOs including Jack Welch of General Electric, John Chambers of Cisco Systems, Larry Ellison of Oracle, and Bill Gates of Microsoft.

Advantages of the Various Online Course Designs

Raymond M. Rose
Concord Consortium
United States of America
ray@concord.org

Zahrl Schoeny
Curry School, U Virginia
United States of America
zgs@virginia.edu

Alese Smith
United States of America
alese@concord.org

Abstract Online learning as a term includes many different approaches and technologies, but there's little that's been done thus far to identify the effectiveness of the various approaches, and offer guidance to those who have been told to "do something with online learning." There are advantages and drawbacks to the various online strategies. This panel will explore the relationship between learning outcomes and elearning course design.

Online learning is a very inclusive label, but used as if it were a single thing. It is not, and the range of approaches, whether based on technology or pedagogy are vast. There has been little done to help those considering online education to differentiate between the various online education approaches. Currently the arguments seem based more on vendor and vendor products, than on the learning outcomes expected by the content developer.

It's no surprise then that many online courses don't seem to meet the needs of the participants or the course developers themselves. What's needed is a discussion about the efficacy of the various elearning approaches, and how to match learning objectives to those approaches. In doing so, there is far more likelihood of developing an effective online learning experience for all concerned.

Online courses are frequently characterized as synchronous or asynchronous; but there are other dimensions. Instructor-led is frequently associated with linear-sequential structure while non-instructor led programs have greater potential for non-linear structures , but none of those characterizations provide any sense of which strategies hold the greatest potential for economically achieving a particular set of learning objectives. Conversely, what's the best online approach for developing knowledge on a topic that can be applied to a variety of diverse situations? It's time to being the discussion.

The three panelists -- Alese Smith, Zahrl Schoeny, and Raymond Rose -- come to this panel with over 15 years of experience in online education.

- Alese has been an online course developer with the Concord Consortium, and was one of the lead developers in creating the online teacher professional development course for the internationally recognized Virtual High School program. She has helped design a variety of online courses. She is co-author for Concord's new book; *Essential Elements: Prepare Design & Teach Your Online Course.* She is a strong believer in asynchronous courses.
- Zahrl is an advocate of blended online course delivery. He developed an online professional development program for school administrators in Virginia. He is in the process of developing a new online program that will prepare online course designers. Zahrl was part of the expert panel that developed the online course delivery standards for the Virtual High School.
- Ray has been the leader of Concord Consortium's online efforts over the past seven years. He currently directs Seeing Math a project that uses video case studies as a primary strategy for teacher professional development. Over the course of his work with Concord he has been involved in projects using a variety of online delivery techniques. He helped develop the NSCD Standards for Online Teacher Professional Development, and is on the board for a number of online education projects. He was recently recognized at the tenth annual Marketing Opportunities for Business and Entertainment Conference as one of the Influencers and Innovators of the Internet and Technology. He is a recognized proponent of online asynchronous education.

Supporting Learners for E-Learning

Diane Ruelland, Ph.D.
druelland@videotron.ca
Associate Researcher with the LICEF Research Center of Tele-universite, Montreal, Canada

Donna Gabrielle, MA.
Donna.Gabrielle@usma.edu
Associate Director of the Center for Teaching Excellence, United States Military Academy, West Point, NY, USA

Gail Derrick, Ed.D.
gailder@regent.edu
Assistant Professor with the School of Education at Regent University, Virginia Beach, Virginia, USA

Jane Pilling-Cormick, Ph.D.
info@prolt.com
Researcher & President of Professional Learning & Training (PL&T), Toronto, Ontario, Canada

George Piskurich
GPiskurich@cs.com
Organizational Learning and Performance Consultant, USA

Abstract: The panel will address the topic of eLearning from the adult learner's point of view. The objective is to expose the motivational, cognitive, metacognitive and social efforts required to succeed in an on-line web-based learning environment (WBLE). The panelists will describe strategies implemented in academic, workplace and military fields that support self-directed learning (SDL) skills required by eLearning. Discussion with participants will help designers, teachers, and human resource officers understand the importance of supporting self-learning skills in order to provide authentic and efficient access to eLearning. The discussion will also propose supportive solutions to alleviate the difficulties faced by the eLearner.

Key words : **eLearning, self-directed learning, web-based learning, learning skills, instructional design**

A new role for the eLearner

Distance learning, multimedia information processing, and network collaboration are three features of eLearning that create flexible and open-ended learning environments, which in turn put the learner into a controlling position of the learning process (1).

Due to the distance between the teacher and the learner (2), the adult learner needs to be able to set priorities and plan of actions, set a time schedule, organize the environment, assess his learning progress and accurately diagnose the problems and find help to solve the problems.

In processing multimedia information (β), the learner needs to be able to evaluate continuously one's own knowledge in order to decide which information to search, express appropriate search strategies, take on the teacher's role to create the accurate knowledge links.

When collaborating with peers (4), the learner needs to be able to manage teamwork and/or group work, negotiate acquired knowledge with others, validate the others' knowledge and communicate results to the team/group.

BEST COPY AVAILABLE

This leading position involves a particular set of learning skills and requires innovative conditions for successful learning (5).

Difficulties to assume

ELearning puts the learner in a proactive position in order to progress and succeed. To adopt this position may be confusing for most adult learners of today because it requires the application of high level (SDL) skills such as planning, self-monitoring, self-reviewing, self-discipline and self-confidence (6). These skills were unfamiliar in traditional learning (7) and in an eLearning situation new components make them more complex due to the combination of distance, multimedia and network collaboration (8). For example, to manage one's rhythm of learning in an asynchronous and collaborative setting is different than in a classroom setting. It is also different to control one's comprehension while reading a print book than while searching and consulting web pages on a specific topic.

To succeed as an eLearner one has to accept the additional effort required by eLearning conditions. One has to mature in learning.

Strategies to support the eLearner

If SDL is an important set of learning skills to master in eLearning, it is also an important source of difficulties mainly related to a low awareness of eLearning conditions and to a poor mastery of comprehension and time management (9) (10) (11) (12). These difficulties can be related to personal or organizational constraints and the high drop out rate in distance education shows that it is crucial to address this problem with efficient support strategies in order to allow the eLearner to succeed and adopt eLearning.

The panel will allow the participants to discuss five different support strategies using one or more of the following resources : the assistance of an eFacilitator and peers collaboration, a training plan to develop the SDL skills and the use of interactive self-management tools embedded in the WBLE. These strategies were implemented in academics, workplace or military field and the possibility to adapt them to other environments will also be considered.

Self-management Tools to Support the E-Learner's Self-management Process

This strategy aims at supporting the SDL process through the use of tools embedded in a WBLE (http://www.licef.teluq.uquebec.ca/anglais/index.html). A skill profile, a workplan and a progress assessment are tools designed to inform the eLearner about the main learning conditions which are the knowledge content, the learning events, the time schedule, the motivational, social and technological resources available. They allow one to prepare a workplan, self-monitor, review and adjust the plan according to the on-going progress. At the user's request, self-management strategies can be supplied as well. These tools were designed according to a conceptual model of eLearner's needs for support and they have been used and tested with adult eLearners in academic and workplace settings. The presentation will emphasis the link between the model and the tools and the adaptability of these tools to various settings will also be discussed.

Motivational Strategies via Technology to Enhance Self-directness, Performance, and Satisfaction

This discussion concerns a large scale study (13) (14) at the U.S. Military Academy on integrating technology-mediated motivational strategies to enhance self-directedness, performance, and motivation of cadets. The motivational strategies are communicated via email messages, with a link to content-related strategies intended to encourage the learners to self-direct by accessing the material (web-based simulations, online quizzes, PDA-based content) on their own time and outside the requirements of their courses. Post-strategy SDL surveys are used to determine whether or not cadets accessed the material, if not, why not; and if so, whether their curiosity to learn was piqued, how beneficial they feel it is to learning the course content, and open ended questions asking them for further input on the strategies. Readiness for Self-Directed Learning (as measured by the SDLRS instrument) was also measured.

A Self-Directed Learning Perception Scale to Guide the Design of Supportive Self-Directed Learning Environments

Online learning involves much more than transferring knowledge to learners. The Self-Directed Learning Perception Scale (SDLPS) (15)(16) is a tool which lets facilitators and course designers move beyond the "bells and whistles" of what computers can do to build supportive online self-directed learning environments. The SDLPS is a questionnaire that gives a snapshot look at online learning experiences to show if opportunities exist for learners to address individual needs, develop more responsibility for their learning, experience a non-threatening learning environment, interact with others and develop relationships. Numerical scores and practical suggestions for building even more supportive online learning environments are part of the SDLPS feedback.

Support Strategies to Design Environments that Enhance Desire, Resourcefulness, Initiative, and Persistence in Learning

This presentation will provide a conceptual model (17) (18) for understanding learner autonomy and autonomous learning within the confines of self-directed learning specifically within an eLearning environment. Autonomous learning is the process in which the learner makes an intentional decision to assume the responsibility for a learning situation. The concept of autonomy can be placed within the framework of personal attributes. Thus, within this structure, learner autonomy can be identified and understood as the characteristic of the individual who exhibits agency or intentional behavior with respect to their learning endeavors. Learner autonomy is one of the personality characteristics associated with autonomous learning (i.e. desire, resourcefulness, initiative and persistence). Facilitating and developing learner autonomy in any environment is challenging but even more so in distance learning. Strategies to enhance and develop learner autonomy with the idea of facilitating the move from learner dependence to learner independence will be discussed and will provide a conceptual model for understanding learner autonomy and autonomous learning within the confines of self-directed learning.

A SDL Classroom-based Program to Enhance the Ability and Comfort with Self-directed Learning Activities such as E-learning

The classroom-based program (12) (19) is a transition strategy that utilizes organizational definitions and policies, personal analysis instrumentation such as the SDLRS, and self-directed learning contracts to provide new eLearners with information and a support structure that will give a chance to practice learning on their own as well as involve their supervisors in the process.

Literature References

(1) Belisle, C. & Linard, M. (1996). Quelles nouvelles competences des acteurs de la formation dans le contexte des TIC?, *Éducation permanente*, 127(2), 19-47.

(2) Baynton, M. (1992). Dimensions of Control in Distance Education : A factor analysis, *American Journal of Distance Education*, 6(2), 17-31.

(3) Marchionini, G. (1989). Information-Seeking Strategies of Novices Using a Full-Text Electronic Encyclopedias, *Journal of the American Society for Information Science*, 40 (1), 54-66.

(4) Henri, F. & Lundgren-Cayrol, K. (2001). *Les environnements de collaboration a distance*, Presses de l'universite du Quebec, Quebec.

(5) Harasim, L. M. (1995). *TeleLearning Network Centers of Excellence, Building a Knowledge Society, Strategic Plan*, C1-C22.

(6) Jones, M.G., Farquhar, J.D. & Surry, D.W. (1995). Using metacognitive theories to design user interfaces for computer-based learning, *Educational Technology*, July-Aug, 12-22.

(7) Mayes, T. (1996). *Distance Learning and the New Technology; A Learner-Centered View*. Institute for Computer-Based Learning, Heriot-Watt University, Edinburg. http://www.icbl.hw.ac.uk/ctl/mayes/paper10.html.

(8) Ruelland, D. (2000). *Vers un modele d''autogestion en situation de teleapprentissage,* These de doctorat en education, Universite.

(9) Garland, M. (1993). Ethnography Penetrates the «I didn't Have Time» Rationale to Elucidate Higher Order *Reasons for Distance Education Withdrawal, Research in Distance Education*, 5(1-2), 6-10.

(10) Caron, M. (1994). *La gestion du temps en apprentissage a distance*, mémoire de maîtrise, faculté des études superieures, Universite Laval.

(11) Ruelland, D, (2002). *Self-Directed Learning + , a model to support sefl-directed learning in the workplace*, In H.B. Long & Associates. CD-ROM. Schaumburg: Motorola University. Florida.

(12) Piskurich, G. (2001). The Instructional Technology Handbook: Preparing for e-learning: *A Learner's Perspective.* ASTD.

(13) Gabrielle, D. (2001). Society for Information Technology & Teacher Education (SITE), *Distance Learning: An Examination of Student Satisfaction and Perceived Effectiveness in Higher Education*, - International Conference, March, Orlando, Florida.

(14) Gabrielle, D. (1997). *Distance Learning: An Examination of Perceived Effectiveness and Student Satisfaction in Higher Education*, Florida State University.

(15) Pilling-Cormick, J., Nuckles, C. & Kimora. (2001). Profile component analysis of the self-directed learning perception scale. In H.B. Long & Associates. *Self-directed learning and the information age.* CD-ROM. Schaumburg: Motorola University.

(16) Pilling-Cormick, J. (1997). Transformative and self-directed learning in practice. In P. Cranton (Ed.), *Transformative learning in action: Insights from practice* (New Directions for Adult and Continuing Education, Number 74, pp. 69-77). San Francisco: Jossey-Bass.

(17) Derrick, G. (2001). *The Measurement of the Intentions to Exhibit Persistence in the Adult Autonomous Learner*, Doctoral Dissertation, March.

(18) Derrick, G. (2002). *Persistence and the Adult Autonomous Learner*, Twenty-First Century Advances in Self-Directed Learning, January.

(19) Piskurich, G. (2001). The American Management Association's Handbook of e-learning : *Preparing Learners for e-learning.* ASTD.

A Successful Online Education Program Panel Discussion

Kaye Shelton, Online Education, kayeshelton@sbcglobal.net
Dallas Baptist University, USA

George Saltsman, Educational Technology, saltsman@acu.edu
Dr. Paul Lakey, Scholar-in-Residence, Walter Adams Center for Teaching Excellence, lakeyp@acu.edu
Raye Lakey, Faculty Development and Instructional Development, lakeyr@acu.edu
Abilene Christian University, USA

Abstract: "How did you do it?" "What makes your online education program so successful?" "How did you get your faculty to agree to teach online and your administration to support the funding?" "How do you get the students engaged and complete the class?" Repeatedly, education professionals pose these questions at many conference and workshop presentations. Afterwards, the subsequent email and phone calls to the panelists confirm the overwhelming need for solutions to these issues in online education and academia today. There is no single prescriptive solution; however, successful online education programs do exist and share many common practices. Based on first-hand experience and a review of successful models, the presenters will offer guidelines for educational institutions and professionals who seek insight into the complexities of online education. This presentation will serve as an excellent resource for creating an online education program or for improving a struggling one.

Panel Discussion

"How did you do it?" "What makes your online education program so successful?" "How did you get your faculty to agree to teach online and your administration to support the funding?" "How do you get the students engaged and complete the class?" Repeatedly, education professionals pose these questions at many conference and workshop presentations. Afterwards, the subsequent email and phone calls to the panelists confirm the overwhelming need for solutions to these issues in online education and academia today.

There is no single prescriptive solution; however, successful online education programs do exist and share many common practices. Based on first-hand experience and a review of successful models, the presenters will offer guidelines for educational institutions and professionals who seek insight into the complexities of online education. This presentation will serve as an excellent resource for creating an online education program or for improving a struggling one.

This panel discussion contains frameworks of information for three specific audiences: educational leaders, program directors, and faculty/course designers. The audience will gain a general insight into the overall design of an online education program, and will also be provided with detailed information tailored for their specific areas of focus.

This presentation will be based on the presenters' significant experience in working with online education, faculty support, and educational technology. They will offer concise accounts of their own pioneering efforts and knowledge gained through academic study. Case studies, sample documents, expert advice, and pertinent debates of pedagogical issues will support the presenters' rationale. The panelists will offer examples of what works and humorous illustrations of, all too often, what does not. The audience will gain valuable knowledge from insight and experience in online education, surveys of academic professionals, and interviews with key people in both successful and struggling online programs.

Primary challenges such as program leadership, setting goals and objectives, faculty development and support, instructional design, and online teaching recommendations will be addressed. Each challenge will be presented with successful strategies that have worked for different institutions. No single, universal

BEST COPY AVAILABLE

method exists to tackle the many challenges of an online program. Institutional culture, differing goals, and attitudes toward technology will suggest varying solutions that institutions can utilize effectively.

Many established institutions have found that creating an online education program is a struggle. Years of deep-rooted tradition, resistance to change, lack of understanding about the medium, and the fear of loss of academic reputation and quality have either caused schools to be slow in accepting this medium or have caused fatal errors in program design.

The presentation will address four critical areas of online education:

1. Leadership Models: Why They Are Important
2. Setting Goals and Objectives
3. Faculty Development/Online Instructional Design
4. Online Teaching Recommendations

In addition to these four critical areas, the panelists will be prepared to lead discussion regarding other important areas of online program design such as: preparing the institutional infrastructure, accreditation issues, selecting an online courseware management system, marketing the program, selection and retention of online students, and online student support.

Leadership Models: Why Are They Important? This discussion will concentrate on the need for upper-level administration support and faculty buy-in. One of the paramount truths of building a successful online education program is that it must have top-level administrative support. We will propose several leadership models and will examine their advantages and disadvantages. Examples will be cited where programs floundered or failed because the upper-level administration failed to give adequate support to the program. Positive examples will be given where strong leadership removed the obstacles and a successful program developed.

Setting Goals and Objectives. This discussion will address the institution's goals, scope, and objectives. The purpose of this discussion will be to persuade the audience to define the institution's overall purpose for creating the program. Methods will be presented to establish objectives that are both realistic and obtainable. The ideal method for goal setting is to form a group of interested individuals, preferably from both academic and administrative departments. The group should be kept small but diverse with representation from each of the key areas involved such as admissions, registrar, faculty, advising, information technology, and key administration. This important group of individuals analyzes the critical issues and discusses program direction and rate of growth.

Faculty Development/Online Instructional Design. The presenters will cover valuable aspects of faculty support and online instructional design. Preserving academic integrity and the rigor of online instruction is critical for quality online education. Faculty must be supported in this new method of teaching. Instructors should not be expected to learn by trial and error. Not only will the students suffer, but also the instructor will have a dissatisfactory experience and may never return to teaching online. A sample web style course guide will be presented as well as sample course designs and instructional recommendations. A variety of methodologies, pedagogy, and curriculum design issues will be discussed for the course designer. Methods will be presented for designing online courses including procedures for asynchronous learning including a web content chunking approach. Also included will be a list of excellent resource texts and websites for both instructors and course designers.

Online Teaching Recommendations. This important discussion will suggest successful techniques for online teaching and classroom facilitation. An online education director must be keenly aware of the changes and challenges that face faculty in this new instructional medium. Creating policies and procedures for teaching and learning online is a complex task. This topic will provide sample policies, online classroom guidelines, and Internet etiquette behavior suggested by successful online education professionals. For example, will an instructor know how to manage an online student who speaks sharply in a threaded discussion or verbally attacks the instructor in front of the class? This is difficult to deal with in

BEST COPY AVAILABLE

the traditional classroom, but eliminate the physical presence of the student and instructor (and with that, a layer of communicative clarity) and it becomes even more difficult to control.

The online learning community is a critical development strategy for encouraging online learning, especially at an asynchronous level. Students must feel comfortable with posting their discussion replies and gleaning knowledge from each of their classmates. The presenters believe the instructor is ultimately responsible for creating and nurturing this community of online learners and thus will need resources and strategies in which to create this important element of the online course.

Discussion Format – Each panelist will address one of the four critical areas of online education. Audience participation will be encouraged, as the panelists' desire for this discussion is to equip the audience with pertinent information that can be taken back to their own institutions and put into place to help successfully create or improve an online education program. Adequate time will be allocated for numerous audience questions.

Panelists Background

Kaye Shelton, MSEd
Topics covered: *Instructional Design, Online Teaching Methodologies, and Courseware Management Systems*

Kaye Shelton is the Director of Online Education for Dallas Baptist University, a university instructor, and an online education consultant. A certified online instructor, her education includes a BAS in Management of Information Systems and an MS in Education emphasizing Online Teaching and Learning.

Mrs. Shelton is employed as Director of Online Education at Dallas Baptist University. After accepting the challenge of developing an online degree initiative in 1998, in the setting and culture of a traditional Christian liberal arts college, the program resulted in prominence and success. Fighting ingrained culture, resistance to change, and the retraining of faculty, Mrs. Shelton helped lead the online program to an enrollment of over 900 students in just three years. She continues to train instructors in the design and teaching of an online class. The online program rivals the traditional program in quality, academic integrity, and financial stability. This popular online program carries a prominent level of respect among peer institutions.

Mrs. Shelton is a university instructor who has developed and taught classes online. She enjoys teaching online, teaches throughout the academic year, and receives exemplary ratings of evaluation from her students. Mrs. Shelton has presented at numerous conferences and workshops including CITE, Stop Surfing Start Teaching, Blackboard Users Conference, and the Datatel Users Group Conference on the topics of the creation of an online education program and the best methods for teaching online.. She is regarded as an opinion leader in the field of online learning and distance education and has served as an advisor to online education programs for peer institutions. Currently, Kaye Shelton and George Saltsman are co-authoring a book concerning online education program development.

George Saltsman, MS
Topics covered: *Program Leadership, Technology and Goal Setting, and Program Objectives*

George Saltsman is the Director of Educational Technology for Abilene Christian University, a university instructor, an electronic publishing and marketing consultant, and a board member of several local technology corporations. His education includes a BS in Computer Science and an MS in Organizational and Human Resource Development.

Mr. Saltsman is employed as Director of Educational Technology in the Adams Center for Teaching Excellence at Abilene Christian University. In his 13 years of employment at Abilene Christian University, he has gained vast experience in working with technology and faculty. He helps oversee the ACU distance learning program and designs and constructs computer labs and technology enhanced classrooms. He teaches appropriate technology use to faculty and consults with faculty on many complex technological issues. He is consistently recognized for his ability to make complex issues easy to understand and has a track record of leading edge technology deployment among peer institutions.

Mr. Saltsman is also the instructor for the Interactive Media course in the Journalism and Mass Communications Department at Abilene Christian University. His energetic teaching style and ability to convey technological concepts in an easy-to-understand manner have consistently earned him excellent ratings from both undergraduate and graduate students. His students have won national awards for their student-produced works and have gone on to be successful in many careers in the interactive media field.

Paul N. Lakey, PhD
Topics covered: *Program Leadership and Goal Settings and Objectives*

Paul Lakey is the Director of the Human Communication Division at Abilene Christian University in the Department of Communication and Scholar-in-Residence in the Walter Adams Center for Teaching Excellence at ACU. His education includes two master's degrees and a Ph.D. with a dual emphasis in Organizational and Intercultural Communication.

He joined the ACU faculty in 1988. Dr. Lakey has received numerous teaching awards including the "Best Teacher in Abilene" award in 1998 and selection as "Educator of the Year" in the College of Arts and Sciences in 1999. His teaching specialties involve leadership, conflict management, and training.

He has presented and published articles pertaining to a range of communication issues, particularly cultural adaptation and conflict management. He is also active as a communication consultant and trainer particularly in the areas of conflict management and leadership. In his role as scholar-in-residence, a faculty development assignment, Dr. Lakey has directed initiatives in faith and learning integration, cultural diversity, learning teams, and teaching effectiveness (technology integration, active learning strategies).

Raye Lakey, MEd
Topics covered: *Faculty Support, Faculty Development, and Instructional Design*

Raye Lakey is the Director of Faculty Development and Instructional Development at Abilene Christian University. She also serves as Associate Director of ACU's Adams Center for Teaching Excellence.

Mrs. Lakey has provided leadership in faculty development and instructional development at ACU since 1991. She has developed a broad system of faculty development for the university's faculty, addressing traditional topics such as teaching strategies and portfolio development and cutting edge topics including the scholarship of teaching and online faculty development opportunities. Her active involvement in national and regional faculty development organizations has brought national recognition to the Adams Center for Teaching Excellence.

Mrs. Lakey has authored a number of online tutorials for faculty development and her work was cited in the 2001 issue of *To Improve the Academy*, published annually by the Professional and Organizational Development (POD) Network. The most noteworthy tutorial for faculty, entitled "Active Learning Online," is available at www.acu.edu/cte/activelearning. Her key areas of expertise include teaching effectiveness, instructional design, web-based faculty development, and faculty development assessment. Mrs. Lakey has conducted workshops, faculty development assessment, and consultations regarding faculty development for a number of other university faculty development programs.

Open Source Software Can Open Minds *and* Help Solve the U.S. Technical Education Problem

By Matthew J. Szulik
CEO, Red Hat, Inc.

Right now Microsoft is torturing the Philadelphia public school system. Acting on an anonymous tip, the giant software monopolist is making Philadelphia go through a lengthy and expensive audit of every computer in all 264 schools within the impoverished school system. Why? Because Microsoft heard that a teacher had illegally copied a Microsoft application onto a school computer. So now the school system must inventory every application on every computer in the system and produce proof of valid licenses for everything. I'll grant you that this is fairly typical behavior for a proprietary software vendor that must defend its intellectual property. But doesn't this seem like killing a mosquito with a nuke? If the Philadelphia schools had chosen open source software my company and others would have encouraged them to make as many free copies as they needed. The schools would have saved millions of dollars and hundreds of hours of inventory work.

This unfortunate incident is only the latest evidence of an ongoing crisis in computing and technical training in our schools.

Despite all the computer equipment and software that companies have donated to schools over the past 20 years, students are still advancing through the grades and graduating with inadequate technical skills – technical in this case being a synonym for "computing." The way things are going this will only get worse. The job market demands more skills and sophistication, while at the same time school budgets are shrinking. It's getting harder for us to provide the computing and technical skills that will be the foundation for the success of our economy of the 21^{st} century.

This seems crazy – haven't computer and software companies donated mountains of equipment and applications for years? How could things be getting worse?

I believe the problem is the underlying philosophy with which technology companies approach our schools. They've treated education as a *marketplace*, not as a *responsibility*. Technology companies, particularly those that create and sell proprietary software, see educational institutions in terms of market development. They think: "hook the kids today on our applications and they'll stay with us forever. They'll have to – we're the only source for upgrades and fixes."

A proprietary software company sells a school their wares (often at an attractive discount) and locks them in. The school system must return to that vendor for upgrades, bug fixes and service. Even if school staff or students possess the technical skills to repair, customize or improve the software they can't. The restrictive licenses that encumber proprietary software make it a crime to do anything with it but use it – or call the vendor and pay for help.

I want to be clear in stating the problem: by extending their lock on the educational system the proprietary software vendors have restricted choice, institutionalized inefficiency and imposed artificially high prices (even after discounts) that hurt taxpayers. Your taxes are paying for the pricing practices of a proprietary monopoly.

This can eat up school budgets quickly, and there's not much budget to begin with. In the U.S. public school system the average technology budget per pupil is $104. In my home state of North Carolina, wrestling with a serious budget deficit, it's even worse: $15.98 per pupil per year. That will buy about one quarter of one Windows license upgrade, or a couple of boxes of floppy disks. It's certainly not the level of commitment it takes to prepare students to fill the one million high-paying technology jobs that are unfilled in the U.S. right now.

There's more depressing evidence if you look at other state education budgets. That's where you have to look, because federal spending covers only seven percent of the costs of public education – the states pay the rest. Think of the impact on technical education as Ohio wrestles with an $850 million deficit. Alabama had to cut $300 million out of its education budget. New Jersey, by law, must spend first in the poorest school districts. That's an admirable approach, but it will require $1.3 billion in *additional* spending in a state that is already facing a deficit. Clearly, we have to make a major change in the way we approach and fund public technical education and that starts with breaking the traditional ways in which schools spend their meager computing budgets.

So, what should we do? We should open up our school systems to the benefits of open source software (full disclosure: that's the business I'm in). We're way behind other countries in doing this. Some examples:

- In Mexico, the government's Scholar Net program is working towards creating 140,000 computer labs in schools throughout the nation. The ambitious project, scheduled for completion in 2003, uses Linux as the operating system for these school computers. Why? The director of the program estimates that software for each lab would cost $885 if equipped with proprietary Windows, or $50 with Linux.

- In South Africa, the Zingasa Comprehensive School in Umtata, an impoverished part of the country, has created a computer learning center with old 386-based computers running Linux. Unlike Windows, Linux runs very well on 386 systems. Now every student in the high school takes Computer Studies as their seventh course. Linux is also playing a key role as South Africa moves to network 28,000 schools around the country.

- In France, under the guidance of the French Minister of Education's Centre National de Documentation Pedagogique program, 350 primary and secondary schools in the Grenoble academic district are accessing the Internet through inexpensive Linux servers.

In the United States, admirable groups such as K12 Linux and the Linux in Schools Project are working hard to stretch education dollars with open source software. These are volunteer groups, however, without government support and without the resources to overcome the marketing machinery and lobbyists of the proprietary software vendors.

If the current efforts in the U.S. are insufficient, then how can we solve the growing technical education problem? I propose the creation of an Open Source Education Corporation modeled after the Civilian Corps of Engineers. I envision public educators and local school boards working together to improve the quality of local technical education at a much lower cost, bypassing the proprietary, high-cost vendors. *This will not require new government spending.* In fact, it will reduce spending through a much more efficient use of the state and federal money that is already earmarked for technical education.

Initially, I envision four primary undertakings for this organization:

1. *Open up the spending process to welcome open source software.* Most requests for proposals (RFPs) for educational computing spending are heavily skewed towards the proprietary vendors. Many of them actually specify Windows software, or Windows compatibility. That means that from the start the bidding process excludes the products that could provide equal or better utility at a far lower price. If school systems and boards of education made just this simple change – include open source software in their RFPs – taxpayers could save hundreds of millions of dollars.

2. *Target the neediest schools.* I'm on the board of a predominantly black, under-funded college in North Carolina. The students are bright, eager, full of ideas and ready to help improve our nation. They're also hindered by an inadequate computing education. The first target for the Open Source Education Corporation should be poor schools in poor areas. Paradoxically, the fact that these schools have such meager computing environments will help them benefit from open source: they are not locked in by restrictive proprietary software licenses.

3. *Create an open source hardware exchange.* Few people realize that proprietary software licenses are tied to the computer system. If you donate an old 386-based PC loaded with Windows, the school to which you donate it must pay another licensing fee to Microsoft. Your gift costs the school money and inconvenience. But if the school strips Windows off the machine and loads Linux instead (freely downloadable from several web sites) they give new life to a computer, get software that runs well on that machine, and pay nothing. An Open Source Education Corporation online exchange could match donated computers to schools that need them and help the schools get the Linux software to make them run. The proprietary vendor loses a licensing fee but a school gets a useful computer.

4. *Create and share educational applications*. By freely sharing innovations, participants in the Open Source Education Corporation could create new applications, instantly distributing them through the Internet to any school that wants them, free of charge. This will greatly reduce spending on proprietary applications while enabling students to be innovative and creative.

Open source software promotes the free distribution of technology. It encourages innovation and sharing. It promotes intellectual freedom as students work to make the software ever better – and then spread the results to other schools – legally. And with open source software school systems can pick from a wide range of vendors; they're not locked in. If a school doesn't like Red Hat Linux, there are plenty of Linux suppliers who would love to supply a school system. Innovation and competition – sounds like capitalism, doesn't it? I'd like kids to learn about capitalism – not monopoly power -- while they learn about technology.

A pipe dream? Not really – in some ways it's already happening. Today, across the globe scientists and technical educators are electronically sharing their technical improvements to open source software as they make their work more efficient. This will lead to scientific breakthroughs. Think of the educational breakthroughs we could see if we applied these principles more widely in public education!

Our failure as a nation to adequately prepare people for the challenges of the 21st century will catch up with us. Already we see the economic clout created by very well-trained technologists from China, India, Ireland, South Korea and many other nations. But through open source software we have the tools today to improve technical education, encourage innovation, enhance our competitiveness and save money all at the same time.

Isn't it time that we changed technical education from a market development program for corporations to a cost-effective priority that operates in the national interest?

The New Generation Working Force: The Homo Zappiens

Prof. dr W. Veen, W.F. van Valkenburg, prof. mr dr ir S.C. Santema, R. Genang

Abstract: In this paper we discuss the new generation of workers, the Homo Zappiens. The Homo Zappiens is led by new skills: skills to quickly scan content, skills to multi task, skills to process discontinued information and he is used to non-linear learning. These skills can be related to ways we learn and it seems that the Homo Zappiens has developed more natural strategies for learning. These skills and competencies that Homo Zappiens is developing are crucial for future citizens of the information and creative society and society should adapt to this with new ways of learning, like blended learning, non-linear learning and authentic learning.

Introduction

Corporations will have to cope with a new generation of labour force. Workers will demand new ways to professional development using technologies such as messenger, chat and e-mail programs. The traditional out-of-office training days will no longer satisfy tomorrow's demand-based learner. These new ways of learning have different attractive names, such as non-linear learning, authentic learning, interactive learning, collaborative learning, learner-centered learning (Huang 2002) and scenario-based learning, but why are these new methods better than the ones we have used for decades? In this paper, we discuss the new abilities and skills of the next generation workers. They will be the driving force for changes in human resource management.

Homo Zappiens

The change force is Homo Zappiens, the new generation that is preparing for future information and creative society. Homo Zappiens is the generation that has grown up using three devices: the remote control, the mouse and the cell. These three devices have enabled nowadays' children to deal with huge amounts of information, selecting it properly, swiftly and according to their needs. HZ is an active processor of information, using strategies to solve problems by gaming, and to communicate effectively. Homo Zappiens considers learning as playing, exploratory play (Rushkoff 1997).

Children – the workers of the future – create electronic personalities on the net communicating in three chat rooms at a time. Such chatting demands quick scanning of scrolling messages and responding adequately. Children have learnt to be trace and select information they are looking for and deal with rapid ways of communication with many. Searching the web is the most natural way for children to find information. For booking tickets for the cinema, buying CD's, downloading music files, and also finding about the latest earthquakes or pictures of the Hubble Telescope. Online presence is just as normal as onsite presence. Using technology for learning goes without saying. Such abilities and skills are critical in an information society where knowledge is changing rapidly.
Homo Zappiens also differs from former generations in the way they play games. Instead of playing games according to fixed rules, they like to invent their own games and set their own rules. Most of the time these games do have neither winners nor losers. Nowadays kids like to determine their games like Casper and Hobbes. Casper ball is much more fun than baseball. Homo Zappiens is trying to push new sports such as skeelering and snowboarding. Sports that challenge them to explore the edges of laws of nature and the human body. They search actively for new equilibriums.
It is also the generation that considers school as a meeting place for friends rather than a learning environment. School does not challenge them sufficiently for learning the way they have been accustomed to. Of course, children who are used to be in control and to be active do not suit 'chalk and talk' classrooms. Therefore, schools complain Homo Zappiens to be hyperactive and not willing to listen for 40 to 50 minutes. Homo Zappiens feels uncomfortable not to be able to zap a talking head... and start learning. Current teaching materials and teaching methods are in conflict with the pupils' learning approaches.

Skills

BEST COPY AVAILABLE

But let's stop complaining Homo Zappiens and let's see what children have on offer for learning. By using the web for searching and communicating, by playing PC games, and by zapping TV channels, they have developed skills that are critical for learning. These skills are also critical in an information society in which it is no longer the content that matters but where the context is the core issue. Four skills are discerned and discussed below.

The first skill relates to scanning skills when Homo Zappiens deals with screens. Nowadays' children do not start reading characters when they are in front of a screen. Instead, they scan including colors, images, icons, symbols, movements and sounds. This approach makes them decide must faster where to go next and which button to press. This is the reason that parents always loose in competing to find information on the web. This skill makes kids efficient information seekers.

The second skill relates to multi tasking. Screenagers are able to do different tasks at a time. The screenager can be doing his math homework and communicating with a friend and at the same time finding some relevant information on the web. He is learning by active searching using technology as a tool. In our society, which is said to become more complex, individuals will have to deal with many different tasks at a time. Homo Zappiens is finding his way in advance.

The third skill is about processing discontinued information. Zapping TV channels is watching various interrupted information flows and making sense out of them. Notice that Homo Zappiens does not zap ad randomly, on the contrary, they have learnt to understand the principles of visual communication and consciously zap across the different channels. This skill helps kids to deal with huge amounts of information.

Many generations have been trained to read and study linearly. Homo Zappiens differs here again. He has learnt to look for solutions of problems at the appropriate time. When playing a PC game they do not start by reading the manual. They start by playing the game and only use the manual whenever needed. This is also the way students use books for learning. Web content by itself is organized in a non-linear way and it is the experience with this organization of information that they have internalized.

Learning

Do the skills and approaches of Homo Zappiens relate to learning? We think so. We learn by reflecting on our experiences creating 'mental maps' and 'mental models' (Bruner 1973). Learning is the process of adapting our mental maps and models by including new experiences. From a constructivist point of view, learning is searching for meaning. Individuals who learn try to transform new information in to meaningful knowledge. As a matter of fact, they construct knowledge.

Within the framework of complexity theory (Cilliers 1999) human brains are often discussed as examples of complex systems that are never in equilibrium, adaptive to continuous influences from the outside world, and self-organizing. They function in a highly non-linear way, building complex networks between neurons. Therefore, learning is a non-linear activity in nature (Robertson 2000 & Dennett 1998), in which association and creativity are crucial strategies. Homo Zappiens seems to have developed more natural strategies for learning.

Learning linearly, step by step has been a major pedagogical approach for decades. However, this is in contrast with the way Homo Zappiens is triggered for learning. He wants to be challenged by complex problems, which are presented in an authentic context, rather than isolated from real life situations. Learning should involve intense activities, including discussion, finding out on your own and using technology. Learning is an active mental process of the learner, which means that learning hardly occurs when students are listening somebody talking. Research has shown that the retention rate of lectures is around 5% only! The more active learning methods are, the more students learn. The learner himself can only do transforming information into meaningful knowledge. Therefore, teaching is facilitating students to learn. Churchill has put it this way: 'I do not like to be educated, but I like to learn.'

The skills and competencies that Homo Zappiens is developing are crucial for future citizens of the information and creative society.

We consider the screenagers' competencies crucial for the survival of our civilization in the 21st century. These competencies relate to strategies how to deal with information, how to process information, how to work together, and finally they relate to thinking. We need flexible individuals who are independent and self-directing and who are good thinkers.

Concluding Remarks

Teacher led learning has been widespread in education and training to date. It is the traditional teaching method of chalk and talk. However, as Homo Zappiens has developed the attitude to learn by himself he is very uncomfortable with this old pedagogical approach. Learner led approaches are much more appropriate for learners that have grown up in a technological society. Therefore, teachers will have entirely new roles to perform.

Independent learning cannot happen within the traditional sequence of out-of-office training days. A whole day of listening is a torture for Homo Zappiens and as we already know from educational research a very ineffective way of learning. Homo Zappiens should be able to learn *on-the-job* and *just-in-time* in *virtual learning and professional communities*. This means that human resource management has to change in the direction of e-learning. In addition to economical reasons for turning towards e-learning (e-learning costs about 50% of the traditional training) there seems to be another reason to adopt new ways to manage human resources. This reason relates to an upcoming labour force willing to learn and work differently.

References

Bruner, J. (1973). *Going Beyond the Information Given*. New York: Norton.

Cilliers, P. (1999). *Complexity & Postmodernism, Understanding Complex Systems*. London: Routledge.

Dennett, D.C. (1998). *Brainchildren, Essays on Designing Minds*. UK: Penguin Books.

Huang, Hsui-Mei (2002). Toward constructivism for adult learners in online learning environments. *British Journal of Educational Technology*, vol. 33, No 1, 27 – 37

Kindley, R. (2002). Scenario-Based E-Learning: A Step Beyond Traditional E-Learning. [Online] Available: http://www.learningcircuits.org/2002/may2002/kindley.html

Robertson, I. (2000). *Mind Sculpture*. Bantam Press; ISBN: 0593043863.

Rushkoff, D. (1997). *Children of Chaos, Surviving the End of the World as We Know it*. London: Flamingo.

Communities Of Practice for Improved Learning Systems in the Corporate, Government, Higher Education and Health Care Sectors.

Etienne Wenger, CPSquare (Panel Chair)
etienne@ewenger.com

Mary Lynn Benninger *Clarica*, Canada
mary.lynn.benninger@clarica.com

Roy Greenhalgh, Roy Greenhalgh Associates, UK
rgreenh@attglobal.net

Thomas Ruhl, *Lewis and Clark College*, USA
RUHL@lclark.edu

Céline Monette, *Aventis Pharma, Canada*
Celine.Monette@aventis.com

Abstract: This panel session explores issues in relation to technologies and facilitation of community in the four key domains of the E-learn 2002 Conference, Health, Higher Education, Corporate and Government. While it is commonplace to say that people are the most important resource in organizations, we seldom understand this truism in terms of the communities in which individuals develop the capacity to create and share knowledge. These communities of practice are an organization's most versatile and dynamic knowledge resource. The panel presenters will demonstrate how in practice organisational learning can be supported through the marriage of online technologies and community development. Participants will have maximum opportunity to raise issues, both theoretical and practical, with the esteemed panel members in the discussion time devoted to this panel session. Follow these issues through the related Interactive, Roundtable and Special Interest Group sessions that accompany it in the Communities of Practice Strand.

Panel Chair: Etienne Wenger

CPSquare

Etienne is an independent thinker, researcher, consultant, author, and speaker, mostly known for his work on communities of practice. Theoretically, his work focuses on social learning systems. He is trying to understand the connection between knowledge, community, learning, and identity. The basic idea is that human knowing is fundamentally a social act. This simple observation has profound implications for the way we think of and attempt to support learning. Practically, these ideas are helping people who face all sorts of challenges, such as: design more effective knowledge-oriented organizations, create learning systems across organizations, improve education and lifelong learning, rethink the role of professional associations and design a world in which people can reach their full potential.

Communities of practice are emerging as the most promising structures for building knowledge-based organizations. They are the key to the knowledge strategy of a growing number of leading companies, government agencies, and non-profits. Community development is new to most organizations, however, and there is an urgent need for accelerated learning in this area.

BEST COPY AVAILABLE

The Communities of Practice

The Corporate Sector – *Clarica Agent Network*
Mary Lynn Benninger
Clarica, Canada

Mary Lynn is with Clarica, an innovative insurance company in Canada. Clarica was an insurance organization with approximately 3000 agents selling our products exclusively. As of December last year it was purchased by another large Canadian insurance organization and will have in the neighbourhood of 5000 agents. Communities will be a significant enabler during integration and moving forward.

During her 25 years with this company Mary Lynn has led teams, managed learning centers and end user departments. Her roots are in Information Technology. Five years ago she had an opportunity to work with Sr. Vice President of Strategic Capabilities, Hubert Saint-Onge. While working with Saint-Onge, Mary Lynn was responsible for the implementation of Clarica's Knowledge Strategy, leveraging web and groupware technologies. This included both Knowledge Access and Knowledge Exchange, focusing on the seamless integration of knowledge and e-learning.
Communities are the essence of the Knowledge Exchange work. The most important strategic community has been operational for 18 months now, and is called the Agent Network. Mary Lynn has a plethora of knowledge to share with us relating to the Agent Network; growth strategies beyond pilots, including keeping a community vibrant; the relationship between explicit and tacit knowledge and how communities fit into the bigger picture.

The Government Sector – *Change Management*
Panellist: Roy Greenhalgh
Consultant, UK

Roy is an independent consultant with over 30 years experience of designing and implementing IT systems in the private and public sector. As a Systems Thinker, he designs from the view-points of the end-user and encompassing end-to-end considerations. He has worked with some of the larger local authorities in the UK for over 15 years as the lead consultant in Public Sector division of IBM (UK). He has extensive experience of using Systems Thinking and process improvement tools in systems and process re-design.

Since becoming independent, he has worked with large local government authorities in developing and delivering major Change Management programmes designed to introduce middle and senior managers to current management techniques and skills. The programme also taught and enabled managers to understand how to design and manage improved processes within their own departments in line with the desire of UK government to deliver better value for money in public services.

His exposure to the problems of introducing IT systems and major change programmes has allowed him to study the informal CoPs that emerge in local government. A key part of any Change Management programme is to find the emerging CoPs and nurture them. They often form the key to turning an indifferent implementation into a successful one! All of the groups operate in local councils in the UK. Many are small, a group of 4 who facilitate the Help Desk for internal users of a council's IT system. Some are large crossing council boundaries. Typical is a CoP of administrative officers who administer Benefits. Not only do they share problems, expertise and skill amongst the physical group in each council office, but they also share expertise if the councils use, for example, the same proprietary software packages. The encouragement of such CoPs is a sensitive affair, requiring gentle tiller movements, and simply allowing members to get on with it.

The Higher Education Sector - *The Principals' Center*
Panellist: Thomas Ruhl
Lewis and Clark College Graduate School

Thomas Ruhl, Ph.D. is an Assistant Professor and department Chair of the Educational Administration Department of Lewis and Clark College Graduate School. He has served as a small school district superintendent, was an elementary school principal for 9 years and three years as a middle school administrator. He currently specializes in areas of school and district change, teacher supervision and program development.

The state of Oregon covers approximately 97000 square miles. Much of the area is sparsely populated with small communities made up of ranching, timber and agriculture families. Schools in these communities need to have leaders capable of leading small groups of teachers toward making continuous improvement in teaching and learning. The Principals' Center in at Lewis and Clark College is dedicated to helping principals in small communities become more effective leaders. One strategy being used to connect principals is through an online Community of Practice facilitated by an experienced principal serving as an adjunct faculty member of the Lewis Clark Graduate School of Education.

The Healthcare Sector - *Professional Education and Scientific Communication*
Céline Monette
Aventis Pharma

Céline Monette leads a scientific communication and a continuing health education group with a research section working on the integration and measurement of new information into practice of the healthcare professionals, and the transfer and management of knowledge. She also is working on the measurement of intellectual capital.

Céline Monette, director of Professional Education and Scientific Communication at *Aventis Pharma*, is also the co-chair of the Continuing Health Education Working Group of *Canada's Research-Based Pharmaceutical Companies*. She is actively involved in the development and implementation of Continuing Health Education as a discipline within the pharmaceutical industry.

Brief Papers

Designing a Dynamic Course Outline System to Integrate Courseware Features

Jason T. Abbitt
University of Idaho, College of Education, USA
jtabbitt@uidaho.edu

Michael R. L. Odell
University of Idaho, College of Education, USA
mirodell@uidaho.edu

Jason A. Graham
University of Idaho, College of Education, USA
jgraham@uidaho.edu

Abstract: The sequencing of online course activities in higher education is a necessity to guide students through the course materials, discussions, etc. in learning environments where students and instructors are separated by time or space. Too often, online course management systems serve as basic course document retrieval and communication tools. Students then are left to navigate a course website haphazardly to determine a path through the wide array resources. This strategy for designing an online course interface at best subverts any instructional design for a course. At worst, it promotes the design of online courses that lack thoughtful consideration of the importance of the sequencing of course activities.

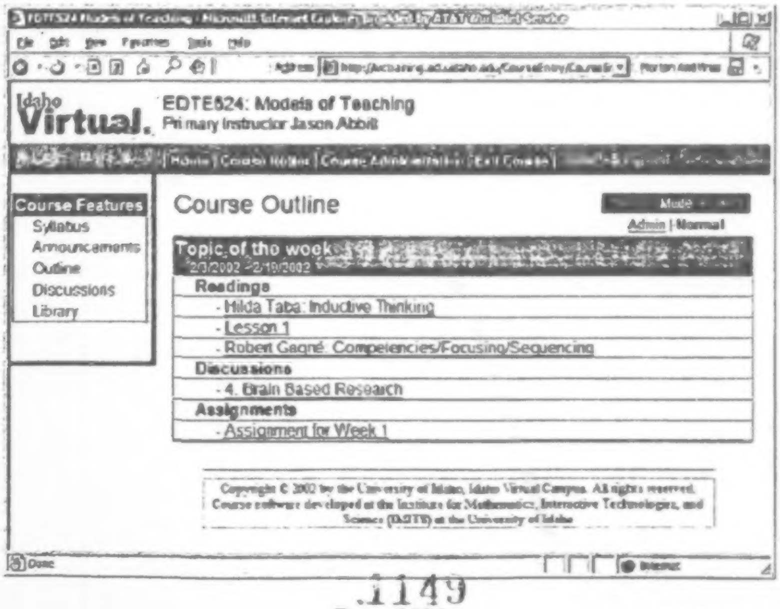
This paper describes efforts by the Idaho Virtual Campus to design a courseware research platform with a central organizing course feature that allows instructors to integrate all of the features of the course system and sequence activities into meaningful modules for online delivery.

Many authors suggest that online course systems should be designed based on educational theory (Huang, 2000; Ko and Rossen, 2001; Leflore, 2001; Smith and Dillon, 1999;). Leflore (2000) describes guidelines for Web-based instruction in three categories: Gestalt theory, cognitive theory, and constructivist theory. Of these three areas, the guidelines described for Gestalt and cognitive theory support the assertion that course activities need to be presented in an organized and meaningful manner. Leflore suggests that "when designing the layout of the computer screen, place related information together so that the learner will automatically group the information together as a unit rather than as separate elements." In designing a course interface, however, the problem arises of arranging items, such as courses readings, together with features of the course system, such as discussion boards. This problem becomes more difficult when using course management systems that are designed to separate course materials from interactive features like discussion boards and require students to move continually refer to a static syllabus or course schedule. This problem is addressed in IVC courses by designing a central organizing feature that allows instructors to group readings, discussions, online journals, assignments, and other items together in an outline form that groups and sequences these activities according to the instructor's design.

While a much of the relevant literature stresses the importance of planning and instructional design before building a web-based course. Instructors, however, are continually faced with either adjusting their instructional design to fit the course system available or creating a completely customized course website based on their design. Creating a customized course website allows the instructor complete control over the design of the course, but time, or a lack thereof, is often an obstacle for those designing web-based courses (Bonk, p. 14). In addition to time constraints, instructors are often faced with challenges of producing interactive and dynamic course websites that uses features such as discussion boards or online quizzes. Such features often require a high level of technical expertise beyond that of most instructors. Thus the problem becomes one of how to create a course system that can reduce the time needed to develop a web-based course and still allow the instructor flexibility to implement a quality instructional design.

The development of the course outline feature faculty was done primarily by designers who had taught, taken, and designed online courses for several years and also involved many other instructors at several institutions who would be using the course system. This development was guided primarily by the desired functionality and instructional principles and then was examined from a web design perspective. Three requirements emerged: (1) a central organizing feature must be able to incorporate all other course features available, (2) it must be allow instructors to organize information according to varying instructional designs, and (3) it must be simple enough to allow for easy organization and modification of material and activities as a course progresses and is revised.

The result of this collaboration was a dynamic course outline feature designed for the IVC which enables instructors to integrate all other features of the IVC course system (i.e. discussions, course library, online journals, etc.) into a single interface for the students. Instructors build the course outline dynamically via web based forms and are capably of organizing readings, discussions, required journal entries, assignments, quizzes, etc.



EDTE624: Models of Teaching
Primary Instructor Jason Abbitt

Course Outline

Topic of the week
2/3/2002 - 2/10/2002

Readings
- Hilda Taba: Inductive Thinking
- Lesson 1
- Robert Gagné: Competencies/Focusing/Sequencing

Discussions
- 4. Brain Based Research

Assignments
- Assignment for Week 1

Copyright © 2002 by the University of Idaho, Idaho Virtual Campus. All rights reserved. Course software developed at the Institute for Mathematics, Interactive Technologies, and Science (IMITS) at the University of Idaho

BEST COPY AVAILABLE

The course outline feature also allows instructors to set a date range for particular sections of the course outline. Those sections are then displayed when a student enters the course on the main course web page that displays current course information.

While there is no single solution to address all of the needs of distance education, it is clear that a course management system should enable and promote quality course design and also that this design should be firmly rooted in sound educational theory. The course outline feature of the IVC course system is an emerging solution that has been developed with these educational theories in mind and also the needs of the instructors who are designing and teaching web-based courses. The ability to organize and sequence course materials and activities into a single and clearly presented interface provides the means by which quality instructional design can be promoted and enabled while also providing stable and useful course tools to the instructor and student.

References

Bonk, C. J. (2001). *Online Teaching in an Online World.* CourseShare.com. Retrieved March 15, 2002, from the World Wide Web: http://www.courseshare.com/reports.php

Huang, H.-m. (2000). Instructional Technologies Facilitating Online Courses. *Educational Technology, July-August*, 41-46.

Ko, S., & Rossen, S. (2001). *Teaching Online: A Practical Guide*. Boston: Houghton Mifflin.

Leflore, D. (2000). Theory Supporting Design Guidelines for Web-based Instruction. In B. Abbey (Ed.), *Instructional and Cognitive Impact of Web-Based Education* (pp. 102-117). Hershey, PA: Idea Group Publishing.

Smith, P. L., & Dillon, C. L. (1999). Comparing Distance Learning and Classroom Learning: Coneptual Considerations. *The American Journal of Distance Education, 13*(2), 15-23.

Classroom Observations through Distance Learning Technology

Phyllis K. Adcock, Ph.D.
Department of Teacher Education
University of Nebraska at Omaha
United States
padcock@mail.unomaha.edu

Abstract: The purpose of this paper is to share how integration of distance education technology, in teacher preparation classes, provides an alternative observation method of school classrooms. A study was conducted in Human Growth and Learning classes at the University of Nebraska in Omaha, which practice both traditional on-site and alternative remote observations in schools. These observations are completed for the preschool, kindergarten, special education, elementary and secondary levels. It has been found that those levels which offer the most interaction between teacher and students in the preschool, kindergarten, and special education classrooms, work best with the alternative remote observation method. The traditional on-site visits by university students are conducted for the elementary and secondary levels, where there is less interaction. The findings indicate that both observational methods provide good experiences for university students.

Introduction

Many teacher preparation programs have teacher candidates in classroom on-site visits in every year of the college experience (Darling-Hammond, 1998). When one considers the time involved, the liability issues of on-site visits, and safety management of schools, as well as the intrusive nature of on-site observation visits, it is possible that those visits could be limited, therefore alternative methods may be needed. Technology can provide alternative observation methods through a two-way audio/video conferencing system, providing remote observations at school sites. This type of alternative observation method is being employed at the University of Nebraska at Omaha (UNO), by conducting part of the required observations through this form of distance learning.

Alternative Observation Technology System

At the University of Nebraska at Omaha, federal funding was secured for a two-way audio/video conferencing system. A two-way conferencing connection is possible through a computer's internet protocol (IP) number that allows remote viewing of any classroom with ethernet connections to the internet. A port in the firewall, which block incoming and outgoing electronic traffic, must be opened at each site to allow for the two-way connection. A T1 line of a high bandwidth is preferred to handle the high traffic these audio/video connections generate. Keep in mind it is the amount of internet traffic an institution has that can make a difference, especially in the video display.

This conferencing system allows for two-dimensional viewing of the classroom through a camera which is about 8 inches high and 4 inches wide and is virtually soundless. The microphones are placed strategically around the room to pick up the voices of the teacher and the children. At the university, the students have the ability to view the remote classroom on a large screen. The university students can make suggestions of what they would like the camera to focus on, because the camera is controlled from the classroom on campus. Therefore the alternative remote observation method can easily follow the learning activity, such as when the teacher is in a large group setting, or zooming in on small group activities.

If an interactive approach is desired, the video display allows for viewing of both classrooms simultaneously with the picture-within-a-picture option. The remote video observation can be taped, which gives the university classes flexibility for viewing during class, or at a later time for example, with evening classes. This taping feature is also helpful with children's classroom schedules which do not provide quality observation time, such as when a child is engaged in quiet reading time, or when children are away from the classroom for lunch and other activities. This conferencing system is similar to other forms of distance education technology that is being used at a few other universities (Olafson and Quinn, 2002).

The Study

In the Human Growth and Learning class (EDUC 2010) at UNO, university students have five observation experiences at the preschool, kindergarten, special education, elementary and secondary levels, which are guided by field competencies. Through these observation experiences, university students can gain an understanding of how children learn, in what type of setting (Darling-Hammond, 1998), and how children differ in physical, intellect and language, and psychosocial development (Flavell, 1993).

From the pilot experiences of integrating this technology into classroom observations, several valuable lessons have been learned. It was determined that the best classroom observations, using technology, occur when there is more interaction between the teacher and the children. Situations which involve younger children, or children with special needs require more interaction on the teacher's part. As a result of this discovery, the remote audio/video observations are scheduled at the preschool, kindergarten, and the special education levels. The traditional on-site visits are scheduled at the elementary and secondary levels where there is less interaction between teacher and students.

A qualitative study was completed, during the fall 2001 and the spring 2002 semesters, involving randomly selected university students who had the alternative remote and the traditional on-site observation experiences. These students were asked the to compare and contrast both observation experiences. In their comparison, the university students were to consider the physical setting of the classroom, the nature of the instruction between the teacher and the children, and the development of an individual child in the physical, cognitive, and psychosocial domains.

Summary

A comparison of the responses of university students who completed both classroom observation methods was conducted. By using the field observation competencies as a guide, the surveys were assessed for the difference in student responses to the two forms of observation methods.

What was found in these surveys was that even though the camera could pan the classroom and zoom in on learning activity, the entire classroom could not be viewed at one time. Students also stated that it was easy to follow the teacher-student interaction, but when it came to focusing on one child's developmental observation it was more difficult, unless the student was in camera range for an extended period of time. The surveys revealed that at times it was difficult to determine who was speaking when the camera shifted away from the speaker to other activities.

Finally, university students stated that the remote observation was convenient and they were impressed with the quality of audio/video output. The students describe the audio as being very clear, and the video was clear enough they felt they were having a 'real' experience.

Conclusions

Considering the observation experiences and the university student comments on the surveys, it has been concluded that both methods of observations provided the university students with good observation experiences for an introductory class. Also, the remote observation experiences work best with the younger and special needs child, due to the greater opportunity for interaction in the classroom with other students. Finally, students claim the remote observation were no more intrusive to the school classroom than the traditional on-site visits. Some of the students thought the remote observations visits were possibly less intrusive, because many of the children forgot about the camera in a few minutes, but continually gave attention to the visiting university students in their class during the on-site observation experiences.

With the continued success of this alternative observation method through the conferencing system, colleges and universities can provide quality observational experiences by integrating distance learning technology into teacher preparation program classes (Christopherson, 1997).

References

Christopherson, J. (1997). The growing need for visual literacy at the university. Proceedings of the International Visual Literacy Association 1996 Annual Meeting, Cheyenne, Wyoming (ERIC Document Reproduction No. ED 408-963).

Darling-Hammond, Linda (1998). Teachers and teaching: Testing policy hypotheses from a national commission report. *Educational Researcher*, Vol. 27, No. 1, pp 5-15.

Flavell, John H., Miller, Patricia H. and Miller, Scott A. (1993). *Cognitive development*. Englewood cliffs, NJ: Prentice Hall.

Olafson, Lori and Quinn, Linda F. (2002). Integrating technology to enhance performance assessment. Proceedings (pp1405-1409) of the SITE Conference, 2002, Nashville, Tennesee.

Acknowledgements

The research and this paper on alternative classroom observation through a two-way audio/video conferencing system was made possible by a grant awarded through the Preparing Teachers to Teach with Technology Program (PT3), of the U.S. Department of Education and the funding provided by the Nebraska Partnership for Quality Teacher Education grant. Many industrious administrators, faculty, and staff from the University of Nebraska at Omaha, such as Dr. John Langan, Mrs. Becky Schnabel,, Dr.Neal Topp, Mr. Bob Goeman, and Mr. Paul Clark, to name just a few, have provided the ground work and continued support for the success of the alternative observations for the Human Growth and Learning classes.

Automating Evaluation and Assessment in a Technology Course

Frank Akaiwa
Operations and Decision Technologies Department
Kelley School of Business
Indiana University
United States of America
fakaiwa@indiana.edu

Bill Littlefield
Operations and Decision Technologies Department
Kelley School of Business
Indiana University
United States of America
littlefi@indiana.edu

Abstract: This paper is a report on efforts to use technology to improve and maintain consistent student evaluation and assessment in two large technology courses at Indiana University. One difficulty in managing large courses is maintaining quality and consistency across all sections. Staff members of these courses have developed a web-based course infrastructure and an automated grading system to help with this problem. The web-based system runs on a UNIX server with pages generated in PHP, using a MySQL back-end database. In conjunction with other components of the course, these automated systems reduce the burden of student evaluation placed on instructors and improve consistency. The development of these systems and the results will be discussed.

Background

Students at the Kelley School of Business are required to take two introductory technology courses. These courses are informally thought of as a technology foundation. The first course, *K201 The Computer in Business*, requires all undergraduate students to demonstrate proficiency in working with spreadsheet and database application software, and demonstrate a basic understanding of the importance of information systems technology in business. This course or its equivalent must be taken to apply for admission into the Kelley School. Since this course is often the student's first contact with the Kelley School, a key aim is for the experience to be consistent for all students. From an admissions perspective a critical goal is to ensure that student grades are consistent and not inflated across sections for a semester or between semesters. The second course, *X201 Technology*, requires students to apply many of their K201 skills to more abstract, less structured examples. Thus the emphasis is much more on analytical skills rather than problem solving skills. Students work individually and in teams on a business case throughout the semester to increase their spreadsheet and database skills, learn spreadsheet-based simulation, and develop an understanding of how technology is adopted in business.

An increasing number of students have been enrolling in K201, placing significant pressure on resources and the quality of teaching. Six years ago K201 was comprised of thirty-two sections per year. This year we will offer and fill over one hundred sections. The demand for this course is substantial. Prospective business students, as well as students from other schools within the university, pushed enrollment above 1,700 students for the Fall 2001 semester. This level of enrollment requires 56 lab sections and seven lecture sections, using 36 instructors and more than 150 other support personnel. This steady increase in demand has required increasing attention to course administration; instructor training and evaluation; and the leveraging of information technology to continue to bring students a measurable, high-quality instructional product. We have been innovative in our strategies for administration and teaching.

A key example of innovation is the course web site and its attendant support system. The web site provides students with access to course information and resources; distributes assignment, lab and tutorial files used in the course; and is the tool used to coordinate access to help and support for students. The system is also designed to allow students to submit their assignments for grading through the site. This submission component is combined with an automated grading system to minimize discrepancies in the evaluation of student assignments.

Because both full-time faculty and part-time instructors are used to deliver course materials, the level of knowledge, experience, and commitment to the course by the instructors is quite diverse. While some instructors have years of experience teaching in technology courses, a large group of the instructors are MBA students assigned to teach in the course as part of their Graduate Assistantship. A comprehensive set of materials is provided to all instructors including teaching outlines and files. These files are composed of before-class exercises, in-class examples, and post-class assignments. These materials allow new instructors to present a technically demanding course in the same manner as more experienced instructors. Automated grading is the cornerstone of uniformity in the course. The goal is to reduce the subjectivity found in grading assignments and problem-based exams by using Visual Basic for Applications to grade file properties for Excel and Access assignments. The result is an online submission and automated grading system that is described below.

Description of System

The web-based system currently runs on a UNIX server with pages generated in PHP. The back-end database is MySQL. The dynamic web site captures the username of the person visiting the site and customizes the website to their individual section of the course. The website displays the current week's lecture and lab topics, assignments, links to web articles, and files used in that week's exercises.

Students submit graded projects throughout the semester. Projects are set up as problem solving exercises using varying levels of structure. Projects are available one week before they are due, and are downloaded from the website by the student. Projects for the first half of the semester have built in feedback to help students learn how to error check their assignment before submission. Later projects lack this pre-submission feedback mechanism. The student's username is captured to the graded project when the student opens the file for the first time. Students do not have access to the location where this information is stored, thus they cannot change the username that has been captured. This username is used later in the grading process. After completing the project, students submit it to the course web server, using the link supplied on the web site. Project submission deadlines are based on the time that class begins for each section on the day projects are due. For example: *the student has lab at 8:00 am on Monday and Wednesday, and the project is due that Wednesday by the beginning of class. At 8:01 am, the student will not be allowed to submit their project online.* The system captures the username of the person submitting the file and adds it to the filename. This keeps students from having someone in a different section submit their project for them. The student's username that was captured when they began work on their graded project or exam is compared to the username of the student submitting the project. If the usernames differ, an investigation for academic misconduct is triggered.

Lab exams or practical exams take a similar form as graded projects. Students are given two hours per exam to solve a set of problems in Excel and Access. Exams are given on weekends at mid-term and the weekend before finals in a five-round format. This places a significant demand on the campus' computing infrastructure. The exam is coordinated between the fifteen exam sites by use of a bulletin board on the instructors' website. This enables constant communication between all proctors and the exam coordinator. This communication is critical when uniformly solving problems that may be encountered during the exam. The lab exams are structured to test the student's understanding of the tool and its application to solving a problem. The automated grading system allows us to build multiple versions of the exam into the same Excel file based upon the version of the exam. The version of the exam the student takes is determined when the student opens the file and enters their name and section number.

Once the files have been submitted, the system places the files in a subdirectory on the server based on the student's section. After all projects have been submitted, the files are released to the section's instructor for grading. The grading process is fully automated. Using Visual Basic for Applications in both Excel and Access, the cells in the spreadsheet and the records in the database are evaluated for a number of different properties. The grading system is composed of an Access database and separate modules developed in Access and Excel designed to grade each of the projects and lab exams. The system is designed to provide individual student performance as well as performance by lab section. The system does not capture keystrokes; it focuses on the methods that were used to find the answer and the correctness of the answer. The average grading time for an instructor with 40 students in a section is less than ten minutes per project. Evaluation of student trends is available to both the lab instructor and the course coordinator. This allows an analysis of teaching outcomes both within a section and across sections.

Following the submission and grading of student projects and exams, the website is used to post student grades. Students have two weeks from the time grades are posted to protest any inaccuracy in their grade. Since the lecture and lab components are taught by different instructors, the centralized posting site allows grades for both components of the course to be joined to provide students with an accurate report of their grades.

Results

The system has allowed K201 to significantly increase the number of sections taught while maintaining quality and consistency. The website enables the efficient distribution of course material, the submission of student work from any location with access to the Internet, and the delivery of detailed student feedback. The automated grading system allows K201 to use more rigorous and realistic assignments than would be possible with manual grading. A side benefit is that instructors get to spend more time teaching and answering student questions. The data collected by the grading system is also used to monitor course quality. Grades can be compared by section and topic at both a summary and detailed level. This information can indicate problems with sections, instructors or teaching materials. The system allows the course coordinator to identify possible weaknesses with lab instructors and work with them to improve their teaching. In the case where a particular topic area has a low average across all sections, instructors evaluate the assignment to determine if it is flawed, or if the teaching materials require revision.

The systems described above are being extended into X201, the next course in the technology foundation. Many of the same benefits have resulted, but differences in the courses have led to difficulties with automated grading. X201 is a much less structured course by design. In an effort to provide a realistic and relevant learning experience, students are given much more freedom to design their submissions for course assignments. The subjective nature of grading in X201 requires more manual grading of student assignments. The grading system has been altered to provide more grading assistance than automation for many assignments.

Conclusion

Overall, the online system has been extremely successful for K201. It is continually being modified to improve the learning experience for both instructors and students. The online system is mostly meeting the needs of X201. The difficulty of scaling the system across two large courses along with differences in the degree of structure for these courses has led to a separation of system development efforts. Nevertheless, the same principles are being used to guide on-going development for both courses. Both courses require an infrastructure that enables the delivery of content that is rigorous, realistic and relevant to the student. This results in assignments that are fairly complex and difficult to grade. This infrastructure must maximize the time an instructor has to teach and respond to student questions.

EFFECT OF LANGUAGE ON E-LEARNING IN THE ARAB WORLD

by

Adekunle Akinyemi
Sultan Qaboos University
Center for Educational Technology
P.O. Box 39 Al Khoudh
Postal Code 123
Sultanate of Oman
Email: akinyemi@squ.edu.om

Abstract

Language is an important aspect of communication which is the only means of interactions in learning. Electronic-learning (E-learning), being a form of a virtual teacher, pseudo-teacher or complementary teacher is characterized with students' interactions. The study of language reveals its importance, whether as first, second or tenth and these are crucial in the conduct of e-learning especially in the Arab world. Language has significant roles in the way in which learning occurs and consequently, the success or failure of e-learning in higher education systems where English is not the first language. The Arab world is conscious of its importance and steps are being taken to face the challenge.

Introduction

The human mind is so difficult and complex to understand. Research in this field must be taken as an on-going process in order to unravel the mystery. While no psychologist has been able to pinpoint exactly when a learner, in a learning situation actually commences to attend to the learning stimuli presented, it remains the duty of a teacher to create a conducive atmosphere and environment and for the stimuli not only to turn the learner on, but also to maintain and sustain attention through out the learning session. Further, attention is drawn to two models, which are of vital importance in school learning. The information processing and communications models reveal the attributes of a learner (internal processes) and his/her environment (external factors) and those barriers and impeding forces that can inhibit learning.

In order to get to grips with the theme and focus of this paper, there is need to understand some related terms in this discourse. These include – Learning, e-learning, the e-learner, language, communication, and the significance of instructional design in e-learning as these all relate to experiences in the Arab world.

Learning and Education

Learning is the essence of education and the literature is replete with definitions, meanings and the complexities of this subject. The Oxford Advanced Learner's Dictionary defines learning as 'knowledge that you get from reading and studying' (Wehmeier, 2000). It suffices also to state that learning is a change in disposition which is not attributable to growth or maturity and which can be retained over time. In order for change to occur in the behavior of a learner, it will do so as a result of a stimulus or stimuli impinging on the learner. The impact of the stimuli must be meaningful, strong, and capable of making the desired change to occur within a short time. Stimuli come in various forms and configurations. These are usually communicated in any or a combination of the following ways - symbolic, verbal, spoken, written and nonverbal in the form of body language.

Learning is known to result from an interaction of symbolic experiences, which may be verbal or non-verbal cues. These are extensively used as means of communication in education. Learning also occurs through vicarious and direct experiences. It is essential to stress the importance of visual literacy in teaching and learning. Visual literacy is the ability of an individual to interpret accurately, visual messages and make applications of them in learning.

In the process of learning, the five major senses involved include seeing, hearing, feeling, smelling and tasting. Of these, seeing and hearing have been found through research (audiovisual) to dominate the learning scene. For example, there is an overwhelming evidence that about 83% of learning occurs through seeing, 11% through hearing, and only about 6% through the senses of feeling, smelling and tasting when added together. Further, evidences have been provided in the literature that retention from sight and sound stimuli is estimated to be 50%. Comprehension has been reported as 15% through hearing and 40% through seeing while the combination of both is estimated to be about 70%. All of these evidences underscore the fact that learning occurs through the multi-sensory approach. It is important to state that individuals who are handicapped partially or totally in any of these two most important senses (the blind and the deaf) can and do learn as their other senses have been known to compensate for the handicap(s) in one way or another. This is, however, beyond the scope of this paper.

The effect of the use of multiple senses affect e-learning since the learner must interact with resources. Direct experience, which involves the use of more than one of these senses, gives an individual the responsibility for learning outcome. The Internet which is central to e-learning has most of its resources in English language and this underscores the need for accelerated attempt to convert materials into Arabic or offer courses in English language, if only to benefit from the rich resources on the Internet.

E-learning refers to the use of the Internet technologies to deliver a broad array of solutions that enhance knowledge and performance. E-learning has been reported to be based on three fundamental criteria:

- E-learning is networked, which makes it capable of instant updating, storage, retrieval, distribution and sharing of instruction or information.
- It is delivered to the end user via a computer using standard Internet technology.
- It focuses on the broadest view of learning – learning solutions that go beyond the traditional paradigms of training.

(Rosenberg, 2001, p.28).

The e-learner can then be described, from the foregoing as the individual who interacts with the resource materials for e-learning with the purpose of acquiring knowledge and information. The nature of e-learning makes it possible to tagged 'an any time, anywhere' learning mode. Let us now consider the language factor in learning and in e-learning..

Language Factor in Learning

Language is a unique and powerful means of communication. It may be verbal or nonverbal and it occurs in both living and non-living things. Inanimate objects do communicate as well. They react and respond to stimuli around them. The sunflower for example, responds to sunrise by turning to the direction of sun rise. The stem of the yam root tuber and similar plants like this will twist around their stakes in response to the order of the farmer. In other words, inanimate objects can also be said to respond to human communication!

It is language that makes us human and enables us to work together in all activities of life. It is a rich, varied and very flexible instrument, which plays a major part in our daily activities as well as in teaching and learning, regardless of the region of the world we are in. Though distances separate individuals, language and communication can bridge the gaps in feelings, thought, intentions and plans as ideas can easily be articulated. The importance of language is underscored in the statement that 'the mastery of the word is the mastery of the world'. Word power is indeed magical and language (verbal and nonverbal) remains the most important factor in communication. This is the essence of the focus of this paper on the effect of language on e-learning. Kelliny (2002) reports the dominance of English as the Internet language of choice. Language can make or mar an e-learning system if due attention is not given to its form and structure in the design of Web materials. This is not only with regards to the Arab world but also other educational systems where English is not the first language.

Kelliny (2002) states that the first challenge in the use of the Internet is the working knowledge of English Language for the non-English speaking world as English is the universal language of communication, information technology (IT), business, technology, industry, advertising, entertainment and leisure. In the Arab world, the Arabic language is used in most of the communication activities. In the context of Kelliny, the Arabs might be some how disadvantaged in that those who are not literate in English, cannot benefit from the wealth of available information which are predominantly in English.

Communication in Learning

Communication is the activity or process of expressing ideas and feelings or of giving people information. Effective communication is the key to reaching the highest level of learning. This is particularly important in e-learning where the teacher may be 'virtual' not real. Even in ordinary conversations, when communication breaks down, we feel helpless, frustrated, angry and mystified. The importance of language in e-learning cannot be overstated in view of the high degree if interactions with the resources.

Communication is a two-way process between the source (teacher/e-teacher) and the destination (learner/e-learner). The process is not complete without the inclusion of the message/e-message, channel of information flow (virtual), feedback/e-feedback and possible sources of noise/e-noise, which may render communication ineffective. Between the source and the destination are the critical activities of coding, encoding and decoding. The teacher must be able to code and encode information, the coded information must be relayed to the learner and the learner has to be able to decode information so transmitted. As a complement of the available communications model, there is the information-processing model (Gagne et al, 1992) which explains what is involved, when the information is received from the learning environment by the learner, to the time when the response generated by the learner is given back to the environment in writing, action or both. The importance of language and communication in any learning setup are issues which educators are interested in so as to maximize learning.

In the Web-based parlance, there are two main types of communication modes. The asynchronous and synchronous communications characterize much of e-learning approaches and there are combinations of these as well. Asynchronous delivery refers to programs that are independent of time as in the case of prerecorded audio, video and CD materials being used in e-learning. In this case anyone can access the program at any time and as many times as desired. There is no live component and it may not involve strict scheduling. Communication between people does not take place in real time. Synchronous approach refers to programs which are time dependent, where communication takes place in real time as in 'chats' and 'video conferencing'. Delivery is live and once a learner misses it, that would have been the end except the program is repeated or recorded for later viewing. Whichever approach is adopted, the language component remains an important determinant of its ability to effect learning only when the learner is literate in English language.

Instructional Design and E-learning

Text presentation and density are very important in e-learning. The Arab higher education institution have long recognized the role of instructional design (Educational Technology) in teaching and learning and virtually all Colleges of Education in universities and teacher colleges have programs or courses in this new discipline. Our concern in this paper will not extend to issues of text characteristics, text formatting, and text density on the monitor as well as the screen density of texts. However, research in the area of text density has suggested that low density text is a viable technique for presentation of lengthy text materials (Berry, 2000) and also that text should be presented on Web pages in short chunks and should be edited to simplify content (Nielson, 1997).

The factor of instructional design in e-learning is an important and complex activity as even the language expert will need to be guided in making a success out of the web design venture. Many models exist in the systematic design of instructional materials, which can also be applied in e-learning (Heinick et al, 1999, ASSURE model; Gagne et al, 1992; Dick and Carey, 1990, Systems Approach model). No particular model is a panacea, however, it is necessary to design a suitable and convenient model (hybrid) for the Regional e-learning practice where the Internet materials and resources are to be converted from English language to Arabic or other languages. The evaluation and revision phases of any model, if properly executed, will eliminate language anomalies in the e-learning system.

Berry (2000) indicates that the World Wide Web (WWW) is essentially a visual medium and that designers should rely primarily on visual displays to communicate their message while at the same time de-emphasizing lengthy text passages (Berry, 2000, p.48). If the concern for text density and page overload are not detected and adjusted at the design stage, the whole e-learning design exercise will be ineffective. Berge et al (2000), further prescribes some vital elements in the design of Web-based courses.

Language effect on e-learning is far from being restricted to programming languages. The emphasis here is on communication and learning through the tools of interaction either with the e-teacher (Web materials) or with the others in the learning community through synchronous/asynchronous communications. Language, whether as first, second or tenth is the tool of interaction on the Web and as earlier indicated, it may be as symbols, verbal or non-verbal. Language defects and problems are easily identified and rectified at the formative stages of the design phase rather than at the implementation stages

Conclusion

Learning, language and communication constitute an intricate web in education. They are inseparable ingredients in e-learning. Courseware designers and instructional developers must integrate them as they apply the system approach principles in designing materials for effective education. The language used in e-learning courses must be of high standards to promote virtual learning. Communication techniques and the technological set up must be user-friendly as not to leave the learners frustrated and mystified through the use of inappropriate feedback and reinforcement principles.

The language used in the text must be according to the level for which it is prescribed and of appropriate vocabulary level. The use of technical terminologies must be carefully explained and the text density must be such that will not overload the e-learner. Sentence complexity must match the level of the learners for which material was designed. Concern for language is perhaps most fundamental in a successful e-learning system as well as all training and other educational endeavors. Finally, e-learning has been coined by Al Balooshi (2001) as the 'now big thing' and not the 'next big thing' in the Arab world as well as in other parts of the world (developed and developing). This is further endorsed by the words of Canning-Wilson for the language teachers in the Arab world. Teachers of other school subjects must also take a cue from this warning:

> "Soon the on-line language teacher will replace the EFL/ESL classroom teacher.....Those trapped in the world of the chalkboard and textbooks may be left behind as education advances into the 21st Century" (Canning-Wilson, 2000).

References

Berry, L. H. (2000). Cognitive Effect of Web Page Design. In Abbey, B. (ed.) Instructional and Cognitive Impacts of Web-Based Education. London, UK: Idea Group Publishing.

Canning-Wilson, C. (2001). E-learning with the Eteacher: Considerations for On-line Course Design. Available: http://www.eltnewsletter.com/back/December2000/art422000.htm

Gagne, R. M.; Briggs, L. J. & Wager, W. W. (1992). Principles of Instructional Design. NY: Harcourt Bruce Jovanovich College Publishers.

Dick, W. and Carey, L. (1990). The systematic design of instruction. Glenview, IL: Scott, Foresman.

Heinich, R., Molenda, M., Russell, J. D. and Smaldino, S. E (1999). Instructional media and technologies for learning. Upper Saddle River, NJ: Prentice-Hall, Inc.

Kelliny, W. W. H. and Kelliny, I. M. (2002) Is the Internet a tool for Linguistic and Cultural Dominance, Immersion or Integration? In Kelliny, W.W.H. (ed.) Surveys in Linguistic and Language Teaching III : E-Learning and EResearch. European University Studies. Series XXI Linguistics Berlin: Peter Lang (In Press).

Nielson, J. (1997). Alertbox: Jakob NielsonUs column on Web usability. Internet. Available: http://www.usit.com/alertbox/.

Rosenberg, M. J (2001) eLearning: Strategies for Delivering Knowledge in the Digital Age. New York: McGraw-Hill.

Wehmeier, S. (ed.) (2000) Oxford Advanced Learner's Dictionary. Oxford: Oxford University Press.

E-LEARNING: A REALITY IN SULTAN QABOOS UNIVERSITY

By

Adekunle Akinyemi
Sultan Qaboos University
Center for Educational Technology
P.O. Box 39 Al Khoudh
Postal Code 123
Sultanate of Oman
Email: **akinyemi@squ.edu.om**

Abstract

The adoption of Web-CT marks the beginning of a new era of instructional delivery mode at the Sultan Qaboos University (SQU). Increase in faculty interest in the use of e-learning marks a significant evidence of technology infusion into higher education. Faculty members from colleges have registered substantial participation in various training programs of the Center for Educational Technology (CET) with a view to utilizing this technology in teaching. The challenges of the new technologies are being surmounted. Solutions which encourage faculty utilization of technology are being proffered and these will also promote a lasting integration of technology into teaching and learning in the Sultanate of Oman.

Background

Traditional education can no longer cope with the modern teaching and learning requirements. Cunning-Wilson (2001) warns that soon the on-line language teacher will replace the EFL/ESL classroom teacher and that those still trapped in the world of the chalkboard and textbooks may be left behind as education advances into the 21st Century.

The rate of technology and information explosion calls for the use of appropriate technology to cope with the contemporary education practice. In order to improve teaching and learning and improve the services of the CET, cutting edge technology equipment were acquired. E-learning had long been talked about but never seriously pursued in SQU. The CET took a bold step of studying many of the available e-learning programs (Blackboard, Learning Space, Web-CT and others) for their infrastructural needs, ease of operation, effectiveness and efficiency and then recommended the Web-CT to the University. The University acquired this program, being the most widely used in higher education, after satisfying the criteria for selection.

Web-CT Adoption

The Web-CT vendors were invited to make presentations and run a workshop to familiarize the potential users (Faculty members) with the rubrics of the new program.

The CET set up the machinery for running the program for the first time in the Fall semester with nine early adopters from four colleges and in nine courses. The implementation and perspectives of the early adopters have been reported in Akinyemi et al. (2001). In order to properly install he new program and explore the full benefits of e-learning, a special meeting was convened with the early adopters to obtain information on their perspectives and implementation related issues. Deliberations at the meeting brought out many substantial information which contributed to the improvement in running Web-CT with the second batch of adopters in the Spring Semester.

Expanding the Scope of E-Learning

In order to intimate faculty with the availability, value and use of the new e-learning package, awareness presentations were made on a college by college basis. A Web-CT help-desk was formerly established and necessary assistance is given to faculty on student registration. Two workshop sessions were run for interested faculty members on the Web-CT rubrics. Workshop contents were basically the program features and the management of students and courses. The University is working on improving the infrastructures and increasing the numbers of computer units and laboratories for Web-CT utilization. The logistics for increasing the opening hours of computer laboratories and the institutionalization of dedicated times for Web-CT are being considered to make e-learning a worthwhile experience in SQU.

CET has collaborated with the College of Medicine in putting one of its learning segments – Case-based Respiratory System on the Web-CT. The new design is currently being run on an experimental basis. It is hoped that other segments will be put on the Web as soon as the present study proves successful. Other colleges are considering going online with some of their courses as well.

Challenges and Issues

Innovations are usually never effected without some teething problems. Change is not easy to effect in any system, especially with human beings (faculty) and this is perhaps why it is often said that "you cannot teach an old dog a new trick". People will ordinarily resist change especially if it is, at a cost. Putting a course on the Web-CT requires a substantial amount of time and effort on the part of faculty. This was the essence of the faculty awareness presentations and workshop series being embarked upon by CET. The faculty attendance and participation at the presentations and workshops provide a comfortable feeling of interest and willingness to embrace the new technology.

In the course of running the Web-CT we have faced some challenges such as student difficulties in accessing the server, inadequacy of computer units, faculty computer inadequacy, need to increase bandwidth/infra-structural capacity, and the need for online helpdesk. These are just a few of the challenges facing this new technology. Measures are being taken to provide solutions to these challenges and issues on a short and long term basis. A new Web-CT Vista version, which is supposed to be more versatile and easier to run, will perhaps encourage more lecturers to go online. The University is considering purchasing the new Vista version in due course.

Conclusions

Technology infusion into higher education in Sultan Qaboos University is becoming a reality. The spill-over effect of e-learning will positively affect the entire Sultanate of Oman as technological literacy permeates the learning processes across the colleges.

Teacher education programs will produce teachers who are technologically competent as opposed to the traditional education system which produced teachers who are prone to technophobia. The positive attitude of faculty across programs towards e-learning as demonstrated through their willing attendance of presentations and workshops is a reliable proof of interest in technology adoption. The increasing trends of faculty adopters of the Web-CT are adequate justifications for the reality of e-learning in higher education in the Sultanate of Oman.

Reference

Akinyemi, A., Osman, M. T. and Al Kindi, M. (2002) Implementation and Perspectives of Web-CT Sultan Qaboos University. Unpublished Research Report, Center for Educational Technology, Sultanate of Oman.

Canning-Wilson, C. (2001). E-learning with the E-teacher: Considerations for On-line Course Design. Available:
http://www.eltnewsletter.com/back/December2000/art422000.htm

Technology and Pedagogy
Changing Roles of Pedagogy in a Project-based Constructivist Environment

Ahmed Ali and Dr. Teresa Franklin
Ohio University

Introduction

Educational institutions are reassessing the instructional approaches that have been commonly used in the past, when traditional, teacher-directed instruction was widespread. There have been calls for the need to develop students who are critical thinkers, independent and innovative. Unlike before, when teachers had been deemed the keepers of knowledge and "sages on the stages" (Rield, 1995), advocates of change have focused on utilizing designs that engage students and make them part of the teaching and learning process. In line with this approach, the following have lately been increasingly practiced: discovery learning, problem-based learning, project-based learning, individualized learning, collaborative and interactive learning, and one-on-one mentoring. The common denominator of all the aforementioned strategies is that they are student-centered. In embracing this approach, technology inevitably becomes a viable tool to use.

The site of the study, the Global Learning Center (GLC), was a project-based, student-centered learning program started 2 years ago at a Midwestern University. The program prepared students for leadership opportunities in a rapidly changing world. Open to all majors, the GLC brought together the resources of three of the university's top-performing colleges-Business, Communication, and Arts and Sciences-in an interdisciplinary, 30quarter-hour undergraduate certificate program on global issues, with a strong emphasis on real-world projects and problem- solving skills. This was a learning and living program in which students lived as a community in one residential building. Courses were not traditional classes with lectures, tests, and papers. Instead, students worked in project teams on real-world problems and issues.

Technology's use in the program was underscored by the emphasis on use of the Internet for administrative and instructional activities; every student was given a laptop computer with several different software applications loaded to facilitate student coordination in working on projects, and there was a well-equipped computer lab for the students. Students used electronic database for discussions about their group activities and for dialogue with teachers. Teachers used the database to guide students during their work on projects, and also used it as a forum for other instructional activities with either students or colleagues. The lab had PCs and Apple Macintosh computers, printers, scanners and other accessories. The students had access to the lab 24-hours a day. Rooms used as classrooms had television and VCR, LCD projectors, and laptop computers that students used for presentations and discussions, and teachers used in their teaching. With the widespread use and promotion of technology in the program, we examined the role of technology in project-based learning by seeking answers to the following questions:

1. Does the use of technology impact project-based group work by students?
2. Does technology support the mentoring of students in a project-based learning environment?
3. Do the technology-rich methods for content delivery support the implementation of a project-based learning environment?
4. How do students and faculty perceive the role of technology in supporting the pedagogy of a project-based learning environment?

Changing Teaching and Learning Environments

Newby, Stepich, Lehman, & Russell (2000) contended that changing instructional environments in schools has necessitated a change in the instructional styles. Newby et al. argued, unlike in traditional settings, today's graduates are required to possess skills in problem solving, stating, "Learners must now be viewed as proactive participants in learning, actively seeking ways to analyze, question, interpret and understand their ever-changing environment" (p. 6). Newby et al. asserted that students in today's classrooms are diverse, coming from different backgrounds, with different learning styles and interests, and thus there is need to accommodate individual concerns. They noted that information technology had a great impact on learning, leading strongly towards learner-centered instruction.

Project-based learning is based upon students working on real-world problems with the aim of finding solutions to the problem. Every individual has the potential to find the solution. Kozma & Shank (1998) argued the nature of this approach creates complexities for students and teachers and suggested that technology is an important tool that can be used to facilitate this complexity.

Working on projects is an important strategy for obtaining skills through practice. But working on real-world projects in today's classroom setting is not easy. There is the danger of students focusing on completing the project rather than the learning goals of the project and learning process (Guzdial, 1998). According to Guzdial, while technology may not successfully lead to successful project-based learning practices, it can reduce costs, improve learning, and make project-based learning more practical.

Project-based learning is helpful to the intellectual, social, and emotional development of students. Teachers contribute more actively to the intellectual and social development of their students in a project-based learning setting. Experience in the challenging tasks of a real-world problem improves student's readiness and ability to deal with complex issues within and outside school as they grow. However, not all students and teachers benefit from this approach. Its use should take into consideration the needs of students, teacher preference and skills in the use of this approach, and what is being taught (Katz & Chard, 2000).

Peer Learning

Workingin groups creates a sense of community, where students feel responsible for some of activities that encompass the group. They work together, work out individual differences and disagreements, and participate in decision-making.

In review of research, Sandholtz, Ringstaff & Dwyer (1997) reported that peer learning increases student learning, increases student self-esteem, and is a motivator for students. A study by Sandholtz et al. (1997) on the Apple Classroom of Tomorrow Project, ACOT, project discovered that peer learning made learning personal as students assisted each other on a one-on-one basis, which improved students learning, self-efficacy, and academic achievement.

BEST COPY AVAILABLE

According to Maier & Warren (2000), working in online groups gives students and teachers flexibility in learning and teaching compared to traditional, classroom instruction with fixed schedules and content. They added that the online environment creates more discussions and encourages teachers and students to share their experiences and knowledge. They asserted students have more control over their learning, leading towards a more student-centered learning.

Technology

In an evaluation of the ACOT, Sandholtz et al. (1997) discovered that technology played a major role in changing the instructional style from teacher-centered to student-centered. According to Sandholtz, et al. (1997), "Technology is a catalyst for change in classroom processes because it provides a distinct departure, a change in context that suggests alternative ways of operating. It can drive a shift from traditional instructional approach toward a more eclectic set of learning activities that include knowledge-building situations for students." (p. 48)

Technology has changed the way students learn in schools. Students are no longer expected to learn specific sets of knowledge or skills. Unlike before, when content and subject matter was made and decided for students, today's students have various tools, notably technology, that they can use under the guidance of the teachers (Maier, et, al., 1998).

Technology empowers students. It provides students with opportunities to work on problems in order to provide solutions. It enables students to share their skills and abilities with their colleagues, teachers, and other community members. Technology can make students work on projects that would be difficult to work on without it (Moursund, 1999).

Technology can be detrimental to learning if it is introduced without careful instructional design. The benefits of technology may not be realized if appropriate design and teacher's skills do not precede introduction of technology. "It is the pedagogy, not the technology, that is the key.... It's a mistake to put technology center-stage as we plan and execute educational reforms. Technology should hover shyly in the wings, ready to lend its power out only as needed" (Brackett, 1998, p. 30).

Field work

One-on-one interviews with 20 participants were conducted to gather information concerning the impact of technology in project-based learning (PBL). The PBL involved students working in groups to design and implement projects. The majority of our interviewees (15) were students who used technology for their learning in a variety of ways. While current students provided information about their continuing experiences in using technology, exit interviews were conducted with former students of the program who had either completed or dropped out of the program. To seek another perspective of student's use of technology, four teachers and the director of the program were interviewed.

Participant observation was conducted during classrooms instruction and online activities. We participated in classroom discussions, especially since the nature of teaching and learning in the program was more group-discussion oriented than traditional, teacher-led instruction. The program had an online component, where teachers and students interacted. Teachers used the online database to provide feedback to student work, answered student questions, and led class discussions about activities and events related to student projects. Students used the online database to interact with their teachers and coordinate their group projects. As participants, we participated in the discussions and observed students in their online activities and compared such activities to the face-to-face classroom setting.

Findings

The study found that technology was seen as an important that facilitated the student-centered learning approach used in the program. Students found technology as aiding collaborative and cooperative learning, participation, and providing easy accessibility to resources. They however mentioned that technology is an add-on to their learning, and for students with little experience or interest in technology, it can be challenging and discouraging in the learning process. Information from teachers and administrators revealed that technology supplemented their work. Teachers found in technology a tool that diversified their teaching styles, increased interaction with students and between students especially outside the classroom, and considered technology to be an important teaching aid. They emphasized that technology will be more effective if it is used together with face-to-face learning. They were also concerned about focusing on the significance of technology.

Technology has strong influence

Both students and teachers unanimously were of the opinion that technology played a strong role in influencing student projects. This included the creation and completion of projects. Students cited the Internet as providing access to vast and varied information when researching their projects. Students worked on real world projects, and indicated technology facilitated their work. For example, a group of students coordinated their work with a local community group in rural Ecuador using e-mail. For such students, they could not envision working on the project if they did not have access to e-mail facilities. Another group of students prepared documents about information dissemination to cotton farmers in rural Uzbekistan. According to the students, when reviewing literature and collecting information about the country, the library had a few, old books that were of little use. But the Internet was very helpful in studying the country, and the students felt that it was very invaluable in completing their project. In class presentations, students used Microsoft PowerPoint to present their work in a "clear, professional and well designed" format.

Provides flexibility

For many students, the flexibility that technology provided in working in groups was important. Students stated that they coordinated their group projects through the database, and this reduced the need and frequency for face-to-face meetings. According to the students, as working on the projects required group work, they indicated that without technology (online coordination), it would have been difficult to complete their projects on time. In addition, the use of the online database allowed long-distance learning for students who could not come to class. During the period of this study, a student who was involved in Sweden took a course and worked on projects with students on campus.

Learning outside the Classroom

As pointed out by the director, and supported by the teachers and students, use of technology allowed learning outside the "restricting walls" of the classroom. Students asked their teachers questions, and teachers provided answers to students questions more frequently than in the traditional classroom. Online postings during evenings and weekend revealed the need for interaction

BEST COPY AVAILABLE

between students and teachers outside class. Equating the online database with classroom activity and the e-mail interaction with individual student visits to teacher's offices, a student said technology allowed for teacher-students interaction "anytime, anywhere."

Students empowered

The use of technology changed the learning environment dynamics. Students became active participants in their learning. It increased students' interests in learning and provided students with diverse learning resources. A teacher noted that the relationship between teachers changed from a "vertical to horizontal" relationship. As students worked on real world problems where learning and knowledge is not confined to the syllabus, they developed problem solving and analytical skills, and technology played an important role in these. Students also felt that their virtual meetings reduced the "hassle" of booking rooms for meetings. With online meetings, they did not need any permission to meet. Many students said that the laptops gave them a "sense of power" where they could study anytime, anywhere.

Promotes independent learning

The nature of the program required students taking ownership of learning. Teachers and students said that the project-based learning involved students having more responsibility and engaging actively in the decision making process about their learning. Technology was an important component in the students overall control of their learning. Students felt confident and comfortable as the Internet provided them with "most of the information" they needed, thus limiting need for teachers help. Use of email made students increase interactions between themselves. A student would email another student on a weekend or evening if they need help with their work. These would not have been possible if they did not have access to emails. According to one student, searching the Internet is an "adventure", where learning by doing is common. Technology increased students' realization that they have potential to contribute to their learning.

Alternative Medium

Technology supplemented classroom teaching. Teachers found the limited classroom sessions were not adequate for covering work related to the real world projects students implemented. They indicated the online forum provided them with more time to guide their students in their projects. Students said the online forum was an alternative way of interacting with their teachers. But teachers and students emphasized that technology, whether online or in the classroom, supplemented teacher instruction, and would not replace such instruction.

Increased communication

Technology facilitated communication between teachers and students, and between students. Teachers communicated with students more. One of the teachers noted that he was able to meet his students online more often compared to students in his other classes where web or email use is not strong. Students felt that unlike the traditional teacher-student relations where students have to set up appointments with teachers, technology created an informal environment where students could send and receive messages from teachers any time whether it is weekend or late night. The administrator said that students emailed him without having to go through the bureaucracy of making appointment through the secretary. Some students said that when they wanted to have synchronous communication between themselves, they used instant messaging and chat services.

Improved learning

The vast resources that technology provided students with increased their level of learning. Students said that the Internet gave them access to information and materials from different sources through various media. Teachers said that the different instructional strategies such as the database, use of PowerPoint for presentation, the web and coordination using email, were helpful in teaching and most importantly in learning. Teachers said the different ways in which they interacted with students allayed the fears that one teaching environment or style may make their students find their lessons uninteresting. Students appreciated the different learning styles and settings as change is good for learning.

Team Study

Students had varied feelings about project-based learning. For those positive about teamwork, they cited the sharing of skills and resources. Teachers agreed with students who were positive about working in groups, arguing the quality of work produced by students had mainly been due to the different expertise students shared to implement projects. Narrating one example, Jessica said if in a "group there are students from visual communication working with students from history and computer science, such a combination can produce tremendous results." Even the less enthusiastic project-based learning students were in agreement with the rest of the participants in pointing out the benefits of division of work team study encouraged. But they had reservations about the difficulty in making groups members work on projects. To them, it was difficult to organize meetings, indicating personal conflict could damage project success, and there was a concern of "joy riders" taking advantage of other student's hard work.

In rebutting some students' concerns, teachers found technology to be a tool for dealing with some of the students concerns. According to the teachers, technology provided a means to monitor group activities, which in a face-to-face environment would have been difficult. Teachers said that as students posted their work to the database, they were able to know which students contributed to the group work. In addition, they argued conflict of scheduling was easily resolved if students coordinated their activities on the online forum.

Concerns about technology

Limited technology experience

Several students were of the opinion that the application of technology for instruction, whether online or in a classroom environment, should take into consideration student skills and preferences for the medium of instruction. Some students indicated that they did not have any experience in online learning when they first joined the program, and without any orientation or technology skills, were required to participate in online learning. They cited frustration during the first few weeks into the program and reported of students who dropped out of the program because of limited computer skills, and difficulty in adapting quickly to the use of the online database. There is the expectation that students in college "should be familiar" with programs like the web, email and online databases. Teachers did not provide any technology orientation to students, and students were left on their own to learn technology. Students did not have an alternative to the online database. Though the instructional style was geared to be student-

BEST COPY AVAILABLE

centered, making major decisions such as online learning did not go down well with some students, especially when it was a required medium for learning. Students voiced the concern that a general assumption was being made about the 'goodness" of technology. For students with limited technology experience, they found technology overwhelming and confusing.

Lack of privacy

Several students cited lack of privacy in using the online database. They said that teacher-student confidentiality was breached when they used the database to submit their individual assignments, and teachers provided evaluation of their work online, which was accessible to other class members. Teachers monitored student postings on the database, which some showing concern that teachers may prejudge them as they could be influenced by individual activities on the online forum. An interview with one student revealed reluctance by students to post their work online for fear of peer "intrusion" into their work and a preference for giving a hard copy of their work to the teacher in class.

Technology overemphasized

Students complained that teachers abdicated their responsibility of teaching students by encouraging students to use the Internet. Teachers encouraged students to use the online database when interacting with them. Students said that teachers were hiding behind the "veil of technology" and provided limited support in student research for projects. While students appreciated teacher's support when using the online medium, they indicated that too much emphasis on technology undermined the real concern for content. There was a strong use of the Internet for research. Students felt that they were more inclined to use online sources for guiding their project than teachers.

Limited learning

Online learning did not provide in-depth, synchronous interaction that student got from the classroom, face-to-face learning. Students said that the online learning was "casual" and "superficial". Teachers did not respond to student's queries on time. Teachers' responses to students were "short", "inadequate", "unclear" and "late". Because of the asynchronous nature of the database, follow-up interaction between students and teachers was limited. Immediate feedback was rare, if not non-existent. Many of the interviewees said that with the use of technology, learning appeared a far away activity to them. Students felt learning became detached from the personal and human dimension. Several students said that it was easier to interact with teachers in the classroom.

Affects collaboration

Students stated that while technology facilitated group coordination, it nevertheless undermined collaborative work by students. Some students argued that by posting their reports to the group database, it appeared they were doing their individual work with limited contacts with colleagues. Several students said they were not used to virtual meetings, and would have preferred face-to-face meeting of team members. The reduced human contact, because of the use of the database, lessened some student's belief that they were working with their peers on the same project. One student reported uneasiness in expressing his ideas using the database and pointed out he would have been more productive if he addressed his colleagues face-to-face.

Conclusion

The use of technology in this setting had a major impact on the project-based work of the students. While most viewed the use of technology as positive in supporting the mentoring of students "anytime, anywhere," others saw technology in a less positive light and as hindering their learning. The faculty at the GLC community was very positive about the impact of the use of technology in providing alternative ways of communicating information to students and encouraging " after hours" learning in a project-based learning environment.

References

Brackett, G. (1998). Technologies don't change schools – caring, capable people do. In J. R. Galin, & J. Latchaw (Eds.), The dialogic classrooms: Teachers integrating computer technology, pedagogy and research. Urbana, IL: National Council of Teachers of English.

Guzdial, M. (1998). Tehnological support for project based learning. In C. Dede (1998), Learning with technology. Alexandria, VA: Asociation for Supervision and Curriculum Development.

Katz, L. G. & Chard, S.C. (2000). Engaging children's minds: The project approach, 2ed. Standford, CT: Alex Publishing Corporation.

Kozma, R. & Shank, P. (1998). Connecting with the 21st century: Technology in support of educational reform. In C. Dede (Ed.), Learning with technology. Alexandria, VA: Association for Supervision and Curriculum Development.

Maier, P. & Warren, A. (2000). Integrating technology in learning and teaching, London: Kogan Page.

Maier, P., Barne, L., Warren, A., & Brunner, D. (1998). Using technology in teaching and learning London: Kogan Page Ltd.

Moursund, D (1999). Project based learning using information technology. Eugene, OR: International Society for Technology in Education.

Newby, T. J., Stepich, D. A., Lehman, J. D. & Russell, J. D. (2000). Instructional technology for teaching and learning: Designing instruction, integrating computers, and using media. Upper Saddle River, NJ: Prentice-Hall, Inc.

Rield, J. (1995). The integrated technology classroom: Building self-reliant learners. Boston: Allyn and Bacon.

Sandholtz, J. H., Ringstaff, C., Dwyer, D.C. (1997). Teaching with technology: Creating student-centered classrooms. New York: Teachers College Press.

BEST COPY AVAILABLE

(Re-)Designing an Educational Setting
Trails of Competency in an Open Learning Repository

Heidrun Allert, Christoph Richter
Learning Lab Lower Saxony, University of Hanover, Germany
{allert, richter}@learninglab.de

Abstract: This paper focusses on consulting services, which address the process of (re-) designing an educational setting. The educational setting is supported by technology. Consulting makes explicit requirements and needs, and also has to take into account implicit objectives and assumptions on learning. In order to face these needs we implemented trails of competency and expertise, which are designed along the concept of Communities of Practice, into the metadata-based Open Learning Repository. This repository allows the integration of diverse instructional models. Consulting at this stage focussed on transforming experts' tacit knowledge to explicit knowledge.

Motivation

Higher Education in the field of computer science is dominated by the instructional principle of expository teaching as well as cognitivism. At the same time departments of computer science and electrical engineering often manage projects which develop and implement technology which supports learning, such as systems of Computer Managed Instruction. Web-based learning repositories therefore often focus on the presentation of learning material (web based content presenting domain specific knowledge) and provide access to information units, often called learning objects. Concepts concentrate on how to structure and organize ^learning objects. Some standards for learning objects (LOM, 2001 e.g.) reflect this view on learning.

Forming the team of instructional design and theory-based evaluation at the Learning Lab Lower Saxony (http://www.learninglab.de), which acts as a common research facility for several universities, we offer consulting services in the field of 'innovative learning technologies'. In our work we realised that teachers in Higher Education often have implicit learning and teaching objectives and goals as well as assumptions on learning and the learners which they never make explicit and which they do not explicitly address in their courses. These objectives, goals and expectations often aim at competences rather than domain specific knowledge. Therefore we planned to integrate the idea of competency-based learning into the Open Learning Repository. Its metadata-based architecture is open to the integration of diverse instructional models by forming separate models: the domain model (modelling domain-specific semantic networks) and the instructional model (modelling instructional information such as structuring learning and cooperation processes) (Allert et al., 2002). The guiding question for integrating a new instructional idea was: *how to create a surplus or added value which facilitates a change in teaching and learning culture*. We did not want to simply map and reproduce conventional teaching scenarios to a web-based system. Also, we did not start to design and implement the system based on this learning principle, but started a process of (re-)designing an educational setting. Aiming at the process instead of the product in the beginning is responsible for the restructuring of the entire (social) context. We designed the context and asked the question of how to support this context by technology. We concentrated on making explicit learning and teaching objectives, which are implicit, and offered continuous consulting. Within this process a further instructional principle turned out to precisely meet the needs: the concept of Communities of Practice (CoP). Therefore the core element within the learning repository are trails of expertise, now. Experts are full members of scientific communities. Consulting at this stage concentrated on making tacit knowledge explicit.

Teacher's Requirements and Needs

The development of computer supported learning environments often aims at decontextualized solutions. Re-designing and restructuring an educational setting does require an approach which is contrary. Consequently starting from a concrete setting in order to elicit requirements guides the design of technology which then actually meets the needs. This approach essentially involves the teacher in the design process. We will sketch the steps of design in the following. The dates we added are just to draw a more vivid picture.

Step 1 (April 2002): Teachers and teaching staff often have implicit learning goals and assumptions on learning and the learners but do not address these in teaching. At this stage we focussed on making these implicit goals explicit and conceptualized them.

- We asked the teaching staff, what they demand of a successful student.
- We visited some sessions of the course in order to identify learning objectives which might implicitely have guided the design of the course. Within the course Artificial Intelligence, which we visited, we identified the training of a skill, which is relevant in scientific work. This skill was practiced in an isolated way and was not integrated into a whole and coherent process of scientific work. Another important element of the course was the integration of experts who were invited to give a talk.
- We wrote some scenarios in order to evaluate and communicate what we had observed. The teaching staff wrote scenarios of what they intended. Comparing our scenarios of observed objectives to the teachers scenarios of intended objectives, all of us realized that the lecture did not address the learning objectives that were intended implicitely and which the teaching staff themselves rated as valuable.

Step 2 (Mai 2002): The further design process was guided by scenario-based design. (Bødker & Christiansen, 1997 and Carroll, 2000)

- We started to write scenarios in order to describe an entire educational setting. We re-designed the existing setting and suggested to form a coherent structure: to allow students to understand the whole process of scientific work. We recommended to focus on competences instead of distributing content.
- The later scenarios focussed on how to support and facilitate the intended setting by technology.
- Scenarios were discussed within the design team as well as the teaching staff. (Allert & Richter, 2002)

Trails of Competency in an Open Learning Repository

Step 3 (Mai and June 2002): At this stage we actually designed the Open Learning Repository. Its core idea is providing trails of competency. Its instructional principle is the concept of CoP. Computer scientists within the design team drafted use-cases and prepared UML diagrams (Unified Modelling Language). We built a functional Mock-up as a prototype able to simulate the intended functionality. In order to actually make the system work we perfectly designed the interface, built HTML pages and integrated a basic workspace (BSCW) in order to enable cooperation (http://www.kbs.uni-hannover.de/~allert/olr/studie4/site/). Not implementing the complete metadata-based architecture (which is supposed to generate pages and links dynamically) enabled us to use and evaluate the system as soon as possible.

We identified two major competences which meet the teachers requirements and which we think are core for students of computer science and electrical engineering but also for many others: (a) The competence to manage and coordinate project-oriented teamwork. (b) The competence to plan and conduct scientific work.

Both of these competences are relevant in students' further academic as well as professional career. Many educational models organize learning in phases. Therefore we wondered which phases are relevant in scientific work as well as in project management. From a point of view of psychology both of these processes can be characterised as intentional and goal oriented activities. We decided to structure these activities according to activity theory (Miller et al., 1960 e.g.) and organized the activity into phases and different levels of granularity mentioned in activity theory (Volpert, 1999). The phases are meant to give orientation, structure student activities, and guide navigation.

Reflecting our concept we realised that we could not state universally valid concepts of scientific work. At this point we opted for the principle of CoP which in return provided us with further ideas for design and guided decisions: Not only research methods are diverse (heuristic, empiric as well as hermeneutic among others). Scientific communities are different from faculties. There are communities focussing on multidisciplinary topics such as technology&education. There are communities such *as Semantic Web, Digital Libraries, Peer to Peer, Robotics, Presence, Adaptive Hypermedia, Media Education (a very local community within Germany), Molecular Bioinformatics, Paleo Antropology* e.g.. Any of these communities share different routines, rules, and procedures such as: where and how and how often to publish results and share ideas (conferences, scientific magazines, or books; within months or years), the question on where and how to meet and communicate (at local workshops or at international conferences). Lave & Wenger (2001) view learning as situated activity. Its central characteristic is a process that they call *legitimate peripheral participation*. Learning means to allow students to move from peripheral participation to full membership. Scientists in our approach are full members or participants of the core group within a specific scientific community. Therefore expertise-trails are the central element within the learning repository: Members of specific communities (often members of several related communities) explain their strategies of how to state the state-of-the-art and identify relevant research question, how to conduct research and publish. They do not point to textbooks, but use examples of their own research work, point to relevant sessions at conferences, mailinglists, papers etc. They may explain the use of domain specific ontologies (such as Swebok, http://www.swebok.org) or the Text Encoding Initiative, as well as the use of metadata etc.. We provide several expertise-trails. Students may compare different strategies, procedures and routines within very different or slightly different communities. Students and student groups are enabled to identify their topic of interest and choose their favoured expert to ask him for supporting and consulting them and their work. Students then form instances of expertise-trails in order to share their work and learning progress. They collect documents, write reports and present their ideas and strategies towards an own project. Experts (full members of communities) communicate with students using the integrated workspace. These competency-based trails are called ScieCom: *Introduction to Scientific Communities* (http://www.kbs.uni-hannover.de/~allert/olr/studie4/site/trails/sciecom/sciecom.htm). For the project-based trails we asked experts who actually manage projects. One of these experts gained experience in virtual project management.

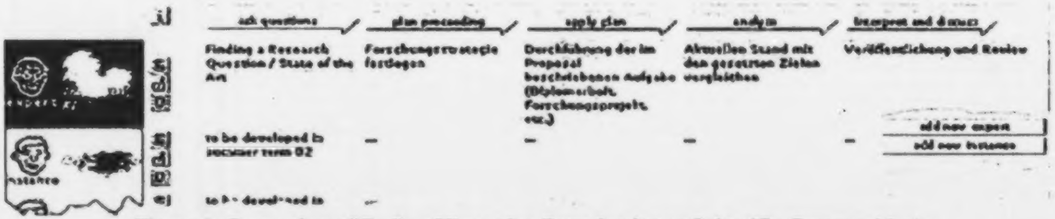

ask questions
plan proceeding
apply plan
analyze
interpret and discuss
Finding a Research Question / State of the Art
Forschungsstrategie festlegen
Durchführung der im Proposal beschriebenen Aufgabe (Diplomarbeit, Forschungsprojekt, etc.)
Aktuellen Stand mit den gesetzten Zielen vergleichen
Veröffentlichung und Review
to be developed in summer term 02
add new expert
add new instance

Figure 1: Screenshot of Trails of Expertise (Introduction to Scientific Communities)

Transforming Tacit Knowledge to Explicit Knowledge: Expertise Trails

Soon we realized that we face a typical problem of knowledge management (Sallis & Jones, 2002): we could not just ask an expert of how he usually does his work. In order to make the tacit knowledge explicit (and provide it in the expertise-trails) we developed the following strategy:

Step 3.1 (June 2002): We proposed the phases of activity theory and stated typical activities within each phase. We formed questions aiming at these activities in order to guide the interviews with experts.

Step 3.2 (June 2002): We explained the use of activity theory for structuring the activity of scientific work as well as the idea of CoP according to Lave & Wenger (Lave & Wenger, 2001) to the first expert. We interviewed him and taped the interview. He pointed out many concrete examples within his work.

Step 3.3 (June 2002): In transcribing the interview we realized that he did not carefully structure his answers along the proposed phases. We structured the interview along the phases and discussed the result with him.

Step 3.4 (June 2002 – open end): A continuing process is now under way. We intensely communicate with the expert about strategies as well as procedures within the target communities. For example: (a) Criteria for comments: the expert is asked to comment on students work and learning process. We asked him not to comment in an arbitrary manner, but to share criteria and make them explicit in the expertise trail: what does he think is a good research question? What are his criteria for commenting on students work in each phase? We also asked students to add criteria for comments they rate as relevant. While actually commenting students work this expert realised his own focus: an important aspect of a good research question does initiate communication between him and the student on the identified state-of-the-art and the student's research proposal. (b) Recently we received a call for student-volunteers at one of the relevant conferences by e-mail. We asked the expert to think about including a hint to this information. He agreed. As the HTML files providing his expertise trail are stored locally at the experts webspace and are simply linked by URL into the Open Learning Repository, the expert is able to change the contents of the trail any time.

This expertise-trail serves as model to further experts. The finished system will provide a library, consisting of, collections of expertise trails, finished students work, tasks, etc. Creating a new course means sampling relevant trails and entities.

Step 4 (July 2002): Students started to use the Open Learning Repository a few weeks ago. They are asked to state the state-of-the-art and identify relevant research questions. They share their work, provide documents and

BEST COPY AVAILABLE

describe their strategies. As scientific work does iterate in several stages, in which research questions are improved and detailed, the teacher does not focus on the perfect research question but on communication.
For evaluation within the process we asked them whether they rate the focussed competences as relevant for their futher academic as well as professional career.

Preliminary Results and Further Work

Organizing a process instead of purely focussing on the implementation of a software product, which might remain isolated, facilitated change in learning and teaching culture. Including the teacher in this process ensured that the re-design of the educational setting does meet his needs. He is motivated to go on with the process and constantly comes up with new ideas which he does integrate in the concept. He did not only change the course according to the new instructional principle, but the entire context: communication between teacher and students, communication between groups of students, procedures within exams e.g. Now, students may be motivated not only to work towards the end of the course but towards their thesis. There is a surplus associated with the Learning Repository: In addition to the acquirement of knowledge, learning processes as well as cooperation and communication is transparent to all participants. We succeeded in overcoming previous problems: tools were simply added to already existing settings, the educational context remained unchanged. Any teacher holds his own view and assumptions on learning. This reduces the scale of changes which are postulated by organizations or programs. The process of change must start from making explicit assumptions and views of all stakeholders within learning and teaching scenarios.
Implementing a prototype that only simulates the intended functionality allowed us to rapidly use and evaluate the learning environment. The Learning Lab Lower Saxony already designed an Open Learning Repository which is based on metadata. This OLR is open to diverse learning and teaching models. Now it definitely seems to be useful also to implement the new instructional model of competency-based learning and CoP.
As we work in the field of metadata and contribute to an initiative of standardisation in the field of Learning (DIN, the German Institute for Standardization) we concentrate on how to extend current standards. One idea is to extend Standards in order to be able to annotate learning environments which are designed along the idea of competency-based learning. We will form a set of metadata to annotate situated learning as well as competency-based learning in order to allow sharing and re-using conceptual structures. Explicitely modelling instructional principles and learning paradigms allows to share and re-use conceptual structures. This is different from initiatives which aim at forming standards which are instructional unspecific (LOM, 2001) or which form a pedagogical meta-model (EML, Koper, 2001).
Next steps: (a) Implementation of the instructional model within the metadata-based architecture of OLR. (b) Further evaluation during the course of Autum/Winter 2002. (c) Integration of further expertise-trails. Experts of related Communities as well as very different Communities. (d) Establish, sample and revise the OLR library, which will contain trails of expertise, a glossary, tasks, and students work.

References

Allert, H., Dhraief, H., Kunze, T., Nejdl, W., Richter, C., 2002. *Instructional Models and Scenarios for an Open Learning Repository - Instructional Design and Metadata*. E-Learn, World Conference on E-Learning in Corporate, Government, Healthcare, & Higher Education. Montreal, Canada, October 15-19, 2002, accepted.

Allert, H., Richter, C., (2002). *Szenarios zur Entwicklung des OLR3*. Technical Report. http://projekte.learninglab.uni-hannover.de/bscw/bscw.cgi/d11434.

Bødker, S., Christiansen, E. (1997). *Scenarios as springboards in design*. In: Bowker, G., Gasser, L., Star, S.L. & Turner, W. (eds.), *Social science research, technical systems and cooperative work*. Erlbaum, pp. 217-234.

BSCW 1995 - 2001. *Basic Support for Cooperative Work*. FIT and OrbiTeam Software GmbH. http://bscw.gmd.de/.

Carroll, J.M. (2000). *Making use: scenario-based design of human -computer interactions*. Cambridge: MIT press.

Lave, J., Wenger, E. (2001). *Situated Learning. Legitimate Peripheral Participation*. Cambridge.

LOM (2001). *Draft Standard for Learning Object Metadata*. IEEE P1484.12/D6.1. 18. April 2001.

Koper, R. (2001). *ModelingUnits of Studies from a Pedagogical Perspective. The Pedagogical Meta-Model behind EML*. http://eml.ou.nl/introduction/articles.htm.

Miller, G.A.,Galanter, E., Pribram, K. H. (1960). *Plans and the structure of behavior*. New York: Holt.

Sallis, E.,Jones, G. (2002). *Knowledge Management in Education. Enhancing Learning & Education*. London.

Volpert, W. (1999). *Wie wir handeln - was wir können: Ein Disput als Einführung in die Handlungspsychologie*. 2. überarb. u. akt. Aufl. - Sottrum: artefact Verlag.

Learning Objects on the Semantic Web
Explicitly Modelling Instructional Theories and Paradigms

Heidrun Allert, Christoph Richter, Wolfgang Nejdl
Learning Lab Lower Saxony, University of Hanover, Germany
{allert, richter, nejdl}@learninglab.de

Abstract: This paper presents a scenario which draws a vision of Learning Services on the Semantic Web. In this context we ask the question of 'What are Learning Objects?' and draft appropriate answers. We describe a datastructure which allows explicitly modelling diversity in the field of learning by including role-based attributes for Learning Objects.

Motivation

Various scenarios illustrate new possibilities enabled by the evolution of the Semantic Web, which is based on the assumption that each object on the web can be described appropriately and in a machine readable form. "*A new form of Web content that is meaningful to computers will unleash a revolution of new possibilities*" (Berners-Lee et al., 2001). But we currently recognize a lack of ideas and visions for the description of learning and teaching services within the Semantic Web. Up to now standards for metadata in the field of learning focus on search, exchange and re-use of learning material, often called content items, learning objects or training components (Cisco Systems Inc., 2000). Accordingly, training concepts focus on "*just in time access to training and information.*" (ibid.). Scenarios, which concentrate on how to structure and organize access to learning objects, are mirrored in concepts such as content packaging (SCORM, 2001).

Search, exchange and re-use of learning objects is a challenging intention, but only one aspect within a more comprehensive vision, based on how these learning objects are actually used in a learning context. We present a scenario which is guided by the idea of a mature learner and elaborate a theoretical model as well as a datastructure including role-based attributes for explicitly modelling specific learning theories and paradigms.

Scenario: *Learning Services within the Semantic Web*

Guiding principle of the scenario *Learning Services within the Semantic Web* is a learner, who does not only identifiy what he needs to learn right now (knowledge, skills, and competences) but also anticipates how he learns successfully (what conceptual/educational model meets his needs). Rautenstrauch (2001) explains: *Life-long learning will be a learners own decision (...) the learner is mature (...) he will identify and define his own needs and prefered ways of learning (...) he will learn to learn selforganized, self-determined, and independent from predetermined curricula and institutional forms of organization.* A scenario, which presents main visions of the Semantic Web and its services, written by Berners-Lee et al. (2001) inspired us to write the scenario of *Learning Services within the Semantic Web*:

–Steve is an employee at an insurance company. His boss asked him to assume the leadership of a group of seven people in the analysis department. He may spend a fixed amount of time and money on advanced training to prepare for this new assignment. Now, Steve is asked to draft a proposal on his further education. Steve reflects on this chance: obviously his boss trusts in his responsibility and planning skills regarding his further education. He is allowed to anticipate his own needs in both form and content. He realizes that he does not only have to reflect his requirements and needs regarding the content but also the way of learning, and the learning and teaching culture which is the most motivating to himself. The company does not run an own training department. Therefore he adjusts his agent to look for external courses offered. He anticipates the content he needs to learn: contract law, financial and personnel controlling [...] but also competences in planning, organization and communication. To define some more attributes he instructs his Semantic Web agent to trust the agent (and its set of attributes) of his colleague, who has often attended courses so far. But he still lacks attributes on the way of learning, learning and teaching culture.

After a short web search his agent informs him of an interesting consulting project on the internet, which offers learning services: The project provides some basic scenarios describing learning situations and context which are written like stories and are easy to understand. Each scenario reflects a specific model, theory or paradigm of learning and teaching. He decides for one that best meets his assumptions, opinions, and beliefs on learning he has drawn from previous learning experiences both successful and unfruitful. He is impressed: there is a scenario which reflects a learning model that confronts learners with complex real world cases and claims that must be handled within a group of learners. Great, collaboration and communication are key issues! He decides to choose two scenarios, called: "Communities of Practice" and "Situated Learning – Case-Based". The scenarios come with specific sets of metadata: the CoP-Profile and the SituatedLearning-Profile. Steve agrees to trust these profiles and adjusts his agent accordingly. His agent now searches for: specific content, a learning group to co-construct knowledge with, a tutor who acts as a coach, for suitable activities, and appropriate media-formats.

The agent comes up with a few suggestions: organizations which can offer what he looks for as well as a skill-management-like database offering tutors, coaches, experts and learning material. Steve sends his agent to the human resource department of his company, to synchronize its results with the companys list of accepted organizations. [...] A few month later Steve reflects on his latest learning experience, which was fruitful, and revises the adjustment of his agent: During the last weeks he has learned much about his own preferred way of learning and learningstyle.–

What is a Learning Object?

Based on this scenario we identify an exemplary list of general Learning Objects:

- Tutors offering services, support and facilities according to specific concepts and models (depending on different learning theories, learning paradigms, instructional principles)
- Experts with their specific area of expertise and competence
- Learning groups to carry out collaborative teamwork enabling collaborative knowledge construction.
- Peers to perform peer-tutoring
- Learning situations: Points of Cooperations - POCs (Wessner & Pfister, in preparation) e.g.
- Learning activities
- Learning material
- Media enabling certain activities (Videoconference, workspace)
- Conceptual structures (these structures reflect specific instructional models/paradigms/principles)
- Instructional ideas (the community of teachers of primary education do not only effectually exchange learning and teaching material but also ideas of how to use them – how to teach and support learning)
- Feedback

The important aspect about these learning objects is their character of not being unspecific with regard to learning theories, learning paradigms (such as cognitivism, constructivism) and instructional principles (such as PBL, case-based, CoP etc). A videoconferencing session is not yet a learning activity. It does neither constitute, characterise nor induce a learning activity. The appropriate learning activity is a session of collaborative learning using videoconferences within project-based learning e.g. . The activity might be even more specific: the mode of dyadic collaboration and the kind of structural support that influences collaborative knowledge construction (Fischer et al., 2000) characterises the activity. Another example: There is not a single concept of tutorial support, but diverse concepts, diverse roles and tasks of a tutor, depending on the design of the learning situation. The design of the learning situation is guided by different learning theories/paradigms, instructional principles. Any theory, paradigm and principle reflects specific assumptions on learning. The term "tutor" therefore does not yet imply a specific task or a specific mode of support. Within a setting of collaborative problem solving the tutorial concept of support might be totally different from a training session guided by the instructional principle of drill and practice.

Explicitly Modelling Diverse Learning Theories, Paradigms and Principles

The basic principle of the Semantic Web is to bring structure to meaningful content as well as the ability to process semantics by automated means (Berners-Lee, 2001). Meaning of information is decoded within context. But the learning sciences per se cannot provide an unequivocal context, only specific theories can serve as centre of references and as context for expressing and decoding meaning. This becomes clear for example with attributes like the LOM Category *Interactivity Level* (LOM, 2001), which is hard to understand and use appropriately, because interactivity within cognitivistic approaches is different from interactivity within constructivistic approaches. Standardization in the field of learning faces the diversity visualized in figure 1. Different approaches have been proposed to now. Initiatives like LOM (2001) aim at forming standards which are instructional unspecific while the Educational Modelling Language (Koper, 2001) forms a pedagogical meta-model. From the point of view of several approaches within the philosophy of science it is not possible to aim at being unspecific. Sets of metadata usually reflect specific learning paradigms and instructional principles (expository teaching e.g.).

In the field of learning we face valuable diversity. Standardization has to address and take into account different scenarios based on diverse requirements and assumptions on learning. The the context for standardization in Learning is well characterised by Lyotards comprehension of science which is explained by Beck as follows: There is need to emphasise in a postmodern manner the conflicting diversity of models, the competition of paradigms, and the impossibility of integrative and finally valid solutions. The failture of integrating theories is specified a characteristics of postmodernism (Beck, 1993). Standards that aim at instructional neutrality must fail from the point of view of the science of philosophy. They risk addressing a narrowed perspective on learning. Also the formation of a pedagogical meta-model (Koper, 2001) is not what we intend and view as a solution. We want to open the view on learning in standardization and propose an approach of *Instructional Roles* in Learning Metadata Standards, which supports the idea of explicitly modelling and annotating different paradigms, models and principles in learning. The concept of *Roles* we use is taken from the field of semantics and formal languages (Steimann, 2000). Steimann recommends to introduce the concept of *Roles* into object-oriented modelling in order to make possible dynamic modelling. In a previous paper we proposed the concept of *Instructional Roles* to specify educational attributes for different learning theories (Allert et al., 2002).

In this paper we present a simple datastructure which reflects the modelling of diverse theories, principles and paradigms. It also allows the mapping of different approaches and therefore the exchange and re-use across the boarder of diverse theories/paradigms/principles – a basic requirement for standardization. We do not propose sets of metadata for any available theory. But we suggest this datastructure in order to prestructure the field and allow communities of practice to suggest specific sets of metadata. As our group has expertise in the field of situated learning we currently work out a set which we plan to propose and bring into discussion soon.

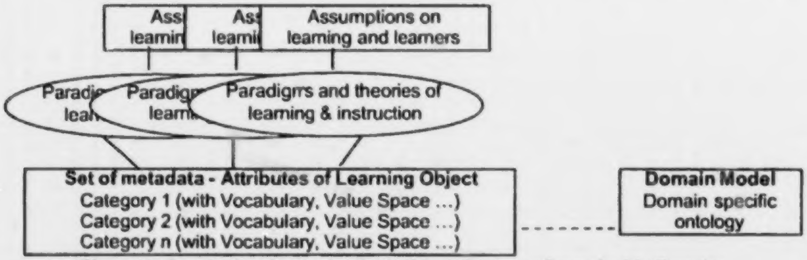

Ass
learnin
As
learni
Assumptions on
learning and learners
Paradi
lea
Paradig
learn
Paradigms and theories of
learning & instruction
Set of metadata - Attributes of Learning Object
Category 1 (with Vocabulary, Value Space …)
Category 2 (with Vocabulary, Value Space …)
Category n (with Vocabulary, Value Space …)
Domain Model
Domain specific
ontology

Figure 1: Standardization in the field of learning is confronted with diversity.

A Simple Datastructure to Describe Learning Objects

Building on previous work in IEEE LOM and IMS, we have those categories which are unspecific and mainly meant to facilitate mapping, search and re-use of Learning Objects independent of their instructional context: General (cp. Dublin Core), Technical, Annotation, etc.. Additionally, we then have those categories which give information on educational/ instructional attributes of Learning Objects, modelled along specific theories/paradigms/principles and are called *Instructional Roles (IR)*. *IRs* allow explicitely modelling diversity, enable dynamic modelling, and serves as centres of reference. In order to allow mapping, search, exchange and re-use at this level as well, we present a common set-of categories. Each *IR* guides the set up of specific vocabulary within a category. As an example we contrast two *IRs*: *Expository* and *Situated* (Table 1). They have vocabulary in common, e.g.the *Tutor* is mentioned in both models. Only the specific *IR* defines the specific meaning of the term and serves as system of reference.

The categories and vocabulary presented here are very vague and not at all a final draft, they serve only to explain the structure of data. We currently contribute to the work at the German Institute for Standardization (DIN) which specifies these categories. The structure of data is on the one hand inspired by the Berliner Modell and the Hamburger Modell (Peterssen, 1994). These theories expose different fields of decisions within educational settings. Pawlowski brought the Berliner Modell into standardization activities (Pawlowski, 2001). On the other hand we introduced layers of abstraction which are exposed by Klafki (1993), and Merrill (2001) and formed the *Instructional Roles* (Allert et al., 2002).

	Category	Vocabulary
General	Author	
	Subject	
Instructional Role:	Actor	Teacher (Trainer) Tutor Learner
Expository	Intention/ Motivation	Learning Objective
	Topic/Skill/ Competency	
	Process	According to Ausubel
	Method	Inductiv Deductic Spiral Elaborating Differentiating
	…	
Technical	Media	Videoconference Knowledge Base
…		

	Category	Vocabulary
General	Author	
	Subject	
Instructional Role:	Actor	Peer Tutor Learning Community
Situated	Intention/ Motivation	Input Case Problem Statement
	Topic/Skill/ Competency	
	Process	
	Method	Multi-perspective view on knowledge. Peer-Tutoring
	…	
Technical	Media	Videoconference Workspace Shared Whiteboard
…		

Table 1: Contrasting exemplary *Instructional Roles* with their categories and vocabulary

Further Work

We currently work on the consulting services in the field of learning mentioned in the scenario: different scenarios (such as best practice scenarios) reflect specific instructional and learning theories, paradigms and principles. They come along with specific sets of metadata. The scenarios help to identify ones own needs in learning and teaching even if one lacks specific terms of the learning science. The scenarios also serve as specification and characterization of categories and vocabulary for those who use and for those who annotate Learning Objects.

References

Allert, H., Dhraief, H., Nejdl, W. (2002). Meta-Level Category ‚Role' in Metadata Standards for Learning: Instructional Roles and Instructional Qualities of Learning Objects. *The 2nd International Conference on Computational Semiotics for Games and New Media*. Augsburg, Germany, accepted.

Berners-Lee, T.; Hendler, J.; Lassila, O. (2001). The Semantic Web. A new form of Web content that is meaningful to computers will unleash a revolution of new possibilities. *Scientific American: Feature Article: The Semantic Web*: May 2001. http://web.archive.org/web/20010815075449/www.sciam.com/2001/0501issue/0501berners-lee.html.

Beck, C (1993). *Ästhetisierung des Denkens. Zur Postmoderne-Rezeption der Pädagogik*. Bad Heilbrunn.

Cisco Systems, Inc. (2000). *Reusable Learning Object Strategy*. Version 3.1, April 22, 2000.

Fischer, F.; Bruhn, J.; Gräsel, C.; Mandl, M. (2000). Cooperative Learning Using Video Conferences: Collaborative Knowledge Construction and Individual Learning Outcomes. In: *Kognitionswissenschaft* Band 9, Heft 1.

Klafki, W. (1993). *Neue Studien zur Bildungstheorie und Didaktik*. Weinheim.

Koper, R (2001). *Modeling Units of Study from a Pedagogical Perspective – The Pedagogical Meta-Model behind EML*. Open University of the Netherlands. First Draft, Version 2. http://eml.ou.nl/introduction/articles.htm.

LOM (2001). Learning Object Metadata Working Group. *Draft Standard for Learning Object Metadata*. IEEE P1484.12/D6.1, 18. April 2001.

Merrill, D. (2001) *First Principles of Instruction. Educational* Technology Research & Development.

Pawlowski, J.M. (2001). *Das Essener-Lern-Modell (ELM): Ein Vorgehensmodell zur Entwicklung computerunterstützter Lernumgebungen*. Dissertation.

Peterssen, W.H. (1994). *Lehrbuch Allgemeine Didaktik. München*, Ehrenwirth.

Rautenstrauch, C. (2001). *Tele- Tutoren. Qualifizierung einer neu entstehenden Profession*. Bertelsmann.

SCORM (2001). http://www.adlnet.org.

Steimann, F. (2000). *Modellierung mit Rollen*. Habilitationsschrift, University of Hanover, Germany.

Wessner, M., Pfister H.-R. (in preparation). Points of Cooperation: Integrating Cooperative Learning into Web-Based Courses. In H.U. Hoppe, M. Ikeda, & H. Ogata (Eds.): *New Technologies for Collaborative Learning*. Kluwer.

Situated Citizen Photojournalism and a Look at Dilemmatic Thinking

Mike Ananny, Carol Strohecker
Media Lab Europe
Sugar House Lane, Bellevue, Dublin-8, Ireland
+353.1.474.2800
{ananny, stro}@media.mit.edu

Abstract: We present an approach to investigating the development of "dilemmatic thinking" in individuals and communities. To study this style of thinking we use a framework called Situated Citizen Journalism (SCJ) in which non-specialists ("citizens") work with professional photojournalists and learning technologists to create and critique images. The participants form a "community of journalistic practice." This paper describes the SCJ approach; the rationale for situating the investigation of dilemmatic thinking within the photojournalism practice; and a project currently in progress to investigate young people's dilemmatic thinking through photojournalism. We conclude with a number of research questions guiding the development of collaborative software to support SCJ.

Introduction

We are interested in dilemmas and how people think about them (Billig, 1988; Gilligan, 1982). That is, how do people create, share and revise opinions about everyday situations characterised by ambiguous and perhaps competing perspectives? We distinguish this kind of thinking from psychological investigations in which dilemmas or scenarios are presented as stimuli to evaluate problem-solving and decision-making strategies (Kahneman and Tversky, 2000). Our interest is in how these dilemmas arise, how individuals and communities think about and represent dilemmas and how contextual factors and learning environment designs affect the development of dilemmatic thinking.

Instead of creating controlled environments to simulate dilemmas and scenarios, we work with people to create tools and environments in which they can work with us to study their own dilemmatic thinking. We do this through the design and use of "objects to think with" (Papert, 1980). We work with people to create tools for capturing images and constructing opinions that they can then use in informal, everyday settings. Our objective is to study *in situ* dilemmatic thinking by letting people create, share, debate and revise opinions in ways that are personally and contextually meaningful.

As a guide for investigating this style of thinking and for designing these new technologies, we use an approach called Situated Citizen Journalism (SCJ). In this paper we present this approach and our early progress on a project to investigate children's dilemmatic thinking as they create photojournalistic images.

Situated Citizen Journalism

Situated Citizen Journalism (SCJ) is a kind of participatory journalism in which citizens, learning technologists and journalism practitioners collaborate to create technologies and stories. Our goal is to support non-specialists as they develop the tools and skills needed to uncover and share perspectives that we don't usually see in traditional, mainstream media. At the same time, we hope to learn how journalistic frameworks and digital technologies can combine to create new ways of constructing unique points of view. We do this in three ways: *collaborative tool design*, *skills sharing* and *broad dissemination*.

During *collaborative tool design*, citizens, learning technologists and journalism practitioners work together to create design specifications and early prototype of the technologies needed to support citizen journalism. During *skills sharing*, citizens conduct fieldwork (with the support of journalism practitioners and technologists) in which they use both traditional and custom tools to capture images they will use to create stories. During *broad* *dissemination*, citizens, journalism practitioners and technologists work together to edit, produce and exhibit their stories, carefully choosing the representation and medium most appropriate to the perspective they wish to present and the audience they wish to engage.

Photojournalism: A Dilemmatic Profession

We choose to narrow our approach to photojournalism for two reasons. First, photojournalism is an inherently dilemmatic practice: the "whole story" can never be told with a single image or even an entire photo essay. Second, we believe photojournalism offers a different kind of accessibility (compared to text -based journalism) for letting communities of people of different ages, backgrounds and literacy skills create and critique dilemmas. People are familiar with taking snap-shots and viewing images in a variety of media but they rarely practice complex skills associated with visual analysis. Photojournalism is a "low-threshold, high-ceiling" domain in which to study dilemmatic thinking.

The good photojournalist uses a number of technical and rhetorical techniques to create literal and conceptual frames that tell stories. At a shoot, she simultaneously judges lighting conditions and camera angles, considering complex relationships among focal lengths, shutter speeds and film types as events unfold around her. She also makes split-second decisions about other more subjective issues: what is the most "important" aspect of an unfolding story? What aspects of the story best lend themselves to an image? Who is the audience for the image and in what medium (*e.g.* newspaper, magazine, Internet) will it be published? How can what's happening outside the frame be represented? As the photojournalist shoots a scene, she is simultaneously documenting a scene and presenting a personal perspective.

The framing continues even after the shooting is over. An editor may choose to crop, resize or even alter a photojournalist's image[1]. The layout designer may juxtapose the photojournalist's image against another image or text that influences the photojournalist's intended story. Furthermore, the publication's perceived bias (deserved or not), the timing of the story in relation to other events and the particular demographic of the target audience can all influence the image's voice. (See Kobré 2000 for a general introduction to photojournalism.)

Although such a process may seem flawed and confusing, there is evidence to suggest that people benefit from interpreting the ambiguity of mainstream media. Participating in conversations about the news is thought to cause deliberations that lead to more "informed" citizens with more concrete opinions and to contribute to a mutual awareness of public opinion and community attitudes (De Boer and Velthuijsen, 2001). De Boer and Velthuijsen acknowledge the limitations of evaluating relationships with mass media through surveys and knowledge tests. However, a consistent finding in their *dependency-exposure-conversation* model is that people seem to use news stories as bases for conversations and that deliberation about news items helps people develop individual opinions and determine how these opinions are received in a community. We are interested in further investigating this interplay between mainstream media, individual opinion-formation and community identity, but we adopt a different methodology.

By situating the SCJ approach within photojournalism, we hope to extend the analytic thinking skills exercised as a media consumer to the dilemmatic thinking skills practised as a media creator. We are more interested in *how* people think about issues, instead of simply *what* people think about issues. Constructing and critiquing seemingly ambiguous opinions and dilemmas through images may reveal new learning processes and new ways of supporting personal expression.

The Situated Citizen Journalism Learning Community

The community within which the citizen journalist develops cannot be separated from the skills associated with "good" photojournalism. Indeed, the professional photojournalist struggling to capture a scene or perspective likely learned her craft through a combination of formal instruction, apprenticeship, quiet observation, reflection, experimentation with tools and techniques and many, many mistakes.

---

[1] Altering news images is controversial but not without precedent. See Jacobson (2002) for a pictorial review of the relationship between photojournalism, censorship and image ambiguity.

Our goal is to create an environment in which citizens and photojournalists can engage in professionally situated, apprenticeship-like learning relationships (Lave & Wenger, 1991; Rogoff, 1991). The learning environment is not a formal pedagogical space but an informal environment where individuals of different ages, socio-cultural backgrounds and technical expertise collaborate to create and critique personally meaningful images.

Since it is often not possible to have such diversity within a single co-located physical community, a central goal of Situated Citizen Journalism is to facilitate diverse learning relationships through collaborative technologies. The exact nature of such an on-line group's collaboration requirements is a function of the individual learning and dilemmatic thinking styles of those who comprise the learning community.

Our current work (and the project described below) centres on identifying these on-line SCJ community requirements by studying how individuals learn and work together in a physical SCJ setting.

Situated Citizen Journalism and Children's Dilemmatic Thinking

Our first Situated Citizen Journalism project is a work-in-progress with two phases. In the first phase (beginning mid-August 2002), two groups of children from Dublin, Ireland aged 11 to 14 complete one-week workshops in which they work with learning researchers and photojournalism professionals to capture, edit, critique and exhibit images using a variety of traditional and digital photographic tools. In the second phase (beginning October 2002), adult students at Loyalist College's photojournalism school in Canada and Irish children collaborate using custom-designed web software to critique and edit the images.

Phase One: Workshops

The workshop participants were recruited through The Ark, a Dublin-based arts and cultural centre for children. The participants for the first workshop are members of the general public who registered with The Ark's summer programme and the participants for the second workshop were selected from a Dublin neighbourhood labelled "disadvantaged" by the Irish government. Both workshops have the same general design.

At the beginning of the week, children build their own pinhole cameras and use them to shoot images. They then develop the images using traditional darkroom processes as a first introduction to photographic principals of optics and light. As the week progresses, children work with a Loyalist College photojournalism professor and two Loyalist college photojournalism students to design their own photojournalism assignments. They then shoot two assignments using more advanced traditional and digital cameras and critique their images and stories as a group. After iterating on different themes and photographic techniques, they edit the images using both traditional cropping techniques and digital image editing tools. They then prepare a final public exhibition consisting of both a traditional, physical show and an on-line presentation.

Phase Two: On-Line Collaboration

The on-line portion of the exhibit will be shown using custom web software and will serve as the basis for the extended collaboration throughout Fall 2002. During this phase of the project, the Canadian photojournalism students work with the Irish children using the web software. Together they critique and edit images with each individual bringing a variety of photojournalistic and editorial expertise. The goal for this phase is to support children's further exposure to the photojournalism editing process as they converse with students of a different age and from another culture who are themselves learning what it means to be a photojournalism editor.

The software is designed using the open-source Open Architecture Community System (OpenACS, 2002) on the Linux operating system. The OpenACS system is a tool-kit for building community-oriented web applications. It is composed entirely of open-source components: an AOL web server, a PostgreSQL database and a set of tcl scripts that offer customisable functions such as user authentication, discussion forums and chat spaces.

Research Questions

There are several research goals behind the design of the workshop and the structure of the web-based collaboration. They are categorized as: *tool development*, *collaborative critique* and *community of practice*:

Tool Development

How do children use and talk about different photojournalism tools (*e.g.* pinhole cameras, fixed focal length cameras, digital cameras, image scanners, digital editing tools, *etc.*)? What features might future digital image capture tools have? How can aspects of the photojournalist profession be modelled in these technologies?

Collaborative Critique

How do children represent and critique dilemmatic and ambiguous aspects of visual scenes? How does the design of their assignments and the images they shoot change in response to critique? How are critiques given differently before, during and after a shoot and how are they *received* and *interpreted* differently?

Community of Practice

How do photojournalism professionals introduce photojournalism to non-specialists and mentor their development? How is this relationship like an apprenticeship learning model? What collaborative tools are needed to support this learning relationship remotely? As the photojournalism students work with the Irish young people, how do they learn from one another and in what contexts do these "learning moves" happen?

Conclusion

In this paper we presented an approach for investigating dilemmatic thinking and our current research project on how children's dilemmatic thinking can be practiced with the support of a situated learning community and, eventually, collaborative software. Our interest is in using the inherently subjective and dilemmatic practice of journalism in general – and photojournalism specifically – to investigate how people create, share and revise opinions about everyday dilemmas by capturing and critiquing personally meaningful images.

Acknowledgements

Thanks to researchers at Media Lab Europe (especially the Everyday Learning group and Elisabeth Sylvan) for helpful comments on the general research project and this paper. Thanks also to the Dara Carroll, Bernadette Larkin, the team at The Ark in Dublin, Ireland and to Frank O'Connor from Loyalist College in Belleville, Canada and Sarah Falkner and Jeff Cooper for their help designing, organizing and conducting the workshops.

References

Billig, M. *et al.*. (1988). *Ideological dilemmas: A social psychology of everyday thinking.* Sage Publications: London.

De Boer, C. & A.S. Velthuijsen. (2001). Participation in conversations about the news. *International Journal of Public Opinion Research*, Vol. 13, No. 2.

Gilligan, C. (1982) *In a Different Voice: Psychological Theory and Women's Development.* Cambridge: Harvard University Press.

Jacobson, C. (Ed.). (2002). *Underexposed.* Vision On Books: London.

Kahneman, D. & A. Tversky. (2000). Choices, Values and Frames. In Kahneman, D. & A. Tversky. (Eds.) *Choices, Values, and Frames.* Cambridge University Press: Cambridge.

Kobré, K. (2000). *Photojournalism, The Professionals Approach.* Focal Press: New York.

Lave, J. & E. Wenger. (1991). *Situated Learning: Legitimate peripheral participation.* Cambridge University Press: London, UK.

OpenACS. (2002). *Open Architecture Community System.* http://openacs.org/.

Papert, S. (1980). *Mindstorms.* Basic Books: New York.

Rogoff, B. (1991). *Apprenticeship in thinking: Cognitive development in social context.* Oxford University Press: Oxford, UK.

The Nature of Electronic International Project Development

Betsy Anderton
Department of Behavioral Studies and Educational Technology
University of South Alabama
United States
betsyanderton@worldnet.att.net

Abstract: This paper is a report on the findings of a grounded theory investigation of international collaboration over the Internet in which partners develop educational products. This study was conducted over a three-month period in the summer of 2002. In this small study, I attempt to identify strengths and barriers to the international and electronic components of Internet international communications. Ten participants with experience in international electronic project development from nine different countries were interviewed electronically. Their answers were coded and compiled. The findings from this study should help prepare pre-service teachers for cross-cultural interaction and project development using the Internet.

Introduction

Schools of education are beginning to realize the need to provide teachers with information communication technology (ICT) skills. In order to supply knowledge workers to governments, businesses, and social institutions, schools of education must provide new teachers in training with ICT skills both in and out of the traditional classroom. It should no longer be considered novel, but necessary that we provide teachers with the training, technology, and collaborative resources to use ICTs in their classrooms, both for management and teaching. Schools of teacher education hold the responsibility to create teachers that will in turn create environments that encourage constructive interaction with students and information.

Along with ICT skills, pre-service teachers also need skills in global interaction. As our world and the information we receive from it become increasingly more global, it is important that teachers encourage students to accurately understand their society as part of a larger world. Von Glasersfeld (1989) believes it is through the views of others that people begin to challenge their own ideas and philosophies enabling them to accept new methods for teaching and learning. At the Society for Information Technology in Teacher Education (SITE), Nikki Davis listed three reasons for making the integration of technology into education an international responsibility, (a) the context of education is becoming more global, (b) the Internet and other ICTs have increased access to education on a global level, and (c) teacher education can be enhanced by an international approach through increased reflection and the provision of stimulating contexts. Davis elaborated on these issues stating that the globalization of teacher education should be a response to industries need for leadership, innovation, and customer service provided by a new type of global savvy worker.

In response to the demands for a new type of learner, teacher, and curriculum, the Internet is increasingly becoming a medium of choice for the development of ICT skills and international collaboration. It is my belief that if we are to encourage pre-service teachers to work with other cultures using an electronic medium, we need to understand the barriers they will face so as to incorporate the needed educational and motivational strategies into teaching and assignments.

Furthermore, by more clearly understanding the strengths of the Internet and international collaboration, teachers can include the Internet in their pre-service teacher education curriculums with more assurance as to the merits of this relatively new learning tool. The benefits can likely be used as motivating factors for involving pre-service teachers in both ICT use and international collaboration on project development. In this study I attempt to illuminate some of the characteristics particular to international Internet project development and communication. I examined these two questions: (a) What is the nature of international electronic project development? (b) How can knowledge of the strengths and barriers to

BEST COPY AVAILABLE

international Internet project development enhance efforts to include electronic international developments for pre-service teachers in colleges of education?

Method

Participants

Participants were chosen in two ways: (a) by looking through publications and noting the authors, and (b) finding organizations that listed individuals involved in international affairs. Participants were teachers and faculty members from a total of nine different countries. The terms *participants* and *respondents* are used synonymously.

Apparatus

Five questions were electronically mailed to each participant. Questions were designed to discover strengths and weaknesses of international collaboration on educational projects, strengths and weaknesses of Internet collaboration and communication, and opinions on international collaboration and pre-service teacher motivation. Questions were piloted on two participants, evaluated and then redeveloped. The final questions can be seen below.

1. What are the strengths to international development of educational materials and projects?
2. What are the barriers or limitations to international development of educational materials and projects?
3. What are the strengths of using the Internet to collaborate and build/develop educational materials and projects?
4. What are the limitations and weaknesses of using the Internet to collaborate and build/develop educational materials and projects?
5. Please provide your opinion on what motivations could be used to encourage international collaboration by undergraduate education students (future teachers)?

Procedure

I began my study by selecting a purposeful sample of individuals. All individuals had experience using the Internet for international project development. Thus the participant's experiences would strengthen the quality and richness of their responses. I sent out 25 emails initially. The low return rate of 4 in the 25 caused me to reflect on both my process and my questions. I then redesigned my salutation and description of the project to include a sentence informing recipients of the value of their contribution to the study, as they were only one of ten individuals being studied. I also researched the individuals project development history so as to congratulate them on a specific accomplishment. I felt that this would create a bond of professionalism and respect. Once I sent this new set out, I found that my return rate increased to 6 of 10.

All communication was in English. Once interviews were returned, I read the responses and began coding them. I first based the codes on the five question areas and then developed subsets of these areas as themes emerged. This method provided me with an effective system by which to question respondents further.

Results

Question #1: Benefits of International Project Development

The responses to the benefits of international development of educational materials were rich and full of enthusiasm. Seven of the participants responded to this question. Below are the most common remarks regarding the benefits of international project development.

• Supports language skill development	7
• Promotes comparisons of lives and cultures	7
o Solving common problems	
o Positive attitude toward differences, tolerance	
• Increases student interaction with materials	3
• Increases variety of student interactions	3

• Increases student enthusiasm	3
• Provides more resources for management, methods, and materials	3
• Supports teacher collaboration	3

Question #2: Barriers to International Project Development

Eight participants responded to this question. Language was stated most often as a barrier to international project development. The following responses were most popular.

• Language	4
• Time	3
• Exam oriented nationally curriculums	2
• Variation in school years	2
• Time Zones	2

Other answers included: difficulty in continuing projects started by other teachers, frustrations with English as the language of choice, student introduction to nationalistic and superior attitudes, lack of curriculum resources, cultural barriers excluding language, and traditional or close minded educators.

Question #3: Strengths to Using the Internet for Collaboration

Eight participants responded to this question. The most beneficial strength of Internet collaboration was its support and promotion of active learning, and student motivation.

• Built in student motivation	4
• Supports active learning through real-time, relevant activities	3
• Supports teacher collaboration	3
• Provides of resources for teachers and students	3
• Supports interaction information communication technologies	3
• Provides immediate access to other cultures	3
• Improves communication skills	3
• Personalizes the learning experience	2

Lack of discriminating elements such as race, age, and gender and the decentralization of national curriculums were also listed as strengths to international Internet collaboration.

Question #4: Barriers to Using the Internet for Collaboration

Eight participants responded to this question. The greatest barrier found to Internet collaboration was skill level of educators.

• Skill level of educators	5
• Internet connection speed	4
• Lack of equipment in schools	3
• Skill level of students	2
• Diversity of resources of partner institutions	2

Lack of resources in student homes and expense of resource were also listed as barriers.

Question #5: Suggestions for Motivating Students

The final question was designed to gather information on motivational strategies that could be used to support international Internet collaboration in pre-service teacher programs. I can not be sure that each of the respondents fully understood the term I used to describe this group, "undergraduate education students (future teachers)" Knowing that education systems differ throughout the world, I attempted to phrase this term as clearly as possible. Four individuals responded to this question. Some suggestions included use of international listservs providing opportunities for relationship building and networking, required online project development across borders, and provide paths by which they could meet leaders in the field and possibly help with projects.

Creating and promoting internship opportunities for students was listed as an additional way to involve pre-service teachers in international endeavors. One respondent finished her interview with these words, "The experimental spirits and the practical need are among the most important factors. As a teacher-to-be, they are self-encouraged to be innovative. Once they decide on exploring the world, they are delighted to create more opportunity to collaborate with others." So, perhaps we can imply that we need to send education students into the world with a certain spirit as well as a tool kit of technical and pedagogical skills.

Discussion

Regarding the use of this study to pre-service teacher education, I can only offer suggestions. Professors in colleges of education can make valuable use of the Internet as a tool for pre-service teacher education project development. Not only are teachers using the tool to collaborate, this tool has built in motivational factors that encourage Internet student collaboration. Such factors include immediate feedback, perspective sharing, opportunities to meet people from other countries, foreign language acquisition, and access to adaptable lessons and projects. However, students need to be versed in appropriate cultural behavior in order to work optimally with international peers. Communication must be clear and students must understand when to ask for clarification. Students from English speaking countries must value the efforts of their colleagues who do not speak English as a first language. This understanding will hopefully be passed on to their future pupils. Schools wishing to use the Internet for international project development need to have reliable and speedy Internet connections available for students to use. International electronic products should be planned carefully so as to fit into the year and curriculum. If projects are to be continued goals and project guidelines should be clearly communicated to follow-up teachers. Furthermore, project partners should communicate their motives for project participation.

There were several problem areas in my study, which I would like the reader to be aware of. First of all, response was initially low. I feel there were two reasons for this. First, I sent the email from an unprofessional hotmail address, which might have made my study appear less legitimate. Second, my first set of emails did not specify the limited number of individuals I was attempting to contact. Perhaps this lessoned prospective respondents motivation to return the questions. My second attempt in which I sent only ten emails and took efforts to inform the respondents received a greater response rate.

Internet interviewing is not a timely process. For those participants that responded, the delay averaged four-days between the time the message was sent and the time a response was received. Not knowing the preferred name of individuals also proved to be a hindrance to communication. I feel that although I received lengthy responses, it was hard to develop a relationship as I might have done in a face-to-face interview.

I agree with respondents that language is indeed a barrier and should not be overlooked. It is very important to pilot questions with a variety of nationalities before attempting to collect data. For example, my pilot test revealed various interpretations for the word "graduate student". I had several peers review my questions for clarity, but cultural interpretations were still an issue. Just as my questions could have been misunderstood, there may be some responses that I interpreted incorrectly.

References

Davis, N.E. (1999). Why should IT in teacher Education have a global dimension? Proceedings of SITE'99 in San Antonio, Texas, March 1999.

Eisler, D. L. (2000). The Portal's Progress: A gateway for access, information and learning communities. Syllabus Magazine, 14(1), Retrieved from http://www.syllabus.com/syllabusmagazine/sept00_fea.html

Von Glasersfeld, E. (1989). Cognition. Construction of knowledge and teaching. *Synthese,* 80, 121-140.

BEST COPY AVAILABLE

A Framework for Developing and Managing Resource-Based Distance Learning Content in Higher Education

Carlos F. Araujo Jr., Ismar F. Silveira, Luiz H. Amaral
Center of Distance Education – Department of Computer Science and Information Systems
University Cruzeiro do Sul
Sao Paulo, Brazil
carlos.araujo@unicsul.br, ismarfrango@uol.com.br, luiz.amaral@unicsul.br

Abstract: The aim purpose of this paper is to show a framework for elaboration and management of pedagogical contents used in distance, resource-based e-learning. The present article is based in current research being conducted at University Cruzeiro do Sul in Center of Distance Education (UNICSUL-NEAD) , Sao Paulo, Brazil, where the WEL Project (Web Engineering for Learning) is under development. The main goals of this research is to develop pedagogical content and generic tools, like simulations and assessment methods, for Web-based learning over the context of Computer Sciences and Information Systems undergraduate courses. The foundations for this project are the use of regular concepts of usability, reusability, , functionality, reliability, efficiency, maintainability and scalability over an implementation of learning objects, whose concept is recent but promising. Therefore, the framework here presented can be used on massive distance learning projects in formal and informal educational levels. The results of applying such framework over an undergraduate Information Systems course are reported.

Introduction

The use of Internet/Web for educational purposes has been discussed in several researches last years (Abbey 2000, Aggarwal 2000, Ryan et al. 2000). Experiences in the use of Web-based technologies have been applied in several segments of Teaching-Learning Process showing results that have contributed for a more efficient use of these technologies in the educational process. The Computer Sciences and Information Technologies areas are accomplishing a wide range of studies about the effectiveness in using Internet/Web as a learning and communication tool (Gal-Ezer & Lupo 2002). Such areas are directly concerned with research and development of ICTs (Information and Communication Technologies), and there is a large interest about the use of these technologies in educational programs. It is not possible to assert peremptorily -and in an unequivocal way- that the use of ICTs leads to a more efficient, better learning. However, as their use is increasingly becoming inserted into learning's social context, on schools or even at work, there is a need for more studies on this area, applying and analyzing the use of these technologies on the educational environment in order to move forward to a mode tailored use of ICTs on the Teaching-Learning Process (MacCormack & Jones 1998).

Recent advances in Web Engineering (Olsina 1999, Pressmann 2001, Nielsen 2000), mixed with the concept of Learning Objects (Wiley 2002) have crucial importance for developing a web-based course content that follows six basic standards: usability, functionality, reusability, reliability, efficiency and scalability. In this context, the WEL Project (Web Engineering for Learning), that is being conducted at Center of Distance Learning in University Cruzeiro do Sul, at Sao Paulo, Brazil, has as its main goal to research a framework for the development and management of pedagogical content for e-Learning programs, as well as to investigate what methodologies and tools can be used in order to reach such a goal. Thus, the whole research is based on Web Engineering basic principles, making use of the modern concept of Learning Objects applied to resource-based distance learning systems, whose content is in domain of Computer Sciences and Information Systems areas. However, the proposed framework can be used in several other areas, in order to manage massive courses in higher education. As this framework is well suited for educational aims, its use demonstrates a severe reduction of development efforts, so having a very positive impact on the cost/benefice ratio.

Our study was conducted on a course offered in the half-presence modality. All students that joined up this experience were Information Systems undergraduate classes. The results of such a research are shown here.

The Basic Foundations of the Framework

A working definition for the term "Learning Objects" was given by IEEE (Institute of Electrical and Electronics Engineers) Learning Technology Standards Committee (LTSC). According to that definition, Learning Objects mean any entity, digital or non-digital, that can be used, reused or referenced during technology-supported learning processes, including computer-based training systems, interactive learning environments, intelligent computer aided instruction systems, distance learning systems, and collaborative learning systems.

The Learning Objects concept is a starting point to the definition of standards for development of online learning contents, tools and assessment tools. As a consequence, we gain competitiveness to dispute into corporate e-learning market, in addition to more efficiency and flexibility in developing resource-based distance learning content for higher education (Whalen & Wright 2000). These standards converge to the Web Engineering specifications (Olsina 1999, Pressmann 2001), interface design theory (Shneiderman 1998) and the object-oriented paradigm (Booch, Rumbaugh & Jacobson 2000).

To build a high quality, efficient web-based content is a very expensive, time-consuming task. At first sight, content development include a wide range of tasks, like instructional design, multimedia design, text production, as well audio, motion video, graphics and photos conversion to machine-readable formats. In addition to these tasks, we have also other ones, like course authoring, software development, content integration and testing, modification/adjustment, training; and so. The cost analysis for asynchronous web-based course cases studies presented by Whalen (2000) show an average of 1,321 hours of content development for a two-day course in the context of web-based training in a corporate sector. The time for developing a synchronous course is pointed to be 89% fewer or 144 development hours (Whalen & Wright 2000). The convergence between the concepts of web engineering and learning objects in the context of higher education content development of didactical content leads to a optimization of the process, so that it allows the massive use of ICTs. Therefore, this background also allows the purpose of an effective framework for web-based course content development. Such background is structured in a n-tiered architecture which can be reused in several contexts than educational ones.

The (Figure 1) shows a Unified Modeling Language (UML) Use-Cases Diagram (Booch, Rumbaugh & Jacobson 2000) that depicts the main roles played by two actors – the Teacher/Expert, mainly responsible for the Instructional Design phase (Bergi 2000 in Abbey), when the content to be modeled is related to the expected goals of the teaching-learning process, and it is also the moment when all strategies that will be applied in such process are defined. In addition to that, to this actor is also assigned the responsibility of developing the content itself, and test its implementation, which is done by another actor, here called WebEngineer that has to model and implement the content previously planned by the Teacher/Expert.

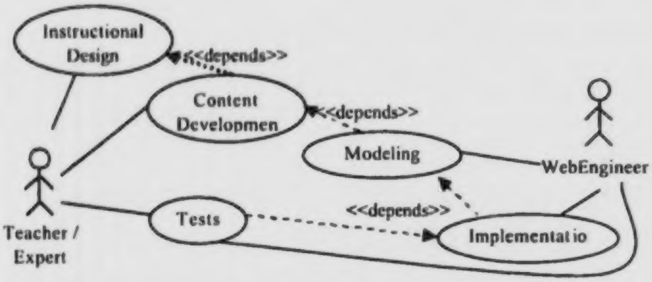


Figure 1: UML Use-cases diagram as a design pattern for content development process.

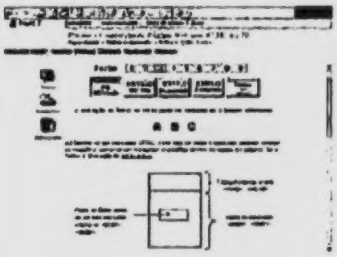


Figure 2: Webpage with contents for the "Internet-based Information Technology" undergraduate course for Information Systems classes.

The (Figure 2) shows a screenshot of a webpage built over the proposed framework. The (Figure 3) shows a UML Component Diagram (Booch, Rumbaugh & Jacobson 2000) for two use cases from (Figure 1): the "Content Development" use case, responsibility of Teacher/Expert, and the Modeling of this content, responsibility of the Web Engineer. The main component, named "Online Content" is specialized in two other components: "Static Content" and "Dynamic/Interactive Content". In this

BEST COPY AVAILABLE

context, "Static Content" means all that content that is drafted by Teacher/Expert during Content Development phase, after modeled and implemented by WebEngineer. This implementation is done basically through webpages, in general elaborated over DHTML, Javascript and other technologies under the W3C (Word Wide Web Consortium) standards. It is important to note that most of the components that are shown in (Figure 3) are implemented in (Figure 2).

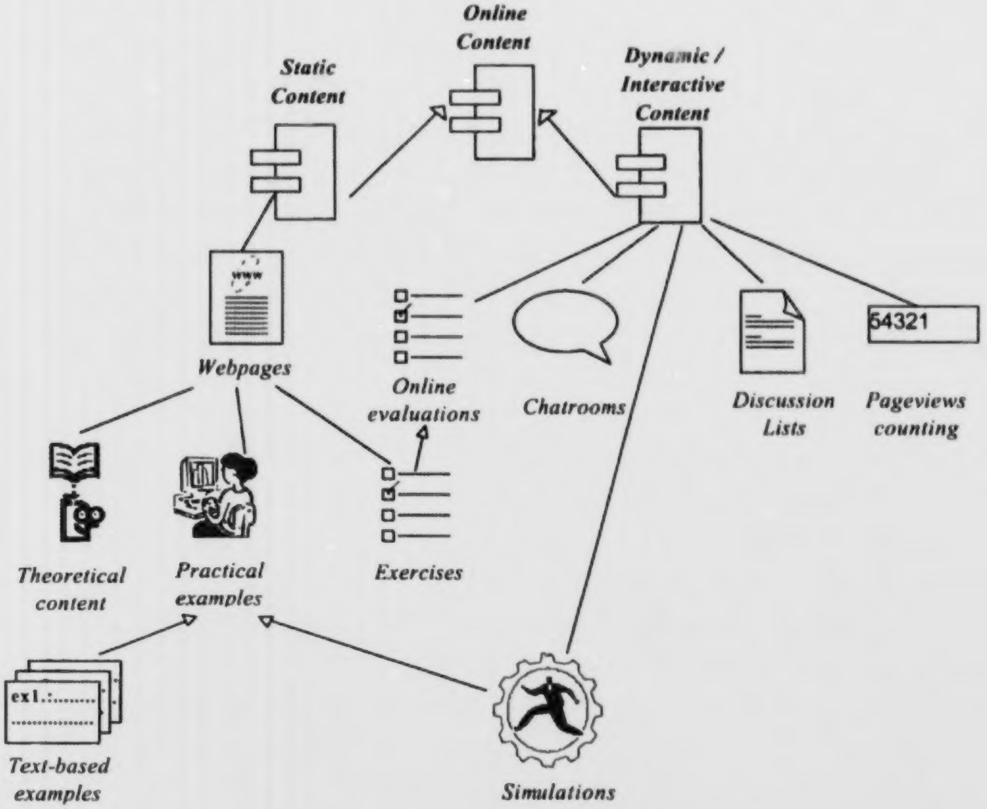
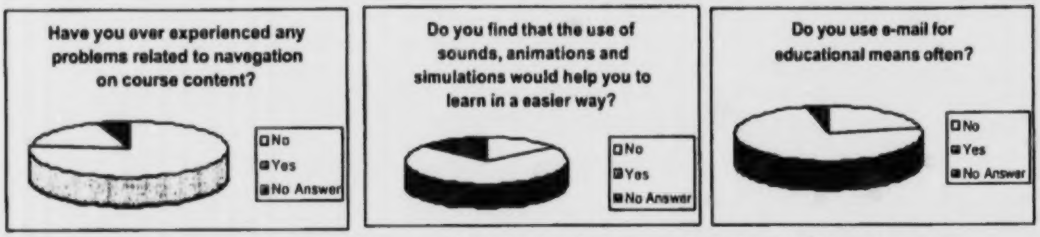

Online Content
Static Content
Dynamic / Interactive Content
Webpages
Online evaluations
Chatrooms
Discussion Lists
54321
Pageviews counting
Theoretical content
Practical examples
Exercises
ex1.:........
Text-based examples
Simulations

Figure 3: UML Component Diagram for the content development framework over WebCT virtual learning environment context.

Preliminary Results

The implementation of the framework was made using the WebCT learning environment. It is important to emphasize that such framework can be used in several ways than educational ones, independently of the virtual learning environments over which is implemented. The application of this framework results in a modeling content (Pressman 2001, Nielsen 2000 Lynch & Horton 1999). This modeling content was applied in a first undergraduate course in Information Systems area, and a larger range of experiences are being drawn from this one, based on a survey that has been realized in order to evaluate de pedagogical impact of the framework over students.

Questions about navigational issues on the proposed modeling content show that 77% of students had no problem in navigation, against 18% that have had. It was asked the students' opinion about the utilization of multimedia resources like sounds, animations and simulations in the learning process. The answers for this question showed that 70% of students believe that these resources could help in learning process, 16% of them found that such resources would not help them to learn in an easier way, and 14% of them have no opinion about this. The students also declared that 74% of them use regularly e-mail for educational purposes against 22% that do not. These results are depicted in (Figures 4a, 4b and 4c):



Figures 4a, 4b, 4c: Questions proposed in a survey for evaluating the framework's pedagogical impact, as well as the use of ICTs on educational process.

Conclusions

The results of this research shows that the implementation of any project on distance learning in higher education must follow a straightforward, well-coordinated pattern on planning, modeling and developing its content, in order to reach students' expectancies and requirements. At this point, the need for a framework as proposed in this paper appears. The proposed framework allowed a drastic reduction of efforts on content building, and its use showed adaptive to the specific needs of each course planned after this.

The intrinsic problems related to the course subject itself had no change if faced to previous experiences without the use of ICTs. However, we could observe a greater motivation from the students, perhaps by the fact of using a friendly environment to study some subject, whose content were available whenever and from wherever. Other point that must be emphasized is the growing of peer-to-peer contact, among the students themselves, and among them and the teacher. We believe that fact is a trigger for a crescent motivation, consequently a breaking some of the uncountable barriers that separate learners from learning.

Acknowledgements

The authors acknowledge University Cruzeiro do Sul by the financial support for this research. We would like to thank Prof. Dr. Jaime Sandro da Veiga for his help on scientific discussions about resource-based learning.

References

Abbey, B. (Ed.) (2000). *Instructional and Cognitive Impacts of Web-Based Education*. Hershey(USA): Idea Group Publishing.

Aggarwal, A. (2000). *Web Based Learning and Teaching Technologies*: opportunities and Challenges, Hershey (USA): Idea Group Publishing.

Bergi, Z. L.,Collins, M. & Dougherty, K. (2000). *Design Guidelines for Web-Based Courses. In: Instructional and Cognitive Impacts of Web-Based Education* , Beverly Abbey (Ed), Hershey (USA): Idea Group Publishing.

Booch, G., Rumbaugh, J. & Jacobson, I. (2000). *The Unified Modeling Language User Guide*. Reading: Addison-Wesley.

Gal-Ezer, J. & Lupo, D. (2002). Integrating internet tools into traditional CS distance education: students's attitudes. *Computers and Education*, 38, pp. 319-329.

Lunch, P. J., & Horton, S. (1999). *Web Style Guide: Basic Design Principles for Creating Web Sites*, New Haven:Yale University Press. Available: http://info.med.yale.edu/caim/manual/contents.html.

MacCormack, C. & Jones, D. (1998). *Building a Web-Based Education System*, John Wiley & Sons.

Nielsen, J. (2000). *Projetando WebSites*, Rio de Janeiro: Ed. Campus.

Olsina, L, et al. (1999), Specifying Quality Characteristics and Attributes for Web Sites, *Proc. First ICSE WorkShop on Web Engineering, ACM*, Los Angeles, May.

Pressman, R. S. (2001). *Software Engineering: A Practitioner's Approach*. New Jersey: McGraw-Hill.

Ryan, S., Scott, B., Freeman, H. & Patel, D. (2000) *The Virtual University: the Internet and Resource-Based Learning*, London: Kogan-Page.

Shneiderman, B. *Designing the User Interface: strategies for effective human-computer interaction*. Reading: Addison-Wesley, 1998.

Wiley, D. A., (2002) Learning objects. In A. Kovalchick & K. Dawson (Eds.) *Educational Technology: An Encyclopedia*. Santa Barbara: ABC-CLIO. Available: http://wiley.ed.usu.edu/writings2.pl.

Whalen, T. & Wright, D. (2000). *The Business Case for Web Based Training*, Norwood: Ed. Artech House.

Evaluation of web based communication and cooperation in a course in teacher education at a German University

Most of the universities have established some kind of e-Learning courses to support virtual learning. Often they use web based software platforms like WebCT or Blackboard. The experiences with such forms of learning are very different. Some are very enthusiastic; others are very sceptical about such platforms. Teaching and learning with new media is a great challenge for teaching at university, because to use the technique in a proper way needs some important prerequisites. For example the handling of the platforms must be easy for everybody, and the students must have the ability to use computer and internet.

To work with e-Learning software platforms there are different options: one is information, one is communication, and one is cooperation. For communication there are synchronic and asynchronic forms. Synchronic communication forms are for example chat and instant messenger services. Asynchronic forms are for example e-Mail and Discussion Boards. For cooperation or collaboration one can use file transfer function or whiteboards.

There are several reasons why students have problems in using such platforms. One could be a lack of understanding; one could be a lack of experiences. In a study at the university of Hamburg teacher students which attend a course on 'virtual school' where asked to use an e-learning platform for information, communication and cooperation during their group work. The groups had the task to evaluate websites for teachers in different subjects, to analyse learning software for young students, and to develop classroom projects from a constructivist point of view. To work on these tasks they have to use e-Learning software platform Blackboard. Blackboard is one of the biggest players in the e-Learning market and offers the user to create course sites in which students can enrol. The system offers a wide range of possibilities. One can make announcements, provide course documents, and they are possibilities to send emails, to chat or to use discussion boards, e.g. After a period of eight weeks of group work the students had to present the projects on the course website for discussion. The course was attended by 80 students of a course for teacher education. Most of the students were freshmen, two third were female.

A questionnaire was used to evaluate the experiences by using Blackboard. The questionnaire has several dimensions which focus to different aspects. One aspect has been the ability of the students to use computer and internet which was called media competence. Another aspects focus on the students' experiences in using Blackboard.

The results show that 20% of the students have had technical problems to use Blackboard in a proper way. One of these problems has been a slow modem for internet access. Most of them used Blackboard only for information and communication but not for cooperation. They preferred to meet 'offline' to work on their tasks. Only one group of twenty-five groups used a discussion board, none of them the chat room or the whiteboard. Two third of the students used Blackboard up to ten times, one third less than five times. Most of the students 'forgot' to read some of the course documents. Asked which of the options of Blackboard they find useful and which they really used, most of them find that announcements and emails to the instructor are very useful and has been used too. But there is a big gap for the more cooperative options of Blackboard. Half the students answered that chat and discussion boards are very useful, but only a few of them used them. More than one third of the students called working with Blackboard very awkward. Further results are presented.

One of the conclusions of the evaluation study is that it is very necessary to give the students an extensive introduction in working with e-Learning software platforms. And another conclusion is that the pedagogical sense of using such platforms must fit the communication and cooperation demands of students.

Evaluating distributed learning

Isabel Azevedo, Constantino Martins, Carlos Vaz de Carvalho
Instituto Superior de Engenharia do Porto (ISEP) - Portugal
iazevedo@dei.isep.ipp.pt

Ligia Maria Ribeiro
Faculdade de Engenharia da Universidade do Porto (FEUP) - Portugal

Abstract: The evaluation of distributed learning, in a systematic and a rigorous way, is a mandatory process to assure its quality and efficiency. At the Engineering Institute of Porto (ISEP), distributed learning has been adopted by an increasing number of disciplines, either as complement to f2f classes or as the main delivery methodology. This led us to design and propose an evaluation methodology to assess the results of these actions. We are currently validating the methodology, using a course from the Computer Science BSc. Once subject to other courses, the methodology can easily be extended to other higher education distributed learning courses.

Background

Evaluation is the systematic determination of merit or importance (Scriven, 1999) that allows problems identification, classifications and comparisons to be done. This activity is essential to assure the quality in education (Gilroy, 2001), benefiting all the stakeholders in the process. Evaluation is especially relevant to any form of distance learning, including distributed learning, because the need to establish this form of education as valid is still felt ([Mann, 1998] [Williamson, 2000]).

According to Moore (1999), an adequate accompanying and an effective evaluation can also contribute significantly to distance education courses success, but only a small number of institutions have recognized that these courses success depends on so many related parts and that the failure of one of them can compromise the role initiative (Alexander, 2001).

For instance, little attention is given to the learning processes in distance education courses. The students' frustrations aren't recognized in many courses (Hara, 1999) where only the students who did not drop out answer final evaluation questionnaires. Perhaps this lack of interest can be the main reason for the high number of students that can't finish their distance education courses. According to Evans (2000), 30 to 50% of distance education courses' students drop out their courses before the end, independently of the technologies that were used, but Alves (2001) presents a figure of 80% in some courses. These values suggest that something has to be reconsidered since the beginning of any course. The courses development cannot be the only aspect that matters in distance education.

In summary, evaluation is not an activity to be carried only in the final of a course, because at this time it is too late to do changes for the course success. Clark (1989) defends that the evaluation specialists have to be effectively involved in the courses implementation as soon as possible. Even if the evaluation process is very time-consuming and even if educational tasks are not often considered for teachers' professional progress in higher education schools.

Evaluation Methodology Design

To design the evaluation methodology we followed four evaluation phases, based on Scriven (1980):

- **1st phase**: Selection of the aspects/parameters to evaluate attending to the overall goals, identification of the metrics that will guide the evaluation for each aspect considered and also the identification of the context

variables that can affect the aspects that will be evaluated and the possible cause/effect relations of these variables;
- **2nd phase**: Determination of absolute or comparative levels that must be reached to guarantee that the objectives were satisfied;
- **3rd phase**: Data gathering about the selected aspects;
- **4th phase**: Data integration and analyze.

Our evaluation objectives were defined as follows:
- Assure that the students have learned in an enjoyable way to them;
- The technological tools used were not a barrier and permitted the desirable communication;
- Guarantee that the contents were sufficient and adequate to their success.

In the first phase, we decided which aspects are relevant to our evaluation objectives. We selected five aspects:

1. **Content quality** – All items from the discipline program have to be covered with clarity and the adequate rhythm – but also in an interesting way that could motivate the students. The contents presentation has to follow a consistent and an intuitive design.
   It is important to provide a rich learning experience to the students but this is not obtained by simply providing more and more online information to them. It is necessary to assure that they will use and interpret the available information to construct their knowledge. For instance, by delivering frequently assignments for students to discuss and solve. Usually these exercises originate the posting of a lot of messages in the discussion forums, some of them answered by other students.
2. **Technological efficiency** – This aspect can be a source of frustrations for the students. Volery (2000) classify this aspect as one of the most important variables that can affect the effectiveness of online delivery. We want to assess if the technological tools used in a course are robust, reliable and easy to use.
3. **Communication effectiveness** - According to Law (1997), there is evidence that distance education permits an effective learning with intellectual and emotional improvements. Teaching cannot be simply deliver materials and for this aspect we essentially want to measure the involvement of the students and the created interaction, factors that stimulate the clamping of knowledge (Daniel, 1996).
4. **Students' satisfaction** – Teaching is not only concerned with student satisfaction, but this aspect matters. The fact that the user continues in a system is sufficient to assure some satisfaction since in an absence of any satisfaction, students drop out the system (Silva, 1999). The number of students that drop out compared with previous instances of the course can be used as a measure of their satisfaction. It is also recommended to collect students' opinions.
5. **Students' success** – The learning outcomes of the students has to be measured. The number of successful students (compared with earlier courses) is not the only evaluation measure. Before the beginning of a course, it is needed to analyze their previous qualifications and complete an individual characterization of the students, in order to verify if there was any improvement in their skills.

Data collection can be done thought questionnaires, interviews and surveys that together with record collection tools (from the Learning Management System we currently use) provide heterogeneous but integrated form of triangulating results. Statistical methods permit the final analyze of all data collected, which can give important contributions for subsequent courses.

Current work

We implemented this evaluation methodology in the Algorithms and Programming course (APRO). This discipline, with 4.5 credits – the highest possible, belongs to the first year of the Computer Science BSc. By completing this course, students are able to understand algorithmic concepts, analyze problems, develop and implement solutions.

This is considered a structural discipline. For this reason students must be successful before advancing to other programming courses. The school decided to allow failing students to repeat the course in the following semester, but with a different learning methodology: a mixed methodology with one weekly f2f practical session together with self-learning assignments and asynchronous online discussion. This methodology is also especially suited to a set of students, already employed, that have huge difficulties in combining their professional and social obligations and their school schedules.

In this study, our motivation was to test our evaluation methodology, verify its usability and determine if it could be used in other courses. We employed the five aspects selected in the first phase of the methodology:

1.**Contents quality** – In order to the APRO students use and interpret the available information, they had exercises to solve and sent by email until each Sunday every week; these exercises originated doubts that are answered by anyone. We used questionnaires to determine the quality of the contents (the contents were classified between 3 and 4 in a Likert scale from 1-very bad to 5-very good for all five contents' aspects argued) and also the number of mistakes detected (just two: one discovered by a student and the other detect by a teacher).

2.**Technological efficiency** – We evaluated the students' difficulties using the LMS that are supporting the APRO course and using other technological tools. Unfortunately, for some tools disposed to the students, 10% of them didn't use these tools, because they didn't know how to use them (for the more enthusiastic tools, no one said that).

3.**Communication effectiveness** – The number of email messages sent to teachers and messages sent to our discussion group by each student was used as a measure of this aspect.

4.**Students' satisfaction** –The number of APRO students that drop out the course compared with this rate from previous APRO courses will be used as a measure of their satisfaction. We also collected their opinions 2 times: in the middle of the course (68% of them were satisfied) and in the course closing (74% – we believe that the increase is because we carried out some of the suggestions given in the first inquiry).

5.**Students' success** – The learning outcomes of the students was measured in a similar way that was used in the past so we can compare the results at the end of this semester and can verify if there were great differences or not. Before the beginning of this semester we analyzed their previous examinations and completed an individual characterization of the students and we concluded that their main difficulties were the complex reasoning necessary to solve the problems proposed. All students that did the final examinations improved or kept (3 of them) their programming language (syntax and semantics abilities) and improved their previous grade from 1st semester.

We selected some context variables that could affect students' performance in a programming course: math background and previous programming experience (Wilson, 2001) and some others that we want to verify if they had any impact in the final results.

Data collecting (3rd phase evaluation) was done in a variety of forms: questionnaires, quizzes, interviews, surveys, pre and post tests, email registers and even in other more specifics way, some obtained thought the LMS (Learning Management System) that was used in the APRO course. This phase finished in the final of July, when the APRO students did their final examinations, so the data integration and the final data analyze (4th evaluation phase) is still being done. In the final database obtained, we have more than 50 variables.

Conclusions

Any evaluation has to identify problems, not only those that may become critical, but also discover the aspects that should just be improved in future courses. Only in this way it is possible to guarantee the continuous enhancement of the quality and efficiency of distributed learning courses.

In this paper, we discussed the importance of distributed learning evaluation and described an evaluation methodology that we think suitable for higher education courses. We present a study realized with 1st year Computer Science students, which permitted the improvement of our methodology, with later application in other initiatives.

Through an evaluation methodology, we intend that the evaluation can be done in a rigorous but fast way. The methodology being developed will be a guide to any course evaluation, with some adaptations, as the courses can differ in so many aspects. For example, eight hours seminary cannot be evaluated in the same way that a 120 hours course. Later, when this project is finished, we will study the automation of some of their evaluation phases.

References

Alexander, S. (2001). *E-learning developments and experiences*. Education + Training, vol. 43, number 4/5 (pp. 240-248);

Alves, R. (2001). *E-learning: Novos modelos de aprendizagem*. Cadernos Management do Semanário Económico nº 746 de 27/4/2001, vol. 1 – Recursos Humanos e Organizações, Portugal (pp. 59-62);

Clark, R. (1989). *Evaluating Distance Learning Technology*. Final Draft Prepared at the invitation of the United States Congress, Office of Technology Assessment, May 23;

Daniel, J. (1996). *Mega-Universities and Knowledge Media: Technology Strategies for Higher Education*. Great Britain (pp. 106);

Evans, R., Murray, S., Daily, M. and Hall, R. (2000). *Effectiveness of an Internet-Based Graduate Engineering Management Course*. Journal of Engineering Education, January 2000 (pp. 63-71);

Gilroy, P., Long, P., Rangercroft, M. and Tricker, T. (2001). *Evaluation and the invisible student*. Quality Assurance in Education, vol. 9, number 1 (pp. 14-21);

Hara, N. and Kling, R. (1991). *Students' Frustrations with a Web-Based Distance Education Course*. First Monday. Available at http://www.firstmonday.org/issues/issue4_12/hara/index.html;

Law, S. (1997). *Learning lessons: why choose distance learning in education management?* International Journal of Educational Management, volume 11, number 1 (pp. 14-25);

Mann, C. (1998). *Quality assurance in distance education: The surrey MA (TESOL) experience*. Distance Education, vol. 19, number 1 (pp. 7-22);

Moore, M. (1999). *Monitoring and Evaluation*. The American Journal of Distance Education, Editorial, vol. 13, number 2. Available at http://www.ed.psu.edu/acsde/ajde/ed132.asp;

Scriven, M. (1980). *The Evaluation of College Teaching*. Syracuse, N. Y.: National Dissemination Center, Syracuse University School of Education;

Scriven, M. (1999). *The Nature of Evaluation Part I: Relation to psychology*. Practical Assessment, Research & Evaluation, vol. 6, number 11. Available at http://ericae.net/pare/getvn.asp?v=6&n=11;

Silva, L. (1999). *Student Satisfaction: The Consumers' Side of Higher Distance Education*. Socio-economics of virtual universities: experiences form Open and Distance Higher education in Europe, Gerhard E. Ortner & Friedhelm Nickolmann (editors), Deutscher Studien Verlag-Weinheim (pp. 123-137);

Volery, T. and Lord, D. (2000). *Critical success factor in online education*. The International Journal of Educational Management, volume 14, number 5(pp. 216-223);

Williamson, C., Bernhard, J. and Chamberlin, K. (2000). *Perspectives on an Internet-Based Synchronous Distance Learning Experience*. Journal of Engineering Education, January 2000 (pp. 53-61);

Wilson, B. and Shrock, S. (2001). *Contributing to Success in a Introductory Computer Science Course: A Study of Twelve Factors*. ACM SIGCSE 2001, volume 2, number 1 (pp. 184-188).

Acknowledgements: The European Commission under the programme SOCRATES-MINERVA is supporting this work project GALECIA.

How Can University Professors and Elementary School Teachers Work Together in Virtual Teams?

Mary Kay Bacallao
St. Thomas University
Miami, Florida
mbacalla@stu.edu

Aldo Bacallao
Lloyd Estates Elementary
Oakland Park, Florida
Aldobacallao@attbi.com

Abstract

A three-year virtual teaming project that connected professors from several universities with in-service teachers from diverse schools has led to some interesting discoveries about the nature of on-line work groups. These teams focused on the process of virtual teaming and produced an outstanding collaborative product for future use.

I. Overview of the Team Formation and Objectives

Across the state or across the street, people from different institutions with different roles and responsibilities came together on-line with a common purpose. In the first year of the project, their goal was to find out what works and what does not work in classroom technology integration. Eight distinct teams with subject matter focus posted weekly messages on a discussion board about attempts to integrate technology into teaching and learning.

The second year of the project built upon the foundation of the first year of trial and error in attempts to integrate technology into classroom instruction and relate to team members with different job responsibilities and philosophies of education. The team members had either achieved an acceptable comfort level or dropped out of the project. Some teams remained intact from the start of the project while other teams experienced a high dropout rate. The objectives for the second year were product based rather than process based, unlike the first year. The professors and pre-service teachers on the teams cooperatively wrote technology enhanced lesson plans according to the ISTE and Sunshine State Standards and published them on-line. The elementary teachers on the teams supplied the topic to be addressed and field-tested the lesson plans. The interaction between the team members took place via e-mail, posted discussion boards and chats. In some cases, the professors and the pre-service teachers made visits to the elementary school classrooms.

In the third year of the project, the teams will be multidisciplinary. Professors and pre-service teachers will be paired up with elementary teachers. They will cooperatively write multidisciplinary technology enhanced units according to the ISTE Technology Standards and the Sunshine State Standards. Although most of the work will still be accomplished on-line, there will be times for the paired groups to meet in person in the elementary teachers' classrooms.

II. Lessons Learned from Distance Virtual Teams

An analysis of the teams that were successful and the teams with high dropout rates were used to determine the qualities of team leadership that make for successful on-line work groups. Other factors such as the quality of the work produced were also taken into consideration. With attention to both the relational aspects of on-line learning and a focus on quality control from the team leadership, the components of an on-line environment for productive and comfortable on-line work groups will be discussed.

III. The Result of Cooperative On-Line Group Work: A Valuable Resource for Future Use

The ninety-six resulting technology enhanced lesson plans that are available on-line, written according to the ISTE Technology Standards and the Sunshine State Standards and field tested for Math, Science, Reading/Language Arts, ESE, ESOL, Curriculum and General Methods will be shown as resources for session participant use.

Multi-disciplinary E-Learning for Future Educators

Mary Kay Bacallao
St. Thomas University
Miami, Florida
mbacalla@stu.edu

Aldo Bacallao
Lloyd Estates Elementary
Oakland Park, Florida
Aldobacallao@attbi.com

Carol Wilson
Sandpiper Elementary
Sunrise, Florida
Carolwilson2@yahoo.com

Abstract

Where can professors find technology enhanced lesson plans for their college methods classes? St. Thomas University and Florida Gulf Coast University partnered with several elementary schools to connect pre-service teachers and professors with elementary school teachers. Eight subject-area teams met on line and then worked collaboratively to write technology enhanced lesson plans. Written based on the Sunshine State Standards and the ISTE Standards, the plans were housed on a database provided by a partner in Bay County, Florida, BEACON. (http://www.beaconlc.org) The lessons were field tested by the teachers at the partner elementary schools. The lesson plans are complete with the necessary assessment rubrics, web links, and/or associated files so that any teacher can download them for personal use. If you want to find many great technology lesson plans in one place, you can go to http://coe.fgcu.edu/pt3.

I. Virtual Teams are Formed

How can college professors make sure that they are preparing tomorrow's teachers to use technology in the elementary school setting? St. Thomas University and Florida Gulf Coast University partnered with several elementary schools to connect pre-service teachers and professors with elementary school teachers. In the first year of the project, subject area teams met on line to talk about attempts to integrate technology into teaching and learning.

II. Technology Enhanced Lesson Plans are Written to Address State and National Standards

In the second year of the project, the subject area teams worked collaboratively to write technology enhanced lesson plans. Written based on the Sunshine State Standards and the ISTE Standards, the plans were housed on a database provided by a partner in Bay County, Florida, BEACON. (Http://www.beaconlc.org) Once approved by BEACON for curriculum content and alignment with state standards, the lessons were field tested by the teachers at the partner elementary schools. The teachers provided feedback based on the field test to the professors and pre-service teachers. The lessons were then updated and put back on the web. The lesson plans are complete with the necessary assessment rubrics, web links, and/or associated files so that any teacher can download them for personal use. If you want to find all of these lesson plans in one place, you can go to **http://coe.fgcu.edu/pt3**.

III. Technology Experts Provide the Expert Review

On Saturday, June 8, 2002, technology experts from Miami-Dade and Broward Counties in South Florida met at St. Thomas University to participate in an expert review of the technology lessons created by the eight subject area teams. Their objective was to select the lessons that exemplified appropriate technology integration. The reviewers included: Rick Cunningham, Social Studies from ETS, Broward County Public Schools; Jose Enriquez, Exceptional Student Education, Assistant Principal, Palm Springs Middle School; Patricia Fritz, Reading Language Arts, 5th Grade Teacher, Tropical Elementary School; Shatril Harris, Science, START, Intel® Teach To the Future and Succeed Project Coordinator, Miami Museum of Science; Tanya Martin, ESOL, Human Resource Development, NOVA, Broward County Schools; Rose Parsons, General Methods, Senior Technology Specialist, Broward County Schools; and Dr. Pei-ru Wang, Curriculum, Educational Technology Professor, Union Institute and University.

IV. Lesson Plans Selected

The team of expert reviewers selected the following lesson plans:

Reading/Language Arts

Integrating Language Arts, Health, and Visual Arts by Dr. Antonio Fernandez (STU) and pre-service teachers Vinnie Vinciguerra and Zoyla Nodarse
View it by going to: http://www.beaconlc.org/boa/display.asp?lessonid=6413

Language Arts Through Web Page Research by Dr. Antonio Fernandez (STU) and pre-service teachers Vinnie Vinciguerra and Zoyla Nodarse
view by going to: http://www.beaconlc.org/boa/display.asp?lessonid=8331

All About Me Vinnie Vingena Vinciguerra
View it by going to: http://www.beaconlc.org/boa/display.asp?lessonid=6654

Social Studies

America's First Pictures by Dr. Frank Sicius View by going to: http://www.beaconlc.org/boa/display.asp?lessonid=9513

Disasters--Where, When and Why by Irving Kohn and Christina Chuderski
View it at: http://www.beaconlc.org/boa/display.asp?lessonid=9425

American Spy With Money to Spend by Joyce Honeychurch and Angela Greene
View it at: http://www.beaconlc.org/boa/display.asp?lessonid=9492

Alaska the Elephant by Dr. Joyce Honeychurch and pre-service teacher Angela Lavigne
View the lesson by going to: http://www.beaconlc.org/boa/display.asp?lessonid=8473

Are U.S. Presidents Leaders or Figureheads? By Irving Kohn View the lesson by going to: http://www.beaconlc.org/boa/display.asp?lessonid=8284

General Methods

How Much Do You Really Weigh? By Margaret Bogan and Linda Weber
View it at: http://www.beaconlc.org/boa/display.asp?lessonid=9359

English as a Second Language

Community Quilt by Dr. Manuel Bustamante
view it at: http://www.beaconlc.org/boa/display.asp?lessonid=8492

Science

The Many Phases of the Moon by Dr. Elizabeth Elliott and pre-service teachers S. Zamorski and L. Dwyer
view by going to: http://www.beaconlc.org/boa/display.asp?lessonid=8411

Exceptional Student Education

Guess What It Is? by Vicki McWhorter and Brenda Lazarus
view it at: http://www.beaconlc.org/boa/display.asp?lessonid=8486

Let's Go Fact Fishing by Tamre Church and Marci Greene
view by going to: http://www.beaconlc.org/boa/display.asp?lessonid=8428

Ocean Vocabulary Word Scramble by Tamre Church and Marci Greene
view by going to: http://www.beaconlc.org/boa/display.asp?lessonid=8421

V. What's Next?

The teams will now be re-arranged. They will be multi-disciplinary teams. Their next task will be to write technology enhanced mini-units for publication on the BEACON website. We can look forward to the completion of their work in December of 2002.

Essential Strategies for Connecting with the E-learner

Kathleen Bacer, Ed.D
Advanced Studies, Educational Technology
Azusa Pacific University
United States
kbacer@apu.edu

Abstract: This paper addresses essential strategies to effectively connect with the e-learner. The online learner enters the virtual classroom with a unique set of needs, expectations, and skills. Gaining access to those needs and expectations allows the online educator an opportunity to capitalize on strategies that effectively connect and create a dynamic e-learning experience. Strategies for communicating and connecting with the e-learner along with the utilization of a variety of online tools are delineated.

Introduction

Critical to any teaching/learning process is the ability to effectively connect with the learner enabling them to transform the instructional delivery system into a personal educational experience. While this is essential for any learning community, the online community poses a new set of challenges as the dynamics of the human interface are changed and facilitated by methods of telecommunication rather than the physical presence/interactions of students and teachers. As e-learning continues to sweep across the business and educational marketplace, many of the complexities of connecting with the learner continue to challenge us. Without the visual clues from the e-learner, the online educator must acquire a new set of communication skills to connect and implement sound instructional practices while translating them into an effective online teaching environment. It is an exciting and daunting challenge. The purpose of this paper is to provide strategies to equip the educator for connecting to the learner in an online environment!

Understanding the Online Learner and the Role of the Instructor

The online learner enters the virtual classroom with the same basic learning needs as the face-to-face (f2f) learner. They are usually on a quest to acquire new knowledge and skills, to validate who they may already be by obtaining a degree, and/or to be connected to colleagues for camaraderie and collaboration as they embark on their learning journey. Expectations may be another story. There may be expectations that they will have a lot more free time and/or the journey will be much easier by choosing the online paradigm. Coupled with those expectations also may be many apprehensions and fears that they will have problems with the technology and not be able to function online without the physical presence of an instructor to help when problems and questions arise. On the forefront though, the online learner is unique in that they value learning in their own time and space as more important than attending a physical classroom bound by time and space. While the connection to their immediate world is a high priority, they do still seek a sense of support and connection to their online learning community. Thus, the effective utilization of strategies to virtually connect with this learner becomes essential.

The online learner also has to acquire a unique set of skills independent of the familiar traditional learning environment. E-learning not only requires a higher level of responsibility and independence on behalf of the learner, but also an ability to attain proficiency in the utilization of technology to facilitate the learning. Perseverance and problem solving take on new dimensions in the e-learners' world.

Instructing e-learning provides an incredible opportunity to create a dynamic teaching and learning environment, if done properly. The online instructor's role is that of developing, delivering and creating a learning partnership within a community of learners. There are now many tools available to assist not only in the creation of online learning environments, but also for communicating the curriculum and connecting with the e-learner.

Strategies for Connecting with the E-learner

Connecting with the e-learner is at the core of effective online teaching. It is an art that requires an educator to effectively utilize the tools within the e-learning environment to deliver not only curriculum content, but to nurture, sustain, and challenge the e-learner in collaboration with the other e-learners.

1. Select an effective delivery system (e-learning environment)

Every e-learning environment has a delivery system whether it is as simple as a series of newsgroups, or as dynamic as a multi-dimensional learning portal. Although the purpose of this paper is not to focus on the many types of delivery systems currently available, an essential strategy for consideration when analyzing your goals and objectives and student outcomes for the online learning environment is what features and tools the delivery system offers for

BEST COPY AVAILABLE

communication and collaboration. I currently utilize ecollege http://www.ecollege.com and TappedIn http://www.tappedin.org for the delivery of a Master of Art in Educational Technology program.

Things to consider when selecting a delivery system:

- Is it relatively easy to set up, edit, utilize?
- Whose server does the curriculum content reside on? Is it stable?
- What tech support services are available for the student and instructor?
- What collaborative tools are available for asynchronous and synchronous discussions?
- Is the interface transparent or is transparency easy to master? In other words, it is user-friendly and intuitive so that the interface doesn't hinder the learning? After one session, will students no longer think about the delivery system, but focus on the curriculum?

2. Utilize the delivery system's interface to effectively communicate/present the curriculum.

For e-learning, how you utilize the capabilities of the interface becomes your vehicle for communicating the content of the course. This involves first and foremost the use of instructional design elements in a manner that we as educators have never been asked to implement before. We so often depend on the "lecture" modality in higher education. A modality I have always scrutinized in relation to an effective teaching/learning strategy/environment. Moving instruction online actually forces us out of the lecture mode and into the interactive mode. A much more effective teaching pedagogy! Thus, I consider the instructional design of the curriculum within the interface the most critical element. It is where the learning actually revolves, where the e-learner formulates many first impressions, and often decides what kind of a learner they want to be in the environment. For a f2f classroom, a physical classroom/building and the physical interactions with colleagues and instructors may determine these learning factors. The interface that the course is encased in and the manner in which the content is delivered becomes the external environment of the virtual classroom. Ask yourself:

- What will you do to promote inquiry and learner-construction of the knowledge instead of reading pages of text driven online materials?
- How will you design an instructional environment that stimulates and encourages the learner to take the learning to the next level?
- How will you engage the learner without your physical presence?

In delivering online curriculum, tapping into and utilizing the wealth of resources available in the e-world are essential. I cringe when I see instructors scan pages of lecture notes, post what I call "scroll down marathons", videotape whole lectures, and post pages of text driven information. Resist the temptation to take your current teaching strategies in the f2f classroom and try to transfer them online unless they are dynamic and interactive!

Things to consider in designing and delivering the curriculum:

- Are you utilizing a variety of ways to present the information such as visually stimulating presentations with graphics, colors, bulleted lists, graphs, audio and video clips, interactive pdfs (portable document format), web resources, etc…?
- Does your content have built in student accountability? In other words, is there a communication system that allows the learner to interact and respond to the content thus demonstrating learning and continued construction of knowledge?
- Is the content in sizeable learning chunks? Since elearning is no longer bound by time and space, content needs to be "resized" so to speak to maximize flexibility and empowerment for the learner. Believe it or not, brevity utilized online actually reinforces attentiveness.

3. Invest in the Learner – Connect, Communicate, and Collaborate

This is obviously the heart and soul of any effective teaching pedagogy. The online environment is no different, and in many ways requires a much different time and instructional commitment on the part of the instructor. In the online environment, since visual cues are almost non-existent and gaining a sense of teacher/learner presence is more challenging, investing in the learner with effective ways of communicating and developing a sense of community become essential and foundational. E-learning does provide many unique opportunities to effectively connect, communicate, and invest in the e-learner. It is important to note that the online environment you create needs to include a high level of collaboration not only with you as an instructor but fellow colleagues otherwise you will have for example, twenty isolate e-learners. Although at times it may appear to be a 24/7 task, it is well worth the learning outcomes. Out of an effective virtual classroom, the learner may experience a depth that is sometimes not obtainable in a f2f environment. E-learners cannot "hide" behind other learners, e-learners have much more time to reflect on their "verbal" contributions, and e-learners have access to a non-threatening, virtually risk-free learning environment in which the hierarchal levels of instruction become an equal communication field. Within this arena are many different interactive communication/connection tools that can be successfully utilized. For clarification, communication tools can be categorized into two groups – synchronous and asynchronous. Tools that facilitate synchronous communications allow the participants to communicate at the same time within a common virtual space. Tools that facilitate asynchronous communications may share the same space (as in threaded discussions), but the e-learners are working and collaborating at different times. Note that space is virtual, not physical.

BEST COPY AVAILABLE

Outlined below are some of the most common and effective communication tools available to the e-learner and online educator along with utilization strategies.

Synchronous communication tools

- Telephone

Many forget this simple and effective communication tool in the online environment. I find it essential to connect with each of my students via phone in the beginning so we can "hear" each other's voices and establish a connection with a familiar modality. Since the online environment is sometimes initially invisible to the learner, a simple phone call is very helpful in getting them started. I also encourage the students to have phone numbers of several other colleagues for those times when all else fails.

- Virtual classrooms

Many delivery systems are now including a "chat" area where synchronous conversations and collaborative work can take place. This is a great way to virtually meet and work with students. Within them, many have white boards and capabilities of recording the conversations. Obviously time zones need to be taken into consideration for all synchronous class sessions. My personal favorite is Tappedin – http://www.Tappedin.org. This is a dynamic professional educational environment linked to a whole community of educators and teaching resources. Although there is a little bit of a learning curve to be able to function within the environment, there are powerful teaching tools within to enhance synchronous online instruction.

- Instant Messaging

Much like the telephone, instant messaging actually provides a unique mode of connection to the learner/s. I create "buddy lists" for each of my classes so that students, when online can have a sense of connection to not only the instructor, but to each other for support and collaboration. Suddenly the sense of aloneness and isolation that can easily occur in the online learning experience disappears! The nice feature with Instant Messaging is that you can choose when you want to be available/visible to others and when you don't want to be disturbed.

Asynchronous communication tools:

- Snail mail

While one may question if this even has a place in e-learning, I have found it a refreshing tool for the learner encased in an online environment. Sending a written note of encouragement or even a small "care" package at some point during the class is a powerful connection tool!

- Email

Usually everything in an online class revolves around this basic communication tool. It is what I refer to as the first layer of a class, commonly known as "push" technology. You don't have to go through layers to retrieve it. It's right there in your face, so to speak. The key to effectively utilizing email is an efficient organization, management and possibly a filtering structure if you deal with a high volume of email. It is well worth the time and effort to educate your students on the use of effective subject headers that include their name and assignment, and an email management system. A good delivery system has a communication center within that facilitates the ease of individual and group emails.

- Threaded discussions

Acting as the hub of classroom issues, learning and conversations, threaded discussions allow for adequate reflection and interactive discussions. Author editing and being able to view all conversations/threads at the same time should be a part of this interface. While this can be an important forum for teacher/student interaction, it also can be utilized to keep the learner on task, move the learning to the next dimension, and allow the learning community to construct knowledge in new and meaningful ways. The key is to teach students how to include parts of previous conversations so that the discussions are held together and the flow is maintained.

- E-Journals

Some delivery systems have a method within the interface in which students and the instructor can interact privately. Much like what can be done in email, e-journals provide an environment within the virtual classroom for one-on-one personal reflection and interaction with the instructor. They are private and I have found them to be an excellent tool in establishing an effective relationship while gaining valuable insight into individual learning and perspectives. A dynamic e-learning experience allows both instructor and student a new sense of shared space.

- Data collection resources (known as a webliography in ecollege)

This is a place where students and instructors can share online resources they feel are important to the learning objectives. Utilizing a space in the online environment for resource sharing allows for the next level of resource sharing and networking.

- Document sharing

This is all part of collaborating, reflecting and learning from each other's work. While this should be a dimension of online learning, an important factor to consider is how you would like your students to share their documents whether it be as word documents, portable document format (pdf), PowerPoint presentations, web sites, or all of the above. If your delivery system has a document sharing area, it greatly facilitates this form of communication versus having students send their work as attachments to emails. Student work becomes an expression for all to benefit from when appropriate.

- Online gradebooks

In the online environment, I find it most effective to provide feedback weekly. Initially some of the work may not be as visible and expectations are new, thus providing weekly feedback is an essential part of the communication process.

Other helpful strategies

- Timelines

One of the common challenges in the online environment for the e-learner is time management. Since there is a newfound flexibility, many times what I refer to as "out of sight, out of mind" syndrome takes over. I have found it most effective to divide the modules (sessions, weeks, workshops) into time frames in which the modules are "time released." While I have tried many different strategies, the most effective has been to open the sessions on Friday so students can use weekend time to get ahead, and then close on the next Friday (if working with a weekly timeframe). It is also very beneficial to set participation criteria in the online classroom so that there is adequate collaboration and construction of learning. For example, require students to post at least 4 different days within a week. Postings need to add significantly to the discussions for credit.

- Useful Software

While a good word processing software is essential for online work, Adobe Acrobat is also a powerful tool for sharing work as portable document files (pdf) preserving the fonts, graphics and look the author intended for their work. It is also beneficial to invest in utilities such as StuffIt Deluxe (for Mac) and WinZip (for PC).

- Class size

The ideal manageable online class size for both instructors and learners, I have found is actually twelve. Take into consideration the increased level of interaction, responses and collaboration that occur within the virtual classroom – much higher than a f2f classroom. To adequately service each learner and also provide him or her with a manageable environment, class size is a much-debated issue. There are many misconceptions that it is much less time consuming to teach online – simply not so if done effectively and dynamically.

While these are some of the most common communication and collaboration tools, there are others that may prove useful. It is important to focus on the effective utilization and implementation of any online tool to break down the barrier between the instructor and student, to create a dynamic learning community and to enrich and celebrate the accomplishment of connecting and empowering the learner. One of the unique benefits of connecting with the e-learner in an online environment is the equal playing field that emerges. By this I mean the hierarchy between instructor and student disappears online. Students whether synchronously or asynchronously have an equal voice and chance to participate, learn and grow. While it is sometimes a timely investment, your presence and being available is extremely important to the success of any online environment. Make that online presence positive, supportive, and creatively visible!

BEST COPY AVAILABLE

Evaluation of a Web-based Tutorial on the History of Technology in a University Science-Technology-Society Course

Patricia Ryaby Backer
Department of Aviation & Technology
San Jose State University
San Jose, CA USA
pabacker@email.sjsu.edu

Abstract: This paper will discuss the development and evaluation of this new unit on the history of technology. The web-based tutorial was evaluated both by content experts as well as through a student-driven assessment model. Although this web-based unit was developed by the course coordinator, four other faculty regularly taught this course and all faculty teaching this course use both the multimedia CDs as well as this web-based unit. It was critical to the success of this web-based unit that all faculty could feel secure in using this web-based unit in their classes.

Introduction

In university settings, the field of technology education has been expanded in the last ten years with courses that focus on the interactions of technology and society. These courses are presented in various ways; some focus on the ethics of technology while others take an artifact-based approach. In many cases, however, these courses expand the traditional field of technology studies to a greater student population through either General Education or as required courses in other disciplines. In broadest terms, these courses can be classified as science, technology, and society (STS) courses.

The Department of Aviation and Technology at San Jose State University (SJSU) has offered a STS course under the university's General Education (GE) curriculum since 1981. This course, *Technology and Civilization*, has been housed in three different General Education areas. It began as a course in the Social Sciences area and was categorized under Social Issues. In 1992, SJSU dramatically revamped their GE program. GE was divided into lower division GE, which a student could complete a local community college or at SJSU, and upper division GE, which had to be completed at SJSU. All the classes in the upper division GE had to be interdisciplinary and include an extensive writing requirement. *Technology and Civilization* was granted advanced GE status as a course in two Areas: Earth and the Environment and Cultural Pluralism.

SJSU revised the GE program again in 1998; this revision required that the university's Board of General Studies certify all courses. The focus was put on designing the courses to ensure that the students met the student learning objectives for the GE area. The general education program at San José State University (SJSU, 1998) is different from many in the United States. Instead of specifying a specific series of courses as part of the General Education (GE) of each student, SJSU has five Core GE areas (Skills, Science, Humanities & Arts, Social Sciences, and Human Understanding and Development). In addition, every SJSU student must take Advanced GE courses in four areas: Earth & Environment; Self, Society & Equality in the U.S.; Culture, Civilization & Global Understanding; and Written Communication. Any department may propose a course for any area of GE. Beginning in Fall 2000, *Technology & Civilization* (Tech 198) was approved in the Advanced GE Area V, Culture, Civilization & Global Understanding where it remains an approved course today. The department decided to move it from Earth & the Environment to Culture, Civilization & Global Understanding because the course no longer fit within the revised goals and student learning objectives of its original GE area.

The structure of this course

Tech 198, prior to its certification as an advanced GE course in 2000, already used a variety of multimedia to deliver the content. The approved Fall 2000 version of this course had seven units: **The Nature of Science and Technology, The History of Technology, Technology and Work, Technology and Gender Issues, Technology**

BEST COPY AVAILABLE

Transfer, **Quality of Life Issues**, and **Ethics**. Previously, Backer (1996, 2000) had developed two of these units as self-paced multimedia units that currently are being used by all instructors in this class. In order to meet the area goals and student learning objectives of SJSU's GE area V, the department decided to add a new unit on the history of technology.

This web-based unit on the history of technology was part of a reconceptualization of this course as a hybrid (self-paced multimedia/Web/in-class) delivery model. When completed, four of the units would be delivered through self-paced multimedia CDs (**The Nature of Science and Technology**, **Technology and Work**, **Technology and Gender Issues**, and **Technology Transfer**) one would be a web-based unit (**The History of Technology**), and two (**Quality of Life Issues** and **Ethics**) would be delivered in a traditional classroom mode. The department faculty had committed to retaining the two in-class units so as to provide more active learning and open-ended inquiry for the students. In addition, the faculty believed that the two in-class units would best be taught using a traditional, face-to-face classroom environment. The key issue for all the self-paced modules was their effectiveness in promoting student achievement of the course's learning objectives.

The introduction of a new unit on the history of technology enhanced the content of this course in many ways. First, this unit addressed the contributions made by people of different cultural groups. Second, this unit, since it was positioned between the existing Unit 1 (**The Nature of Science and Technology**) and Unit 2 (**Technology and Work**), provides a stronger historical context to this course and subsequent discussions of technology and society. The History of Technology web-based tutorial is divided into three major sections: Technology in the Middle Ages, Chinese Contributions to Technology, and Islam Spain and the History of Technology. This web tutorial is available at two different sites: http://www.engr.sjsu.edu/pabacker/history/ OR http://www.mastep.sjsu.edu/history_of_tech/.

In order to retain certification as an Advanced General Education course at SJSU, all sections on this course had to meet the learning objectives for Area V (Fig. 1). Therefore, the effectiveness of this unit in meeting the goals of GE at SJSU is critical in evaluating its content. In fact, since this course has to retain GE certification to continue in General Education, one could argue that the achievement of the GE learning goals for Area V are the most important measure of student success in this class. This shift in focus, from a content-driven to student-achievement model, led the development and assessment of this web-based unit.

1. Goals

Courses in Culture, Civilization, and Global Understanding should give students an appreciation for human expression in different cultures and an understanding of how that expression has developed over time in different cultures. These courses should also increase students' understanding of how other cultural traditions have influenced American culture and society, as well as how cultures in general both develop distinctive features and interact with other cultures.

2. Student Learning

Students shall be able to:

- compare systematically the ideas, values, images, cultural artifacts, economic structures, technological developments, or attitudes of people from different societies;
- identify the historical context of ideas and cultural practices and their dynamic relations to other historical contexts; and
- explain how a culture changes in response to internal and external pressures.

Figure 1. Area Goals and Learning Objectives for Area V of SJSU's General Education. Available: http://www.sjsu.edu/ugs/ge/geguidelines.html

The Study

There are two parts of the assessment of this unit. First, there is the content assessment. The content of this unit has been evaluated by faculty from various departments at SJSU including faculty in industrial technology, history, and engineering. A section on Muslim contributions to science and technology was added based on the feedback from content experts and a review by student focus groups. The second part of the assessment is centered on the efficacy of this unit as a learning modality for students.

The web-based unit on the history of technology was first used in Fall 2000 in all three sections of this course, which were taught by three different instructors. Since then, they have been used continually in all sections of the class each semester. This has allowed the faculty to complete a long-term assessment of the effectiveness of this module. As discussed previously, this course is structured to measure assessment by student achievement of the learning goals for Area V of SJSU's GE program. At the end of each semester, every instructor submits an assessment report to the course coordinator that describes how the student learning goals were measured and how many students met each learning goal. Each instructor may use various, and usually multiple, measures of student performance. Overall, in the thirteen sections offered between Fall 2000 and Winter 2002, eighty-four percent of the students (266 out of 316 students) demonstrated that they achieved Area V student learning objective 2. Although this web-based unit was focused on this specific student learning objective, the instructors of this class generally used multiple measures of student learning. Five individual sections were analyzed in detail to determine the effectiveness of this web-based unit alone in assisting the students to meet Area V learning objective 2.

This detailed analysis of the five sections (Tab. 1) showed that the history of technology web-based unit was very effective in helping student achieve Area V student learning goal 2. Most of the students in five sections of the class (71 %) demonstrated their achievement of understanding "the historical context of ideas and cultural practices and their dynamic relations to other historical contexts" by their responses to the class activities at the end of this web-based unit. Ideally, all the students should be able to demonstrate they met all the student learning goals; however, not all students are motivated to excel in all of their classes. Considering the number of different instructors teaching this course, the results confirm that this web-based unit is effective in helping students to demonstrate their understanding of this student learning objective.

Semester	**Total Number of Students in Each Section**	**Students meeting learning objective 2 using all measures**	**Students meeting learning objective 2 through Unit 2 class activity**
Fall 2000	23	22	22
Winter 2001	26	23	21
Spring 2001	31	27	20
Summer 2001	24	22	12
Winter 2002	26	20	17
Total	**130**	**114 (88 %)**	**92 (71 %)**

Table 1. A detailed analysis of the effectiveness of the web-based learning unit in assisting students to meet Area V learning objective 2, "identify the historical context of ideas and cultural practices and their dynamic relations to other historical contexts"

Conclusions

Over the last several years, the use of the Internet has burgeoned. The World Lecture Hall (2002) at the University of Texas indexes web-based courses—it lists hundreds of web-based courses that cover a wide spectrum of Internet use in the college classroom including eight that are in STS studies. It is common to find instructors creating a course web page that has links to their syllabus, lectures, and web links related to their course; these courses are classified by Schmidt (2002) as web-enhanced classrooms. Other courses are offered totally in an online environment and might include text, video, or audio lectures or seminar discussions through email and listservs (Bazillion & Braun 1998).

As the use of the Internet explodes, there has been little emphasis placed on the effectiveness of these web-based classes in facilitating student learning (Ehrmann 1997). A seminal study (Russell 1999) analyzed over three hundred articles that evaluated multimedia and web-based materials and found that overall there was little difference between technologically-enhanced courses and traditional lecture courses. Efficiency is also a concern with web-based delivery systems. Many studies (Harapnuik, Montgomerie, & Torgerson 1998; Morgan 2000; Hecht & Schoon 1998) have noted the extensive time involved in developing web materials. Now, in addition to being a content expert, the average faculty member must become a web designer. The question is: Why use web-based instruction in a course?

Web-based instruction in industrial technology programs, like any other area of expertise, should only be used when it can add value to a course. The self-paced multimedia and web-based modules developed for this course fulfill this expectation. The web-based history of technology unit provided links to digitized primary sources and integrated technological development with history. More importantly, it allowed the sharing of expertise among the faculty. The faculty teaching this course were able to utilize the expertise of the course coordinator who developed this web-based unit. Since this course is taught by many different faculty, it allowed them to individually focus on selected topics in more detail after the students had completed reading the web-based material. The links to primary sources also are critical to expanding the students' world views. Also, this unit requires students and instructors to expand their perceptions about technology. Including the two sections on non-Western contributions to technology have lead the students to an increased understanding of the complexities of both technological development and history itself. Each semester, several students comment as to how this unit really "opened their eyes" to either Chinese or Muslim contributions to technology.

Although some would argue that there is a lack of studies on the general effectiveness of university instruction, the existing teaching model has persevered for a long time. Now, when confronted with a new model of instruction—web-based learning—faculty need to re-evaluate the measures they use to evaluate the effectiveness of the learning experience. The student-centered model presented here focuses on student achievement rather than faculty expertise. Although used here to evaluate web-based instruction, class evaluation using student achievement of learning objectives can be applied to any teaching modality. For technology-based courses, what students learn should be more important than what instructors teach.

References

Backer, P. R. (1996) *General Education through Multimedia: A Course on Technology & Civilization*. Paper presented at *ED-MEDIA/ED-TELECOM 96*, 1996.

Backer, P.R. (2000). Effectiveness of a multimedia General Education course. *2000 ASEE Annual Conference & Exposition Proceedings*. Washington, DC: ASEE.

Bazillion, R. J., & Braun, C. (1998). German history on the web: An experiment in "studio-based" teaching. *Mid-South Instructional Technology Conference*. Available: http://www.mtsu.edu/~itconf/proceed98/rbazillion.html

Ehrmann, S. C. (1997). *Asking the right questions: What does research tell us about technology and higher learning?* Available: http://www.georgetown.edu/crossroads/guide/ehrmann.html [2002, July 5].

Harapnuik, D., Montgomerie, T. C., & Torgerson, C. (1998). *Costs of Developing and Delivering a Web-Based Instruction Course*. Paper presented at WebNet 98 World Conference of the WWW, Internet, and Intranet Proceedings (3rd, Orlando, FL, November 7-12, 1998). ERIC Document Reproduction Services Number ED427 703

Hecht, J. B. & Schoon, P. L. (1998). : *Bleeding on the Edge: Experiences from Teaching a Multimedia-Rich Course over the Internet*. Paper presented at Webnet 98 World Conference of the WWW, Internet, and Intranet (3rd, Orlando, FL, November 10, 1998). ERIC Document Reproduction Services Number ED430 543

Morgan, B. M. (2000). *Is Distance Learning Worth It? Helping To Determine the Costs of Online Courses*. ERIC Document Reproduction Services Number ED446 611

Russell, T. L. (1999). *The no significant difference phenomenon*. Montgomery, AL: IDECC.

SJSU (1998, Spring). *General education program guidelines*. Available: http://www.sjsu.edu/ugs/ge/geguidelines.html

Schmidt, K. (2002, February-April). The web-enhanced classroom. *The Journal of Industrial Technology*, 18(2). Available: http://www.nait.org/jit/Articles/schmidt011802.pdf [2002, July 8].

World Lecture Hall (2002). Available: http://wnt.cc.utexas.edu/~wlh/ [2002, July 5].

BEST COPY AVAILABLE

Blackboard and Beyond

Alan Bailin
Newman Library
Baruch College, CUNY
United States
alan_bailin@baruch.cuny.edu

Abstract: The aim of this paper is to develop a perspective on the use of computers for teaching and learning in higher education that can help us to devise strategies for research and development. In so doing, the paper examines current computer applications in order to gain a better sense of the ways in which computers have become a part of teaching and learning in higher education, and the ways in which these uses are limited. The focus is on the mainstay of instructional technology, course management systems, and Blackboard as a prime example of such software. The paper contends that now that course management systems have become the primary platform for the distribution of computer-based instruction in higher education, it is time to develop more fully the instruction these systems deliver.

Introduction

The aim of this paper is to develop a perspective on the use of computers for teaching and learning in higher education that can help us to devise strategies for research and development. In so doing, the paper examines current computer applications in order to gain a better sense of the ways in which computers have become a part of teaching and learning in higher education, and the ways in which these uses are limited. The focus is on the mainstay of instructional technology, course management systems, and Blackboard as a prime example of such software. The intent is to foreground not only what Blackboard and other such systems actually do, but also what they do not do, and thus to shed some light on areas that need to be addressed in the future.

Blackboard in Context

There are, of course, any number of ways of viewing instructional technology. For present purposes, functionality is of primary importance since we are concerned with the uses of technology. From this perspective, we can identify three distinct classes of software used in higher education: productivity and communications software, stand-alone instructional courseware, and course management systems. Let us look at each in turn.

Productivity and Communication Software

We rarely think of productivity and communication software as instructional in nature. And yet such software is, without doubt, the most frequently used in higher education for teaching and learning. Faculty create syllabi and other course documents with word processing software, while few students would even dream of writing their assignments without it. Spreadsheets are used by professors to enter grades and frequently by students as a software aid for calculating and organizing data. Email software has made it easier for students and faculty to communicate with each other and among themselves, as well as providing a new way of sending and receiving student assignments. The World Wide Web and the graphical browsing software we use to access it have allowed both students and faculty to gain access to volumes of material that would not otherwise be available.

How ubiquitous is the use of productivity and communications applications? As anyone in higher education in the United States knows, word-processed student written assignments are the rule, while the Web has become a primary means for students to obtain research information (OCLC White Paper, 2002,

p. 8). The use far outweighs computer applications that are more specifically focused on education. Consider the fact that according to the Campus Computing Project in 2001 only 35.2% of courses have a course Web page, and that the number of courses that use course management systems is under 30% for both four-year institutions and community colleges (The Campus Computing Project, 2001). When we think of the role of computers in education, it is important to keep in mind that the most frequently used applications in the teaching and learning process are not those specifically intended for education.

Stand-Alone Instructional Courseware

Stand-Alone courseware comes in many different varieties. For present purposes, we will briefly touch on four types: page turners, quizzes, games and simulations. Page turners, or tutorials as they are frequently called, allow students to access materials from a computer monitor. These page turners may be nothing more than one or more web pages (see, for example, FindTutorials.com). Quizzes and tests come in a variety of formats, just as they do in Blackboard, and there are a wide variety of feedback and scoring mechanisms (see, for example, Darling, 2002). Simulations allow students to see what happens, for example, to investments or to the well-being of a city, given alternative sets of facts, (see *alphaWorks*, 2001). In instructional games, targeted knowledge or skills are required for success; for example, a virtual tour of France in which the student can only get from one point to another by using the correct French terms.

Colleges and universities then have a variety of choices for creating stand-alone programs. Not only is stand-alone software offered in prepackaged forms; templates and authoring software are also available. The courseware creation software can range from generalist products such as Macromedia's Authorware to the programs that focus on creating specific kinds of software for a specific kind of domain. There is a wide range of software, and the issue is not so much finding software, but rather deciding on the particular strategy that is appropriate in a particular educational context.

Course Management Systems

Course management systems are a force to be reckoned with. Nearly three-fourths (73.2%) of the institutions participating in the *2001 Campus Computing Survey* have selected a single course management system for use in courses. This figure indicates a dramatic increase from 57.8% over the previous year (The Campus Computing Project, 2001). If nothing else, the numbers suggest increasing institutional resolve to encourage the use of course management systems in postsecondary education. For this reason, if no other, it is important to look carefully at what course management systems offer to assess their role in teaching and learning in higher education.

Two of the largest providers of course management systems are Blackboard and WebCT. Although they differ in a number of respects, their basic functionalities remain the same (Sabine, 2001), and discussion of functionality can be restricted to Blackboard in order to simplify discussion without any substantial loss of generality.

Blackboard may be considered to have three basic sets of functions: (1) features that allow the teacher to present content of one sort or another, (2) features that allow the teacher and students to communicate with each other, and (3) features that allow the teacher to assess in one manner or another. All three offer functionalities that exist elsewhere, a point that becomes quite evident from even a cursory examination. Let us look briefly at each in turn.

In Blackboard, there are three basic mechanisms for delivering content: (1) adding it directly to a page, (2) attaching files, and (3) adding links to other material. The first of these is rather straightforward. You simply type or paste in text, or using Blackboard procedures, you insert a graphic. Attaching content is really nothing more than the process we use when we attach email files. The file—be it a text or image file or some form of multimedia—is made available by uploading it to Blackboard. Links are created by specifying the address of the file; the student then simply clicks on the link to access the material.

Communications in Blackboard has four basic components: email, Discussion Board, the Drop Box and the Virtual Classroom. Unlike WebCT, Blackboard uses external email accounts, but in either case the basic functionality is the same. The Discussion Board is a posting board where students and faculty can post and respond to messages, while the Drop Box provides a way for faculty and students to send files back and forth to each other. The Virtual Classroom combines chat with a whiteboard through which slides can be presented to students.

Assessment in Blackboard comprises quizzes and surveys. Both use the same basic question forms: multiple choice, fill-in-the-blank, item ordering, true-and-false, item matching, multiple answer, and short answer/essay forms. The assessment component of Blackboard also offers a record-keeping facility, and the results from all assessments except short answer/essay types are marked automatically. Still, there is a difference between surveys and quizzes: answers to surveys are anonymous, while the results of quizzes are not. As well, teachers can use the record keeping facility as a kind of basic spreadsheet in which they can enter marks from other assessments that are not part of Blackboard.

The Role of Blackboard in Teaching and Learning

If we step back and examine Blackboard's capabilities, we are struck by one basic fact: all of Blackboard's basic functionalities are available elsewhere. Consider what it offers by way of delivering content: the ability to attach (upload) files, link to other addresses, or paste and type in content. Anyone with basic Web skills can do the same without Blackboard.

The communication functionalities are also available elsewhere, as we can see by looking at each Blackboard communication component in turn. Blackboard's takes advantage of external email accounts, but even if it followed WebCT and offered its own, the basic functionality would be the same. The Discussion Board takes essentially the same form as the Internet News Groups and the many discussion boards that are ubiquitous on the Web. The Virtual Classroom is basically a combination of chat and whiteboard functions—both of which are easily available elsewhere.

Just as the functionality of Blackboard's communications features mimic the functionalities of general communications software, so do the functionalities of the assessment component mimic the functionalities of basic testing software. The basic assessment quiz types can all be created even by a general authoring system such as Authorware. Moreover, there is a wide range of materials available as stand-alone packages, and templates and authoring systems offer far more strategies and options than does Blackboard.

What is it then that course management systems offer that cannot be found in either productivity and communications software or stand-alone courseware packages? What accounts for the fact that between just 2000 and 2001 the number of postsecondary institutions participating in the Campus Computing Survey selecting a single course management system has risen from 57.8% to 73.4% (The Campus Computing Project, 2001)?

The answer, at least in part, is quite simple: distribution. Course management systems offer a standardized means of delivering content, communications and assessment. The key point is not just that they allow a standardized way of distribution, but that they offer a way of controlling the distribution. Course management systems offer a way to deliver instruction to those who are supposed to receive it, and a means of keeping out those who are not. This gate keeping function is basic to the integrity and survival of postsecondary institutions, and neither communications packages nor stand-alone courseware offer institutions anything similar, while at the same time providing a diverse array of teaching and learning functionalities.

Beyond Blackboard

The large and increasing number of institutions selecting a single course management product would suggest that such systems are becoming the basic standard for offering computer-based instruction at the postsecondary level. Nevertheless, course management systems, for the most part, employ little of the computer's potential as an instructional tool.

It is true that publishing companies are beginning to supply course materials to accompany the texts they sell, and some of these materials can be offered easily through course management systems. Still, the potential for instruction delivered through these systems has barely been tapped

A modest step towards harnessing the potential might be to find ways to deliver through course management systems at least some of the wide array of stand-alone programs that offer at times more sophisticated learning technologies than the course management systems themselves offer. This, however, would be only a first step. Much more is possible.

Consider the fact that our ability to track online behaviors can allow us to identify areas of student interest to a degree that neither teachers nor librarians could ever hope to achieve without technology. This ability is already being used commercially by Amazon and other retailers. Educators could well use the same technology to push automatically links to articles and other types of educational content, based on a tracking of online articles a student has accessed from a course management system.

Consider also the potential of the computer to individualize instruction. One of the things that computers force us to do is to represent knowledge in terms of interrelated but logically discrete units. The knowledge that goes into making a simple arithmetic computation, for example, may be represented in terms of a series of discrete, logical steps. These representations can allow us to identify in a clear manner what students know or don't know—at least as it can be inferred from their performance on some task or set of tasks. In fact because of the logistic nature of computational representations, we can make precise identifications of areas in ways in which no human teacher could even under the most optimal of circumstances. This, in turn, can allow us to adjust instruction to fit what a student needs (see Wenger, 1987). The area is still relatively new, but research and development in the field (see *Intelligent tutoring systems*, 2000-2002) offers the very real possibility of using instructional technology to individualize the teaching process itself in ways that might not be otherwise possible.

These are only two ways in which course management systems could be harnessed to offer more individualized teaching and learning; many others are no doubt equally worthy of attention. The potential is there. Now that the course management system has taken hold as the basic distribution paradigm, we can begin to investigate more thoroughly such ideas, ideas that relate directly to the actual instruction we want the systems to deliver.

References

alphaWorks: City Simulator. (2001). Retrieved August 15, 2000, from the IBM Web site: http://www.alphaworks.ibm.com/tech/citysimulator

The Campus Computing Project. (2001, October). *eCommerce comes slowly to the campus.* Retrieved August 1, 2002, from The Campus Computing Project Web site: http://www.campuscomputing.net/pdf/2001-CCP.pdf

Darling, Charles. 2000. Interactive Quizzes. Accessed August 15, 2002, from the *Guide to Grammar & Writing* Web site: http://ccc.commnet.edu/grammar/quiz_list.htm

FindTutorials.com. (1999-2002). *FindTutorials.com—home page.* Retrieved August 15, 2002: http://www.findtutorials.com

French for the Real World. 1997. Torrance, CA: Kaplan and Knowledge Adventure. CD-ROM.

Intelligent tutoring systems. (2000-2002). Retrieved August 1, 2002, from the Web site of the American Association for Artificial Intelligence: http://www.aaai.org/AITopics/html/tutor.html

OCLC White Paper on the Information Habits of College Students. (2002). Retrieved August 1, 2002, from OCLC Research Web site: http://www2.oclc.org/oclc/pdf/printondemand/informationhabits.pdf

Siekmann, Sabinne. (2001). *WebCT/Blackboard.* Retrieved August 1, 2002, from the *CALICO Review* Web site: http://astro.temple.edu/~jburston/CALICO/review/webct-bb00.htm

Wenger, Etienne. (1987). *Artificial Intelligence and tutoring systems.* Los Altos, CA: Morgan Kaufmann Publishers.

Factors Contributing to the Success of a Successful Distance Education Program

William D. Barber
Department of Language, Reading & Exceptionalities
Appalachian State University
United States
barberwd@appstate.edu

M. Beth Bell
Department of Leadership & Educational Studies
Appalachian State University
United States
pandy@vol.com

Sherry Bell
Exceptional Children's Director
Mitchell County, NC Schools
United States
sbell@vol.com

Tonya Patterson
Department of Language, Reading &Exceptionalities
Appalachian State University
United States
tonya_asu1@hotmail.com

Kathy W. Taibo
Speech-Language Pathology
Iredell County, NC Schools
United States
kathyunc1@hotmail.com

Abstract: Appalachian State University, in conjunction with the North Carolina Consortium for Distance Education In Communication Sciences and Disorders, makes it possible for public school Speech-Language Pathologists to upgrade their credentials by obtaining a masters degree. Naturalistic inquiry was used to identify factors important to surviving and succeeding in ASU's distance education program. Specific procedures used in this investigation included (1) initial interview, (2) data analysis, and (3) subsequent interview (emergent design). Participating subjects unanimously and independently identified the following factors as the most important determinants of success in this program: (1) immediate and extended family support, (2) advisory assistance, (3) career motivation, (4) persistence, (5) camaraderie with other students, and (6) development of technology skills. Advisory assistance and student support mechanisms provided by the program structure are described.

Introduction

Appalachian State University (ASU) students pursuing a masters degree through the North Carolina Consortium for Distance Education in Communication Sciences and Disorders (CSD) have performed very well (Barber, 2002). They have been successful in distance coursework even when enrolled in two distance education courses while maintaining full time employment as public school Speech-Language Pathologists (SLP), despite low admissions formula scores. They have accomplished this feat while living and working in their pre-enrollment environment, so they have had to make dramatic changes in their personal time habits.

Most of the students participating in the Consortium masters program in CSD through ASU have been unable to attend classes during the traditional public school year, even at interactive sites. Therefore, most have viewed classes via videotapes. Other than a one time a year retreat, their communication with other students has been almost entirely via email or telephone. They also have very limited face-to-face interaction opportunities with course instructors. Almost all of the distance courses of the Consortium program rely heavily on technology, including web pages, threaded discussions, and chat rooms.

Consortium students take distance courses while working as public school SLPs during the school year, but they are usually on campus for summer coursework. ASU distance students take on-campus summer courses during eight-week sessions in each of at least two summers, and they complete a supervised clinical practicum each of those two on-campus summers. These summer experiences afford the opportunity for students to develop working friendships with each other that undoubtedly enhance their distance interactions during the traditional public school year.

BEST COPY AVAILABLE

Student Support Mechanisms

The Consortium provides support for the CSD distance education students through four mechanisms. Personnel who provide support include a Consortium Coordinator, and five Campus Coordinators. Support to facilitate communication and network building is provided by scheduling a pre-admission orientation and a yearly fall retreat for the students in this program.

A Consortium Coordinator answers telephone inquiries and maintains a list-serve and Consortium web page through which general information on course offerings, interactive sites, videotape distribution, course texts, course web pages, and related matters are disseminated to Consortium students. Students contact the Consortium Coordinator when they have questions about textbooks or course delivery mechanisms, when there are problems with videotape delivery or quality, when they have issues with instructors or campus coordinators, when they experience conflicts between their public school jobs and their distance education course workload, or when they have personal problems.

There is a Campus Coordinator at ASU and at each of the other Consortium universities; the Campus Coordinator serves as an academic advisor, technology information resource, distance-education student advocate, trouble-shooter and primary contact for the students enrolled through that campus. The Campus Coordinator is a faculty member with other duties, but with some reassigned time for serving in the campus coordinator capacity. Students contact the Campus Coordinator when they have scheduling or enrollment problems, financial aid issues, or technology issues, or when they need help navigating the bureaucracy of university administration. The Campus Coordinator is also frequently contacted about conflicts between student's public school jobs and their distance education course workload, or when students have personal problems, so these functions are shared with the Consortium Coordinator.

The Consortium conducts an orientation for all incoming students prior to their first summer of enrollment. This orientation lasts about six hours, and includes an introduction to the structure of the Consortium, delivery modes for distance education courses, library access, and technologies to be utilized in dstance coursework. The orientation provides the opportunity for review and discuss home computer needs and requirements, to insure that all incoming distance students are fully aware of their technology needs. Orientation also provides the first opportunity for distance education students to meet other new students enrolling through the same university, as well as students enrolling at other Consortium universities who will be their fellow students in their distance courses.

Early in each fall semester, the Consortium holds a Friday evening and all-day Saturday retreat to bring together students from all five Consortium universities. Attendance at these retreats has been close to 100% every year. The overnight stay is characterized by a lot of bonding of students who had previously known each other mostly via email, and who have much in common since all are, or recently were, working as public school SLPs. Instructors of current and future distance courses attend the retreat, so students get to talk with their instructors face to face. The retreat serves as a forum for airing concerns and problems, and provides valuable feedback to the instructors. There are also more general discussions about Consortium plans and the addressing of issues that arise when students try to balance their roles as students and public school SLPs with their roles as parents, wives or girlfriends. After the first student cohort graduated, Consortium graduates were invited to attend these retreats to share with current students the problems they had encountered as distance education students and solutions that worked for them. On more than one occasion, open forum statements by Consortium graduates, and sometimes by students nearing graduation, have turned into pep talks, or into testimonials praising this distance masters program.

Statement of Problem

Gordon (2000) identified three factors that he said were inevitably lost in on-line education. In addition to the obvious factor of "campus life", he listed "full communication" and "empathy and courage of commitment" as being lost. The students in this program do have the opportunity to stand up for what they believe during their on-campus summer experiences, in their off-campus clinical practica, during a full-time internship experience, and at retreats. Students viewing videotapes or attending interactive classes can pick up the instructor's non-verbal cues. Still, the reduction in opportunities to communicate with the instructor and other students might be expected to have an undesirable impact on the educational environment. Yet, ASU students have been very successful in this program and the program has retained or graduated sixteen of the eighteen students who enrolled in the ASU distance education program. In fact, only one of the those eighteen students did not continue graduate work in CSD; the other student who left the ASU distance program became ineligible when she chose to move back to her home state of New York, where she enrolled in an on-campus graduate program in CSD.

Both the low attrition rate, and the high scholastic performance, of the ASU distance students in this program are contrary to many experiences with distance education that have been reported in the literature (Gordon, 2000). We wanted to investigate how students in this program were able to succeed in distance education under these circumstances. In order to allow the course of this investigation to follow the perspectives of the successful students, we chose to conduct a naturalistic inquiry.

The Naturalistic Inquiry

Lincoln and Guba (1985) proposed an alternative paradigm to the "rationalistic" method of inquiry. In the "naturalistic" approach, the investigator chooses not to manipulate research outcomes, but to "hang loose" and "hang out", notepad in hand, with the subjects being investigated. Naturalistic researchers go to the particular setting under study because they are concerned with "context". Naturalistic inquiry focuses on "where, how, and under what circumstances." Four of the five subjects evaluated in this study were interviewed independently at their homes or workplaces.

Naturalistic inquiry begins with the researcher determining a focus for the inquiry. Then the paradigm is fitted to the focus. After determining the fit of the inquiry paradigm to the substantive theory selected to guide the inquiry, the researcher determines where and from whom the data will be collected. As the investigation progresses, data collection is constantly adjusted and molded to the initial results. Our investigation was initially shaped by a discussion with the one student who chose not to continue graduate studies in CSD. After an initial interview with one of the successful students, the format and interview design for three other students was developed. When those four students unanimously and independently identified six factors contributing to their success, and those factors were verified by follow-

BEST COPY AVAILABLE

up interviews with three of these students, the lead investigator reached the conclusion that interviews of other distance students were not necessary.

Though out the naturalistic inquiry process, data collection and analysis follows concepts and procedures used in qualitative analysis. The procedures described in Strauss and Corbin (1998) are particularly suited to naturalistic inquiry, so we employed those procedures in the analysis of our results. Qualitative research, as defined by Strauss and Corbin, is "a type of research that produces findings not arrived at by statistical procedures or other means of quantification." Qualitative data, collected from microanalysis, is coded and recoded in a series of steps designed to allow the researcher to detect themes, common threads, and discrepancies. Embedded in the qualitative approach is the step of theory building, which is revisited as the research direction evolves. If any step of the qualitative analysis process should be considered the final step, it would be "refining the theory."

In this study, the ideas that led to identification of six critical factors for success in distance education were tentatively defined during analysis of the contrasts between interview responses of the four successful students and information gathered from the student who did not continue pursuing CSD graduate work. Although initial interviews with the successful students were open for discussion of the entire range of their distance education program experiences, the lead investigator directed isolated segments of the discussion toward problem areas described by the student who did not pursue graduate work in CSD. The six critical factors described in this paper emerged from similarities in descriptions provided by the four successful students, and were verified during follow-up interviews with three of those four successful students.

Factors Critical to Success in Distance Education

This study identified six factors as critical to success in the Consortium distance education masters program. While these factors may have more or less importance in other distance programs, it is likely that most of these six factors are also critical to success in any distance education program in which students have both heavy academic loads and a full time job.

Immediate and Extended Family Support

During the three follow-up interviews, *immediate and extended family support* was identified as the most critical factor for success in this program. In open forums at retreats, students have repeated spoken of the adjustments they had to make in their family and social lives. Those statements support the selection of this factor as being critical to success in distance education. Anecdotes presented include "my husband has taken over the cooking, dishwashing and laundry," and "my friends have learned when they phone me that the first thing they should ask is what is the time limit for this conversation because they know that I will set a limit and stick to it." A common joke among Consortium students is that they are looking forward to getting reacquainted with their husbands after graduation.

One of the authors has tried to recruit several potential distance education students who have not enrolled in the program. More than one of these potential students identified the opposition of their husbands as at least one of the reasons they chose not to enroll. For some other potential distance students, the requirement to be on campus for two summers tipped the scales against enrollment. Certainly, husbands and children had to be accommodating when students chose to spend their entire summer breaks away from home as students, foregoing family and vacation time.

Advisory Assistance

These ASU distance students believed that they could not have made it through the program without a dedicated Campus Coordinator who would give immediate attention to their needs and concerns. They spoke of having faith that the Campus Coordinator would "find a way" when they ran up against university policies that created unnecessary roadblocks because they were written for traditional on-campus students. Certainly distance students face unique problems because they cannot move around campus from one office to another until they find a person who understands specific problems and how to deal with them. Even when problems are easily resolved when you know how to approach them and who to call, those procedures are not always clear to students. On-campus students often find the solution in conversations with other on-campus students. In fact, those conversations often provide on-campus students with a "heads up" about various requirements and deadlines. Distance students need an advocate who will watch out for their interests in that regard.

Being able to call on either the Campus Coordinator, or the Consortium Coordinator, may have given ASU distance students extra security, and may have contributed to their satisfaction with their advisory assistance. Advisors are sometimes out of town, in the hospital, or otherwise indisposed. Since the Campus Coordinator and the Consortium Coordinator of this distance education program have closely coordinated their student support efforts, each has usually been able to at least partially address student concerns when students were not able to reach the other person.

Career Motivation

Students report being "at the end of their ropes," but realizing that they love being public school SLPs and that they do not want to change careers. It is no surprise that having clear educational goals would contribute to a willingness to make sacrifices in one's personal life in order to achieve those goals. Being in a job, liking it, and not wanting to give it up must be a powerful motivator.

Persistence

Some students labeled this attribute as "stubbornness." At times, they did not know how they could continue, but they were not willing to quit. On the surface, this trait might seem equally appropriate for on-campus students, but distance students may need a special kind of persistence because they are isolated. In fact, that quality might be a much better predictor of success in distance education than any of the traditional admissions criteria.

Camaraderie with Other Students

All but two of the sixteen "successful" ASU students began the program with an on-campus summer experience. The bonding that occurred that summer was cited by all of the naturalistic inquiry subjects as vital to their success as distance students. Distance students often become cheerleaders and confidants for each other. At retreats, distance students have spoken of knowing they could call on someone at any time they needed to vent or cry, even at 2:00 a.m. Not being hesitant about calling another distance student may go a long way toward canceling a major negative in distance education, at least for some students. This camaraderie is likely a principal reason that Consortium students have been so positive about their retreat experiences.

Development of Technology Skills

Many of the distance students, especially the older students, were computer illiterate when they entered the Consortium distance education program. Their ability to overcome their lack of knowledge, and even phobia, of technology is undoubtedly a function of most of the other five factors they identified as critical for survival in distance education.

Discussion

Although at least half of the six factors identified as critical to success in distance education by this study were expected, and would probably seem obvious to most educators, at least two factors were somewhat surprising to the lead investigator. Camaraderie with other students is not a common feature of most distance education programs, and is probably often dismissed as an impractical goal by distance education instructors. The students interviewed in this study believe that it was an essential factor in their success, and the student authors recommend that instructors of distance education courses make every effort to facilitate its development.

Advisory support is probably too often taken for granted. Perhaps many instructors do not realize its significance for on-campus students, and assume that distance education students have equal opportunity to access such assistance. It is a factor that can have a major effect on retention and success, and one that is probably too often overlooked because "the resources are there on campus somewhere." There is also the temptation to label additional advisory support for distance students as "expensive," by ignoring the cost of that support for traditional students and the fact that such support is neither efficient nor effective for distance students.

The importance of family support is easily dismissed, since distance education program administrators and instructors are not in a good position to adjust this factor. However, prospective students can be counseled about the importance of this factor. Doing so may be one way to reduce attrition rates in distance education programs.

References

Barber, W.D., Cochenour, L., Barr, D.G., Suddreth, J., & Setzer, R. (2002). Using traditional predictors to make distance-education graduate program admissions decisions. *Journal of American Association of Behavioral and Social Sciences (Special Issue on Distance Education)*, 18-25.

Gordon, O.E. (2000). Pedagogical Issues in Internet Education. *Journal of American Association of Behavioral and Social Sciences* (3) 8-15.

Lincoln, Y.S. & Guba, E.G. (1985). *Naturalistic inquiry*. Thousand Oaks, CA: Sage Publications Inc.

Strauss, A. & Corbin, J. (1998). *Basics of qualitative research: techniques and procedures for developing grounded theory* (2^{nd} Ed.). Thousand Oaks, CA: Sage Publications Inc.

BEST COPY AVAILABLE

Evaluation of the Q-matrix Method of Fault Tolerant Knowledge Assessment

Tiffany M. Barnes (tmbarnes@unity.ncsu.edu) and

Donald L. Bitzer (bitzer-m@nova.novanet.com)
Department of Computer Science
North Carolina State University, USA

Abstract – Distance education, delivering high quality, individualized instruction in inexpensive, expandable, and accessible ways is a major challenge for today's universities. This paper presents the most recent work in the field of fault tolerant teaching (FTT). Fault tolerant teaching systems will augment computer-based learning materials with the tools to assess and correct student knowledge. FTT methods automatically create a concept model of an instructional topic, based solely on student responses to tutorial questions, using a statistical method related to data mining. This concept model can be used to assess student knowledge as he progresses through a tutorial, while tolerating the usual errors that occur during testing – such as a student guessing answers or mistyping a response. This paper presents the ongoing results of an experiment designed to test the validity and accuracy of FTT-based assessment methods.

1 Introduction

Universities are now challenged to deliver quality service to students of widely ranging abilities and backgrounds across all distances. To rise to this challenge, distance education must pair individuals with expert instruction that is interactive, adaptive, and accessible. Ideally, computer based educational systems can approximate the benefits of private tutoring at a much lower cost. To deliver this performance, researchers must develop a systematic approach to designing, implementing, and evaluating online educational systems.

One of the main challenges of creating online tutoring systems is knowledge assessment (Stauffer 96, Dietel et al. 91). In other words, a computer tutor must be able to diagnose and correct student misconceptions, and distinguish these from careless errors or guesses. Indeed, much of the research in diagnosing misconceptions acknowledges the importance if distinguishing 'slips' from true misconceptions (Birenbaum et al. 93, Brown & Burton 78, Tatsuoka 83). Once student knowledge is assessed, a tutor, human or computer, must then determine how to best lead a student to reach her educational goals. In many computer-based learning systems, this guidance is based on procedural models for student knowledge (e.g. Brown & Burton 78, VanLehn & Martni 98). However, procedural and other expert-derived models may often fail to diagnose student misconceptions (Brown & Burton 78, Stauffer 96). Because of this and the costly time associated with procedural student models, the Q-matrix method was developed to model actual student behavior and to use this model to diagnose and correct misconceptions (see Barnes et al 02, Birenbaum et al. 93, Hubal 92, Sellers 98).

The Q-matrix method described in (Barnes et al. 02) examines the inputs of many students to automatically extract relationships between questions and underlying concepts, and then uses those relationships in diagnosing and correcting student misconceptions. The Q-matrix method builds in fault tolerance and robustness, optimizes for student performance, and can be used to optimize teaching strategies for effectiveness. This combination of assessment with the ability to optimize teaching strategies will help make it possible to deliver individualized, high quality education at a distance – near or far.

This paper will briefly outline fault-tolerant teaching theory as described in (Barnes et al 02). We will then present our combinatorial experiment designed to test FTT methods in three computer-based tutorials in Discrete Mathematics. In particular, our experiment will examine statistically-derived concept models for each tutorial for validity, compare automated knowledge assessments with instructor assessments, and evaluate the ability of each model to direct remediation of knowledge.

2 The Q-matrix Method

The Q-matrix method uses a body of student responses to questions to create a model of the concepts underlying the tutorial questions. The resulting model is a matrix of concepts by questions, where the value for (c,q) represents the probability that concept c is needed to answer question q correctly. We model student knowledge using "concept states" – bit strings where a 0 means a concept is not understood and a 1 means that it is. For example, the concept state 01 means that a student understands concept 2 but not concept 1. Based on the Q-matrix, we compute an "ideal response vector" for each concept state. Ideally, a student in state 01 would answer all questions needing concept 2 correctly, but would miss questions related to concept 1 – so the ideal response vector for the concept state 01 and the Q-matrix in (Tab. 1) is 11000. While using the tutorial, each student is matched to the closest ideal response vector, and is assumed to understand the concepts associated with the state generating that vector.

	q_1	q_2	q_3	q_4	q_5
c_1	0	0	1	1	1
c_2	1	1	1	1	0

Table 1: Example binary Q-matrix

3 The Experiment

The research reported in this paper is an ongoing experiment to test FTT methods across multiple topics and difficulty levels. We have implemented FTT methods in three NovaNET lessons, testing them with 50 students each, and evaluating the extracted Q-matrices for each lesson. The three lessons include: an existing binary relations lesson, a propositional proof evaluator, and a new lesson in counting. These three tutorials involve problems at several levels of thinking. The proofs program involves synthesis of proofs, a very high level of thinking. The binary relations lesson tests memory and application of definitions, while the counting program spans a wider range of problem-solving skills.

We will compare Q-matrices extracted over multiple semesters for each tutorial, and compare each Q-matrix to Q-matrices developed by experts. We will also examine the extracted Q-matrices for interpretability, and compare their knowledge assessments with those made by instructors. Our goal is to determine what factors affect the extraction of Q-matrices, the effectiveness of their assessments, and their application in directing remediation for students. Along with these evaluations, we will also analyze student surveys, to determine student satisfaction with the tutorials.

The counting tutorial, including lessons in permutations and combinations with and without replacement, was completed and tested with students in Fall 2001. Its interface was built to include the functionality students desired in the binary relations program, including menus for direct access to topics, and keys to move forward and back in the program. Each problem was programmed to randomize numbers in the problems given, and to interpret answers automatically. More in-depth help was also developed for this program, increasing student satisfaction.

The propositional proofs program has offered us the greatest challenge in applying Q-matrix techniques. Since writing proofs is very open-ended, it is difficult to extract relationships between problems. We have designed a solution to this problem. Instead of simply marking whether a student has successfully completed a proof or not, we will also consider each student use of a particular axiom as a question. In this way, we can compare

BEST COPY AVAILABLE

work among students, and create a model that can extract the relationships among proof axioms. This will provide another good test of the Q-matrix method, since axioms can be readily compared to one another. We realize that this comparison of student answers falls short of a full analysis of student responses, and plan to apply several different analyses to student responses to find the best application of FTT methods.

4 Conclusions

The most important aspect of this research is student knowledge assessment. During the course of instruction, the tutorials developed for this research will collect data about student answers and estimate the appropriate knowledge state for each student, without knowing the subject area or specific questions. This estimate of student knowledge will be made based on statistical analysis of a body of student responses to the same questions. Once this analysis relates questions by their underlying concepts, student responses can be diagnosed for conceptual understanding. Using this diagnosis, the tutorial can then tailor the lesson to students' individual needs. In addition, group assessments can reveal which concepts are being taught more effectively, to direct further development of teaching materials.

There are two aspects to evaluating system knowledge assessment. The first aspect is to compare automatic knowledge assessments for each student to those made by the student's instructor. The second aspect is to evaluate the use of this knowledge assessment in directing learning. Knowledge assessments and remediation plans for each student response will be evaluated by instructors for validity. In future experiments, we plan to compare student performance and satisfaction using self-guided work with automated direction based on their knowledge assessment.

If FTT methods can successfully assess student knowledge, this method will provide a powerful tool for investigating teaching strategies: once a student's knowledge state is known, the effects of any teaching strategy on changes in student knowledge can be measured. This research will be the first that we know of to implement a fully automated, general diagnostic tool that can be used to compare different teaching strategies.

The concept structure used for knowledge assessment is also an important outcome of this research. For each tutorial, the extracted concept structure can be examined for interpretability – i.e., for whether the structure makes sense to a human expert. A hypothesis of this research is that this structure will be understandable and usable.

In addition to the analysis of FTT methods, this experiment will also yield knowledge about differences in performance and satisfaction of online education. Students taking the online lessons will be assessed and surveyed and compared with a control group of students enrolled in the same class but not taking the online lessons. It is hoped that students will find the tutorials more effective than self-study, and perhaps at least as effective as in-class lectures.

This research contributes to automating two very important aspects of computer-based education and fault tolerant teaching research: 1) comparing teaching strategies for effectiveness, and 2) determining and correcting student misconceptions. These two results can provide a very strong, scientific basis to the continued development of computer based education and fault tolerant teaching.

In conclusion, this research will provide an experimental analysis of the effectiveness of fault tolerant teaching methods across three topics and difficulty levels, with three groups of students. Regardless of the outcome, this analysis will provide valuable data about the problems of automatic knowledge assessment, and make a significant contribution to the fields of computer based education and fault tolerant teaching.

5 References

Barnes, T. & Bitzer, D. (2002). Fault Tolerant Teaching and Automated Knowledge Assessment. *Proceedings of the ACM Southeast Conference (ACMSE 2002)*, Raleigh NC, April 2002.

Birenbaum, M., Kelly, A., & Tatsuoka, K. (1993). Diagnosing knowledge states in algebra using the rule-space model. *Journal for Research in Mathematics Education*, 24(5), 442-459.

Brown, J.S. & Burton, R. (1978). Diagnostic models for procedural bugs in basic mathematical skills. *Cognitive Science*, 2, 155-191.

Dietel, R.J., Herman, J.L., and Knuth, R.A. (1991). *What does research say about assessment?* NCREL, Oak Brook. Online. [http://www.ncrel.org/sdrs/areas/stw_esys/4assess.htm]

Hubal, R. (1992). Retro-adaptive testing and evaluation system. Computer Science Masters Thesis, North Carolina State University.

Sellers, J. (1998). An empirical evaluation of a fault-tolerant approach to computer-assisted teaching of binary relations. Computer Science Masters Thesis, North Carolina State University.

Stauffer, K. (1996). *Applications of student modeling*. Athabasca University. Online. [http://ccism.pc.athabascau.ca/html/students/stupage/Project/sm_app.htm]

Tatsuoka, K. (1983). Rule space: An approach for dealing with misconceptions based on item response theory. *Journal of Educational Measurement*, 20(4), 345-354.

VanLehn, K., & Martin, J. (1998). Evaluation of an assessment system based on Bayesian student modeling. *International Journal of Artificial Intelligence and Education*, 8(2), 179-221.

Acknowledgements

This research was supported by a grant from the National Science Foundation. The data presented, the statements made, and the views expressed are solely the responsibility of the authors.

Facilitation Considerations and Tips for Online Educators and Trainers

Julie Batovsky, Instructional Designer, Syrtis Technology-enhanced Instructional Solutions, Syracuse University, USA,
JUBatovs@uc.syr.edu

Abstract: Online learning is prolific. Advanced technologies are incorporated into education and training as distance learning expands from corporate organizations to universities and new populations of distance learners. Course design must now account for the learner's preferred learning styles, characteristics, and needs while accommodating the learner with less technological resources. This shift to implement an asynchronous technological pedagogical model is necessary to enhance cognition. The shift toward student controlled learning requires extensive preparation by both facilitators and students, a shift it does not appear they are currently prepared for. Technology allows for the exploration of various learning options. A shift toward student controlled learning requires extensive preparation by professors and students. Technology-enhanced instruction can be used to enhance cognition when used in conjunction with principles of instructional design. Supported by powerful technologies, students can become responsible managers of their instruction, and instructors can become enabling facilitators and co-learners.

References

Demystifying Learning Management Systems (n.d.) Retrieved December 4, 2001, from http://socrates.berkeley.edu/~fmb/articles/demystifyinglms/

Flowers, Jim (2001 Fall). *Online Learning Needs In Technology Education.* [Electronic version]. Journal of Technology Education. Retrieved November 26, 2001 from http://scholar.lib.vt.edu/ejournals/JTE/v13n1/flowers.html

Greenaway, Roger (n.d.) *Enabling Facilitator or Intrusive Complicator?* Retrieved December 5, 2001, from http://reviewing.co.uk/research/resindex.htm#reflections

Johnston, Michelle A. and Cooley, Nancy (2001). *Toward More Effective Instructional Uses of Technology: The Shift to Virtual Learning*. The Technology Source. Retrieved on November 28, 2001 from http://ts.mivu.org/default.asp?show=article&id=869

Klemm, W. R. Ph.D. (n.d.). *Eight Ways to Get Students More Engaged in On-line Conferences*. The Higher Education Journal. 26 (1): pp. 62-64 Retrieved June 29, 2001 from http://www.cvm.tamu.edu/wklemm/Eight%20Ways/8waystoengage.htm

Klemm, W. R. and Snell, J. R. (1997) *Instructional Design Principles for Teaching in Computer Conferencing Environments*. Retrieved June 29, 2001 from http://www.cvm.tamu.edu/wklemm/instruct.html

Merriam-Webster's Collegiate Dictionary (n.d.) "Facilitate". Retrieved on December 2, 2001, from http://www.m-w.com

PITAC Report (2001). *Using Information Technology to Transfer the Way We Learn.* Arlington, VA, President's Information Technology Advisory Committee, Panel on Transforming Learning. Retrieved on December 2, 2001, from http://www.itrd.gov/pubs/pitac/pitac-tl-9feb01.pdf

Richey, Rita C., & Fields, Dennis C., & Foxon, Marguerite (2001). *Instructional Design Competencies: The Standards* (Third Edition). Syracuse: ERIC Clearinghouse on Information & Technology.

Soles, Carolyn ME.D. and Moller, Leslie Ph.D. (2001). *Myers Briggs Type Preferences in Distance Learning Education. International Journal of Educational Technology.* Retrieved July 26, 2001, from http://www.outreach.uiuc.edu/ijet/v2n2/soles/index.html

Sonwalkar, Nishikant (2001). *Changing the Interface of Education with Revolutionary Learning Technologies*. Syllabus pp. 10-13.

Streaming Media Spending to Hit $5 billion per year (n.d.) Retrieved November 30, 2001, from http://www2.cio.com/metrics/2001/metric253.html

U.S. Web Sites Integrating Training Education (2001). Retrieved November 27, 2001 from http://www.idc.com/ebusinesstrends/ebt20010927.stm

Introduction

It is estimated that by the end of 2001, about 38 percent of U.S. organizations will have integrated education and training with their web sites (U.S. Web Sites Integrating Training Education). It is likely that more advanced modes of technology such as streaming media, voice and pattern recognition, wireless devices, and virtual reality will start to be incorporated into education and training solutions in 2002. Spending on streaming media services for example is expected to surpass $5 billion per year by 2005 in corporate organizations (Streaming Media Spending). Distance learning is expanding from corporate organizations to universities and new populations of distance learners are emerging. Course design in distance courses should account for the learner's preferred learning styles, characteristics and needs while at the same time accommodate the learner with less technological resources available to them (Flowers). Also important in course design and implementation is recognition that a shift from a teacher-to-student model to a technology-enabled interface to fit individual learning styles and needs is occurring. This shift to implement an asynchronous technological pedagogical model is necessary to enhance cognition. The shift toward student controlled learning requires extensive preparation by both facilitators and students (Johnston & Cooley), a shift it does not appear they are currently prepared for.

Recommendations

In a report submitted to President George W. Bush by the President's Information Technology Advisory Committee (PITAC) in February 2001, the overarching recommendation of PITAC was to "Make the effective integration of information technology with education and training a national priority." The PITAC recommended that the following four specific actions occur at the Federal level:

1. Establish and coordinate a major research initiative for information technology in education and training.
2. Establish focused government-university-industry-foundation partnerships to aggressively pursue the information technology research program required to advance education and training technology in the United States.
3. Enable educators and related professionals to use information technology effectively.
4. Develop and promote standards for education and training.

With recommendations to research and better enable educators to use information technology, the PITAC report indicates that educators are not yet effectively integrating information technology with education and training. The focus of the research that follows deals specifically with number three, enable educators and related professionals to use information technology effectively. Discussion will for the most part be limited to the technology currently available to online facilitators. Please note that this discussion does not differentiate between education and training. While these settings differ, education and training are both forms of learning and the information technology is adaptable to both settings (PITAC, p. 3). By identifying considerations and providing tips for facilitators of distance education and training, I hope this discussion becomes a useful tool to those educators to begin to integrate currently available information technology more effectively.

Considerations

Instructional design is "systematic instructional planning including needs assessment, development, evaluation, implementation and maintenance of materials and programs" (Richey, p. 181). Many educators are being required to design and implement online courses without much (if any) lead-time. This short lead-time may eliminate the ability to conduct a needs assessment, or properly conduct a formative evaluation cycle prior to implementation of learning in this new environment. They are asked to develop web sites or use learning management systems (LMS) with little or no training on how to do so effectively. Research cautions educators not to make the mistake of recreating a classroom-teaching model within an online learning environment during course design (Sonwalkar, p.11). But how can educators possibly determine the needs of their new audience, learn technical issues, identify constraints, identify standards (or lack thereof) for each LMS, and modify the course's design to be student controlled given short ramp up times?

To answer this question let us turn to the role of the educator or trainer in the online learning environment. I would argue that their role is that of a facilitator. What then is a facilitator? Merriam-Webster's collegiate dictionary defines facilitate: "to make easier : help bring about". Given this definition the term facilitator seems appropriate for the online educator or trainer. With the shift to a student-centered learning model in distance education, the role of the educator or trainer is to facilitate learning – to make it easier for students to learn. This is accomplished by:
- Making it easy for students to communicate their experiences, thereby enhancing them.
- Encouraging and helping students to reflect upon their experiences.
- Assisting students to develop their own learning processes, making them better learners.

This approach keeps the focus on the student and focuses on "what learners experience and how learners learn from these experiences" (Greenaway).

Facilitation Tips

When creating online courses, facilitators should allow plenty of time prior to the start date for development. Since creating new subject matter while building an online course may overload an individual, an educator or trainer should consider converting an existing course rather than creatinga new one to start. For facilitators who are not familiar with web site development, LMS tool kits are designed to manage courses and course materials. Some of the features provided by LMS include helping facilitators to communicate with students, track student web site use, and administer online surveys and exams (Demystifying Learning Management Systems). Links to web sites may also be included if a combination of web site development and LMS features is desired.

Facilitators should attempt to exploit the full power of online learning by making the course content interesting. When possible, they should allow the students to create some of the topics so that they have a vested interest and so they can anchor new information to their previous life experiences. Even when students help create topics the facilitator should structure all activities and specify objectives clearly and in detail (Klemm, 1997). Students may be asked to conduct "debates" where each student is asked to take a position on and post supporting arguments for or against the topic as well as critique other arguments (Klemm, *n.d.*). The PITAC report agrees that assignments should be sequenced to help students comprehend and piece together information, establish a broader context, promote discussions, evaluate results, and be redirected as needed (PITAC, pg. 9).

To ensure students receive a high quality, online learning experience attention should be given to the depth of content, accommodations for significant interpersonal interaction, and the facilitation of a wide variety of learner needs and capabilities (Flowers). Facilitators should determine the learning preferences for the current group of learners and structure course activities appropriately to aid their learning. Soles suggests online distance learning activities appropriate for each Myers-Briggs learning preference in Table 1. Online Distance Learning Activity Suggestions for Myers-Briggs Preferences.

Myers-Briggs Preference	**Myers-Briggs Learner Traits**	**Online Distance Learning Activity**
Introverted and Sensing Learner (IS)	• Thoughtful realist. • Knowledge is important to them in establishing the truth. • Perform best when dealing with what is real and factual. • They can work in a careful unhurried method.	• Asynchronous • Problem-solving case studies • Critical analysis of real-world situations • Project that allows planning, practical application of concrete principles to real world situation • Requires and allows time for research and reflection • Learning contract
Extroverted and Sensing Learner (ES)	• Practical realist. • Knowledge is important to them for practical purposes. • Perform best when they are dealing with concrete factual information and the practical information of the information is obvious.	• Synchronous, video conferencing. • Real-life case studies • Problem-solving exercises that focus on facts and practical information. • Learning contract
Introverted intuitive Learner (IN)	• Thoughtful innovator. • Knowledge is important for its own sake. • Perform best when dealing with concepts, theories and to achieve a depth of understanding. • Like to work in a scholarly, introspective fashion.	• Asynchronous • Critical analysis of new ideas, possibilities • Research exercises • Reflection journals • Formulate hypothesis exercise
Extroverted intuitive Learner (EN)	• Action-oriented innovator. • They see knowledge as the basis for creating change. • They perform best in new situations and they see challenges as opportunities to make things happen.	• Synchronous, videoconferencing • Collaborative exercises • Brainstorming exercises • Problem-solving case studies • An unstructured, construct-as-you-go activity with a variety of options.

Table 1. Online Distance Learning Activity Suggestions for Myers-Briggs Preferences

Activities should be carefully selected to stimulate reflection, insight, integration, creative or critical thinking, or in-depth problem solving. To achieve this, try using team-learning techniques. Group interaction is enhanced through cooperative learning and an increased access to experts (PITAC, pg. 6). Working in teams, students are likely to form bonds with one another and become more likely to participate in other online conference activities.

Learning can be encouraged by assigning students to research information on assigned topics, piece it together, report the information and discuss it with the class (PITAC, pg. 8). In his paper "Eight Ways to Get Students More Engaged in Online Conferences", Klemm's first solution is to make participation a required portion of the course grade. He believes that this will engage the student and produce thoughtful responses because students will not want to post low quality postings for peer review. Several authors also suggest that the facilitator become actively involved in the conference. Students benefit from the knowledge, experience and insight offered by the facilitator. To further allow students to integrate, synthesize and apply information they find through research, facilitators should consider requiring a deliverable or term project that captures a main topic of the course.

Finally, remember that each group of learners is different and things will not always go as planned (this is no different than the *classroom environment). As a result it is required that the facilitator* be a good troubleshooter and problem solver. In the event the problems are technical, it is helpful to have technical support available and know how to use it.

Greenaway suggests three strategies to turn 'intrusive complicators' of online learning into enabling facilitators.
1. Ask learners what is helping and hindering their learning.
Conduct formative evaluation while working with learners. The insights and perspectives from the students on the learning process can help identify the learning strategies that are the most successful.
2. Demonstrate confidence in the process of learning from experience.
Being a facilitator also means empathizing with the students and actually becoming a learner. By becoming a better learner you will become a better facilitator.
3. Notice the realities and possibilities with the current group of learners.

Working with current experience matters more than what worked well in another time and place with other people. Our experience and knowledge of 'similar situations' or 'familiar types' is useful background but no more than this. We can draw from our past experiences, but they should not overshadow our present experiences. How we work should be a creative response to the current situation.

Conclusion

For better or worse, technology has already changed the educational environment in ways that educational leaders must recognize and address. Expectations regarding new technologies will rise as they continue to be implemented in more organizations. As the standards continue to emerge in the area of learning management systems and other education and training solutions, both students and facilitators must be educated so that they may better comprehend their new and emerging roles in this instructional environment. Pedagogical models will continue to evolve and be redefined to better design, develop and evaluate instructional materials delivered via these technologies. Educational leaders should continue to conduct research on learner styles, characteristics and needs so that instructional goals, activities, etc. may continue to be updated and improved.

Not all students and not all instructors, facilitators or faculty are comfortable with this shift to student-led inquiry or problem-based learning. Some still prefer more traditional models. Technology allows for the exploration of various learning options and ability to account for different learning preferences. A shift toward student controlled learning requires extensive preparation by both professors and students (Johnston & Cooley). Technology-enhanced instruction can be used to enhance cognition when used in conjunction with principles of instructional design. Supported by powerful technologies, students (especially those who have grown up with powerful technologies) can become responsible managers of their instruction, and instructors can become enabling facilitators and co-learners.

Online Course Design: An MBA Course Example

D'Arcy Becker
Department of Accounting and Finance
University of Wisconsin - Eau Claire
Eau Claire, WI 54702
USA
dbecker@uwec.edu

Abstract: Course design is the key to student learning, whether the course is taught in a traditional setting or online. Research espousing the benefits of online courses routinely refers to the ability to help students learn in a constructivist manner when using online resources. This paper presents a detailed analysis of an online MBA course, Introduction to Assurance Services, which was designed with much of the current research on constructivism and online courses in mind. The paper outlines the assignments and the rationales for using them; it also presents student reactions to the assignments.

Introduction

The recent trend of placing courses online is having a profound impact on higher education (Bennett 2001), although many questions concerning the value of online learning remain unresolved because of a limited amount of scientific inquiry into the effectiveness of online instruction (Spector 2001). Theoretically, quality need never be compromised when a course is delivered online; online courses should provide learning experiences that are at least as meaningful as courses using traditional teaching methods (Hobbs 2002). Online instruction may even be superior to traditional methods for some content and some students, helping reach students with diverse learning needs (Ross and Schultz 1999). Online MBA courses may offer advantages over traditional MBA courses that are often overlooked, including the unique possibility for greater appreciation of content, and the ability to instigate creative and critical thinking (McCallister and Matthews 2001). Course design may determine whether online students reap these learning benefits.

This paper describes an online MBA course, Introduction to Assurance Services, and provides data on the effectiveness of course learning components from the viewpoint of students in the course. Assurance is an independent professional service that improves the quality of information for decision makers. Experts provide oral or written testimony that the assertion of another party meets (or does not meet) specified criteria or standards. Examples include whether a company follows a stated process for handling customer returns, whether credit card information is kept securely, whether child labor is used to produce a product, and whether the percent of money a charity uses for charitable purposes is as high as claimed.

Major elements of the course were designed in accordance with constructivist learning theory. Constructivism is not a teaching theory but instead a theory on knowledge and learning. Its basic premise is that students can actively construct their knowledge, thus modifying their understanding, by assimilating new information with prior knowledge and promoting active and cooperative learning (Bennett 2001). Constructivism emphasizes the learner's role in constructing meaning as opposed to simple transmission from teacher to student (Wilson and Lowry 2000).

Student Characteristics

Nineteen students all had basic background in business courses but need not have had prior online courses or any specific course content prior to enrollment. The course ran for four weeks on the web-based system BlackBoard. All data reported below were obtained via two student surveys. Students who did not return surveys were contacted with email reminders, which resulted in a 100% return rate for each survey.

Average years since undergraduate degree was 7.5 years (median 5.5). All students except one were working full-time during the course. Students worked in middle and upper management at companies varying in size from five employees to multinationals. Every area of business was represented, resulting in students bringing a wide variety of backgrounds and experiences to the class. Some course elements were specifically designed to take advantage of this variety.

The average number of prior online courses was 2.94; sixteen students had at least one prior online course. Eleven students reported routinely taking a lap top computer along on business trips; eleven students reported routinely engaging in ecommerce transactions (such as buying online). All students reported using the Internet outside of class or work for at least three hours per week (average 6.6 hours/week). Students reported they had been using the Internet an average of 5.9 years; one student reported belonging to an Internet chat group. Fifteen students obtained course access via dial-up modem, three obtained access via cable modem and one obtained access via DSL phone service.

Overview of Course Design

Course information was taught in two units, each of which contained multiple lessons. The major goal of the first unit was to have students learn background information about assurance services. The major goal of the second unit was to have students investigate real-world applications, identify situations when assurance was needed and assess its quality in various contexts. This type of modular design for online courses has been advocated in the education literature; the function of the modules is to deliver course content and make available all necessary information to meet the learning goals, including the opportunity to put that information together in a meaningful way (Tilson, Strickland, DeMarco and Gibson 2001).

A key component of an ideal online course, the course calendar (Carr-Chellmand and Duchastel 2000), provided information about all assignments and deadlines. The outline listed the due date for every assignment along with its point value and referred students to the details about each assignment that were stored in a course materials folder in BlackBoard. This outline helped students see the workload over the entire course to enable them to adjust their schoolwork to fit their work schedules. Only one student (who had no prior online course experience) had a difficult time following the schedule; he mistakenly believed the course would run like a correspondence course, allowing him complete flexibility in meeting assignments.

Constructivism does not imply certain specific teaching methods (Wilson and Lowry 2000); this course used a variety of teaching techniques including lectures, web-based research, papers and discussions. The Internet affords the opportunity to use multiple representations of knowledge and a way to sequence that information in a way that makes pedagogical sense (Arnone 2002). This course centered around Internet use and followed the three core principles for effective use of the web in teaching as proposed by Wilson and Lowry (2000): access to rich information sources was provided, meaningful interaction with content was encouraged, and students were brought together to challenge, support and respond to each other.

Each lesson contained readings including an online instructor lecture and online business press articles; reading guide questions were provided to add structure. Each lesson also contained online research activities, some of which were completed individually and others in groups, as described below.

There were three small group (three students per group) discussions and one class-wide discussion. For small group discussions, the instructor assigned students to groups and different pairings were used for each discussion. Students were always paired so each group member was from a different school, so there was no possibility of in-person communication among students. Participation in all discussions was monitored to assure a minimum of free riders. For the first discussion, the instructor sent messages to all students regarding their participation in an effort to make discussion monitoring more visible. Shortly after the discussion period ended, all students received their discussion participation grades, which helped ensure students understood the expected level of participation.

Gaining an Understanding of Assurance Services

Students benefit from applying concepts in specific contexts; when concept and context are separated, knowledge is seen by learners as the final product of education rather than as a tool to help solve future problems (Herrington and Oliver 2000). Further, learners bring their own experiences to learning situations, and those experiences help set the context for new knowledge by helping learners construct new knowledge (Grabinger 1996). In unit one, students held a class-wide discussion in which they posted examples of assurance services being used by their employers (along with a description of their current position and employer). Each student responded to at least one example, engaging in a discussion of the apparent usefulness (or lack thereof) of the assurance example.

Interaction with a series of real events or examples has also been shown to help learners develop a deep level of competency (van Merrienboer 2001). Therefore, the next lesson required an investigation of common applications of assurance in e-commerce. The goals of these investigations were to illustrate the necessary components of assurance services and to enable students to understand how and why companies provide assurance information. Students wrote papers about the use (or the potential use) of e-commerce by their employers and the need for accompanying assurance information.

To develop further understanding of the connections between the goals of assurance and the kinds of assurance disclosures organizations make, the issue of social audits was highlighted. Students read background information about social audits and then examined two companies' disclosures: The Body Shop Inc. and Citizen's Bank of Canada. The companies' disclosures were evaluated for thoroughness and quality; students wrote papers addressing the inferences they had drawn about the companies' reasons for making the disclosures. Students also examined social audit disclosures made by The Gallup Poll and held small group online debates about whether these kinds of disclosures meet the requirements of assurance services (they generally do not).

Students found the initial discussions very helpful in making assurance services seem relevant and in helping them identify a wide range of types of services. Fifteen of 19 students reported this discussion as very interesting; all felt it led to either a modest or large increased in their knowledge of assurance services. Students reported this critical review of information increased their knowledge of assurance and helped them better understand the use of assurance services across a broad set of business applications.

Application of Knowledge to the Real World

The second unit of the course allowed students to enrich and deepen their basic understanding by focusing on socially responsible investment mutual funds' disclosures of investment criteria and related information. These funds attract investors by promising to make investments in companies that meet a defined set of social responsibility criteria, which provides an ideal setting for assurance. Students each investigated a fund that claimed to follow a social responsibility philosophy; no two students investigated the same fund. The only restriction on fund choice was it had to be listed in either www.socialinvest.org or in www.socialfunds.com. This was the first time students found their own examples and investigated them; in all prior course assignments, students were directed to specific examples of assurance.

The funds provided an authentic context for studying assurance. Adults learn best when knowledge is presented in a real-life context (Huang 2002) and involves experiential learning (Harper, Squires and McDougall 2000). This assignment also allowed students the freedom to explore Internet information on these funds, thereby permitting students to construct individual learning experiences (McCallister and Matthews 2001).

Students wrote individual papers addressing the investment criteria, purposes assurance services might serve and the quality of the assurance information provided by their funds. Next, students held small group online debates about which fund had the best example of social responsibility criteria and accompanying assurance that the investment criteria were being followed. To participate in this debate, each student posted a summary of their individual findings and nominated it for consideration (or no consideration) as "best". Each group formed consensus about one fund and submitted a group paper explaining the group's conclusions.

Students found these investigations helpful in enhancing their understanding of assurance services. When asked whether there was another decision setting they would rather have investigated, 18 of 19 students replied no. Students also reported the project as interesting and informative because it addressed a current business controversy, was something they can relate to in their business, and helped them see the wide range of information available and evaluate that information more rigorously.

Rating the Assignments

When asked to rank the seven major course assignments according to the amount learned, all students rated the employer examples class-wide discussion either as one or two. This is not surprising given that it was early in the course when many students still have relatively vague knowledge of assurance, and the fact that this assignment allowed students to see concrete, interesting examples from actual businesses. The next most popular assignment was the socially responsible investment fund paper.

Interestingly, the third most popular assignment was the guide questions provided for each reading assignment. Gupta (2002) states that just posting lecture notes, assignments and the solutions does not help the student in E-learning. While these assignments would not fare well if they were the sole learning opportunities, such learning elements may play an important role in an online course. In this course, many students found this traditional course element helpful in focusing on the important aspects of the material. Online courses should not eliminate any one type of assignment but instead should consider how best to incorporate many types.

Conclusions

This course allowed students to capitalize on advances in information processing and the Internet. There was a high level of interactivity between the instructor and students as well as between students as is suggested in the literature (e.g. Sampson, Karagiannidis and Kinshuk 2002). Students' individual backgrounds were used to enhance learning, as was the wide variety of information available online. Most assignments used Internet information and would not have been possible without its use. Students reported learning a lot from the assignments and did not seem to feel negative effects from the lack of face- -to-face contact time. Online courses, designed and executed well, can provide a high quality learning experience.

References

Arnone, M. (2002) Online Education Must Capitalize on Students= Unique Approaches to Learning, Scholar Says. Chronicle of Higher Education. March 4, 2002.

Bennett, G. (2001). Student Learning in the Online Environment: No Significant Difference? Quest. 53(1): 1,13.

Grabinger, R.S. (1996). Rich Environments for Active Learning. In D.H. Jonassen (Ed.), Handbook of Research for Educational Communications and Technology. New York: Macmillan: 665-692.

Gupta, A. (2002). Content Development for eLearning in Engineering Education. Interactive Educational Multimedia. 4(April): 12-23.

Harper, B., Squires, D. and McDougall, A. (2000). Constructivist Simulations: A New Design Paradigm. Journal of Educational Multimedia and Hypermedia. 9(2): 115-130.

Herrington, J. And Oliver, R. (2000). An Instructional Design Framework for Authentic Learning Environments. Educational Technology Research and Development. 48(3), 23-48.

Hobbs, D.J. (2002). A Constructivist Approach to Web Course Design: A Review of the Literature. International Journal on E-Learning. 1(2): 60-65.

Huang, H. (2002). Toward Constructivism for Adult Learners in Online Learning. British Journal of Educational Technology. 33(1): 27-37.

McCallister, L. and Matthews, L. (2001). Electronic MBAs: The Future is Here. S.A.M. Advanced Management Journal. 66(1): 41-47.

Ross, J.L. and Schultz, R.A. (1999). Using the World Wide Web to Accommodate Diverse Learning Styles. CollegeTeaching, 47(4): 123-138.

Sampson, D., Kinshuk, and Karagiannidis, C. (2002). Personalised Learning: Educational, Technological and Standardisation Perspective. Interactive Educational Multimedia, 4 (April): 24-39.

Spector, J.M. (2001). An Overview of Progress and Problems in Educational Technology. Interactive Educational Multimedia. 3 (October): 27-37.

Tilson, E.R., Strickland, G., DeMarco, M. and Gibson, D. (2001). Online Teaching: Design Techniques. Radiologic Technology, 72(5): 488-491.

van Merrienboer, J.J.G. (2001) ID for Competency-Based Learning: New Directions for Design, Delivery and Diagnosis. Interactive Educational Multimedia.3, 12-26.

Wilson, B. and Lowry, M. (2000). Constructivist Learning on the Web. In Liz Burge (ed.) Learning Technologies: Reflective and Strategic Thinking. San Francisco: Jossey-Bass. Available at http://ceo.cudenver.edu/~brent_wilson/WebLearning.html.

Digital Literacy and Reflective Competencies

Claire Bélisle
LIRE-CNRS-Université Lumière Lyon 2,
France
claire.belisle@ish-lyon.cnrs.fr

Abstract: The competencies teachers need to integrate information and communication technologies in their practice are just beginning to be identified. This paper argues that the most productive way to integrate the emerging digital culture in the fields of education and training is to have teachers become "reflective practitioners" as they acquire a mastery of the technological basis of this culture. The traditional teaching competencies, applying problem solving strategies to well defined problems, need to be augmented today with competencies that can deal not only with 'indeterminate zones of practice' but also reframe goals and problems as educational paradigms and landmarks are questioned.

*E*learning has raised many hopes as an entry point into a digital XXIst century. In the European context, *e*learning corresponds to four types of objectives; there are first equipment objectives, aimed at providing teachers, trainers and learners access to online multimedia resources in every learning and training institution; secondly, digital literacy must become an integral part of teacher training, whilst learners develop a critical approach to learning with ICT (Information and Communication Technology); a third objective is the development of a multimedia content industry and of services; and, finally, accelerating a complete networking between teaching and learning institutions. This paper examines the second type of objectives, bringing digital literacy into learning environments and ultimately to learners. The background material is a report on user studies of ICT integration in education and training (PNER, 2002). It will be argued that, because the new competencies of digital literacy are just beginning to be identified, the most productive way to integrate the emerging digital culture in the fields of education and training is to have teachers become "reflective practitioners" as they acquire a mastery of the technological basis of this culture. This however is not the dominant approach. ICT integration is usually presented as lying within the conventional boundaries of professional competence of teachers, provided acquisition of complementary technical skills.

Integrating Technology

The methods used to implement technology have been very much dependent on the conception of learning dominating the field at the time of the technological implementation. Computers were initially integrated into teaching and learning in the seventies in a behaviourist approach. This paradigm, based on an objectivist epistemology, sees knowledge as externally mediated information which a teacher transmits to a learner. Learning is therefore acquiring existing knowledge. Information and knowledge are interchangeable and are externally referenced. Therefore the drill and practise applications were by far dominant as were the modular design of educational contents geared to acquisition of objective knowledge.

Reference to a constructivist epistemology has now become dominant in the integration of technology in education (Becker & Riel, 2000). In this approach, technological tools are interesting inasmuch as they become cognitive tools, that is tools that amplify thinking processes and help learners to develop their own knowledge, based on the constructs and processes provided by their environment. Integrating multimedia in learning activities is intended to extend cognitive functioning during learning, to facilitate cognitive processing, to support, guide and extend the thinking processes of their users. However this approach produces qualitative results and leaves managers, producers and decision makers, working within the technical rationality approach, lacking clear cut guidelines, rules, norms and specifications for design and implementation in schools.

These approaches have both brought to the fore broader questions and challenges about information, knowledge and schools. Web use and hypermedia are associated with portals, maps, visualisation, or guides and tours. Navigation is integrated as an alternative to classical information retrieval through query and answer process. Apart from the way navigation is used to find information, one very important aspect is the way navigating in information resources is bringing about a different way of reading, of interpreting texts and images and of constructing meaning. Research on hyper-thinking or thinking processes involved in the use of hypermedia or information resources structured by hyperlinks, has shown that new cognitive patterns are beginning to emerge in user conduct (Nunberg, 1996).

Multimedia gives access to metaphorical thinking. Analogy is a basic process in thinking and especially in learning. It is used to describe objects or to explain how a mechanism functions in reference to another object already known. With the development of 3D graphics, of haptic or tactile experiences of virtual reality systems, a new relationship to information is gradually emerging, based on sensory experience, visual deployment and *multi-referentiality*. Multiple knowledge sources, that began with television and CD-Roms and are now implemented by advance communication technologies, are more and more integrated in uses and practices. Should they also be integrated in teaching and learning practices? Can knowledge be constructed using multiple modalities?

Fostering A Digital Literacy Culture

Many learners, teachers and trainers are now computer literate: they can generally use without needing outside help word processors, spreadsheets, graphic applications, electronic mail, CD-ROMs, and hyperlinks. This integration of IC technology by teachers in their daily practices at work and at home has meant not only familiarity with technological tools as such but also becoming aware of what these tools enhance, of what they change and of what they empower.

Literacy for the digital era requires new core competencies that have been described under the term of "digital literacy" as "the ability to understand and use information in multiple formats from a wide-range of sources when it is presented via computers"(Gilster, 1997). Literacy can be understood as encompassing "a complex set of abilities to understand and use the dominant symbol systems of a culture", multimedia literacy skills as a combination of computer literacy (understanding of hardware and software) and media literacy (ability to access, analyse, create and evaluate information through a variety of media). More specifically, these competencies have been analysed as new analytical/critical thinking skills and production skills. Identifying them is part of the solution, but the most difficult part is bringing them about, having them emerge in the educational situations.

Integrating ICT in education and training brings about important changes concerning the way educational problems are identified, addressed and dealt with. Mediating contents and interaction by technology obliges to a very exacting and precise organisation of learning situations and learning contents. Multimedia makes a difference when it is integrated as an interactive dimension in learning, when its multimodal dimension activating multisensory experience is elicited, and when its hyperlinking functionalities are exploited to bring about rich semantic experiences. Teachers and trainers have found that these technological tools have led them to important changes in their activities and their daily routines, that they have had to re-elaborate their conduct by letting the technology take over certain tasks and by developing new ones. Accounts of these changes in user studies testify of the complexity of the issues involved.

As many teachers found out, integrating technology entails constraints and requirements. It has meant moving from products to processes and from developing curricula to implementing learning environments. It involves domesticating technology to enhance human learning experiences. It brings about a new approach to educational resources with their formatting for wide range use. It requires addressing ICT literacy and leads to re-negotiating educational aims, methods and evaluation procedures. The technological tools need to be enhancing processes involved in the learning/teaching/training activities. Learning happens in a learning environment when motivated learners decide to interact with learning materials. The specific characteristics of the teaching and learning situations have to be taken into account.

Competencies For New Information Challenges

One of the most interesting characteristics of the multimedia technology is the possibility of accessing vast resources of information and alternatively of making available at apparently little cost vast resources that were dormant in drawers, schools or libraries. But the advantage of the networked information technology is also its drawback. The huge amount of information available diminishes the chances of finding the pertinent or specific information that one is looking for. Even though education and training communities usually have access to these large knowledge resources, most teachers work with paper information whether in itself or through bibliographical descriptions. Handling large amounts of digital information is still a relatively new situation. Unsurprisingly, interaction with information has now come to the forefront as an urgent and complex problem for the information society and more specifically for education.

But most importantly, the integration of ICT brings about new 'indeterminate zones of practice', 'situations where there are no right answers or standard procedures', with 'decisions that have to be made under conditions of uncertainty'. This can be seen in the evolving interaction with texts, information, and knowledge. For example, the printed book has brought about a representation of knowledge as established, universal and stable. The web offers knowledge that is under discussion, coming from varied sources and constantly being updated. How can these two representations refer to common grounds? Another example is the problem faced by teachers when students reproduce information texts without referring to their sources: with whom will they discuss this important issue of imitation and whether or not it is legitimate learning to 'borrow" literary content without acknowledging it.

The formatting and labelling of information for machine retrieval is no small decision. Who will be making it? It also means that teachers need to become familiar with research results, such as those of the Dublin Core work group on metadata, and to combine them with a reflection on their practice in order to be competent to interact with an emerging educational semantic web, that is with machines capable of analysing the educational data on the Web: the content, links and transactions between people and computers. Having to describe educational contents, or producing meta-information on learning and teaching contents, is not a new task in itself, but making it a competence of every learner, teacher or trainer is a new challenge which can bring about a deeper understanding and mastery of knowledge.

In such a context, automating information research and retrieval appears strategically as having high priority. Structuring information in a database and providing the necessary descriptors for formatting the information in a manner decipherable by machines implies using tools teachers are not familiar with. Research on metadata or machine readable description information about an information source is one of the solutions being researched. The use of a machine readable syntax included in the information resource is what the Semantic Web approach is trying to implement. As Tim Berners-Lee wrote, " *The first step is putting data on the Web in a form that machines can naturally understand, or converting it to that form. This creates what I call a Semantic Web, a web of data that can be processed directly or indirectly by machines.*"

IC technology in a learning environment is not only a means of transmitting and storing information, but also, if not mainly, a means of facilitating interaction with information, that is generative processing, relating new information to prior knowledge, activating appropriate schemata, interpreting new information and inferring new knowledge. This is a very indeterminate zone of practice at the present time and needs to be explored by practitioners engaged in everyday teaching activity. Informed decisions need to be based on a reflective practice of using such resources in actual teaching and learning situations. Will the classroom situation and the face to face interaction become more and more blended with online distant learning? What will be the contours of the teaching-learning activity, as information resources grow and their access becomes more and more user friendly?

Schön's ideas, as voiced in his seminal work "The Reflective Practitioner" (1983), have been largely integrated by the educational community. Reflective practice has shown its benefits for teaching and for teacher training and ongoing training programmes have integrated reflective thinking geared to action. (Beedle, 2002) Yet, even the "enriched reflection", based on personal professional practice and helpful examples, of Penny Ur (2000) remains within the 'planning to evaluation' cycle. It falls short of taking into account the questioning of the very aims of teaching today and of the consequences for learning. The kind of competencies needed by teachers to cope with the new resources and demands of information and knowledge, and the digital literacy that it entails, cannot be acquired by reflection on action alone. The traditional teaching competencies, applying problem solving strategies to well defined problems, need to be augmented today with competencies that allow teachers to identify and elaborate new problems and questions.

Teachers have been invited for some time now to experiment the uses of ICT in their practice. They are therefore already in the midst of new situations involving ICT and have been reporting on these situations for some time now. User studies and use account by teachers have produced many findings that remain largely dormant, because of their local validity. However, teachers could gain much more insight from these studies and become more apt to reflect on their own practice, if they had access to some 'experience in the methods of normal science research', a 'superb preparation for reflection-in-action" (Schön, 1987). Scientific research begins by questioning the frontiers of the initial problematic situation and by redefining what is at stake. For example, the use of collaborative technologies could lead to taking into account the findings on co-operative vs. individual learning and the social psychology findings on group dynamics and group work; the introduction of video and graphics could result in the exploration of cognitive psychology findings concerning mental imagery, illustration, visualisation and cognitive processes. Or course development of some of these competencies is already taking place, but at a very discrete scale.

Implementing a 'reflective practitioner' approach within the training of teachers and as part of their daily practice, when integrating educational multimedia in schools, could lead to the development of core digital culture competencies for teachers. Some of these competencies are similar to those requested in research and can be developed through a systematic initiation for student teachers to research procedures and processes. This would mean opening up the reflective practitioner not only to pedagogical issues and problems, but mainly to framing, and dealing with, the new equilibrium, between school and society, of information management and knowledge construction.

References:

Becker, H. & J., Riel, M. (2000) *Teacher Professional Engagement and Constructivist-Compatible Computer Use.* Report #7,Teaching, Learning and Computing: 1998 National Survey, Center for Research on Information Technology and Organizations, The University of California, Irvine, and the University of Minnesota http://www.crito.uci.edu/tlc/findings/report_7/startpage.html (April 2002)

Beedle, Paul (2002) The Reflective Teacher – Putting Theory into Practice. In *International Outlook*, Newsletter, Issue N° 9, Cambridge International Examinations, Cambridge : University of Cambridge.

Gilster, Paul (1997). *Digital Literacy.* New York: John Wiley & Sons, Inc.

Nunberg, Geoffrey, (Ed.), (1996). *The Future of the Book.* Berkeley , CA: University of California Press.

PNER 2002, *Étude PNER N° 3. Méthodes et outils pour l'observation et l'analyse des usages.* Paris: Programme de Numérisation pour l'Enseignement et la Recherche, Ministère de l'Éducation Nationale

Schön, Donald A. (1987). *Educating the Reflective Practitioner, Toward a New Design for Teaching and Learning in the Professions.* San Francisco: Jossey-Bass Publishers, 1987.

Schön, Donald A. (1983). *The Reflective Practitioner. New York: Basic Books.*

USING XML IN ELEARNING COURSES

Youssef BELQASMI
Ecole Normale Supérieure de l'Enseignement Technique Mohammedia Morocco
belqasmi@ensct-media.ac.ma

Amine BENKIRAN
Ecole Mohammadia d'Ingénieurs Rabat Morocco
benkiran@emi.ac.ma

Rachida AJHOUN
Ecole Nationale Supérieure d'Informatique et d'Analyses des Systèmes Rabat Morocco
ajhoun@ensias.ma

Abstract: To take advantage of the asynchronous telelearning, documents representing courses must fit appropriate characteristics. The most important of these characteristics is the ability of the courses to adapt itself to the learner profile. The courses must also be interactive, structured, multimedia, web compatible, etc.

The purpose of this paper is to show how using XML and its associated tools is the way to fit all of these characteristics. It also describes the manner these characteristics are integrated.

Introduction

This study is a part of the SMART-Learning (System for Multimedia Adaptative and coopeRative TeleLearning) project at the RIM research unit (Réseaux Informatiques et Multimédia) at EMI. The goal of this project is to provide courses to distant learners without any space or time constraint, including the possibility of having synchronous sessions (real time) for the conversation between the various actors intervening in the process of learning (learners, trainers...). In addition, the fundamental goal is the adaptability of the courses to the learner according to pedagogical requirements and learner capabilities (Benkiran 2001).

Generally, courses that are available on the Internet are hypertext documents. The structure of the hypertext and the reading modes it leads to are opposed to some educational principles. A learner can access any pedagogical sequence of a course without order constraints of these sequences and without having the preliminary knowledge. Consequently, the teaching objectives aimed by the access to the course will not be reached. In our view and to ensure a pedagogical learning, the course must take account of the learner profile (capacities of training, previous knowledge, language,...) and the learner evolution (prerequisite, speed of knowledge acquisition...) (Ajhoun 2001).

Another limitation of the hypertext is that the course has no structure and its content is mixed with presentation markers, which makes it impossible to automatically process the course.

In order to meet the courses needs in telelearning, it is necessary that the course document fits the following characteristics:

(i) The course must be a hypermedia or at least a hypertext document, in order to guarantee the interactive aspect of the course,
(ii) It must moreover be written in a syntax allowing it to be put on the Web,
(iii) The course document must be able to reproduce the course structure and contents,
(iv) It must also be modular. A course part can be added or updated without changing the whole structure,
(v) The document must be structured so that its manual or automatic processing is easy,
(vi) The course document must respect a course model previously defined on pedagogical bases,
(vii) The structure as well as the content must be independent of the presentation aspect of the course in order to allow the modification of the document style in a global and content independent

manner,

(viii) The course is a hypermedia document that must be able to guarantee the synchronization (or scenarization) of the media it contains,

(ix) Finally and overall, to guarantee the adaptability of the courses which is a very important feature allowed by the telelearning.

We will show, in the continuation of this paper, how XML and its associated tools make it possible to guarantee, to the documents which represent our courses, the characteristics that we have just listed. We applied and tested these methods in our SMART-Learning system.

Course Characteristics in SMART- Learning

SMART-Learning is mainly asynchronous. It provides courses to distant learners without any space or time constraint. The objectives of the SMART-Learning course structure is to fit the characteristics defined above and take advantage of the asynchronous telelearning.

The power of SMART-Learning appears in the ability of the courses to be adapted according to the learner profiles, as well as the ability of cooperating through the document.

We are mainly interested in presenting the model for structured and adaptative courses in the Internet (characteristic (ix)). The course structure is essential to satisfy the objectives listed above including the adaptability objective in SMART-Learning. It must allow the production of a generic course which will be used to generate a specific course at the moment of the training (Fig. 1). This model provides the general structure of a course in such way that the sequences presented to the learner are adapted to his profile and to the training level he wishes to reach.

Figure 1 shows how adaptability is processed in SMART-Learning. This schema will afterwards be realized using XML technology which is the only one that allows, in the same time, the adaptability and the other characteristics.

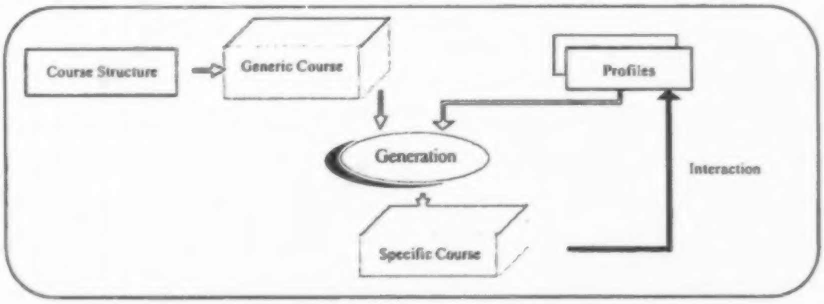


Figure 1: Learning Process in SMART Learning

This approach makes it possible to generate for each learner, based on his profile, a specific course by using a generation system (Fig. 1) during the training while the learner is accessing the course. If, for example, the learner profile is modified following the result of an evaluation, the course will be automatically regenerated so as to consider the new knowledge obtained by the learner.

Course Structure in SMART-Learning

In order to fit the above listed characteristics as well as the pedagogical process, we defined a structure for the course document of SMART-Learning which will be then represented in XML. The production of a course is based on an educational design, which is used to structure the contents in order to facilitate the learning. The course structure must take into account the following criteria (Fleury 1994):

- To stratify information in order to take account of the complexity levels and to adjust it with the preliminary knowledge of the learner (characteristic (ix));
- To structure the presentation in media elements in order to facilitate the selection, the organization and the integration of information to be presented to the learner (iii, vii, ix);

BEST COPY AVAILABLE

- To produce the course in several languages in order to improve its deployment for a larger number of possible learners (ix);
- To consider the use of various media (text, audio, video...) which encourages the learner to take a telelearning course (i, ii, viii),
- To have a hierarchical structure to represent the course document (iii, iv, v).

The generic course is then seen like a set of pedagogical sequences (PS) structured as a tree with a single root. Each sequence constitutes a distinct whole. It can be a course, a chapter, an evaluation or other. A pedagogical sequence (PS) is then broken up into other pedagogical sequences or elementary pedagogical sequences of the lowest granularity. The leaves of the tree constitute the contents to be presented to the learner, they are the media elements (ME). For adaptability reasons, each component (PS, PSe and ME) is annotated by a set of selection criteria which will be used by the learning process in order to generate or not the component according to the learner profile at a given moment. Thus, we defined four categories of selection criteria : Educational, psychological, localization and technical.

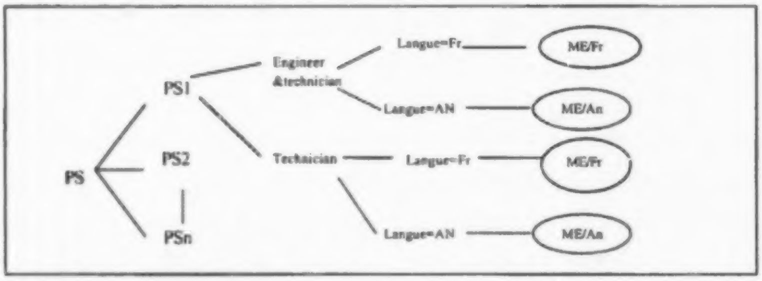


Figure 2: Example of relations between the criteria

XML as a Solution

The XML language, reputed by its facility to exchange complex document on the Internet, is in fact the ideal solution to fit all SMART-Learning and telelearning courses characteristics we defined earlier. XML comes with a set of tools based on XSL, DTD-Schemas, CSS and parsers.

Hypermedia Structured Documents on the Web

The eXtensible Markup Language (XML) allows to write hypermedia course documents (i, ii) just like the HTML, but gives in addition the possibility of defining new personal tags contrary to the HTML which presents an extremely rigid and present tagging set.

The automatic processing of course documents (v) is made possible by the XML associated parsers like XT of James Clarck , Xalan from Apache or others. The tagging language also allows, by the means of name spaces, the use of several vocabularies in the same document. We can, in particular, represent the tags corresponding to the course structure and the tags corresponding to rules of time precedence between the elements. The synchronization language SMIL (Synchronized Multimedia Integration Language) integrates in this manner into any XML document and thus a course. It conforms, itself, to the XML syntax. In SMART-Learning, the media elements could thus be sequenced and scenarized (viii).

Definition of course types

XML allows it using the DTD (Document Type Definition) concept which is a model which makes it possible to define a document class for SMART-Learning courses. Each document corresponds then to an instanciation of the DTD. Schemas are even more flexible than DTDs to define more rigorous documents types.

Separation between content and presentation

The great drawback of HTML is the mixing of the content and the presentation instructions (format, style) in the same document. These difficulties are overcome (vii) with XML and the associated tools. The structure and the contents of the document are described in an XML document whereas the

BEST COPY AVAILABLE

presentation is defined in an associated document which can be described with several style definition languages depending on the desired presentation. We currently use the first version of CSS. CSS2 will allow much more possibilities when it is recognized by the various browsers. These possibilities will be more increased with the even more complete language XSL:fo.

Current browsers visualize XML documents. However, not all of them recognize the whole set of the XML associated tools functions. It is however always possible to transform an XML file into HTML using XSLT by associating formats described in XML to it.

Course adaptability

The adaptation of the course according to the user profile is made possible using XSLT. It will first of all be necessary to adopt a structure defining the relation between the course and the profile as in the case of SMART-Learning.

XSLT can transform an XML document into another XML document according to present selection criteria. In SMART-Learning, these criteria (educational, of localization) can be associated to any element of the course (PS, PSe, media). Thus, a generic course, containing all the possibilities, will be transformed into a specific course thanks to an XSLT document which includes specificities of the learner profile (Fig. 3). In fact, the general transformation parameters contained in the generic XSLT document are transformed using the profile values.

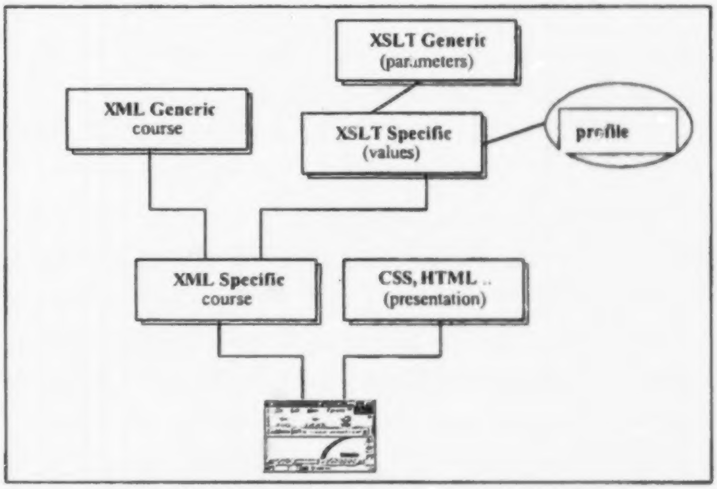


Figure 3: Successive transformations of a SMART-Learning course

Conclusion

XML and its tools allow thus, using a relatively simple representation, fitting the characteristics of a telelearning course and in particular the adaptative and structured courses of SMART-Learning

References

A. Benkiran R. Ajhoun (2001).Towards an adaptative and a cooperative Tele-Learning. ICEE, 2001, Oslo, Norway. 7B1.22-27

R. Ajhoun (2001). Adaptabilité et coopération des cours dans le système de télé-enseignement SMART-Learning. thèse d'état (PhD), 2001. Ecole Mohammadia d'Ingénieurs rabat morocoo

M. Fleury (1994). Implications de certains principes de design pour le concepteur des systèmes multimédias interactifs. Revue EDUCATechnologiques. Vol1, N°3.

"TELEWEB" FOR DISTANCE LEARNING: THE EVOLUTION OF TELEVISED TEACHING INTO WEB COURSE

William M. Bercu
Distance Learning and Technology
Arizona State University
USA
bercu@asu.edu

Abstract: The delivery of distance learning has developed at a rate that corresponds with that of technology. This paper is an experiential account of the evolution of a televised course supplemented by the World Wide Web to a Web course supplemented by television. "Internet Skills for the Working Professional" is a course that uses the Internet to teach students how to use the Internet. This course was originally designed to be taught using television and face-to-face workshops and has developed into a primarily Internet-based course. This allows the participation of students outside the broadcast area. The level of participation, satisfaction and student learning and mastery of the essential material has in fact improved by using the Internet as the primary technology for this course.

Introduction

Arizona State University (ASU) has been delivering televised credit courses as part of its distance-learning program since 1955. Courses were originally broadcasted over a local commercial television channel. Televised courses are now delivered over a variety of different educational networks, campus based intranets, and local cable television. The medium for delivering distance education is evolving with the advance of new technologies. The U.S. Department of Education reported in 1995 that 75% of universities offering distance-learning courses planned to increase their use of computer technology and interactive teaching. Student enrollments for distance learning classes have increased substantially, as well (U.S. Department of Education; 1997). Many students enrolled in distance learning courses live within commuting distance of the university, but choose the convenience offered by distance learning. A major shift has occurred over the past five years in the technology used to deliver off-campus courses. With the increase of the Internet as a learning resource, student enrollments in web courses have dramatically overshadowed enrollments in televised courses. Table 1 compares student enrollments at Arizona State University in televised and web courses over six years.

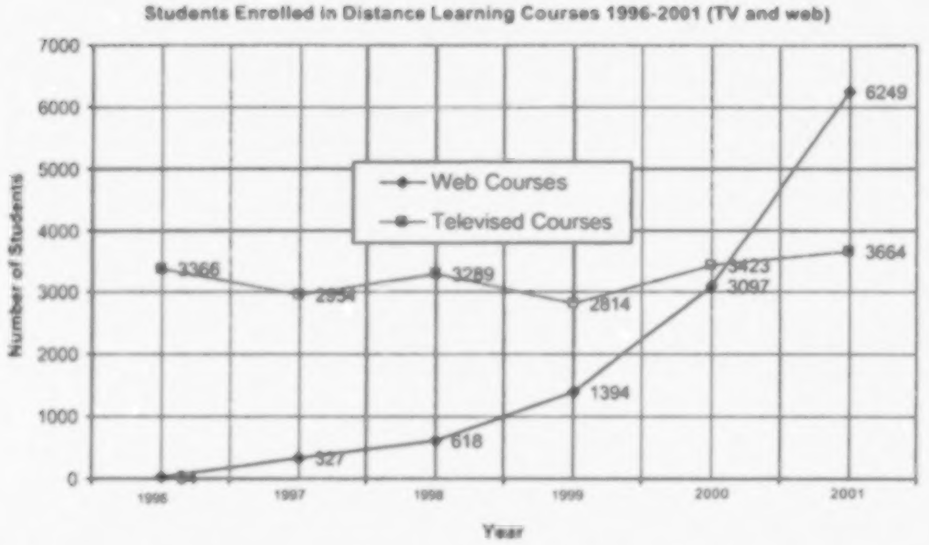


Table 1 : Comparison of distance learning enrollments in web and televised courses 1996-2001.

During fall semester, 1999, a televised Internet skills class was designed to provide students with a variety of skills using the web. This class was to be part of a program of study for a Master of Education Degree being offered on the Navajo Nation. Classes are conducted for two consecutive summer sessions on-site in the upper Northeastern corner of Arizona. Students complete 12 semester hours each summer and take web-based classes during the fall and winter semesters. One problem discovered in the early planning stage of the program was that many of the prospective students lacked basic Internet literacy skills. The face-to-face hours each summer session were oriented towards the M.Ed. content (teaching reading). Moreover, there was no computer lab space available at the site. To teach these basic Internet computing skills, students needed to actually see the different procedures demonstrated so they could master them on their own.

Developing a Tele-web Course

"Internet Skills for the Working Professional" was originally designed to use weekly, televised lessons that would normally be taught in a computer lab environment. Students, who live outside of the viewing area, purchase videotapes from the University's library system. These tapes are mailed the day of the prerecorded broadcast. The course, which is taught in a fifteen-week semester, uses the World Wide Web to provide materials, to foster student interaction, and to teach students how to use the World Wide Web. This course has evolved considerably during the nine semesters it has been taught. The purpose of this paper is to describe the design of this course and the major modifications that continue to provide a greater reliance on web delivery.

An advantage of designing and teaching a televised course is the ability to interview a number of different content authorities to supplement the instructor's presentations. Video taping and editing the interviews allows these "guest lecturers" to be reused in subsequent semesters. Examples include interviews with the three high-speed Internet service providers in Phoenix, Arizona: cable, direct microwave, and DSL. In another interview, teaching librarians gave presentations on searching the web and web resources. Each class session would have a different recorded interview or presentation, most of them taped at remote sites.

BEST COPY AVAILABLE

The Web portion of this course uses Blackboard course management products as well as custom designed web pages linked to the Blackboard site. A major feature of Blackboard that is used regularly is the discussion forum (asynchronous bulletin board). Students are tasked in some assignments to post responses to readings or projects. Forum postings are graded assignments. The five-stage model of computer-mediated conferencing is used as the weeks' progress. Students are expected at first to become familiar with posting to threaded discussions and assure that they overcome problems with accessing and navigating the website. Steps progress to online socialization, exchanging information, and creating an online learning community (Salmon; 2000)

In the original design, Internet Skills was taped on Tuesdays and broadcast on educational cable on the following Saturday. Out of town students received a copy of the videotape usually on the Friday before the broadcast. Immediately after the broadcast on Saturday morning, an on-line lab was held for one hour. The class used *Tutor-net*, Blackboard's synchronous chat tool, for these meetings.

During the second year offering this course (the third and fourth semesters) the "library" of guest speakers and content experts was increased by inviting guests to the broadcast studio in order to demonstrate different types of technology. A panel discussing the Arizona Department of Motor Vehicles online licensing program was hosted, as was a presentation on identity theft from a U.S. Postal Inspector. Recordings of these guest speakers further enhanced each broadcast topic.

The fifth rendition of this class, during Summer Session 2001, *Internet Skills* made its next evolutionary step by providing a live webcast for each session. Broadcasts were streamed to a RealSystem web server. The broadcast was simultaneously archived as a real media file and linked to the "lectures" section in the Blackboard course site. During this session, a student who returned home to Taiwan for the summer used RealPlayer in a cyber café to view the broadcast portion of the course. Broadcasts and archives are encoded in a "Multi-rate SureStream" format. (Real Networks 2002) This adjusts the stream of the broadcast to the dynamic conditions of the user's Internet connection. Webcasting continued through the following year.

During the next summer session, Internet Skills was only offered as a web class, with no broadcast television component. Webcast archives from previous semesters were edited into shorter pieces focusing only on the guest speakers. These clips were included throughout the web-based instruction and students used RealPlayer to view them. The instructor was able to devote more time developing interactivity in the course, by not having to present a broadcasted lesson each session. Student satisfaction and achievement were both extremely positive.

Planning for the Future

Currently, it is planned to broadcast the course one more time using the public educational cable channel. Added this semester will be a question and answer session for students who telephone the studio during taping and webcasting. Digitized media will be provided on a CD-ROM for introductory portions of this course in lieu of mailed videotapes for those students taking the course outside of the broadcast area.

This Internet skills class is gradually being tailored with its content and media to possibly facilitate publishing a DVD to accompany the web-based instruction. The experience of designing and teaching ten semesters of this course has corresponded with changing technologies, pedagogical trends, and student preferences to delivery. This distance-learning course, which was originally television based and supplemented by the web, has transformed into a web course, supplemented by (digitized) media.

References

Department of Education. National Center for Education Statistics (1997). Statistical analysis report: distance education in higher education institutions (NCES 98-062). Washington, DC: U.S. Government Printing Office.

O'Malley, J., & McCraw, H. (1999). Student's perceptions of distance learning, online learning and the traditional classroom. Online Journal of Distance Learning Administration, 2(4), 1. Retrieved July 16, 2002, from State University of West Georgia, Distance Education Center Web Site: http://www.westga.edu/~distance/omalley24.html

Real Networks. (2002, April 5). Introduction to real system production. Retrieved July 16, 2002, from http://http://service.real.com/help/library/guides/realone/IntroGuide/PDF/ProductionIntro.pdf

Salmon, G. (2000). E-moderating: the key to teaching and learning online (Rev. ed.). London: Kogan Page.

Cases of Multimedia Applications to Enhance Learning

Ian Bertie
Universidad Católica de Chile

Introduction

At our university we had the usual Computer Center in the sixties with an IBM 1620, later with a Burroughs 3500, etc., and the use of computers done mainly by engineering and math students. The change of paradigm came in 1985 with the Macintosh's graphic interfase and the approval of a campus wide proyect to insert computer labs in all other areas, such as art, literature, social sciences, languages, etc.

In the late 80's we designed a plan to introduce teachers to the use of computer aids in their work, and devised a yearly contest of ideas where financing was won to be able to carry out those more promising ideas. Some interesting products came of these efforts. We produced a software developed for history students called "Tierra" (Land on sight!) regarding Columbus' discovery, and the following year were able to win the "Wheels for the Mind Contest" as best university in Latin America.

We produced the best Hypercard application for LA with "HyperEstática", to teach structures to architecture students.

MacWorld considered as Best International Entries in a Superstacks contest (a Canadian SW being the third entry) a couple of teaching software we produced: another history teaching aid (Revolution!) and a second SW for architects (Earthquake!)

Why these programs were succesfull as compared to the multiple other ones (about 200) we produced is a source of practical knowledge.

Some of the software we have produced can be seen the catalogue on
http://www.puc.cl/sw_educ/catalogo/index.html

Communication in the 80's was slow and dull compared with todays possibilities of multimedia material, such as comparing the telex machines to faxes.

At the time data communication networks came through another university, older and owned by the state. We decided to band together with other universities and become independent, creating the first ISP as there were no commercial providers of internet in the country at the time. When Internet service was taken up by the commercial sector later on, we sold out in order to concentrate on our specific mission in teaching and research and hired the service for ourselves.

We were the first university to provide e-mail and free internet access to all our students. We designed our university site and put information on the web for our students to see, and discovered to our surprise we were amongst the country's top ten sites as far as number of hits go.

A reduced number of teachers were enthusiastic about the Web, a large number stepped back and shrunk from HTML, FTP, ISP and such. And many of the enthusiatic ones wanted someone – not themselves- to paste the books they had written on the web.

So we produced a typical course website and easy to use tools to enable faculty to interact with the web, and here we are now, convincing faculty that a new teaching approach is needed – not just pasting the stuff they have.

We have designed a WebSite that has three areas:
Teaching Materials
Administrative Information
Communication aids.

I do not plan to go into detail of the typical website for a course at the Universidad Catolica since it can be easily appreciated at:
http://www.puc.cl/html/framecur.html

The issue I plan to analyze is the appropiateness of the material that can be put on the Web.

The possibitities of putting material on the web are varied. You can of course put reading material. Some consider that more of a way to distribute said material that a way to have people read it, since a number of users still prefer studying material in hardcopy than reading it on the screen. You can put presentation slides, which can be used for class and the students can review the same material later.

You can put video clips to be seen on demand. And you can produce a variety of didactical games students have to go through.

The idea is to take a quick, practical look at a simple checklist versus a determined software, to see if an adequate number of points are met to insure the appropiateness of the technology to the occasion or content.
The simple checklist will be set as evaluation parameter against examples taken from last academic year's production of software to be used as aid in teaching:

- Chilean Musical Activity in the XIX Century, by professor Carmen Peña, from the Music Institute, financed by the Teaching Devepoment Fund
- Chilean Seas, by professor Ana María Errázuriz, from the Geography Institute, financed by the Fundación del Mar.
- Virtual Catalogue of Professional Practices, by professor Rodrigo Tapia, from the School of Architecture, financed by the Teaching Devepoment Fund.
- Vital Cicle Care, by professor Patricia Masalán, from the Nursing School, , financed by the Teaching Devepoment Fund.
- Drug Prevention, by Carolina Méndez, ATEES Proyect, for local schools.
- Mathematics of Movement, by Jessica Puschel, ATEES Proyect, for local schools.
- Lets get to know the Mapuche Indian World, by Jessica Puschel, ATEES Proyect, for local schools.

These applications, and others from previous academic years production, can be found at The Catholic University of Chile Website (**www.puc.cl**) in Aids to Teaching, Software to Aid Teaching:

Apoyo Educacional
Software de Apoyo a la Docencia
http://www.puc.cl/html/frameswacad.html

Uses that are innappropiate for the new technologies, or even when they do not take full advange of that certain technology's potential, may end up making it seen rather banal.
This is specially so when the saying "there is no second chance for the first impression" applies. Non technical people who witness for the first time a demonstration of a new technology that fails, or proves unsatisfactory, do not necessarilly distinguish content from container, do not always differ the technology with the specific use it has been given. The tendency to be prejudiced against the technology developes, when the responsibily of that failure is in the mismatch of use versus the technology chosen.

The Simple 12 point Checklist

1. Intensity

The more senses involved in delivering the message makes it more intense, and gives it a better chance of being remembered by the different types of memories individuals have: drawings (better than a thousand words) for those with visual retentiveness, sound for those those with audio retentivenes, movement for those with kinestesik memory.

The earthquake SW had a brief introduction where some buidings moved and toppled and the cry Terremoto! was heard and read. Similar ocasions presented themselves within the SW for some key concepts, as when showing the effects of rigid buildings founded on rigid soils, etc.

2. Repetition

Repetition fixes knowledge to the neurones as we know from kindergarten and up. The trick is of course to have some repetition and some variability interwined, so as to avoid the dullness of plain repetition. One of the great advantages is that with hyperlinks you can use different roads to get to the same conclusion and reinforce it. The other possibility is to repeat the concepts but with variations in the depth in which the subject matter is covered.

In the Earthquake SW you could move through the whole SW at a simple introductory level to get a first overall view, go through it at an intermediate level for normal study content, or inmerse and analyze matters in depth by dicking on icons that contained more detail in some themes (similar to boxes in books or magazines). But in software you don´t have the distraction of on view boxes as you have in books, you don´t see them unless you choose to do so by clicking on an icon and making the boxes appear).

3. Attention.

Capturing the users attention and retaining it is no minor chore, starting with the need to give it a rememberable name. Give it a short simple name that catches the attention of those interested and that manages to conveys its contents.

If you fall into the temptation of naming your software with a long name in sake of accuracy name/content such as ..."Genetics of the degradation of lignite mediated by fungi" or..."Mecanisms of transcriptional activation of defense genes to stress in plants" (yes, they are the real names) and no one will be able to repeat it.

We had The use of Computer Aided Design as exemplified by its Applications on Classical Architecture of Palladio, and left that as a subtitle with simply "MacPalladio"

as rememberable one, which brought the Macintosh Computer to mind, and Apple´s funding to the institutional pocket.

4. Association.

Whenever possible, images that had the possibility to be known by the students are to be used. This also favours the idea of establishing association with things in real life.

We put this into practice when designing the Structural Basics software, when depicting buildings with different static loads according to their use: a photo of the actual classroom, a photo of the campus library for 600 kgs/sq.meter, etc

5 Affective links.

Whatever previous knowledge the student brings along may come in handy when trying to add new concepts by stablishing links from one to the other.

In both software programs to teach structures we had a character that explained some concepts (such as twisting a rod to show flexion in beams). A trio of characters was designed, and students were requested to choose the one they felt most identified with, which turned out to be a lanky, bearded, woolscarfed representation of a local architecture student.

6. Variety of Presentation Material.

Because of some unknown reason, some teachers think that because its all about transmitting their image across the ether, that makes it enough.

We try to diplomatically encourage teachers to use additional material. This is done at the meeting where the project is prepared: we ask the teacher **when and how** (and not if) he wants to time the introduction of the charts, video clips, models, etc, taking it as a matter of fact issue.

7. Clear Indexing

This rather obviuos item is inexplicably often forgotten. One can see the names Chapter 1, Chapter 2, etc., as if this gave any useful information.

The finding of the right page in a book is a must, to find the way to a needed file in the web is essential. This is specially so when the file must be opened to see its contents, and even more so in the case of large files. Some very good video libraries have been seen to have little use by professors and students in spite of the great material that has been collected. We think it is mainly due to the lack of the time needed to peruse through the tapes in search of the adequate material (by professors and students).

The disadvantage of the secuential media should be solved in the video on demand / streaming video solution by having short clips that are very easy to find, in indexes that should have names as obvious in conveying the contents of the clips as possible.

8. Simultaneity

When simultaneity is not possible in real life, or is very difficult, the computed aided resourse can be very valuable.

We all know the advantages of an animated model to explain how an internal combustion engine works, but there are instances when a moving model is more valuable still.

The vision of a cross section of a human heart in movement and the sound a certain cardiopathy makes on the stethoscope is only made possible by superimposing an animation and the recording of the sound., since the cross sectioned real heart will certainly not be moving!

9. Size scale different to normal

When size scale is different to normal (microscopic or macroscopic), the computed can replace or aid in preparing for the actual experience in the use of costly instruments.

The difficulty in giving access to an electronic microscope to a large number of students makes it desirable to make the most of such occassions. A round of previous practice on the computer makes the use of limited access equipment highly effective. This is also valid for telescopes and such, especially since the university's astronomical observatory is located rather far from the main city campuses.

10. The difficulty of access to some material.

Even if the materials for study are present, a large body of students wishing to gain acces to them is not easy to accomodate.We do not propose to substitute the real thing by replacing it with a computer image, but we have found that the previous knowledge of a simulation quickens the pace of the students time spent withthe real-difficult to access material.

Such is the case for the Aapgard test for babies, where no mother would want her child to be handled by a dozen nursing students, the vision through an electron microscope for pregrad students, the time spent with real corpses for anatomy students, etc.

11. The recording of scarce occasions.

Visual aids in motion are very valuable in quite a few instances. We evaluated and bought video on demand servers from Real and Apple. Similar to what happened with static graphic material to be put on the web, most faculty at first want to do the old things with the new resources. When a certain event is very unfrequent its register in video makes it more valuable.

Por example, video takes during an earthquake, a flood, the mating of an animal of one a year fertile period, an operation to separate siamese twins…

12. Time scale is different to normal.

A process can take much longer than the lapse of a semester, such as the growth of trees for the forest/lumber industry, or a process can be so quick as to be difficult to behold by the normal eye (MIT's high speed photography lab). In these instances the use of animation brings the process into the adequate time frame by accelerating it or freezing it, and permitting its repetition.

Promoting the Development of Students' Information Literacy Skills: Insights from the Postsecondary Classroom

Ty Binfet, Ph.D.
School of Education
Loyola Marymount University
United States
tbinfet@lmu.edu

Abstract: The principal aim of this pilot study was to explore the development of students' information literacy skills as they completed annotated bibliographies related to a topic in educational psychology. One challenge facing postsecondary educators is to encourage students to conduct comprehensive on-line searches of resources related to course assignments. Thirteen graduate students in educational psychology were asked to compile a web-based, annotated bibliography in lieu of writing a traditional term paper. Self and peer assessments were administered and revealed that students do not profess to have a search strategy in mind prior to starting their on-line research, that they do in fact develop strategies to streamline their search efforts, and that they report an increase in their comfort level using on-line databases as a result of having completed an annotated bibliography. Implications for postsecondary instruction and information literacy are discussed.

Introduction

"In today's information age, one has to be able to define information needs, formulate search strategies, access information, assess and interpret the information sources, and communicate a stance on a problem or hypothesis." (Herro, 2000, p. 555). One challenge facing postsecondary faculty is to encourage students to conduct comprehensive on-line searches of resources related to course assignments. Students completing research assignments have a tendency to consult resources that are convenient and easily accessible (Gutierrez, Wang, & Herring, 2001). In their haste to find esources related to their research topic, students often conduct compromised searches due to a variety of factors. These include: a lack of time (e.g., leaving the assignment to the last minute); unfamiliarity with how to efficiently use databases (e.g., on-line information databases such as EBSCOHOST, ERIC, and PYSCINFO); and/or a lack of understanding of the criteria required for selecting high quality publications (e.g., peer-reviewed journal articles).

With current trends of incorporating technology within classes, faculty are increasingly asking students to be "informationally literate" and to apply information literacy skills in order to complete course assignments. Information literacy has been described as having multiple dimensions. The components comprising information literacy are many and include: the creation and transmission of information; the construction and application of a search strategy; accessing information; the physical organization of information; and the evaluation of information (Kapitze, 2001).

Information literacy strives to enhance the student's ability to explore text-based communities and to forge connections between varied resources of information (Cope & Kalantzis, 2000). Kapitze (2001) argues that information literacy " . . . should not be the domain of the teacher librarian alone and that training in it should be integrated across all subject areas . . . " (p. 453). Indeed, frequently, faculty make assumptions as to the research abilities of students with respect to compiling information for class-related projects and assignments (Scott, Schaad, Mandel, Brock, & Kim, 2000). Leckie (1996) posits that "Faculty must assume more responsibility for teaching information-retrieval skills in their courses, . . ." (p. 201). Thus, in order for students to meet the demands of in-class assignments requiring extensive on-line searches, faculty must make efforts to support the acquisition and development of students' information literacy skills.

In an effort to encourage university students to develop their information literacy skills, students were asked to complete an annotated bibliography in lieu of writing a traditional term paper. The principal aim of this project was to explore the development of students' information literacy skills as they completed an annotated bibliography related to a topic in educational psychology. Specifically, this project strived to answer the following question: What aspects of students' information literacy skills are impacted by the completion of an on-line research assignment?

Method

Participants

A small sample of 13 students (3 males, 10 females, M = 23.5 years, SD = 1.97, 6 Caucasian, 3 Asian, 2 Hispanic, 1 African-American, and student of blended ethnicity) participated in this pilot study. All of the participants had completed 4-year undergraduate degrees and were seeking their teaching credential as part of their graduate training in education. Students received information in their course syllabus describing the web-based assignment and outlining the expectations for researching their chosen topics. Briefly, each student was asked to conduct an extensive on-line search of resources related to a topic in educational psychology (e.g., the impact of anorexia on academic achievement, the effects of same-gender schooling, recreational alcohol use and academic achievement, etc.). Over the course of a six-week, summer semester, students were asked to generate a list of references and resources related to their research topics. For each resource, students were asked to submit a 1-page written reflection that provided a summary of their chosen resource as well as information regarding how their resource helped them better understand their overall research question. Table 1 illustrates the nature and number of resources required.

Source	Expectation
Peer-Reviewed Journal Articles	4
Internet	2 URL's (+ description of pathway to target information)
Popular Periodical	1 resource (e.g., TIME, NEWSWEEK)
Newspapers	1 National News articles
Local Support Agencies	1 (e.g., Community-based resource groups)

Table 1: Nature and number of references to be included in web-based assignment.

Measures

Information Literacy Comfort Scale

Information regarding students' information literacy skills was assessed via three distinct sources. First, at the beginning of the semester and after informed consent had been obtained, students completed a pretest measure assessing their comfort level in applying information literacy skills in on-line academic searches (e.g., "I have a hard time telling the difference between poor quality and high quality web-based resources", "I know tricks or tips that save me time when researching web-based resources"). This scale consisted of 10 items that required rating on a five point Likert scale (1 = True, 2 = Somewhat True, 3 = Neither True nor False, 4 = Somewhat False, 5 = False). At the end of the semester, students were asked to complete the same measure again (i.e., the post-test).

Self-Evaluation of Information Literacy Skills

This measure was comprised of 11 items that required both a rating (i.e., Strongly Agree through to Strongly Disagree) and open-ended responses (e.g., "Three tips I have learned from researching resources on the internet are: ", "After having completed this project, what have you learned about differentiating a high quality internet-based resource (i.e., something you would include in your project) from a poor quality resource (i.e., something you would not include in your project)?"

Peer Interview

Insights into students' information literacy skills was gleaned from a peer-based interview comprised of three questions (i.e., "What is information literacy? What does it mean to be *informationally literate*?", "To what extent are you convinced your partner answered his/her research question in compiling his/her annotated bibliography?", "What has your partner learned about researching internet-based resources after having completed this project?").

1244

Results

Recall that information regarding students' competency with information literacy was collected via self-assessments of students' comfort in applying information literacy skills, open-ended questions regarding students' information literacy skills, and peer interviews aimed at exploring students' knowledge regarding on-line searches.

Information Literacy Comfort Scale

From pre- to post-test, after having completed their annotated bibliography, five of the 13 participants reported feeling more comfortable conducting on-line research-based searches. When asked whether or not they had a search strategy in mind before beginning their research, the majority of students (i.e., 11 of 13) responded that they did not. Last, after having completed their research project, the majority of students (i.e., 9 of 13) reported that they were better able to discern high from poor quality on-line resources. Table 2 illustrates pre- to post differences in self-assessments for 9 of the items used in the Comfort Scale.

Variable	n	Pre-test M	Post-test M
Comfortable researching academic-related sources	13	2.12	1.35
Able to explain the concept of Information Literacy	13	3.69	2.19
Able to research internet-based academic sources quickly	13	2.50	1.58
Uncomfortable using internet to research academic projects	13	4.04	4.23
Hard time telling difference between poor & high quality web sources	13	3.08	3.65
Know difference between peer-refereed article & popular periodical	13	2.23	1.42
Have favorite database used when researching academic articles	13	2.96	2.19
Know tricks to save time when using internet-based resources	13	2.96	1.85
Have strategy in mind before starting research on a new topic	13	2.73	2.23

1 = True, 2 = Somewhat True, 3 = Neither True nor False, 4 = Somewhat False, 5 = False

Table 2: Mean scores on self-ratings on the information literacy comfort scale.

Students' Self Evaluation

Several themes emerged across the responses generated by the participants' self-assessments of their information literacy skills. First, when asked to identify tips for researching internet-based resources, students remarked that one must be efficient in differentiating high from poor quality resources. As one student wrote, "You must find more than you need. The closer you read, the less (fewer) resources you'll find that actually fit your research question." Several students remarked that resources were easy to find but that one needed to be critical in selecting resources (" . . . there is a lot of stuff which is easy to find, but one needs to be critical of sources; look for accountability and where the authors get their information."). In an effort to discern credible (or high quality) resources from internet "junk," (i.e., resources not directly related to one's research topic) students additionally suggested looking at within-text referencing and the bibliographies of individual resources. That is, were the resources well substantiated within current research findings? Last, students raised the issue that wading through large amounts of unworthy resources can diminish one's ability to think critically about the resources one is evaluating. One suggestion to reduce having to sift through unwanted resources was to both use efficient terminology to eliminate finding unrelated resources and to conduct advanced searches (e.g., limiting one's search to "peer-reviewed publications", etc.).

Peer Interviews

It was hoped that the peer-led discussions regarding information literacy would possibly uncover aspects of on-line researching that had not been captured on the paper and pencil questionnaires. Some of the prevalent themes in the students' responses revealed interesting findings regarding how to conduct on-line searches. For example, students reported to their peers that "you must be flexible in using a variety of key words to find information", "there are a lot of unacceptable resources – it takes time to sort out the non-credible ones", and that "different search engines provide different information". Certainly, one common theme among the peer-based responses was the notion that there is a great deal of on-line "junk" that must be sifted through in order to find credible and useful resources. The task of sifting through undesirable resources proved problematic for a number of the participants. In fact, several students admitted to being tempted to change their research topic to fit the resources they found rather than remaining true to their original research question.

Discussion

Recall that the aim of this study was to explore the development and use of information literacy skills by university students as part of a research project exploring topics in educational psychology. Overall, it appears that having students complete extensive, on-line searches of academic topics combined with written reflections contributes to the development of students' information literacy skills all the while supporting their understanding of key course-related topics. That is, through the researching of on-line resources related to topics in educational psychology, students honed their web-based research skills and developed techniques for maximizing their research efforts. For example, students responded that using efficient terminology was key to conducting successful searches and that one's choice of database maximizes one's chances of accessing desired resources. Certainly, in their attempts to discern high from poor quality resources, students were exposed to, and gained, expertise in their chosen topic. This was evident by the complexity of students' written reflections and their demonstration of knowledge related to their selected topic area. Surprisingly, students reported not having a search strategy in mind prior to conducting on-line searches. It appears that students do indeed have ingrained or habitual on-line search strategies in mind when conducting web-based searches. Perhaps, given the high number of searches that students conduct, they are unaware of the steps they may take to render their searches more efficient. Last, responses to peer interviews revealed that even with attempts to streamline their searches, students were faced with the task of having to wade through large quantities of resources unrelated to their area of research. Students commented that the task of identifying key resources was labor-intensive and compromised one's ability to think critically about the information students were seeking.

Kapitze (2001) argues that information literacy requires individuals to construct and apply a research strategy, access a variety of information, and evaluate the quality of the information found. Clearly, as evidenced by the comments and insights offered by the participants in this pilot study, information literacy may be promoted concurrently alongside the research agendas of post-secondary educators. That is, by encouraging students to conduct informed on-line searches as part of regular class assignments, educators can assist students in developing information literacy skills that ultimately contribute to the development of streamlined search strategies, increased abilities to discern high from low quality resources, and increased comfort levels regarding web-based searches.

References

Borg, W., & Gall, M. (1989). *Educational Research*. New York: Longman.

Cope, B., & Kalantzis, M. (2000). *Multiliteracies: Literacy learning and the design of social futures*. London: Routledge.

Gutierrez, C., Wang, J. & Herring, S. (2001). A comparison of an electronic versus print workbook for information literacy instruction. *Journal of Academic Librarianship*, 27, 208-220.

Herro, S.J. (2000). Bibliographic instruction and critical thinking. *Journal of Adolescent & Adult Literacy*, 43, 554-559.

Kapitzke, C. (2001). Information literacy: The changing library. *Journal of Adolescent & Adult Literacy*, 44, 450-457.

Leckie, G. (1996). Desperately seeking citations: Uncovering faculty assumptions about the undergraduate research process. *The Journal of Academic Librarianship*, 22, 201-208.

Scott, C., Schaad, D., Mandel, L., Brock, D., & Kim, S. (2000). Information and informatics literacy: Skills, timing, and estimates of competence. *Teaching and Learning in Medicine*, 12, 85-91.

Taste the difference.
Training and optimizing of synchronous, audiovisual, cooperative telelearning.

Thomas Bliesener

You get a full understanding of many things only when you are able to explain them to others. If you are able to do so even within a teleconference, you have a skill that is highly appreciated in many jobs. Both facts are reasons for the Department of Communication Science at the University of Essen to offer courses for training in teleconferencing. The Federal Minister for Education and Research provides the funding to this project. Supported by trained tutors, groups of three or four students can learn, rehearse and apply synchronous audiovisual teleconferences, using their home computers and telephones, in order to prepare for examinations or to collectively produce documents such as texts, webpages, flash animations or powerpoint presentations including images, sounds and videofiles.

Participants are required to dispose of internet connections with ISDN (2x64k) or DSL, which is the case with a total of 40% and 10% of all students. With ISDN, one line is used for a connection to the internet service provider, carrying a netmeeting data only conference, while the other line is used for a telephone conference by conventional telephone devices or alternatively by the video telephony software Alice, the ISDN card *Fritzcard* and an ISDN based multipoint control unit (MCU). With DSL, netmeeting is used for an audio video data conference by an IP based MCU with an upstream of 110k and a downstream of 440k. In order to avoid incompatibilities among the computers and to minimize efforts for configurations, a master laptop was optimized, and clones of it are borrowed to the trainees.

Every course comprises 15 participants and 5 tutors. The required knowhow is learned and trained on the campus within two days. In the month after, the small groups perform three or four teleconferences of about three hours each to solve their tasks.

Subjects of the first two training days are:

- Hardware, audiovisual add-ons, drivers, conference software, ISPs, MCUs, telephone services, ISDN protocoll, IP networks, DSL formats
- The social organization of synchronous cooperation on identical documents
- Dealing with the differences of monitor and sound display at the different locations of the participants

Differences between locations play an important role in most synchronous telelearnings, and despite the progress in data transfer technologies, they will do so for the next couple of years. That's why this article is devoted to them. Since differences between locations cannot be revealed sufficiently only by *learning by doing*, particular excercises and methods are needed in order to train a better feeling for them and an optimized dealing with them.

1. Exercise: Effects of media on focusing on targets
   Participants can do an exercise borrowed from the didactic of the fraction of light: They are to through darts on a dartboard under water. After a couple of attempts they will intuitively take into account the factor of fraction and compensate it when aiming at the target. Trainees can transfer this experience to addressing remote conference partners via technical media. Alternatively, this exercise can be done with one of the numerous java applets on this subject.

2. Exercise: Rhythm and timing in human communication
   Participants can be given small rhythm instruments and be told to contact each other solely by the use of them. Thus they develop a feeling for a common rhythm and for the power of delays to disturb it. They can transfer this experience to verbal dialogs and their interaction with listener signals. Alternatively, this exercise can be accomplished with a keyboard software as delivered together with many soundcards.

3. Variations and verbalizations in teleconferences
   At the beginning of a teleconference, participants can use their cameras and microphones to make

tours around their workplaces and their own bodies. Thus their partners get a broader basis from which they can infer on the actual relations at the remote location. Moreover, in the course of the conference, participants can describe verbally their perceptions and intentions, and they can announce actions, the consequences of which become perceivable to their partners, e.g. minimizing a window during desktop sharing.

4. Marks and signals in teleconferences
   Many actions on input and output devices are not visible, audible or knowable to conference partners, but can be communicated by explicit signals. E.g. the movements of the mousecursor can be slowed down, the mousecursor can be magnified, and a flag can be attached to it. Similarly, to every click you can attach the display of a colored circle around the mousecursor and a sound on the partner's computer.

5. Additional capturing
   Sights of your workplace, which normally stay invisible to your partners, e.g. the keyboard or the illumination source, can be captured with a second camera. By displaying this capture on your own desktop and sharing your desktop with your partner (not replacing the first video, as it would be done with a document cam!), he can permanently monitor it and mentally combine the two videos to one differentiated model of your location.

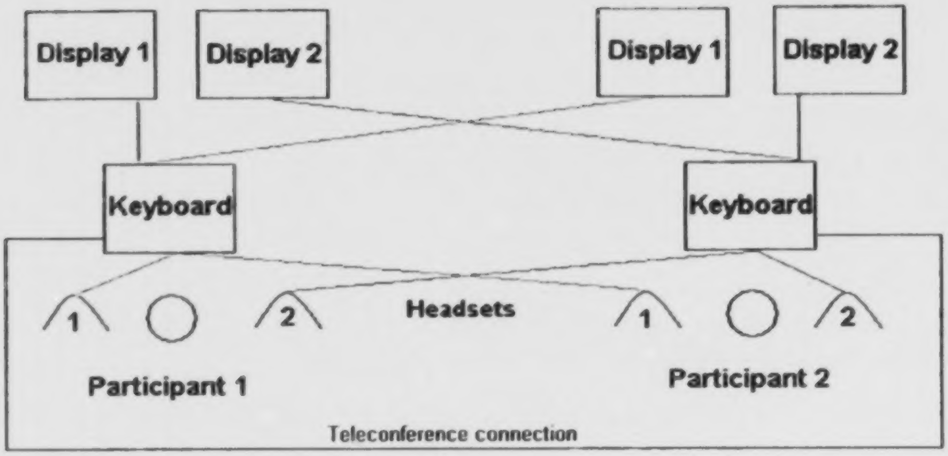
6. Echoing and desktop sharing
   You can also use built-in possibilities of teleconferences for simultaneously sending your partner a feedback of how he is seen and heard. By desktop sharing, he can see his remote video, and by displaying his voice via boxes and re-recording it via microphone, he can hear his remote voice. Neither of these feedbacks, however, represent the true quality and timing at the remote location, since on their way back, they undergo additional losses and delays. So they mislead to an exaggerated impression of the distortions.

7. Exchange of recordings
   You can avoid the exaggeration of distortions by making loss-free capturings, e.g. screenshots with Snag-it and screenclips with Camtasia. Then you transfer the files to your partner, which is a loss-free procedure, too. The disadvantage of this method is its asynchonicity. When the recording arrives, the episode is over. So your partner can relate the recording of the remote side of the episode only to his *memory* of its local side.

8. Syntopical monitoring
   A *realtime and lossfree feedback* can be given this way: You install two computers with cameras etc. for teleconferencing within the same physical room and connect them in the usual way of teleconferencing, e.g. by telephone conference and by netmeeting via ISP 64k. Additionally you supply each computer with a second headset and a second display (or a beamer projection) directly from the other computer. So the two participants simultaneously receive the local and the remote audio and desktop displays in the original timing and qualities - an unbeatably realistic experience of a teleconference as a whole.

   Some precautions, however, are advisable:

   - One's own voice plus a delayed echo cannot be listened to for a long time. For extended acoustical explorations in this setting, you better use neutral live sounds, sound files or CD-rom.
   - One's own desktop plus its shared copy can be monitored only by comparisons which need extra time and effort, so the teleconference must be slowed down.
   - In case an auditory is included, who normally see little of the participants' actions, the teleconference must be slowed down and verbalized. Moreover, it may be better to display a beamer or multiplexer projection in a separated room.



Syntopical monitoring has the advantage that you only need half the number of training rooms, though your need for additional headsets and displays or beamers increases. If equipment is lacking, you can use one setting for syntopical monitoring for many couples of trainees one after the other. Another advantage is that the use of a common physical room encourages the trainees to test application sharing even with objects that tend to disrupt a netmeeting audio connection, especially audio and video files.

Syntopical monitoring is the only setting that allows participants to develop a realistic sense for the relationship between local and remote. After a few hours of training, they can apply their acquired intuition to regular teleconferences – as far as the same conference technology, ISP and MCU is used. For different settings with different distortions and delays, a follow-up training with syntopical monitoring is recommendable. There may arise a problem for participants who live far away and cannot easily come back for a second training. For them, you can show videoclips of a syntopical monitoring recorded under their new conditions. Alternatively, you only do trainings with technological conditions that are agreed upon to be used in later applications.

The courses for students in Essen are done with syntopical monitoring under the lowtech conditions of home learners. Nevertheless, the equipment for doing and recording sessions under an array of different hightech conditions is being installed for other target groups such as telelecturers, professional staff and media consultants. Should you want to get a closer view on a training session in our lab, you are welcome to become an observer – by teleconference.

Longer versions of this paper, including diagrams, screenshots, screenclips and references, can be downloaded from http://www.uni-essen.de/kitt/montreal.htm

Thomas Bliesener, Dr. phil., M.A., Dipl.-Psych., research assistent at the Department of Communication Science (Prof. Dr. H. W. Schmitz), University of Essen, Germany

BEST COPY AVAILABLE

Knowledge Management for Italian Public Administrations

Francesco Bolici
Research Centre on Information Systems
LUISS Guido Carli University
Rome, Italy
fbolici@luiss.it

Alessandro D'Atri
Research Centre on Information Systems
LUISS Guido Carli University
Rome, Italy
datri@luiss.it

Abstract: This brief paper overviews and synthesizes the eLearning aspects that are related to an Italian work-in-progress project (CSCLK) on knowledge management methodologies and tools for public administrations providing in eGovernment services. The project goal is to obtain a deeper understanding of problems which have prevented knowledge management from spreading among public administrations, and to identify main research tasks, major players involved, and most suitable implementation mechanism needed to determine the best solutions for these problems. Moreover, CSCLK aims at the development of a coherent methodological, organisational and architectural approach to support effective knowledge management environments to facilitate public administrations in the design and deployment of e-services to citizens and enterprises.

Introduction

In the last decade, the working procedures of complex organisations were significantly relying on their information systems. In particular, the quality of the databases and the performance of the communication infrastructure appear to be key enablers for successful enterprises. Organisations are continuously evolving and there is a significant shift of importance from information-based systems, mainly dedicated to the management of operational data, towards new systems that are based on more aggregated information (e.g., data warehousing), and knowledge (e.g., business process models), necessary for monitoring and controlling business processes and for strategic decision making.

After the first evolution from function-oriented to process-oriented business models, typical of the '90s, in this decade one of the most significant trend is the evolution from process-oriented to knowledge-oriented models. One of the main characteristics of this approach refers to the so-called "learning organisation" [Senge, 1990], this implies that working processes are not defined "a priori" (like in a traditional workflow), but are dynamically shaped as required by the environment (i.e., the services and products requested by clients or citizens, the available technology, the financial situation and so on). Similarly, the organisation must evolve, to rapidly and effectively react to a continuously changing scenario. In essence, the KM (knowledge management) is a key approach for new organisational models, that have to be: learning, adaptive, and therefore knowledge-based. The management of knowledge implies the enhancement of learning and performance in organisations through processes and practices of creating, acquiring, sharing and using knowledge irrespective of where it resides [Scarbrough et al., 1999]

The PAs (Public Administrations) can be considered as huge knowledge firms since they collect and process data and knowledge about citizens, companies and also PAs themselves. So, PAs need to apply KM strategies and to use IT support to exploit their intellectual resources more efficiently. This knowledge has different shapes and characteristics, examples are: on private citizens and companies, on the environment, on the social welfare, on politics and strategies, on judicial decisions, on practices, etc.

This brief paper discusses the issue of knowledge management in PAs and focuses on the problems which have prevented KM from spreading among Italian PAs. The following section introduces the methodologies used in the CSCLK (Computer supported Cooperative Learning and Knowing: methodologies and tools for knowledge creation and sharing in Public Administrations) project to identify main research tasks, major players involved, and most suitable implementation mechanism needed to determine the best solutions to introduce KM approaches in the public sector. Section 3 concerns the preliminary and expected results of the running project and its main research guidelines. Open problems and possible further evolution of the project are finally discussed.

Knowledge Management in Public Administrations

The term knowledge management is used to refer a broad collection of organisational practices related to generating, capturing, disseminating know-how and promoting knowledge sharing within an organisational, and with the outside world, including: organisational arrangements, personnel development, transfer competencies, and managerial changes and incentives to staff to share knowledge [OECD, 2000].

Public administrations are undergoing important Business Process Reengineering (BPR) as a result of eGovernment projects such as large provision of sophistical Web services to citizens. The most important dimension of change in the new concept of public service involves: (i) the breaking down of barriers between departments and units; (ii) the negotiation and implementation of multi-disciplinary and multi-agency networks and protocols: (iii) a more efficient and effective communication, transaction and co-ordination.

This state of affairs is accompanying the deployment of eGovernment projects for over a decade and it is pervasive: the transformation activity will create analogous problems to managers and personnel throughout the different levels of the public organisations.

The Italian eGovernment Action Plan was approved on June 2000, together with the launch of the eEurope 2002 initiative. The Plan is just entered into the operational stage with the evaluation of the first call of proposals addressed to regional and local administrations. The emphasis of the eGovernment plan is on the development of a public administrations' unified network in which knowledge and information could easily flow, and on the education processes to improve IT competence in the public sector. To reach this objectives, Italian Public Administrations have to start a difficult and exacting re-organisational process in order to change their bureaucratic structure. As a survey on the introduction of knowledge management in Italian public sector points out [RSO, 2001], public administration is an organisation in which there is an intensive exchange of knowledge because all its main processes need knowledge creation, acquisition, sharing and transmission. *Moreover, one of aim of the eGovernment plan is to promote an organisational structure that could facilitate the cooperation (and hence the flow of knowledge and information) between central and local administrations.*

Knowledge Management ideas, methods and tools, together with the conceptual and empirical framework of Communities Of Practice (COP) have a high potential to assist public administration in these eGovernment BPR processes. Some of the most urgent needs are, for example:

- *to secure the availability of knowledge on the introduction, experiences and decisions made when IT (e.g. ERP systems such as SAP) is introduced within a department or organisation;*
- *to extract and exploit the latent knowledge in (electronic) administrative files and records in an appropriate manner;*
- *to support the decision-making and consultancy service of civil servants at the front-desk or public counter with an adequate knowledge base on former cases, judicial decrees, etc.*

However, the attempts to experiment and implement KM based organisational models and information systems in the public domain are still in their early phases, although with different levels of development in the various countries.

Knowledge management can be considered as an industrial process, were knowledge is acquired, stored, processed and distributed to clients along a "knowledge value chain". In this perspective, we have to consider in the first phase the acquisition of the preliminary forms of knowledge (something similar to row material logistics, in traditional manufacturing). Knowledge acquisition is a core learning activity, it greatly varies depending on the kind of knowledge contents considered, and its source (i.e., where it originates from). Learning activities are becoming more and more important in both private and public sector, and knowledge extraction is the first step of its life cycle. CSCLK project focuses on this phase in order to better understand what are the best practices and the possible tools for capturing knowledge and to share and disseminate it. On the other side, before entering into this phase, it would be useful to analyze the strategies of the public administrations, in order to understand what are their priorities, main objectives, and customer requests.

One of the issues on learning organisations, that recently has risen much attention, concerns the informal knowledge that arises from the activities of experts in their fields. It is often difficult to make this kind of knowledge explicit and organise it effectively; knowledge creation process among people develops itself as spiral between creation of tacit knowledge and its transformation into explicit knowledge [Nonaka and Takeuchi, 1995]. There are several proposals in the literature to address this problem by empirical methods to collect knowledge at the source, in its preliminary form (tacit knowledge), and to support its evolution through more organised formats, until it becomes explicit and sharable.

The challenge for public administrators is to find a successful way of re-engineering, managing, distributing and, in one word, improving the administration knowledge. Many obstacles hinder this development: a first classes of them derives from the fact that all KM methodologies, tools and practices have been developed in (and for) the business community, hence their application to the public sector need a deep re-thinking and adaptation work. On the other hand, the general PA culture, although with significant differences from country to country, is rather conservative, and the adoption of a more open and collaborative way of working is often seen as a threat rather than as an opportunity.

CSCLK project

The CSCLK project is running in cooperation with Italian research centres and a group of business schools, and it is also involving some public administrations interested in implementing knowledge based management systems in their organisation.

The aim of CSCLK is to characterize the relationships between various knowledge needs and technological options in the on-going BPR processes in public administration as a result of eGovernment projects. This research is developing and experimenting a coherent approach and methodology for the introduction of effective KM practices and systems in Italian PAs, in different sites and sectors.

CSCLK is investigating the opportunities and the limitations of ICT support for the KM in Italian PAs. This project is based on a state of the art assessment obtained through desk research complemented with the experience and in this area within the consortium: it starts with a definition of the scope of the research, and an initial mapping of the main issues (inter alia, PA needs in terms of KM, best practices, on-going R&D projects, methodologies and tools, technologies and so on). Particular attention is given to analysing the issue of business orientation vs public needs for the existing methods, tools and practices. This "roadmap", that is under development, will address not only research tasks, but also a first indication of the major actors and of the instruments to be put in place for implementation. This is accomplished by reviewing four different sectors encountered so far in the real-world: knowledge as an *object*, knowledge as an *interpretation*, knowledge as a *process* , knowledge as a *relationship*. Based on these four knowledge discourses, there exists different types of ICT functionality and tools inspired by these perspectives on the management of knowledge [Sorensen and Kakihara, 2002].

Another important expected achievement is the creation of a first group of relevant actors representing the initial kernel of a wider community of users, suppliers, consultants and academia: the creation of such a community appears essential to generate the critical mass of expertise needed to agree on rules and common standards, and to ensure an effective take-up and spreading of KM in public administrations. In this phase the project also takes advantage of the cooperation with a European group of stakeholders and actors deeply involved in the deployment of KM in the public sector (e.g. a central government organisation managing the innovation strategies, a Federal and local government organisations).

Moreover, CSCLK consortium will investigate the current and future learning needs in Italian public administration, and it will analyse the most suitable methodologies and tools in implementing knowledge sharing. In this research phase, the project will consider both explicit and tacit knowledge management process. In order to sharing explicit knowledge, we will focus on the peculiarities in designing, building and managing courses in the public context. Particular attention will be given to the reusable learning objects (RLOs) strategy as an innovative approach to develop flexible and modular courses available also by Web (Uskov, 2002). The modularity of the reusable learning objects could be very useful in an organisation, like Italian public administration, that is shifting its organisational structure towards a network model. In such kind of organisation (also characterised by a local and central dimension), it is necessary to guarantee a continuous learning process in which every node could autonomously create its learning path according to its formative needs. As Longmire (2000) suggests, "with the appropriate tagging and knowledge management methodologies and tools, RLO strategy can reduce time spent researching and accessing content, thus facilitating rapid creation of new electronic learning content". RLO approach is characterised by an high flexibility, since the modularity (granularity) of the learning sequences guarantees an easily reuse of the material. Moreover modular learning objects facilitate a just in time approach to the customisation of the content through the recombination of the material at the level of granularity desired. Also searching and management processes of content are simplified by filtering and selecting only the relevant content for a single user through the use of the metadata tags. This approach is also useful because ensures that the design, development and presentation of the courses are consistent across the organisation, both at the central and local administrations level. This last issue is very important in the public administrations context characterised by its enormous organisational size and a lot of different departments and offices often dispersed geographically.

Finally the research activity is addressing Policy implications and implementation mechanisms. In fact, it is felt that proper amount of resources should be allocated to analysing how public administrations can coordinate their efforts in order to harmonise both the national and international policies regarding the implementation of Knowledge Management and eGovernment projects, and which funding schemes and opportunities could be exploited to this end.

Discussion

In this brief paper we introduced problems and technological options for supporting the knowledge based management for public administrations and we analysed the main characteristics of CSCLK running project in which research players aim to provide a contribution to the following domains:

- focusing on the main phase of the knowledge life-cycle: the learning phase;
- analyzing learning organisations: companies (or PAs) that are able to interact with their environment dynamically, running processes to create, capture, store and manage knowledge;

- obtaining a deeper understanding of the problems which have prevented KM from spreading out in Italian and European public administrations;
- investigating and characterize existing methodological and technological options for supporting the management of knowledge in PA;
- identifying those priority research tasks which will have to be performed in order to address the solutions of knowledge management implementation in PAs;
- identifying the major (public and private) players involved;
- analysing the most suited implementation mechanisms;
- developing a methodological and architectural framework for assessing and describing the role of knowledge management in PA involved in the design and deployment of eGovernment services;
- embodying the experience gained in a set of project wide deliverables which may be adapted for use in an extended range of administration contexts and stages of eGovernment maturity as well as in a set of local deliverables in support of ongoing programmes of development of eGovernment services;
- comparing the networks among PAs with the virtual organisation paradigm, focusing on how virtual organisations can configure themselves to effectively and efficiently manage the knowledge flows they enable [Barbini, and all, 2002].

Bibliography

Barbini F.M., D'Atri a., Ricci F.L., Luzi D. (2002): *An Organisational framework for integrating business process in virtual enterprise*, working paper.

Italian Ministry of Innovation and Technology (2000) *Italian e-Government Action Plan* Available at http://www.pianoegov.it.

Longmire W. (2000). *A Primer on Learning Objects*. Available at http://www.learningcircuits.org/mar2000/primer.htm.

Nonaka I. and H. Takeuchi (1995): *The knowledge creating company. How Japanese companies create the dynamics of innovation.* New York: Oxford University Press.

OECD, *Survey on KM* (2000): PUMA/OECD (PUblic MAnagement Programme), Central Administrations of OECD (Organisation for Economic Co-operation and Development).

RSO, (2001). *Sviluppo del Knowledge Managment nelle Pubbliche Amministrazioni*. Ordered by the Italian Presidency of the Council, October.

Scarbrough H., J. Swan, and J. Preston (1999): *Knowledge Management: A Literature Review*. Issues in People Management. London: Institute of Personnel and Development.

Senge P. (1990): *The Fifth Discipline: The Art and Practice of The Learning Organisation*. London: Random House.

Sørensen C. and M. Kakihara (2002): *Knowledge Discourses and Interaction Technology*. In Thirty-Fifth Hawaii International Conference on System Sciences (HICSS-35), Big Island Hawaii, ed. R. Sprague Jr. IEEE.

Uskov V. and M. Uskova (2002). Reusable Learning Objects Approach to Web-Based Education. Proceedings of the IASTED International Conference "Computers and Advanced Technology in Education". May 20-22, 2002, Cancun, Mexico. 165-170.

Component-based Content Development for E-Learning Systems

Andreas Bollin, Roland T. Mittermeir, Roland Wohlfahrt
Institute for Informatics-Systems
Klagenfurt University
Klagenfurt, Austria

{andi, roland, rolze}@isys.uni-klu.ac.at

Abstract: Based on modularisation approaches for easy reuse and adaptation we developed linkage structures between e-learning modules that allow for the dynamic adaptation of presentations to interest- and knowledge profiles of individual learners.
The realization of these ideas is possible by extending LOM-metadata by "standardized" descriptions of the respective LOM's content and the preconditions presumed from learners.
These descriptions can play the role of dynamic link attributes.

1. Motivation

Following the definitions of Rosenberg (Rosenberg, 2001), e-learning refers to the use of internet technologies to deliver a broad array of solutions to support self-directed, open and distance education. But e-learning is more than delivering available content by technical media, it also encompasses new didactical concepts. After the first hype in the mid 1990s it became clear, that the requirements of e-learning systems (exchangeable and reusable learning units, system independent courses) cannot be achieved by just using hyperlink-technology. Various companies and organisations engage in the development of standards and concepts to assure that e-learning resources will be identified easily, are reusable and portable among different platforms. While component reuse is state of the art in software development, it is still a dream of course-authors to write content only once and to reuse it wherever and whenever needed. To support this kind of modularisation, standards (cf. SCORM or LOM, see http://www.adlnet.org and http://ltsc.ieee.org/wg12) are evolving. The general goal is to generate basic learning items (also called e-learning objects, shareable content units, or simply components) that are interoperable, reusable, durable, extendable and, manageable.

The next chapter introduces the concept of hard- and soft-links for supporting content reuse. Chapter 3 describes the basic steps necessary to implement hard- and soft-links and to integrate them in existing platforms. It concludes with an example of how to use the concept for generating a course and how the learner can benefit from the flexibility of the connected chunks.

2. Hard- and soft-links

The basic idea behind this concept is to support the reuse of existing learning components. To do so, we modularise the content of courses into components that can be recombined by future course-authors. The elementary components, referred to as content chunks, are kept with their metadata in a repository. They can be combined to higher level entities, modules, which form eventually the content of the whole course.

This goal is achieved by embedding content kept in a repository (content chunks) in metadata as shown in Fig. 1. The *general metadata* follows the LOM standard and positions the content in a general classification framework. *Pre-conditions* and *post-conditions* describe the learners assumed knowledge before and after studying this component. Finally, a *link section* relates it to other assets in the repository. This link section contains also links relating assets to form higher level entities (modules). The distinction between these link types is seen as a response to the criticism raised in (Seeberg et. al, 2000).

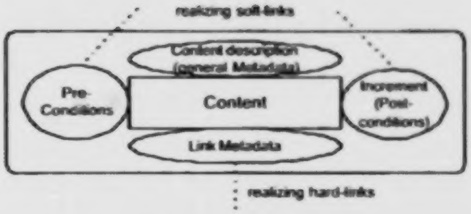


Figure 1: Metadata is attached to the content in order to enable hard-, and soft-link facilities.

Aggregations of chunks or modules leading to fixed sequences of presented material are realized by a type of hard-links we call *directed-link*. This type of link is to be provided by the author when creating a course (or when creating a germane set of learning components). It forces the learning system to provide chunk A (the source of the directed link) before chunk B (its destination). The second type of hard-link is called *r-link* (for relational link) and it describes the following types of relationships: "optional", specifying, that another chunk contains optional information: "special", stating that another chunk provides information in more detail; "general", leading to a chunk that contains a much broader information about the same topic; and "learner type", leading to a chunk containing the same information that is provided for a different type of user. The primary purpose or r-links is to support authors and to structure the repository.

To allow dynamic adaptation of e-learning content during the execution of a course, a user profile has to be taken into consideration. The key-idea is to supply the course in general with more material than the average learner wants to consume or with material presented on different levels. The dynamically updated interest- and knowledge profile of the learner is then used to select the appropriate chunk out of a pool of chunks based on the chunks' pre- and post-conditions. The knowledge necessary to understand a specific chunk has to be described in its pre-condition. The newly gained knowledge is described in a section called increment (or post-condition). Pre- and post-condition tags express implicit connections between matching chunks. Therefore, we call them *soft-links*.

Besides dynamic linking, pre- and post-conditions support course authors. During course-creation, the connections (directed hard-links) between chunks can be checked for feasibility. Pre- and post-condition tags of succeeding components must be compatible and authors could be warned, if the "knowledge distance" between learning components is too large. During repository maintenance, pre-/post-conditions can be used to support consistent definition of r-links.

3. Profiles and pre-conditions for dynamic generation of e-learning content

The previous section explained the concepts needed for dynamically generating user-specific e-learning courses. Here, we show how these concepts can be realized from both, the learner's and the system's perspective. In order to do so, we have to consider first a usage scenario: Let's assume a learner is interested in how to cope with elearning content management. In a heterogeneous group of learners, some might want a general introduction and progress in a systematic manner. Others have specific questions and want just an answer to them. Fig. 2 shows a map through the landscape of e-learning content available for any of these learners.

It is obvious that the content exhibited in Fig. 2 can be perused via different paths. However, it cannot be meaningfully studied in random order. Hence, the course author is challenged to provide sequences of chunks (learning strings) that are to be studied linearly, but can be combined in multiple ways. Students can use different entry points to this content. To satisfy these constraints dynamically, learners cannot be confronted with the raw chunks of e-learning content. These chunks or modules have to be rather embedded in an environment, that allows to assess a user profile and to update it along the users learning path. This embedding is sketched in Fig. 2 by the entry "Course-Portal". It serves to tell the system the users learning aspirations as well as the knowledge, the s/he has already acquired beforehand. In the case of our example, this information can be obtained by offering the student in addition to the main entry ("Introduction to Content Management") also two side entries ("Meta-Data", "Updates of Web-Material"). The individual topics (modules) consist of chunks connected by the course-author using directed-links. Hence, the internal modularisation of these entries remains hidden from the learner. The arrows shown in Fig. 2, represent soft-links. I.e. they exhibit

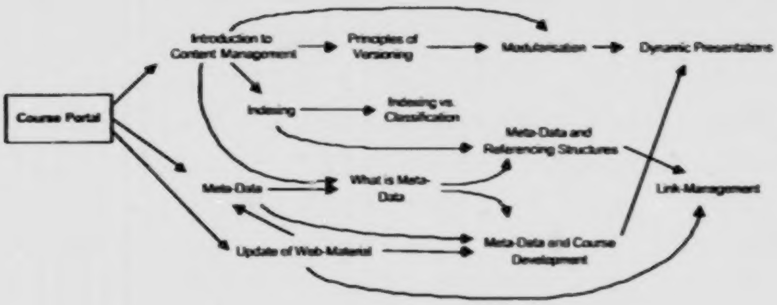


Figure 2: Content structure and relationships between content chunks in a course on Content M anagement

dependencies seen by the author of the course and thus they are dependencies implicitly expressed in the pre-/post-condition embedding of the individual modules.

As pre- and post-conditions specify the learners knowledge in relation to the given module, the knowledge increment provided by the module can be computed as the difference between pre- and post-condition. Basically, for each chunk, this increment can be expressed by a single attribute. Hence, for a complete module or learning-string, it will be a list of attributes. Since many chunks will not start from scratch but rather expand on an issue, the progression of knowledge in a certain domain can be indicated on an n-point scale. (The current implementation uses n = 10). Consequently, the user-profile and the pre-/post-condition structure have to be expressed in the same language. Propositional calculus (with fuzzy logic extensions) serves this purpose. Under these assumptions we have the following rules: *PostCond* := *PreCond* ⊗ *Inc* (with ⊗ representing conjunction of the pre-condition with the module's increment such that higher numeric values in the increment override lower numeric attributes in the pre-condition). Likewise, the choice of candidate modules made available to the learner at a given point is initially the portal only. After the questions of the portal have been satisfied, all modules with pre-conditions weaker than the positive user-profile obtained from the interaction with the portal are furnished in the candidate set of modules offered for study at this point. Preference is given to those modules, where the profile contains a negated term that figures positively in the modules increment or where a positive increment in the degree of knowledge can be identified. Thus, one has basically: *Profile* ⇒ *PreCond*.

It should be noted that the modules profile is mainly determined by the pre-conditions of the individual head-chunks of learning strings. As the learner decides for one of these candidate strings, the learners profile is updated in a piecemeal manner by the knowledge increments of the individual chunks studied by the learner. Within a module, the individual content chunks are hard-linked in a linear manner. When a given topic has been covered in such a way, the learner is offered a new chance to decide. Thus, after perusing the "Introduction" s/he might keep on going to "Principles of Versioning", or directly to "Modularisation", as well as to "Indexing" or to "What is Meta-Data". However, if the learner uses rather the problem-oriented entry of "Updates of Web-Material" s/he can next learn about "Meta-Data" or, if s/he indicated in the profile (or at this point) that s/he is conversant about metadata, go directly to "Meta-Data and Course-Development".

How can this be achieved technically? Even while the course has semantically several independent entry points, formally it has a unique entry point with the single purpose of asking the user what s/he expects from the course and what s/he knows already. This entry point offers the user the front level modules, in case of Fig. 2 "Introduction", "Meta-Data", and "Updates of Web-Material". It might also ask some further questions in order to see whether the user is already conversant about other topics dealt with in this course.

Thus an initial dialog might be: "*This course offers you to learn about A, B, and C… . If you know already α you might also go directly to A1 or A2, if you are familiar with β, you might as well study B1, B2 or B3. However, if you are only moderately aware of η, we recommend that you look at E before going to E1 or E2. …*". It is up to the designer of the portal-page to decide whether these questions are raised as boldly as indicated, or whether a neat graphical interface or an elaborate system of an entry examination leads to the information needed. In any case, a set of concepts indicating positive knowledge results. This set can be considered as a conjunction of concepts known by the learner. Linguistically, these concepts are expressed by words either directly drawn from the vocabulary of terms used for the classification of the module or representing refinements of such terms.

If the initial dialog yields an answer of the form: *"I know A, B, and C. But I want to know X, Y, and Z."* the respective propositional term would be: $A \wedge B \wedge C \wedge \neg(X \vee Y \vee Z)$. Assume, the course contains 6 modules with the following specification:

M1:	*pre:* $A \wedge B$	*inc* C	*post:* $A \wedge B \wedge C$
M2:	*pre:* $A \wedge C$	*inc* E	*post:* $A \wedge C \wedge E$
M3:	*pre:* $A \wedge E$	*inc* X	*post:* $A \wedge E \wedge X$
M4:	*pre:* $B \wedge C$	*inc* Y	*post:* $B \wedge C \wedge Y$
M5:	*pre:* $X \wedge Y \wedge (D,2)$	*inc* $(D,5) \wedge Z$	*post:* $X \wedge Y \wedge (D,5) \wedge Z$
M6:	*pre:* E	*inc* D	*post:* $E \wedge D$

The user has the choice of immediately studying modules *M4*, *M1*, and *M2* with a certain prioritisation for *M4*, since this module leads directly to a leaning goal specified by the user. *M1* can be perused at any time, but it will be always offered as a low key option, since the user claims to know the concepts (i.e. *C*) contained in *M1* already. Hence, *M2* would be a viable alternative, since it teaches *E*, thus preparing the user to study *M3* thus reaching learning objective *Y*. Knowing *X* and *Y*, however, is insufficient to comprehend *Z*. Thus, before venturing into *M5*, the user has to look at *M6*, and using the concepts acquired in *M2* try to grasp *D* sufficiently to study carefully *M5*, a module that does not only teach *Z* but also raise the students understanding about *D* from an introductory to an intermediate level.

One can see from this example that the precondition structure defines an implicit network that needs no global perspective. The global perspective is reduced to the aspect that the individual modules (or chunks) contribute to the overall learning objective of the course. Thus, the terms used in their pre-/post-conditions (resp. increment) have to be drawn from a relatively narrow knowledge domain. Usually it is a sub-domain of some domain referred to in the general metadata classification section. Adding an additional learning concept to the course thus does not require complex updates. It is just necessary to check, whether the pre-conditions of the new module can be met at all by either initial profile specifications or by profiles updated by knowledge increments taught by other modules. It is to be noted, that the pre-condition structure is not only local to the individual modules (learning strings) but repeats itself at the chunk level. Thus, the concept of pre- and post-conditions can also be used by course builders in finding adequate chunks to be combined to learning strings and thus eventually to presented modules of the course.

4. Conclusion

The paper presents an approach to modularise and dynamically re-link e-learning content. It rests on an extension to the metadata proposed by the LOM standard. The concepts presented are implemented on top of the content management system from HyperWave (Maurer, 1996). The power of the approach rests on a stratification of connection types as well as on a flexible notion of reusable learning modules.

References

Rosenberg, M. J. (2001). *E-learning – Strategies for Delivering Knowledge in the Digital Age*. McGraw-Hill.

Maurer, H. (1996). *HyperWave – The Next Generation Web Solution*. Reading, MA ua. Addison Wesley.

Seeberg, C. et al (2000). *Coherence in Modularly Composed Adaptive Learning Documents*. In Peter Brusilovsky P. et al (eds.): Adaptive Hypermedia and Adaptive Web-Based Systems, LNCS 1892, pp. 375–379. Springer-Verlag.

A proposal for using visualisation to support collaborative learning

Luis Borges Gouveia
CEREM, Universidade Fernando Pessoa
Porto – Portugal
lmbg@ufp.pt

Joaquim Borges Gouveia
DEGEI, University of Aveiro
Aveiro – Portugal
bgouveia@egi.ua.pt

Abstract: The paper addresses the problem of how to share knowledge between a small group of people engaged in learning activities. In existing systems that support collaborative learning there is some evidence that difficulties occur when we try to: (1) support the sharing of knowledge between users; (2) support the learning process across distributed groups within a given educational setting; and (3) provide distributed access to knowledge from different types of machines. The proposed work is based on the examination of how a common structure for knowledge sharing can be used in distributed environments for collaborative learning in a higher education context by providing a 3D interactive visualisation. This work proposes the development of a visualisation design to convey information of the common structure for knowledge sharing to be created and enhanced in an educational context. We defend that the use of both the visualisation design and the structure for knowledge sharing can support collaborative learning.

1 Introduction

Currently, there is some pressure to improve learning environments and use Information and Communication Technologies (ICT) in innovative educational contexts [Goodyear, 1999]. The ready availability of networks and computers allows for the development of computer-networked systems that support learning activities in classrooms or distributed situations.

However, current systems for collaborative learning [Britain and Liber, 1999] do not support the same knowledge sharing environment that face-to-face situations enjoy. In particular, there are difficulties to representing context and abstracting information about the knowledge theme being discussed. This is a problem that needs to be addressed in order to facilitate support for Computer Supported Collaborative Learning – CSCL. In particular, knowledge sharing becomes even a great problem in situations where more traditional teaching, based on the presence of the teacher, is expanded to allow for both local and distance education settings [Wan and Johnson, 1994].

Additionally, some authors argue that efforts to improve learning and education must emphasise not only content but also context. In fact, already [Lewin and Grabbe, 1945] defend both that learners play an active role in discovering knowledge for themselves and the strong influence that the social environment of the learner in promoting changes. Also [Vygotsky, 1978] defends that knowledge results, not from a transmission process, but from the internalisation of social interactions.

New technologies that use 3D visualisation facilities and interactivity within virtual worlds seem to assist in minimising the difficulties by allowing abstract information, in the form of structured knowledge for representing contexts and meanings, to be visually mapped and explored using direct manipulation techniques. Such a representation can complement existing tools to allow context sharing of a given knowledge theme – a view of organising information about a particular knowledge theme.

2 Collaborative learning and the use of visualisation facilities

Collaborative learning is defined as groups working together for a common learning propose [Resta, 1995]. To collaborate effectively in work group, each individual purpose must share a common grounding of concepts and be able to specify them in a form that allows individual reflection within the group. Each user in the group must possess a common mental map representation for reference, to understand the meanings and relations underlying a particular situation, topic, or subject knowledge referred as view. The common use of a visual representation of such a mental map allows for collaborative construction and enhancement, providing the opportunity to augment both individual and collaborative learning. An example of a similar system is CSILE (computer-supported intentional learning environments), which is a collective networked database of students' thoughts in text and graphic form. Data is labelled and organised in such a way that it can be accessed allowing a student to analyse a given view and to access related information in another domain [Scardamalia and Bereiter, 1994]

Information to support the meanings and relations of a mental map can be seen as a common information set of which each user must be aware. As this information comprises abstract concepts and their relations we propose the need to develop a structure for supporting knowledge sharing for the view to be shared. Few systems explicitly support such abstract information or consider it an important issue for supporting collaborative learning [Beck-Wilson et al., 1999].

The following ideas are proposed to support both user and collaborative learning:

- a structure for representing the knowledge theme being shared;
- a visualisation design to convey information about the structure being shared;
- an environment to allow the use of the structure and visualisation design to discuss and collaboratively enhance the knowledge being shared.

The work attempts to propose a visualisation design addressing the problems of:

- cognitive overhead: by allowing a abstract high level for information representation [Norman, 1991] and thus providing the means to integrate data using Information Visualisation techniques [Card et al. 1999];
- information overload: by allowing each individual user to take advantage of a structure for knowledge sharing and thus providing a context for reasoning about a particular knowledge theme [Huhns and Singh, 1997].

Additionally, the work is also extended to propose:

- support for data source integration: by taking advantage of a visualisation to merge information about a data source with the common structure for knowledge sharing and a textual search engine for Information Retrieval.

These problems are addressed by using a 3D interactive visualisation based on a structure for knowledge sharing that describes the requisite information. The structure is used to organise abstract information that must be shared for collaborative learning. The proposed solution uses visualisation as means of creating a projected representation for the structure been shared among different users. This work extends previous research on Information and Communication Technologies in education, in particular using Internet facilities for supporting virtual environments for higher education [Gouveia, 1999].

3 Approach of the work

The study of existing practices in collaborative learning and education environments serves as an initial starting point to get insight into ways of using abstract information and how it can be of value for and between students. The study of literature about face-to-face collaborative learning situations and knowledge construction provide important insights to inform about the characteristics that a virtual world system must have, to support similar functionality.

Based on the existing empirical data and from technical solutions developed on existent systems, a number of design solutions where considered. One of those solutions is the use of a structure as the main support for sharing knowledge about a particular theme view ? context. Huhns and Singh propose that users can contribute to enhance an existent domain knowledge model [Huhns and Singh, 1997]. Additionally, Huhns and Stephens efend the idea of using a set of symbols to represent a knowledge domain to be used by each individual [Huhns and Stephens, 1999].

The use of a set of symbols in the visualisation design provides a visual mental map representation that can help to keep cognitive overhead and information overload problems minimised. [Tufte, 1990].

As one of the main characteristics of the structure that must be represented is its relationship network, the visualisation design must provide some clues to organise and orient users. The exploration of a three-dimensional space for human interaction seems a natural option to do this: Cyberspace is claimed to provide a three-dimensional field of action and interaction with recorded and live data, with machines, sensors, and with other people [Benedikt, 1991]. According to Wexelblat, a well-structured view can make things obvious to the viewer and empower interaction. The view structure can convey an underlying mental model and can indicate possibilities for interaction in what Wexelblat proposes as semantic spaces [Wexelblat, 1991].

The strategy followed for the visualisation design is to take advantage of collaboration between users to enhance domain knowledge that can be visualised and manipulated by each user for their own information needs and to allow different data sources to be integrated with the structure for knowledge sharing. This will lead to the combination of data source information and knowledge in a way that there is an independent layer between the knowledge been shared and a given data source. Thus provides the user with additional support to both analysing the data source and help in information retrieval activities.

This high level approach allows for a different kind of integration with existing data sources. It allows, in opposite to alternative low level – data – approaches no need to alter existent data sources and apply precise rules for previous identification – classification – of relevant information.

In order to test both the use of the structure for knowledge sharing and the visualisation design, a prototype has been developed to allow a group of students to use the visualisation design for sharing knowledge [Gouveia and Gouveia, 2002]. The prototype intends to test both the functionality and effectiveness of the use of the structure for knowledge sharing and a visualisation design to support user learning. The learning results from a group of activities such as collaboratively sharing, discussing and enhancing a structure for knowledge sharing.

4 Final remarks

The work defends the need to consider information about tacit knowledge as one of the requirements that must be presented in using Computer Support Collaborative Learning. Other authors defend a similar approach [Lewis, 1999; Mercer, 1995]. One main contribution of the work is the proposal of a structure for knowledge sharing to describe a knowledge theme view. This structure presents a base structure that can be extended to include and reference more information and thus provide richer semantics by adding new elements.

We claim that an appropriate approach to use the proposed structure for knowledge sharing is to provide a visual interface as a 3D interactive visualisation. A direct advantage of this approach is the possibility to represent structure relationships and integrate both knowledge and data source information.

The general outcomes of this research are:

- use of a structure to represent a knowledge theme view: conveying information to be enhanced by collaboration. The structure allows the knowledge specification, knowledge sharing and supports the visualisation generation.
- a 3D interactive visualisation to convey structure information: allowing the visual sharing and individual exploration of the structure for knowledge sharing.
- proposing a generic support to knowledge for collaborative learning: resulting in the joint use of the structure for knowledge sharing and a 3D interactive visualisation to support collaborative learning.
- provide the means for integration knowledge and a data source in the same interface: by giving a visual representation for the knowledge. The integration is made possible by using Information Visualisation techniques [Card et al., 1999].

The novel aspect is the proposal of the use of knowledge to render a 3D interactive visualisation design and an integrated Information Visualisation to combine data source information with the visualisation of the structured for knowledge sharing. Together these facilities provide an environment for collaborative learning support.

The system can be integrated with a data source, providing a tool for sharing and manipulating the visualised structured information as a knowledge map. This means that the system assists users in information retrieval actions within a specific knowledge theme view. The system provides the support for more informed browse and search tactics to be undertaken by the user. It also provides support for sharing, discussing, and exploring the structure for knowledge sharing, providing an environment for collaborative learning.

References

Beck-Wilson, J. and Pfister, H., Schuckmann C. and Wessner, M. (1999) The clear approach: Designed distributed / Computer Supported Co-operative Learning environments. Eurelings, A., Gastkemper, F., Kommers, P., Lewis, R. and Melief, B. et al. (Eds.) *Integrating Information and Communication Technology in Higher Education*. Deventer: Kluwer, pp 107-132.

Benedikt, M. (1991). Cyberspace: Some Proposals. Benedikt, M. (ed.) *Cyberspace first steps*. Cambridge, Massachusetts: The MIT Press, pp. 119-224.

Britain, S. and Liber, O. (1999). *A framework for Pedagogical Evaluation of Virtual Learning Environments*. Report: 41, JTAP, JISC Technology Applications. October.

Card, S., Mackinlay, J. and Shneiderman, B. (1999). *Readings in Information Visualisation. Using vision to think*. San Francisco, California: Morgan Kaufmann Publishers.

Goodyear, P. (1999) New technology in higher education: Understanding the innovation process. Eurelings, A., Gastkemper, F., Kommers, P., Lewis, R. and Melief, B. et al. (Eds.) *Integrating Information and Communication Technology in Higher Education*. Deventer: Kluwer, pp 107-132.

Gouveia, L. (1999a). Digital support for teachers teaching. Current experience on using Internet facilities in virtual university environments. Educational Media International. Journal of ICEM, Vol. 36, nº1, March. Routledge, pp 19-31.

Gouveia, L. and Gouveia, F. (2002). Evaluation of a Visualisation Design for Knowledge Sharing and Information Discovery. Filipe, J. et al. (eds.), *Enterprise Information Systems III*, pp 83-89. Netherlands: Kluwer Academic Publishers.

Huhns, M. and Singh, M. (1997). Ontologies for Agents. IEEE Internet Computing, Vol. 1, No 6, Nov.-Dec. 1997, pp. 96-98.

Huhns, M. and Stephens, L. (1999). Personal Ontologies. IEEE Internet Computing, Vol. 3, No 5, Sep.-Oct. 1999, pp. 85-87.

Lewin, K. and Grabbe, P. (1945). Conduct, knowledge, and acceptance of new values. The journal of Social Issues, no 1 vol 3.

Lewis, R. (1999). Computer Supported Collaborative Learning: Introduction. In Eurelings, A., Gastkemper, F., Kommers, P., Lewis, R. and Melief, B. et al. (Eds.) *Integrating Information and Communication Technology in Higher Education*. Deventer: Kluwer, pp 241-245.

Mercer, N. (1995). The Guided Construction of Knowledge. Talk amongst teachers and learners. Clevedon: Multilingual Matters.

Norman, D. (1991). Cognitive Artifacts. Carroll, J. (ed.) *Designing interaction: Psychology at the human-computer interface*. New York: Cambridge University Press, pp 17-38.

Resta, P. (1995). Project CIRCLE: Student Mentors as a Strategy for Training and Supporting Teachers in the Use of Computer-Based Tools for Collaborative Learning. *Proceedings of the Computer Supported Collaborative Learning* (CSCL'95). 17-20 October. Indiana University. Bloomington, IN.

Scardamalia, M. and Bereiter, C. (1994). Computer support for knowledge-building communities. The Journal of the Learning Sciences, vol. 3 no 3, pp 260-283.

Tufte, E. (1990). *Envisioning Information*. Cheshire, Connecticut: Graphics Press.

Vygotsky, L. (1978). *Mind in society: The development of higher psychological processes*. Cambridge: Harvard University Press.

Wan, D. and Johnson, P. (1994). Computer Supported Collaborative Learning Using CLARE: the Approach and Experimental Findings. In Proceedings of the *Conference on Computer Supported Cooperative Work* (CSCW'94). 22-26 October. Chapel Hill, NC. New York: ACM Press, pp 187-198.

Wexelblat, A. (1991). Giving Meaning to Place: Semantic Spaces. Benedikt, M. (ed.) *Cyberspace first steps*. Cambridge, Massachusetts: The MIT Press, pp 255-271.

How an online survey was used to market, measure, and develop technical eLearning training for Cisco's Technical Assistance Center Customers

Presenters: Dr. Jashoda Bothra & Tina Francis
TAC/AES Training – Customer Advocacy
Cisco Systems, Inc.
255 West Tasman Dr.
San Jose, CA 95134
Email: jbothra@cisco.com
Phone: 408-853-8787

Abstract:

How an online survey was designed to market an eLearning site for Cisco Systems Technical Assistance Center (TAC) customers. Provides insights of how the approximately 7000 responses to an online survey provided customer eLearning metrics and suggestions for future eLearning content.

Statement of the problem:

A large group of Cisco customers use the TAC area of the company's website to find answers to networking solutions, learn about networking technologies, and interact with the TAC support staff to troubleshoot networking cases online. The TAC eLearning Solutions team that services Cisco's internal TAC engineers assumed the role of designing and developing eLearning materials especially for TAC customers. They designed the site to address the shortage of technical eLearning modules specifically on the TAC website. Considering the wide scope of the TAC's technical support oriented website, the TAC eLearning solutions team was challenged with: (a) offering usable and interactive technical eLearning modules; (b) selecting networking content that is suited to an online delivery format; and (c) identifying future learning needs. The team members approached these challenges by sampling other eLearning sites, analyzing the online TAC customers' training interests and finally creating a pilot eLearning site. This paper provides details on how the TAC eLearning Solutions designed, deployed and mined data from an online survey to gather user feedback related to the above issues.

Description of the activity

The online Technical Assistance Center of Cisco Systems, Inc provides a comprehensive web-based knowledge base for customers to find, learn about, and resolve networking related issues via documentation and top networking issues posted on the TAC website. A majority of the information available on the TAC WEB site is in the form of text -based notes or white papers. The eLearning Solutions site was designed to offer a variety of technical resources to help customers interact with, learn about, and resolve common technical issues. Content from thirteen different categories of networking technologies and solution are offered on this site to serve as a comprehensive learning resource for customers. The site includes short (30 minutes or less) training modules in the form of E-courses, e-labs, Netbits, and Audio-on-demands. An e-course provides in-depth network concepts, troubleshooting complex problems and network design. A Netbit is a short animated clip of a select technology or technical problem). Audio-on-demand with Flash animations offer audio and PowerPoint Slides to present the content.

After publishing the first release of the eLearning site, the TAC eLearning solutions team was challenged with attracting the TAC customers to visit and use their online eLearning resources. To address this challenge, the team advertised an online survey via an email to a list of approximately 488820, subscribed to a monthly email newsletter. As an incentive for completing the survey all the survey respondents were informed that they would be entered in a drawing to win a Palm Pilot. This strategy worked very well and the team received 5835 responses from those who visited the site. The online survey was designed to gather information related to four issues (a) identify hot topics, (b) capture user-learning preferences, (c) usefulness for customers, (d) track the technical-access to materials (e.g. browser, bandwidth) and (d) gather needs assessment for future releases. The survey instrument included a total of 10 questions. Considering the online format of the survey, the survey was designed with multiple choice (check boxes and drop down menus), rating scales, and text boxes to capture the responses. At the end of the month a web administrator provided the TAC eLearning Solutions team with an excel spreadsheet containing responses from all 5835 surveys.

Findings:

The eLearning team mined all the responses to determine the most commonly requested technology issues that survey respondents wanted to access on the eLearning site. Results revealed 13 topic areas for as

BEST COPY AVAILABLE

requested by a majority of the users. In response to the survey question "What would you like to see added or changed (on the eLearning site)?" the most frequently mentioned ones were related to requests for more comprehensive content, categorization of eLearning content by level of difficulty, and have content formatted as case studies. Several respondents also requested that the site offer a better indices and description for easier search results, site navigation, and auto-notifying users when new content is posted on the site that is related to their interests. Some of the responses also included suggestions for refining the audio quality of the video-on-demand modules and allowing visitors to download content hence offering them the convenience to view content on their own PC versus on the web.

Discussion:

The primary survey results were gathered, analyzed, and synthesized to contribute to the needs assessment phase of the next release of the TAC eLearning solutions area. ELearning content authors are currently working on 4 of the 13 most requested content areas as identified by survey respondents. The comments also helped the web developers to identify their users' profiles including their learning preferences, technical requirements, and eLearning expectations. New content posted on the site is advertised to audiences who requested technology specific newsletters. Hence the survey results helped course developers, technical writers, web designers and instructional designers to incorporate survey comments pertaining to their role in the site's ongoing development efforts. In parallel with this effort the TAC eLearning solutions team is now focusing on creating more comprehensive eLearning materials organized by level of difficulty for each technology topic area. The suggestions from the survey comments are being incorporated in the development of another version of this site containing more formal technical training curriculum organized by networking professional roles.

BEST COPY AVAILABLE

“And we’ll have fun, fun, fun.........!” Online Games-Based Learning

A Proposal by Bob Boufford and Bonita Bray

Introduction

Television and computer games are creating new generations of learners who "just want to have fun." Online educators can capitalize on this by implementing digital game-based learning activities using tools in course management systems that lend themselves to learning while having fun online. In this session, participants will identify key elements of games, discuss similarities to learning and explore game-based activities that encourage active learning and fun through online communication and collaboration.

Body

Both personal experience and a growing body of literature attest to the changing characteristics of our students. Raised on television shows like Sesame Street, video games and computer technology, they are used to having fun and expect to do so in most of their activities. Increasingly, they do not have the patience to sit in a classroom or read through online content modules. Even communicating with their peers in virtual classrooms can be boring.

While the new computer technology has created this problem, it also offers a potential solution, since many online course management tools allow instructors to include digital games-based learning within a secure structured online course environment. These tools allow the instructor to quickly put up course content with only minimal knowledge of web site development. However, this structured environment does put restrictions on certain activities. While using a web browser provides low hardware/software requirements for students, it does restrict the use of certain types of computer technology that is available on standalone computer systems or games consoles.

Within this course environment, digital games can range from trivia games, through role-playing and simulation, to puzzles and strategy games. In addition, while the course management system may not be adaptable to actual games, the communications features built into most of these systems allows students to collaborate while using various off-the-shelf games such as “sims” (short for "simulators") and strategy games. All of these can provide fun while teaching essential course material.

We will also explore a number of possible learning games possible in an online course such as email games, scavenger hunts, and trivia games. In addition, “off the shelf” Jeopardy-type games, card games with customized course-based questions and crossword puzzles using course materials are other types or games that can be incorporated using a mix of HTML, JavaScript, Java and Flash technologies.

We will identify what Parensky identifies as the six key structural elements of games:

- rules
- goals and objectives
- outcomes and feedback
- conflict, competition, challenge and opposition
- interaction and
- representation

While games and learning may seem poles apart in both their structure and goals, we argue that these elements are very similar to the structural elements of learning. With this information, audience members will be able to consider how games-based learning could be used in their online courses.

As an applied "example", we will share an approach we have used successfully a number of times that supports many of the seven principles of good teaching practices as established by Chickering and Ehrmann and also encourages students to engage in higher level thinking identified in Bloom's Taxonomy. In our game, "students" played the roles of secret agents in a scenario based on the original Mission Impossible television series. This simulation encouraged participants to explore the inherent characteristics of the communications tools while they experienced intense online communication and collaboration.

References:

Bloom, B.S. (Ed.) (1956) Taxonomy of educational objectives: The classification of educational goals: Handbook I, cognitive domain. New York ; Toronto: Longmans, Green.

Chickering, Arthur and Stephen C. Ehrmann (1996), "Implementing the Seven Principles: Technology as Level." AAHE Bulletin, October, pp. 3-6.

Parensky, Marc (2001). *Digital Games Based Learning*. New York, NY: McGraw-Hill.

Virtual-Virtual-Barter For Sustaining And Developing Geographically Scattered Communities; The Example Of "Resource Communautaire Troc-Virtuel".

Gary Boyd Concordia University, Quebec Canada <boydg@vax2.concordia.ca>

Louise Sauve' Tele-Universite', Quebec, Canada <**Error! Reference source not found.**

Abstract: Virtual virtual-barter is a Web-based strategy for `free-give-and-take' or barter of resources. The SAVIE (Societe' pour l'Apprentissage a Vie) Reseau Communautaire troc-virtuel (RCTV) project makes use of a single website and special software to efficiently distribute member organisation' staff requests for materiel & assistance and their offers of assistance to others in the community. Activity tokens (bons d' echange) are generated with each action: offer, request, match, or trade, to keep a global accounting of relative participation by the various organisations and sub-groups (not by individuals) over time. The activity tokens do not correspond to person-time or monetary value of materiel. This system has been in use in Quebec for about two years, and across all of Canada for a year. Initial results will be discussed: Starting with RQuODE and ACREQ in Quebec, the barter system now includes forty organisations across Canada, The Website works well, usability needs improvements.

Introduction: -The Context and Our Main Educative Concerns

.......Our main concern is to find out how best to use Internet based technology to strengthen local cultural communities and the resource-sharing links among them, in this case especially to strengthen the francophone life-long learning community in Canada, and thereby perhaps also Canadian and World society. New communications and exchange technology may help with the very serious challenges we face. Many commercial technical and political forces are weakening our communities and marginalising large portions of the population. Seemingly unemployable young and old persons are widely disadvantaged in these times (Schragge & Fontan 200). The particular venture that we have undertaken to research in practise is one using Web technics to help (re'cherche d' emploi) organisations which help people train for and find good work commensurate with their abilities. These organisations seek to connect clients with eco-socially good lasting employment. Strengthening the core employability linking agencies in Canadian society is becoming very important and urgent. We believe that well deployed tele-technology can help the organizations which actually do help such alienated and disadvantaged persons be more effective. Since most of the organizations which help the unemployed are now seriously underfunded by government, and are but weakly sustained by charity, some new minimal-cost resource-sharing solutions such as LETS barter (linton 2002) or free give-and-take of complementary temporarily surplus capabilities seemed to be an hopeful strategic option to pursue and research in order to strengthen them. The strengthening is in three respects: first directly through shared resources, second indirectly through enhanced acquaintanceship, and thirdly through the extra evidence which a Web based exchange system can provide (via transaction audits etc.) to governments and other funders good evidence that actually so many people are working effectively together so often, in organisation X for the public good. These hard data from the auditing capabilities of Web-based exchange support systems legitimate augmented government and foundation funding. Some tentative conclusions about the practicability of this strategy based on the results to date, and some further research questions which have emerged from it are presented below.

The Strategy: A Website Facilitating Multi-lateral Resource Sharing

To be optimal for strengthening scattered communities exchange support tele-technics should be: *accessible, easy to learn, easy to use, socially convivial, valuable and reliable*. To strengthen large Canada-wide(or wider) communities, the tele-technics system should also be *scaleable* to accommodate very large numbers of transactions among large numbers of people without either undue time burdens, or detrimental side effects.

Website based systems which participants check into as needed, offer obvious advantages(Boyd 1997). The useful configurations range from very simple bulletin board swap sites(e.g. <http://www.u-swap.com/>) up to complex AI-agent brokerage systems such as I-help (Greer et al. 2001). For our purposes we clearly needed more than a listserv or a simple bulletin-board website but an AI system was beyond our capabilities. So we developed an interactive website with many facilitation tools..

Procedure

A number of surveys and focus groups were conduct to rough out the needs and the system design then Two years of developmental work was done with Quebec organisations and the prototype Website. The system design and operation protocols arrived at are given in table 1.

Final Protocols	
Context	In a difficult economic context several community employability service organisations regrouped themselves to form the virtual-virtual barter network RCTV. This network permits them to help one-another to minimise their out of pocket costs through sharing and exchanging goods services and information. Moreover this network helps draw together organisations with common purposes and complementary strengths that are geographically dispersed very widely across Canada. Free exchange, without any notion of commercialisation centred on principles of mutual aid provides an enhanced source of optimism and motivation for struggling service providers.
Variable « objects »	Any sort of "object" ('learning object', working documents, professional consultations , surplus equipment, workshops, etc.) is exchangeable. A certain number of classes of such objects have been defined by the organisations as of particular importance for sharing, and are specifically catalogued through the RCTV Website..
Formula of exchange	Each partner organisation submits a list of objects which it is ready to barter, and also a list of objects which it would like to obtain. The exchanges are made by mutual consent among the organisations as gifts to each other without use of money or scrip.
Type of barter	Multilateral, which is to say it is effected by interaction between two or three or more organisations to meet each other's current needs.
Value of the objects and exchanges	NO monetary value is attributed to the objects exchanged, nor to the tokens of exchange (bons d'entraide). (This is to avoid ill-feelings about possible unfairness, as well as to avoid attracting taxes.)
Type of currency	The organisations offer and acquire objects freely at their convenience. However to keep some trck of relative contribution and benefits a token if exchange is awarded to the provider of any object by the beneficiary. In cases where the exchange is not possible on a bilateral basis, if one of the two lacks anything of interest to the other the exchange can be multi-lateral involving other organisations. The tokens of exchange facilitate this. Since a token is remitted to the organisation which found nothing it wanted at the time it can use the token later when it does find something helpful offered by some other member organisation..
Intellectual Property Rights	IP rights remain with the authoring organisation (or its members). Before any object can be modified , or further traded permission must be obtained from the source.
Protocol for recording transactions	The network of exchanges is supported by a secure transaction system which records the sequence of every transaction for accountability. The private workspace of each organisation involved is automatically updated at the instant of any transaction.
Confidentiality of all exchanges	Total. The network is accessible only to members with passwords which give access to general offers and requests, and privileged access to the transactions of the particular organisation(s) where the person works. Each user who has

BEST COPY AVAILABLE

Final Protocols	
	been mandated to conduct exchanges by their organisation receives a unique password. All transactions are recorded confidentially
Model of association	The RCTV is a co-operative governed by a board composed of representatives of all member organisations and of SAVIE.
Membership	During the prototype development phase there was no charge for organisations to join the network. But they and their participating staff have to agree to abide by the RCTV charter of rules which specifies the modes of exchange, the responsibilities and rights of each partner member (essentially as set forward in this table).
Organisational mechanisms	Each organisation which joins the network must provide a list of 'objects' which it is ready to provide to others, and should place requests for needs it thinks the network might help it with. For each object offered the contributing organisation receives a token of contribution. When an organisation desires an object offered by another organisation it asks the other to provide the object in return for one of these tokens. of contribution. The request is automatically forwarded. The organisation which receives the request can accept, or refuse, or discuss the request by means of a private chat conference space. When the operation finishes the information is recorded in the private archives of the two organisations involved. If an offered object is withdrawn, then the ex-donor organisation loses the token of contribution it had received for offering the object
Hosting and maintenance services	SAVIE is the hosting organisation RCTV. It provides a team of secretarial and technical staff to give user help-line support and to maintain and upgrade the system. It also conducts formative evaluations of the operations and arranges face to face conferences from time to time to obtain guidance from the member organisations. (SAVIE also conducts research on the whole venture.)
Information technology capabilities provided	The RCTV Website system gives access to a range of functionalities and tools, to support exchange of resources and community building, of which the most important are: ❖ a show-window for presenting the profiles of each member organisation (mission, objectives, specialisation, clientele, etc.). A link to the member organisations own Website (if any) is provided. ❖ a searchable show window for the 'objects' offered as contributions. and a display of requests, and tools for matching requests to offers. ❖ Private exchange-status display space for each organisation. ❖ Private conferencing and chat spaces for negotiating details of bilateral exchanges. ❖ Conference for general discussion of common interests among staff of all members organisations. ❖ Conference for dealing with technical breakdowns and other operational problems

Table 1. PROTOCOLS of the "troc-virtuel" system .

Current Status of the Venture

The new Francophone pan-Canadian community virtual-barter network (RCTV) has been brought into existence and continues to function. A repertory of resources available for sharing among the various organisations has been compiled. Staff members of forty-two organisations have participated in the network's development. Face to Face workshops and focus groups have been held in Montreal Quebec City and Vancouver to introduce people to the goals and techniques involved and to obtain their feedback on usability and usefulness aspects of the network. To date, four graduate students have studied and worked on the project. Two undergraduate computer-science students have done internships with the project.

As it has developed the SAVIE/ RCTV Website software system, offers more than all the essential support functions, and is also actually accessible and reliable enough to support valuable exchanges among the organizations across Canada.. However, to accommodate some of the minimally computer-literate and very busy users in the field, improvements in the ease of learning and in the ease of use were found to be helpful. Starting with RQuODE (Regroupement Que'be'cois des organismes pour le de'veloppement de l' employabilite') and ACREQ (Association des clubs de re'cheche du Que'bec) in Quebec, the RCTV system now involves about forty francophone organisations all across Canada, from SYNERGIK in New Brunswick to CETIC in British Columbia.. Theoretically our Website software system should scale well to even much larger numbers of participants and of transactions, but this awaits empirical verification. What we have learned so far, is that the general approach is welcomed by the (francophone recherche d' emploi) community organizations. That the organisations do have a large repertoire of complementary materiel, seminars and professional capabilities, much of which they are willing to share from time to time - if duly credited for their contributions.

The virtual-virtual-barter strategy for community viability presented in this paper is engineered to be self bootstrapping to an important extent once it really gets going. This is possible and likely because of the solid politically relevant evidence it can provide about the numbers of people and the proportions of their time which are actively involved. Such evidence can be used to obtain funding and other kinds of support in on-going positive feedback loops. To fully understand the venture the history of these characteristics of the leading actors would have to be explored and verified. Fortunately Copious details actually are provided in the various project progress reports and final reports available on the SAVIE website<www.savie.qc.ca> upon which we have drawn this account..

Acknowledgements

This work has been supported by the Office of Learning Technology, Industry Canada.

References

Boyd, G. M.(1997b) Distributing Real Learning Conversations With Virtual Money. *Proceedings of the tenth Anniv. Conf. on Computers In Education of China*, Shanghai, Nov. 1997. pp. 97-103. (available <http;//alcor.concordia.ca/~boydg/drboyd.html>).

Greer J., McCalla G., Vassileva J., Deters R., Bull S., Kettel L. (2001) Lessons Learned in Deploying a Multi-Agent Learning Support System: The I-Help Experience. *Proceedings of AI in Education AIED'2001*, San Antonio, IOS Press: Amsterdam, 410-421.

Hardesty, David (2000) Barter Exchanges on the Internet available at <http://www.ecommercetax.com/doc/011300.htm>

Linton, M. (2002) Principles of LETS, Landsman Community Services Ltd. (available at <`http://www.gmlets.u-net.com/explore/home.html`>)

Sauve' L. (2002) *Troc-virtuel* available at <`http://troc-virtuel.savie.qc.ca`>.

Shragge, E. and Fontan, J-M. (2000) *The Social Economy*. Montreal, Black Rose.

Support for Mobile Learners in Distributed Space

O. Brand*, L. Petrak†, M. Zitterbart*†
†Institute of Telematics
University of Karlsruhe, Germany
*Learning Lab Lower Saxony (L3S), Hannover, Germany
E-Mail: brand@learninglab.de, petrak@learninglab.de,
zit@learninglab.de

Abstract: Today, learners on the move are typically disconnected from their learning environment and from other learning partners. With the advances in mobile communication, we envision distributed and mobile learners to be seamlessly connected to learning sessions and learning content. Connection should be supported in an ad-hoc fashion, if applicable, and during mobility (Zitterbart et al. 2001). Mobile learners are usually equipped with mobile devices, such as laptops or handheld computers (PDAs). This has to be considered for the development of collaborative applications. Furthermore, an integration of existing collaborative frameworks into interactive workspaces will be investigated. This requires the development of new learning scenarios that provide support for such integration.

Introduction

Learning may take place in very different settings, for example, interactive lectures or learners meeting in a coffee place. However, today, learners on the move are disconnected from their learning environment and from other learning partners. With the advances in mobile communication, we envision distributed and mobile learners to be seamlessly connected to learning sessions and learning content. The main goal of the project is to provide seamless support for learning teams in distributed space (*d*Space) where the number, quality and timeliness of interactions and communications among learners are increased (Zitterbart et al. 2001). To support learners on the move, the use of mobile clients (such as handheld devices, PDAs) has to be supported. To address these issues, distributed applications for synchronous teamwork that deal with the required scenarios have to be developed. These applications aim at the integration of mobile clients into CSCW/CSCL frameworks. In this context, the adaptation of existing CSCW applications for the integration of mobile clients will be investigated. Furthermore, the integration of existing CSCW/CSCL frameworks into interactive workspaces will also be investigated. The project focuses on experimental work, so the general approach is based on iterative prototyping cycles where the developed prototypes will be successively enhanced, tested and analyzed. Basic parts of the evaluation will be performed with the "interactive classroom" that uses small handheld devices (PDAs) in a lecture room to enhance interactivity among the students (Mauve et al. 2001). The prototypes and applications developed in this project will be enhanced based on the evaluation results.

A Framework for Collaborative Learning

The MACS (*M*odular *A*dvanced *C*ollaborative *S*ystem) framework consists of several components: networking, control, visual session control and application modules. The networking modules are responsible for communication services (i.e. connecting MACS to a local network) and support of both unicast and multicast transport protocols. The control component provides dynamic module loading and the management of sessions, users and applications. The visual session control performs graphical session and floor control in a virtual meeting room supporting group awareness as well as social protocols. Applications are modules loaded on demand at runtime. Currently, a basic set of applications like a whiteboard, a feedback tool and audio & video is integrated.

BEST COPY AVAILABLE

The GUI of MACS is based on a simple, two-dimensional graphical surface on which session and floor control is performed. The participants of the session are displayed as thumbnails, their multimedia equipment (camera, microphone, speaker) is represented by small icons placed above (cf., Figure 1). A speaker, for example, means that the participant is accordingly capable of listening to an audio stream. Various conferencing scenarios - discussion groups, lectures and seminars - are currently supported, which differ in the kind of visualization, the maximum number of participants as well as in the supported floor control policies.

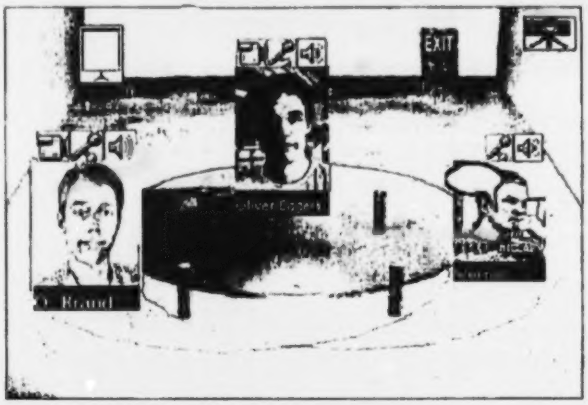


Figure1: Meeting scenario in MACS

In the meeting scenario, session control can be performed within this virtual meeting room. For example, to expel a participant from the session, the session chair just drags the thumbnail of the corresponding participant and moves it to the exit door. Floor requests for the audio resource are visualized as a *speech bubble* within the participant's thumbnail. Several floor control policies are available which contain both implicit and explicit policies.

In the lecture scenario, a virtual classroom replaces the virtual meeting room, and the participants are not displayed via thumbnails but in a symbolic way using group symbols of different sizes and colors. This addresses the scalability issue and permits lectures with a higher number of participants. The size of the group symbol varies according to the number of learners currently listening to the lecture – important information for the teacher. For easier recognition, the teacher is always visualized as a thumbnail. An encompassing overview of the MACS system and details about the supported conferencing scenarios can be found in Brand et al. 2000.

The Challenge of Integration of Mobile Learners

Currently available tools for collaborative work (CSCW/CSCL) lack support for tele-teaching scenarios with mobile clients. Two main goals are followed within this project:

- The investigation of the integration of mobile clients into existing CSCW/CSCL frameworks. In this context, tailoring the CSCW tool MACS for the integration of mobile clients will be investigated. This requires a complete redesign of the graphical user interface of MACS. PDAs offer less screen size and performance power than PCs or laptops, so this has to be considered for an adequate screen design of a CSCW framework to make it usable even on handheld devices.

- Increasing the interactivity with handheld devices. This is evaluated by the interactive classroom submodule of the project (Mauve et al. 2001). The students in a lecture are equipped with handheld devices (such as PDAs). These devices can be used in various ways: for spontaneous call-ins (to submit a question to the teacher), to get feedback from the students regarding some aspects like content, technical quality, etc.

BEST COPY AVAILABLE

Different Learning Scenarios

As mentioned above, the learning process can take place in different settings, i.e. in a lecture room, in a coffee place or at home. For these different settings, there are various learning scenarios that have to be supported by the network infrastructure as well as by the collaborative applications.
There is a variety of possible learning scenarios existing:

- All participants meet in *one* room, so all members are physically present. This can be used for teaching scenarios as well as for interactive meetings, such as brainstorming.
- All participants are physically distributed, potentially mobile, and are communicating with collaborative applications. This can be used to let physically distributed people interact and share the same workspace and/or applications.
- A mixture of the above scenarios: some participants meet in one room physically, and some other participants, physically distributed, are connecting to this meeting via collaborative applications.

Today, learners are often equipped with mobile devices, such as laptops. The use of smaller handheld devices, such as PDAs, will increase in the near future. These devices are easier to handle than laptops, but are less powerful in performance and offer only limited screen space for applications. To deal with these restrictions, new scenarios have to be developed to enable learners on the move using a small PDA still to connect to their learning environment.

The iRoom

The Stanford Interactive Workspaces project, also known as the "iRoom" (Stanford 2000), is an example for a learning scenario that deals with mobile clients. Its main goal is to explore new possibilities for people to work together in technology-rich spaces with computing and interaction devices. The desired scenario corresponds to the first type listed above: *all* members of a working team meet together in *one* physical room, the iRoom. This room functions as a dedicated meeting space equipped with enhanced technological environment such as large displays, wireless I/O devices and the opportunity for integrating mobile devices such as handheld PCs. The team members can share all technical resources in the iRoom. This enhances the communication between the team members and therefore improves the global working process. Here, the focus lies on task-oriented work, such as brainstorming meetings or design reviews.

Currently, there are a couple of features for the iRoom available enhancing communication among the members. *Multibrowse* represents one of them. It allows the "beaming" of a web site from the Internet Explorer to one of the integrated displays in the iRoom. This can be used to share a web site from a participant's laptop with all other present members in the iRoom. For the realization of the multibrowse features and to provide better communication support between members, the *EventHeap* (Johanson et al. 2001) is used. The EventHeap is a small, JAVA based application with client/server architecture. The server controls the applications being used in the iRoom, e.g. an Internet Explorer being visualized on a large display. The client runs on the participant's mobile devices (i.e. laptops or PDAs) and receives events from the local applications, e.g. a web browser. These events are sent wireless to the EventHeap server which analyzes the events and performs the corresponding actions. This feature can be used for a variety of applications, e.g. "beaming" of web pages from a participant's laptop or PDA onto the large displays in the iRoom.

Integration of MACS and iRoom

One possible approach for an integration of the CSCW framework MACS into the iRoom deals with the mixed scenario explained above. Some members of a distributed team are physically present in the iRoom and can use the existing infrastructure. They are able to see and talk to each other. Some members of the team are physically distributed and are connected via the MACS framework to the session in the iRoom. The entire scenario consists of a "mixture" of physically present and remote participants. In this scenario, some problems regarding session and floor control may arise. First, there is the possibility of not considering the presence of remote participants in a discussion or brainstorming. The awareness of the physically present members in the meeting may lead to ignore the remote participants, e.g. for determining the next speaker. Secondly, social protocols, which normally help to control an ongoing conference, might not work as expected. The mimics and gestures of the physically present participants are easy to recognize, but those of the remote participants may be much more difficult to identify, perhaps owing to insufficient audio/video connection or a temporary network loss. A solution for these problems might be the use of video screens. Such a video screen being located next to the physically present members represents each remote participant. In this way, a mixture of physically present members and remote members in the meeting room is created, where the physical members are aware of the presence of remote members. To overcome the problem of the use of social protocols, still images of the remote participants instead of live videos could be used. These images can be expressed with some actions regarding floor and session control. A rising hand may be indicated by the visualization of a speech bubble within the image, and the temporary absence from the meeting may be indicated by the text "back soon" within the still image of the member, just like in the MACS framework explained above. In this way, the feeling of group awareness regarding *all* participants of the meeting – not only for those who are physically present - can be mediated.

The EventHeap structure can also be integrated in the MACS framework. The EventHeap integrated in MACS may interact with the EventHeap structure of the iRoom: The whiteboard application integrated in MACS, for example, may send events to the whiteboard application running in the iRoom, where the events can be used to synchronize both whiteboards and to ensure a common view for both, local and remote participants.

References

Zitterbart, M., & Fruchter, R., & Pehrson, B. (2001). I am here! Mobile Learners in dSpace. *Final WGLN Proposal.* http://www.learninglab.de/workspace/mobile_learner/Doc/MobileLearner.pdf

Brand, O., & Petrak, L., & Sturzebecher, D., & Zitterbart, M. (2000). Supporting Tele-teaching: visualization aspects. *Journal of Network and Computer Applications* (2000) 23.

Stanford Interactive Workspaces Project (2000). http://graphics.stanford.edu/projects/iwork/

Johanson, B., & Ponnekanti, S., & Sengupta, C., & Fox, A. (2001). Multibrowsing: Moving Web Content Across Multiple Displays. *Proceedings of Ubicomp*, Atlanta, 2001.

Mauve, M., & Scheele, N., & Geyer, W. (2001). Enhancing Synchronous Distance Education with Pervasive Devices. *Informatik 2001 (Jahrestagung der GI und der OCG)*, Vienna, Austria, 2001.

Software Architecture for the International Collaborative Environment (ICE)

R. P. Brazile, K. M. Swigger,
Brian Harrington, Ben Harrington, Xiabo Peng, Cynthia Roberts
University of North Texas
Denton, Texas
brazile@cs.unt.edu

Abstract: This paper is a description of the software architecture of the International Collaborative Environment (ICE), a system implemented as a collection of components written in Java. The system allows groups to collaborate, both synchronously and asynchronously, to perform tasks over the Internet. The ICE components, all of which are shared by users in the same group, are chat, whiteboard, editor, file sharing, help, web browser and desktop sharing. In addition to the components provided by ICE, a user of ICE may develop and install additional components of their own design. These user-written components may take advantage of the collaborative features of the ICE system. This feature makes the ICE system user-extendable and able to respond quickly to new and different requirements of users.

Introduction

The functionality of ICE has been described elsewhere (brazile et al 2002). Here is a brief review. ICE allows a person to join a pre-defined group and use the components of the system in a shared synchronous mode although some features such as file-sharing and chat history support asynchronous use of the system. Members of a group may chat with each other, draw using the whiteboard so that all members of the group see the same drawing, and use the shared editor on plain text files. They may use the web browser to surf the Internet and lead the other members of their group to the same site. They may share files with other members of the group using the file-sharing component. They may allow other members of the group to see their desktop and watch while various programs are executed. A user may also allow another member of the group to take control of their desktop and execute programs on the user's workstation.

ICE is an evolution of a system developed by the authors called the Virtual Collaborative University (VCU) (swigger et al 1997). VCU had many of the same collaborative tools but was implemented using C++. A decision was made at the start of this project to implement everything using Java. By using Java exclusively, the system is capable of running on any platform that has a Java Virtual Machine. The ICE system has been tested on all Microsoft Windows operating systems, and several versions of Unix including Linux, Freebsd and Solaris.

Architecture of the system

Software for ICE is divided into four sections: Server, Client, Administration and Core. The server portion is small and handles only the initial startup of each client and the shutdown of each client. The client is larger and contains the launcher and the main program for the client process. It also contains the component modules of the system. The administration contains programs used in the administration of the system, such as transferring log files into the system database. The core contains programs that are used by more than one of the other three sections.

Server

The server listens on port 3000 for clients who want to connect to ICE. The server is task oriented so after accepting the connection, it waits to receive a command from the client. Currently it can perform four tasks:

1. VERIFY: after a user enters their username and password, the client sends a verify message to check if it was valid. If valid the server will send back information for the user (name, email, etc) and a list of the groups that the user may log into. If the username and password are not valid the server sends an error message and the client asks the user to try again.

2. CONNECT: The user may select either the default group, or select an alternate group from the list of groups available to this user. After the user chooses a group, the client sends a connect message telling the server to enter it in the Active User table. The server will send back the current time for synchronization, the IP address of the user and a list of users who are currently connected. Once the client has the user list, which includes IP addresses, it communicates directly with other clients. It communicates with the server only for keep-alive messages (see 4).

3. DISCONNECT: when the user disconnects, this command tells the server to remove the user from the Active User table.

4. CHECKIN: the client sends a keep-alive message at some interval (currently 10 minutes) to the server. If the server does not receive the message it will remove that client and tell group members. This allows the system to automatically handle users that killed the software, did not shutdown properly, lost their Internet connection, etc., though it will take some time before they are removed.

The server contains an FTP server that accepts log files from the client. Log files are sent by the client after twenty log messages have been generated and at the end of a session. The number of log messages before sending the log file, currently defaulting to twenty, may be changed in the client's ICE configuration file. If the system is interrupted before the last log file is sent, the client will send it the next time ICE is started.

Client

The client is divided into three sections; the launcher, the ICE main module and the ICE plugins or components. The launcher starts first and contacts the ICE HTTP server to download a file named iceversion.txt. The current version of the ICE client is stored in a file in the ICE home directory on the client machine. The launcher compares the version numbers and if the downloaded file indicates a newer version is available, then the launcher downloads and installs the newer modules. Only modules that are newer are downloaded. Once the system has been updated, the ICE main module is entered.

The ICE main module is designed to be a flexible container for plugins. This consists of providing user management, networking (between other clients and between the server), and the ability to configure the placement of plugins within the system.

The user management capabilities include keeping track of the active users and the user of this system. When a user connects to a group it notifies everyone who is currently active in that group that the user joined. Similarly, when disconnecting a disconnect message is sent to group members. If the connect attempts fail the user will receive a notice that the system could not connect to that user. If the disconnect fails, no notice is given. However, the keep-alive system allows the remaining clients to keep track of group members. When the client checks in to the server, it will update the active user list if needed. This is how individuals not in your group are maintained. If you select a user who is not in your group to send a message to and they have disconnected, the send will fail, you will receive a notice and that user will be removed from your list. This approach allows the system to minimize the amount of traffic and overhead associated with precise maintenance of the users not in your group. As the number of people in a group is usually small compared to the total number of people on the system and communications are generally within the group, this helps keep network traffic small.

The networking part makes it easy for the plugins to communicate without having to know about all of the details. It uses non-blocking I/O so that all of the accepts and reads from the different users can be done within a single thread. As most users have a single processor this increases performance and reduces the overall memory use (java applications typically require a lot of memory). Since most communication is within the group, persistent connections are set up with group members. When the user connects to the group the connection is established. The user who created the connection is responsible for the connection in case of a failure. This means that the user who first initiated the connection will try to reconnect to the other user if there is a failure. If the reconnect fails the user will receive an error message. The other user will receive an error message as soon as the problem is noticed. For users who are not in your group the system will create a new connection each time you want to send a message. The connection is then closed. This means that it is more efficient to send to group members because you do not have to wait for the connection to be set up each time. As most users send few messages to users outside of their group this is not a problem.

The placement of the plugins is done through the two main configuration files (ice.ini, menu.xml). The ini file allows you to position the components in cardinal directions and in the center. These components are separated in a Java Splitpane so that the size of each can be adjusted by the user. The XML file for the menu allows you to configure the menus so that when a menu item is pressed the system calls a method associated with a plugin or the system (e.g. connect or disconnect). A special method (<init> which is the bytecode signature for constructors) is used to denote that the plugin should be shown in a dialog. In addition plugins can be created that hold other plugins on the interface. For example, in ICE there is a special plugin that shows other plugins in internal frames. This special plugin will show the other plugin when it receives its class name from the menu or via another plugin.

Built-in ICE components include chat, whiteboard, editor, web browser, file sharing, desktop sharing and help. Each of these components may be configured or not, for any individual client. This configuration is indicated in the ICE.ini file located in the ICE home directory. The ICE main module reads the ICE configuration file to determine which modules are configured for this specific client and where they will be positioned on the screen. This may be changed by the user. The main module then loads the configured modules and begins the logon process as describe in the server section above. The main module is responsible for logging on and off the system, sending messages to the group, getting user information, logging and error messages as well as managing the use of the various components of ICE.

Administration

This part of the system contains utility type programs that generally run separate from the ICE system. For example, there is a program that imports the local logs into the database. There is another program used for generating some of the help files in the different formats (all in one, by chapter, by section, with or without images etc.) The clean up program to remove dead users from the database is here. There are also some testing tools, for example a stress test for the FTP server to see if can handle a lot of traffic and a checking tool to see if the log files are in valid XML format. Many of the administrative functions have been moved to a web site that was created to support the ICE system (http://zeus.csci.unt.edu/).

Core

The core is part of the system used throughout the other parts. This includes the network message format (class Message), database access (class DataUtils), and XML conversion for basic types (class XMLDataUtils).

Message takes care of reading and writing data. For example, as client and server send messages back and forth to communicate, the formating of the messages is done there. A message is composed of one to any number of instructions. An instruction is made up of a type and a string for other data. The composition of the string depends on the type. For example, to use the whiteboard it might be:

Type: COMPONENT

String: Whiteboard:<shape type='rectangle'>other information needed for shape</shape>

The database is set up to hold data for three entities: users, groups, and logs. The basic types (User, Group, Log) are used to represent this data as Java objects. Basically, DataUtils converts to and from the database and those types, and XMLDataUtils converts to and from an XML format string and those types.

The remaining program in the core is Talkback. This program is used to help find problems in the software. For certain exceptions that are thrown, Talkback is used to send an email to the developers, which contains a stack trace, system properties, etc, so the problem may be analyzed.

User written components

Additional components to extend the functionality of the system may be written by the user. These components must be written in Java and must extend the class Plugin. Once written the components must be configured in the ICE.ini file and placed into the class path of the client machine. The user must implement an abstract method, getName, that returns the unique name of the component. The component inherits a set of methods that may be called to get information, such as getting User information or to use system functions, such as logging.

The user information is returned as an object and contains the user login name and other information about the current user. In an email client, for example, this information may be used to set the "from" information in the email being sent. The logging method writes an entry to the log file, which will be placed into the ICE database. These log messages may be analyzed to determine how the system is being operated by the user.

Two sample user written components have been produced to illustrate the capability of the system. The first one is an email client component that allows a user to send email to other group members from within the ICE system. The second one is a voice component that allows a user to establish a voice connection to another member of the group.

Conclusion

This paper has described the software architecture of ICE, a system written in Java that may be used by groups of people to solve task oriented problems over the Internet, where the individuals in the groups are in geographically separate locations. Readers can access the ICE system by visiting http://hera.csci.unt.edu where they can download the software. A test/demo system has been set up with five groups and a number of guest IDs. Once you have the software installed, you may logon with an ID of guestXX, where XX is 01-50. The IDs 01-09 and 50 default to group 1, 10-19 default to group 2, etc. Any of the guest IDs may sign on to any group. These IDs do not have passwords.

Acknowledgements

This work was partially supported by NSF Computation and Social Systems grant CSS-9988605.

References:

Brazile R. P., K. M. Swigger,,Brian Harrington, Ben Harrington, & Xiabo Peng(2002), The International Collaborative Environment (ICE), http://zeus.csci.unt.edu/ (select publications from menu.)

Swigger, K. M., Brazile, R., Lopez, V., & Livingston, A. (1997). The Virtual Collaborative University. *Computers & Education*, 29(2/3), 55-61.

Knowledge Management Systems in Schools or How to Sort the Garbage Can?

Andreas Breiter
Telecommunications Research Group
University of Bremen
P.O. Box 330 440
28334 Bremen
Germany
abreiter@tzi.de

Abstract: Building knowledge management systems for schools is a difficult task. The organizational structures and processes can best be described with the garbage can model from organization theory. Ideas, concepts, solutions, decision-making come and go without defined structures. Nevertheless, a group of university students from computer science have tried to gain information from the end-users in schools about their requirements for such a system and to develop a web-based knowledge management system. The idea of student's projects in computer science as part of the degree and as an option for self-centered student learning in the special case of system development for e-learning systems will be described.

Introduction

During the last decade, many countries have started programs for the diffusion of information and communication technologies (ICTs) in schools. It is no longer disputed that digital media technologies play an important role in teaching and learning processes. The goal of computers and internet in classrooms is better teaching and student learning – usually measured by achievement in standardized tests. According to empirical studies on learning effectiveness in the past, there is no hard evidence that the use of ICT for learning is more effective than traditional ways. Some studies found an increase in student's motivation and in the development of basic skills, other studies found ambivalent results – depending on the way ICT is integrated into the curriculum. Although there is this lack of empirical evidence, politicians, industry and foundations put billions of Dollars into hard- and software and telecommunications infrastructure. This is what I call the 'learning effectiveness paradox'. It is derived from the well known 'productivity paradox' described in IS literature (e.g. Brynjolfsson 1993). According to empirical studies, it is difficult to proof that the company's productivity is increasing due to investments in IT. Following the history of IT in companies, the great expectations about higher student achievement, increase of teachers' productivity and promises about new values in teaching and learning which are connected to the diffusion of IT in classrooms should be treated with caution. Nevertheless, the increasing number of digital content confronts teachers and students with the problem of storing, selecting, qualifying and using the existing material. It is assumed that knowledge management systems will help teachers and students for co-operative learning (Koschmann 1996). But the internal co-operation and communication between staff not only in German schools is underdeveloped. This is due to the institutional framework conditions and the intra-organizational structures. The following paper describes a software development and implementation process for a knowledge management system that was organized as a student project at the University of Bremen in the faculty of computer science. It is divided in two parts: (a) the organizational problems of schools in their decision making processes and the resulting difficulties in developing a knowledge management system, and (b) the learning process of university students during the typical software development cycle.

Theoretical Background: the Garbage Can Model in Organization Theory

In organization theory five interrelated aspects determine output and outcome of organizations: social structure, technology, goals, participants, and their relation to the environment (Leavitt 1965). Referring to schools as social organizations, only few studies point out that the interdependence between schools and their environment significantly shapes the outcomes of IT integration. Framework conditions such as budget autonomy, human resource management, information and knowledge management as well as the management of change play a crucial role for a successful integration of ICT. The results of the Programme for International Student Assessment (PISA) highlight the importance of budget autonomy and school-based control over educational resources: "students tend to do better on average in countries with more autonomy, particularly in choice of courses and in budget allocation" (OECD 2001). Autonomy is a key factor for the quality of teaching and learning, and it can be assumed that this leads to a better integration of IT in the classroom. In this case, IT can be regarded as a 'trend amplifier'. For this reason, using IT for better co-operation and communication for teaching and learning seems to be helpful. But, a direct transfer of concepts for knowledge management in business to schools is difficult. Schools can be seen as 'loosely coupled systems' (Weick 1976). Teachers are highly autonomous in their decision making processes in the classroom; on the other hand, the state sets criteria for the organization and restrict the individual action space. Pupils as the largest group have only limited rights and are compelled to be part of the organization (as in prisons). The decision making processes can be described by the 'garbage can model' which was introduced by Cohen et al. (1972). Organizations of this type have unclear goals which are not set a priori but derived from action, the members do not fully understand the inter-relationship and they do not participate regularly in the decision making processes (Cohen, March, & Olsen 1972). Although adequate in some respect, this model underestimates the importance of political interest and power within organizations. Crozier and Friedberg (1977) have developed a model, in which organizations are understood as the political process of constructing and maintaining orderly patterns of interaction among a set of individual and collective actors linked by strategic interdependence. Therefore, less structured and formalized fields of action come into play (see Crozier & Friedberg 1977). Especially in schools with their hierarchical structure and individual autonomy, political power games between departments, principals and staff as well as with parents and district officials cannot be ignored. This delivers a theoretical concept about the character of the inter- and intra-organizational decision-making processes in the school system and the constraints for developing a knowledge management system. Why is this so complicated in schools? (1) Co-operation and communication are not much developed, collective action ends at the classroom door; (2) especially in German schools, there is no space for co-operation – school time is in the morning, the working place for teachers is alone at home in the afternoon; (3) the individual efforts of developing content is high, there are no incentives, i.e. it will not be shared with other teachers; (4) traditional forms of paper-based exchange of teaching material are not working – why should a digital platform? These constraints built the background for the student group to understand the complex decision-making process in schools with respect to build a knowledge management system.

Learnweb – a University Student's Project in Computer Science

At the University of Bremen, all students in computer science have to participate in a two year project that follows the system development process from requirements analysis, specification, design, test and evaluation. During the two years, the group of approximately 20 students form their own project management, quality control systems and produce a final report with all systems specifications. The professors work as moderators, giving input and help for specific topics. One day per week is reserved in the schedule. The projects range from programming virtual soccer teams, to the development of geographical information systems or the conception of protocols for an 'intelligent' house. In our field, applied computer science, we are mainly interested in projects that are connected to workplace experience and the 'real world'. The real world in our project are four schools with their teachers and pupils. The basic idea of student projects in Bremen is to support self-centered learning processes. As future employers in software companies will not only expect clever programmers but team workers with social skills, the concept of building teams of students to develop a system with requirements they have analyzed, seems to be one way of successful university education. In the case of learnweb, the students learned how to develop a web-based e-learning system (see <http://www.learnweb-bremen.de>). In parallel, we have given seminars on learning theory and paradigms and on e-learning development strategies as well as media ergonomics. Additionally, researchers and developers in the field of e-learning have been invited in order to exchange ideas. Thanks to a cooperation with a software company, the students received additional help in professional systems development. Although system development concepts such as participatory design (Schuler & Namioka 1993) or joint application development (Wood & Silver 1995) have been already introduced theoretically, most students see themselves as 'lonesome cowboys' in front of a keyboard. The project in Bremen confronts those 'hackers' with team work and gives them the chance to learn about requirements engineering.

Market Analysis

The project started with a market analysis of existing products. With the following criteria, several products were evaluated together with future users: functional requirements (necessary and preferred functions); use cases with different scenarios; usability; information infrastructure; and financial aspects. The students found products that fit many of the requirements set by the user group. But they had two major obstacles: cost and system platform. Most products with good rating were too expensive for schools, and others could not be used on Apple Macs – Bremen is the only public school district in Germany, where they are still widely used. From the market analysis, the students developed a basic functional framework which was then discussed with schools.

Requirements Analysis

Requirements analysis is the least technical phase of system development, but the most important. If not done thoroughly, the consequences are more serious than in other phases. On the other hand, too much participation of the special group of end-users (teachers) can lead to unexpected twists and requirements that can be hardly met. Nevertheless, the downstream costs of not capturing, omitting or misinterpreting user requirements may prove unsustainable later in the process. Within the requirements analysis it is necessary to define the expected services and constraints that the system must obey. All services have been clustered to describe the scope of the system and its functional features. The concepts of system development end with the requirements document were all requirements that have been accepted by the user are defined, classified, numbered and prioritized. Today, we can assume that the user will play an important role in the cyclic development process. In order to examine the work processes of teachers, the students took part in classroom activities, monitoring the use of digital media. The results were drawn in UML activity diagrams and use case models. The biggest problem of the requirements analysis are methods of requirements elicitation. There is one systematic problem (tacit knowledge of domain experts), and one practical problem: missing methodological know-how by students of computer science (interview techniques, questionnaires). Interviews are an excellent form to gather the right information. In interviews with teachers and pupils it was possible to elicit most user requirements. The students combined structured and unstructured interview techniques. Additionally, they developed a questionnaire about the functional requirements. In some schools, a group of students observed the pedagogical process from course preparation to testing. The requirement document was finally discussed with the user groups and agreed upon. In summary, the key requirement from teachers was simplicity for non-expert users. The problem for the student group was to operationalize this requirement. After longer discussions with teachers it was clear, that it meant the level of expertise that teachers have reached after participating in an introductory course on how to use digital media in the classroom. The end-users also made clear that a complex authoring tool would not be necessary because either it is too basic for the experts who use other tools or too complicated for non-expert users. The end-user also asked for a detailed help system with self-explaining hints.

Design and Prototyping

Today, prototyping is the most frequently used methods of systems development. Prototypes are constructed to visualize the software system as a demonstration. In the literature we find horizontal prototypes (complete functionality of one level of the system, e.g. the graphical user interface) and vertical prototypes (one functional part of the system is usable with a simple user interface but full functionality, e.g. the document management system, Budde 1992). It is an effective means to elicit requirements difficult to obtain in other ways. Especially, when working with teachers as non-expert PC users (but pedagogical domain experts) and pupils as expert PC-users (but non-experts in the pedagogical domain), the demonstration of use cases with a prototype was very effective. Additionally, using an evolutionary prototype helped both the students and the end-users. The students could reflect their own work processes and the end-users could directly participate in the workflow of the system development process. The requirements were directly implemented in the design of the system's architecture:

- *Personal Account (MyTeaching / MyLearning)*: Individual space for teachers and students, where they can organize their files, data, e-mails, appointments.
- *Document Management*: Upload and download of all formats. Storing and coding with metadata according to the standards set by IEEE Learning Technology Standards Committee (LTSC).
- *Communications*: E-mail, chat, electronic bulletin boards.
- *Calendar:* Personal view and school-wide view with reminders that can be sent via e-mail and short messaging system (SMS) which is very popular in Germany.

- *Resource Management:* Booking system for computer labs, laptops, beamer or other movable resources.
- *Administration:* Easy to use, decentralized administration. Import and export of data files.

Testing and Evaluation

In software engineering, much effort is used for formal testing methods. In this application-oriented project, the emphasis was on usability tests in order to specify if the user requirements were met by the systems design. The students used expert-based and user-based usability tests, following ISO standard 9241. With these methods they were able to modify the software system, focusing on the specific needs of end-users in their organizational environments. Although the complexity of schools as social organizations and the difficulties of formally specifying the user requirements were known, the period of usability tests brought new insights about the intra-organizational structure of schools. This led to additional features of the system such as a detailed help system, self-explanatory warnings and the resource booking system.

Conclusion

The process of developing a knowledge management system for schools was successful regarding the two objectives with which the project started: (1) Offering university students in computer science an application-oriented option to learn how to develop a software system in a team; and (2) creating a product that is used in the real world of schools and which helps schools to organize their internal and external communication and co-ordination processes. Within the student's group, there was a split into three peer-groups: hackers, writers / presenters, and evaluators. Although the project management tried to find a way around these strong structures, it was often necessary for the professor to intrude. The naive idea about team work for its own sake did not work. The students expected individual marks and verified unwillingly the well known phenomenon that only marks (instead of other incentives) create the necessary pressure to work. Apart from these obstacles, all three actors involved, students, schools and professors, agreed that this form of teaching and learning should be continued and extended. The organizational problems within schools still remain, the practical tests in the future will show how much the system is used and which functions are adequate.

References

Brynjolfsson, E. (1993). The Productivity Paradox of Information Technology. *Communications of the ACM*, 36 (12), 67-77.

Budde, R. (Ed.). (1992). *Prototyping: an approach to evolutionary system development.* Berlin: Springer.

Cohen, M. D., March, J. G., & Olsen, J. P. (1972). A Garbage Can Model of Organizational Choice. *Administrative Science Quarterly*, 17 , 1-25.

Crozier, M., & Friedberg, E. (1977). *Actors and systems: the politics of collective action.* Chicago: University of Chicago Press.

Koschmann, T. D. (Ed.). (1996). *CSCL: theory and practice of an emerging paradigm.* Mahwah, NJ: Erlbaum.
Leavitt, H. J. (1965). Applied Organizational Change in Industry: Structural, Technological and Humanistic Approaches. In J. G. March (Ed.), *Handbook of Organizations* (pp. 1144-1170). Chicago: Rand McNally.

OECD (2001). *Programme for International Student Assessment (PISA).* Paris: OECD

Schuler, D., & Namioka, A. (Eds.). (1993). *Participatory Design. Principles and practices.* Hillsdale, NJ: Lawrence Erlbaum.

Weick, K. E. (1976). Educational Organizations as Loosely Coupled Systems. *Administrative Science Quarterly*, 21 , 1-19.

Wood, J., & Silver, D. (1995). *Joint Application Development (2nd Edition).* New York: Wiley.

Internationalising the Interface for e-Learning

Ian Brown
University of Wollongong
Australia
ian_brown@uow.edu.au

Abstract: This paper addresses an important and neglected issue in e-learning: user interface designers must acknowledge diversity, recognise differences to communicate effectively. Creating successful cross-cultural interfaces goes beyond tokenistic mechanics, such as, numerical formatting but instead should look more closely at local understandings or a variety of interpretations by the user. Although e-learning has had a dramatic rise in the past few years, research in the area of interface design for cross-cultural users has remained minimal. This paper explores current research on internationalising learner interface, provides evidence from two cultural settings and proposes a number of significant proposals for instructional designers and educators.

In an era where virtual worlds impact on learning and borders cease to exist, course designers must truly transcend national boundaries and cater for a new generation of learners. User interface designers must acknowledge diversity, recognise differences and communicate effectively. Creating successful cross-cultural interfaces goes beyond tokenistic mechanics, such as, numerical formatting but instead look closely at local understandings or a variety of interpretations by the user. This paper proposes a broader understanding of design issues for international users, focusing on more inclusive pedagogical issues. Consideration is given in particular to basic interaction factors and cross-cultural/internationalisation issues. Although e-learning has had a dramatic rise in the past few years, research in the area of interface design for cross-cultural users has remained minimal. As Boor and Russo, acknowledged back in 1993 'research on the topic of designing for international users is sparse'. Acknowledging there has been limited research in the area of cross-cultural translation issues, such as images, symbols and colour, very little has been written that explores the unique connection between cultural awareness, interface design and pedagogy.

As Russo and Boor (1993) claimed 'cultural awareness is an area of human computer interface which is sadly neglected'. The computer interface design areas that require further exploration include: traditional computer human interaction international issues for interface design and interactivity. The integration and connections between the three areas is what really supports successful interface design. According to Laurel (1990), an interface is a contact surface that reflects the physical properties of the interactors, the functions to be performed and the balance of power and control. The complex nature of interaction, the multi-layers that users often bring to the exercise, including cultural considerations, cannot be overlooked.

Traditional computer human interaction considerations

Interactive multimedia poses unique design problems. The experiential nature of multimedia presents users with unique interaction elements or problems to solve. Text, animation, multiple screens, hyperlinks, sound and video add complexity to the interactive environment. The computer human interaction (CHI) environment regularly researches factors that affect the success or failure in interaction with computers. According to Boling and Kirkley, (1995), interactivity is the result of design decisions and that 'quality of design' is supported by the type of interaction desired by the designer and the type of interactivity appropriate for the learners, content and context. The integration of the experience measures the success of the design.

Designers need to construct meaningful frameworks for making appropriate decisions regarding visual design and user interaction. (Boling, Bichelmeyer, Squire, Kirkley, 1997). In the early nineties designers were calling for well designed and documented standards or principles which could translate the equivalence of print based guides to digital forms. At the time graphic interface standards were being written for tool oriented software without looking at the integration of text, graphics and hypermedia links. (Lynch, 1994).

Naturally, consideration should be given to what users expect and need, providing for effective two-way communication. Basically, interface needs to be easy to understand and use. Advances in technology, especially the nature of multi-media instruction, have provided an increase focus on the visual aspects of the interaction. While standard controls, such as icons and menus have provided consistency for the user and computer developers have adopted similar interactions across platforms, there still remain idiosyncratic blocks for a variety of users, especially across cultures.

The designer's goal is to provide a positive interface that supports the user regardless of the cultural context. The user will benefit from simplicity, usability and accessibility. Efficiency for all users results from a well organised interface. Functionality should be readily apparent, void of cultural constraints. Therefore, a minimum number of actions or functions are required to achieve a particular task. Visually, the designer must adopt universal conventions. While arguing for universal conventions there are many purported 'universal actions' that may in fact, not be universal at all. Cultural aspects may need to be considered. The designer must acknowledge both the advantages and disadvantages of the complex nature of multi-media instruction, and provide security for the user. Visual design is an integral part of the design process which should communicate functions without ambiguity and support the user. Visual design skills affect all aspects of multimedia design. Basic visual design skills are a minimum requirement for all designers of interactive multimedia to support the principles purported for success. (Brown, 2000).

Internationalisation for interface design and interactivity

'Understand the users' can be a simplistic statement that demonstrates the obvious, except when the users are drawn from a variety of cultural locations and contexts. Generic and consistent interfaces may be appropriate for some instructional situations, while more authentic and culturally context driven, could be more suitable. Where appropriate, adoption of universal interfaces that draws on prior learning and builds on existing knowledge should be applied.

Badre (2001) undertook a recent study to determine whether any design elements were repeated in different cultures and genres through the World Wide Web. He named the elements that were culture and genre specific. According to Badre, these 'cultural markers' are interface design elements and features that are prevalent with a particular cultural group. Cultural markers signify cultural affiliation. These could include a national symbol, colour or spatial organization. Regardless of cultural context, designers can adopt appropriate mechanisms that ensure usability is obvious, intuitive and conducive to meaningful learning. As a designer of multi-media instruction, the basics of interaction, such as use of metaphors, manipulation, consistency, control, simplicity, support, accomplishment, satisfaction and visual design (aesthetic integrity) are worthy principles to strive for. But what other considerations are required when multi-media instruction becomes global affair? Surely, the user's conceptual model in one culture cannot be same for another. Generic or universal interface concepts cannot always be applied when diversity in cultures exists. Questionably, many who provide human computer interface principles rarely raise the issue of cross-cultural differences and the need to account for them. A major consideration for the designer is the cultural context of the user.

An example can be provided to illustrate the current lack of cultural context considerations in user-interface design. That is, a summary of principles proposed by Talin (1998) from ACM. Talin proposes 'a compilation of fundamental principles for designing user interfaces, which have been drawn from various books on interface design'. The fourteen principles proposed are the principle of user profiling, the principle of metaphor, the principle of feature exposure, the principle of coherence, the principle of state visualisation, the principle of shortcuts, the principle of focus, the principle of grammar, the principle of help, the principle of safety, the principle of context, the principle of aesthetics, the principle of user testing and the principle of humility. Conspicuous is the absence of any issue relating to culture. Perhaps a fifteenth could be added 'the principle of catering for cultural diversity'. International user interfaces issues should be considered when instruction or multi-media product is delivered in more than one country. According to Nielsen (1996), consideration of the special needs of different cultures is imperative in the design of user interfaces for international use.

Schneiderman (1992) raised the issue of cultural issues in interface design when stating 'little is known about computer users from different cultures, but designers are regularly called to make designs for other languages and cultures'. It appears that little has changed. According to Shih and Goonetilleke (1998), user interface guidelines have been developed predominantly in English speaking countries, but aspects related to culture (e.g. local metaphors, symbols, colour and flow) are not universal and have received little or no attention. They propose that the design of culturally and linguistically adapted human-computer interfaces for other cultures be adopted and specific studies are needed to test relevant characteristics of computer interface for users from diverse cultural backgrounds. While AlHunaiyyan, Hewitt, Jones, and Messer (1999), contend that culture is a discernible variable in interface acceptance and interfaces should be designed to accommodate users' cultures.

According to Marcus (2000), current user interface design is based on psychological and social models drawn from European and American research traditions, while recently, cultural psychologists, cultural anthropologists, cultural sociologists and designers have begun reconsidering the applicability of these models by identifying cultural preferences and value orientations more prevalent in Asia, Latin America, the Islamic world and Africa. Between 1978-1983, Dutch anthropologist Hofstede, conducted detailed interviews with IBM employees from fifty three countries and proposed that world cultures vary along consistent, fundamental dimensions. Hofstede identified five dimensions: power-distance; collectivism vs. individualism; femininity vs. masculinity; uncertainty avoidance; long vs. short-term orientation. Marcus and Gould (2000), examined Hofstede's dimensions and applied them to user interface and web design outlining a number of significant implications/considerations in relation to internationalisation issues. Considerations included issues such as, focus on expertise; the importance of the social role; motivation based on achievement; prominence/importance the underlying sense of morality; limits to choice, redundant cues, navigation schemes; complexity; the desire for results and achievement of goals. Marcus and Gould were able to identify World Wide Web sites where Hofstede's dimensions could be applied, suggesting that interface designers should consider the cultural differences in relation to factors such as, power and gender.

Conclusion

As educators we know that all students come to subjects with different thinking and learning styles, but now as we approach these unique technological learning situations, the diversity is much more transparent (Brown & Hedberg, 2001). We must realise the needs of students from other countries and cultures and recognise that at times the lack of shared meaning can make communication difficult for people of different cultures. As instructional designers we must recognise and provide appropriate interface for these learners. As course developers we must also consider the appropriateness and relevance of the content being presented.

Questions arise to what is appropriate for inclusion in a multi-media course instruction. What content is needed? What skills should educators develop? What course components should be categorised mandatory or elective? The problem of content selection could be (and should be) as problematic as the delivery of the course. Visual design skills affect virtually every aspect of software interface design. Students need to develop skills in areas such as, spatial relations or layout, perceptual or aesthetic principles (that is, proximity, similarity, continuity, closure etc), designing for computer screens, graphic interface design, visual design conventions (such as, typography, or colour), animation, sound. There are many principles relating to interface design that should also be developed and included in course. Importantly, as course designers of subjects that includes interface design, we must also provide cross-cultural design considerations as outlined in this paper. Students need to be aware of the role of visual communication and the impact on the learner. A successful on-line course, web page or educational multi-media package needs to bring together all the elements of successful interface. Success for all users.

References

AlHunaiyyan, A., Hewitt, J., Jones, S., & Messer, D., (1999). *Multimedia Interface Design jk in Relation to a Learners Culture.* In B. Collis and R. Oliver (Eds.). Proceedings of EdMedia 99: World Conference on Educational Multimedia, Hypermedia & Telecommunications. (pp. 1187-1192). Seattle, Washington: AACE.

Badre, A. (2001). *The Effects of Cross-Cultural Interface Design Orientation on World Wide Web User Performance.* Technical Report. Graphics Visualization and Usability Center, Georgia.

Boling, E. & Kirkley, S. (1995). *Interaction design for multimedia software.* Proceedings from the Association for Applied Interactive Multimedia 4thAnnual Conference on Multimedia in Education and Industry. College of Charleston SC.

Boling, E., Bichelmeyer, B., Squire, K. & Kirkley, S. (1997). *Visual design profiles: making sense of web site design guidelines.* Proceedings from AMTEC'97. Association for Media Technology in Education.. University of Saskatchewan, Canada.

Brown, I. & Hedberg, J. (2001). *Recognition of cross-cultural meaning when developing online web displays.* In C. Montgomerie & J. Viteli (Eds.). Proceedings of ED-MEDIA 2001: World Conference On Educational Multimedia, Hypermedia & Telecommunications. (pp.202-206). Tampere, Finland: AACE.

Brown, I. (2000). *The forgotten partner: the role of visual, graphic and design principles in educational multi-media course instruction.* In J. Bourdeau & R. Heller (Eds.) Proceedings of Ed-Media 2000: World Conference on Educational Multimedia, Hypermedia & Telecommunications. (pp. 123-126). Montreal, Canada; AACE.

Del Galdo, E. & Nielsen, J., (Eds.) (1996). *International User Interfaces.*
NY: John Wiley & Sons.

Laurel, B. (1990). *The Art of Human-Computer Interface Design.* Reading, MA: Addison-Wesley..

Lynch, P.J. (1994). *Visual design for the user interface.* Journal of Biocommunications, 21(1), 22-30.

Marcus, A. & Gould, E.W.. (2000). *Cultural dimensions and global web user-interface design.* ACM Interactions, 7(4), July, 32-46.

Marcus., A. (1992). *Human communications issues in advanced UIs.* Communications of ACM, 34(4), 101-109.

Schneiderman, B. (1992). Designing the User Interface. Singapore: Addison-Wesley.
Shih, H. M., & Goonetilleke, R. S., (1998). Effectiveness of Menu Orientation in Chinese. *Journal of Human Factors,* 40(4), 569-576.

Talin. (1998). A Summary of Principles for User-Interface Design. [Online] Available URL:
http://www.sylvantech.com/~talin/
projects/ui_design.html [Accessed 20th October, 2001]

A Development Framework for Re-useable Learning Resources for Different Learning Styles and Requirements

Catherine Bruen
Centre for Learning Technology
University of Dublin
Trinity College
Ireland
cbruen@tcd.ie

Abstract An existing Adaptive Hypermedia System in use in Trinity College allows for student customisation of a course. However, the author has decided to examine the considerations and aspects of learning styles that could make a considerable pedagogical impact on both the narrative selection - using Gregorc's model - and then the content selection - providing for fine grained learning - using the VARK model for learner preferences. A descriptive framework or mechanism was created against pedagogical considerations, for the metadata that would determine the three levels of adaptivity – Narrative Selection, Content Group Selection, Candidate Selection. The author set about modifying the way the information is currently modelled (the pagelets representing SQL content are created using XML) to allow for learning style specific content. The metadata was then reconciled with the current learning content. The design of the narrative model was investigated and the relevant changes were made in order to support personalized learning based on the preferred cognitive or learning styles of the students. The rules dynamically generate the navigation structure (this is the personalized process) based on the learner and content metadata, which is derived from the descriptive framework.

Introduction

One of the challenges in teaching is trying to meet the needs of a variety of students. This is particularly challenging in large classes, where the typical teaching mode is heavily dependent on lectures. In the majority of learning environments a generic course is presented to the learners and a "one-size-fits-all" philosophy is imposed with little or no regard for a users learning needs or preferences and pedagogical theory. If the learning theory is not taken into consideration, the lack of regard for an individual's learning style could cause a student's discomfort level to be great enough to hinder or prevent learning (Felder 1996). The constructivist theory introduces the idea of how the learner is intrinsic to the learning experience. Learners construct knowledge by making sense of experiences in terms of what is already known (Brandt 1997). A learner's objectives, pre-knowledge, and how they learn – their learning style or preference – is therefore fundamental to how the learner will retrieve and map (to their frame of knowledge) any new information presented to them. As well as issues concerning the learner, there are financial and time considerations for the development of quality digital online learning content for the educational providers as they face a significant challenge in achieving return for investment (Marchionini, 1995). One means of optimising the return of investment is to facilitate the repurposing of learning objects across multiple related courses. Adaptive hypermedia systems (AHS) are aimed at tackling and overcoming these difficulties by customising courses to individual users despite differences in ethos, learning goals, pedagogical approach and a learners prior experience (Conlan et al, 2002). Adaptive hypermedia has the potential to break through traditional educational barriers by allowing the tailoring of applications to specific user needs and requirements by possessing a model of the user. Much of the focus in adaptive hypermedia for educational courseware has attempted to alleviate the difficulties of content comprehension (cognitive overload) and orientation (so-called 'lost in hyperspace' (Laurillard, 1993). Adaptive presentation techniques which effect changes to both the selection of different media depending on a users preferences and adaptation of the content based on an individual's user model are beginning to show success. Also the use of adaptive navigation which effect changes to the link structure between elements of the hypermedia courseware based on an individual user's (mental) model, has proven effective since learners using such systems have demonstrated faster learning, more goal-oriented attitude and take fewer steps to complete a course (Conlan, 2000). There is a two-tiered aim to this study: the corroboration of the premise that the design and delivery of educational technology should depend upon the pedagogic designs conceived by educators rather than depend on the characteristics of the technologies (or AHS) itself. And secondly, to explore the concepts of learning styles and their implications for the design and development of on-line distance education courses. Through this process some underlying pertinent questions will be addressed: Do individual learning styles have an affect upon learning outcomes in Adaptive Hypermedia Systems (AHS)? What implications could this have for AHSs? And to what extent is it possible to incorporate the principles of learning style theory into the design and delivery of personalized courses using AHSs?

The Study

The author approached this difficulty from the position of the instructional developer, identifying and cultivating the learning styles of an SQL class using a VARK inventory for learning styles, and adapting a framework that has been created by a computer engineer for personalized learning by modelling information to allow for Learning specific content. The Adaptive Hypermedia service to be adapted for learning preferences and styles is at present being successfully employed in the delivery of undergraduate degree courses at Trinity College as well as being used as part of a major EU research trial (EASEL). The project aimed to create a mapping between the educational designer's expertise and the technical implementation of adaptivity by modifying three architectural models – content, learning and narrative – so that the current AHS can use the extra knowledge provided to enhance learning. Increasingly, the most important question being asked about the application of new technologies is - What is known about the way students learn via the new technology? Pedagogy should take precedent when implementing new technology and new educational technologies and Web based learning offers great potential in that there is a chance to learn from previous mistakes of previous technologies and develop new learning experiences for students that have not been possible before (Clarke, 1983)(Parson, 1998)(Alexander, 1999). Technology, multimedia and software can go a long way in filling the gaps caused by a dichotomy of learning and teaching styles but "…whether or not the processes of teaching and learning are enhanced by the use of ICTs depends more upon the pedagogic designs devised by educators than upon the characteristics of the technologies themselves"

BEST COPY AVAILABLE

(Kirkwood, 1998). The emphasis on meaning making has increased due to the influence of constructivist approaches to teaching, and in learning, much more emphasis is placed on personal meaning making. Students face the task of appropriating external knowledge and turning it into personal meaning. The advent of the web, coupled with constructivist views, places additional demands on students, lecturers, and the ways in which they process this particular web form of extrasomatic knowledge. The demands are pedagogical challenges and universities are showing increasing interest in pedagogy and are beginning to regard the web not as a delivery medium but as a potential teaching and learning tool (Fetherston and Cowan, 2001). Once the focus shifts from delivery medium to pedagogical tool, we can consider pedagogical constructs that can be applied to the use of the web shifting the debate from the technical issues (Fetherson and Cowan, 2001). Technology needs to be tempered with reference to sound pedagogical principles – we need to be reflective about the direction and nature of such change and to keep the focus on pedagogical concerns (Fetherston, 2001). Educators must be competent managers of learning experiences in order for learners to attain success. The message should be clear to the learner and the medium should convey the message with interest, accurate perception and effective learning (Blanton, 1998). During the course of this study, a literature review was conducted on learning styles, Adaptive Hypermedia Systems (AHS), and instructional design models. The author aimed to elucidate the design of an artefact and explain how it was influenced strongly by the literature reviewed. Throughout, the main thrust of findings is derived from the design, rather than the development and implementation of the project. Final implementation of this project is due to be carried out in the future on a Java course.

Findings

An individual's personal learning style describes the way in which they habitually approach or respond learning tasks presented to them (Riding and Rayner, 1998). Although learning styles theory has become very popular over the years, it is far from being universally accepted as a theoretical construct. There is a glut of research on learning styles but there does not appear to be any widespread agreement upon, or acceptance for, any one particular theory to measure individual learning differences. Educators are becoming increasingly aware that if different people learn in different ways and individuals' preferred learning style influences how best a learner learns and as a result some aspect of learning style theory must be considered when designing, developing and delivering instructional processes or programmes. Motivational and learning strategies are also crucial aspects of self regulated learning. Learning "strategies" are often discussed as an integral element of learning styles but must not be confused with the "styles" themselves. "Style" has a psychological basis, it is relatively permanent state for the individual, and it refers to the way in which a person thinks. Learning Strategies on the other hand are behaviours or methods that learners use to improve their understanding, integration and retention of new information in the learning process (Cross and Steadman, 1996). Self-regulated learning involves use of motivational and learning strategies to the degree that students are motivationally, metacognitively and behaviourally active participants in their own learning processes (Zimmerman, 1989)(Pintrich, 1995). The instructional design approach taken took its cue mainly from a constructivist approach which emphasises the interpreted and individual nature of knowledge (Duffy and Jonassen, 1992) while keeping in mind that the web can be used as a teaching and learning tool because it can support social constructivist approaches to learning (Fetherston, 2001). Within Trinity College the approach to implementing an adaptive education system undertaken by (Conlan et al, 2002), is to provide a generic model for integrating the learner model (which describes the pertinent learner characteristics), content model (which describes the pedagogical qualities of the content) and the narrative model (which describes a mechanism for combining the content to produce a coherent educational courseware component). The adaptive engine within Trinity provides facilities for reconciling the Content, Learner and Narrative models to produce individualised content. This is achieved in a manner, which is independent of the content or the specific properties of the learner. This generic interpretation of how the Adaptive Engine interprets the models is central to its ability to integrate into different Learning Environments. XML is the key technology used to describe the models and it is the association and reconciliation of different XML elements in the models that is the responsibility of the adaptive engine. Key concepts in the adaptive engine are candidacy and abstraction. Having multiple candidates that fulfil the same learning goal enables the systems to choose the most appropriate candidate, for the learner, at runtime. The system must, however, have criteria upon which to base the selection. The information upon which the selection was based is characterized in the metadata. A VARK inventory was used as a guideline for creating a descriptive framework for producing this metadata. The VARK inventory is widely used in educational institutions around the western world and has received high acclaim from students and professors for its simplicity [http://www.vark-learn.com/wwwboard. It appeared to make good intuitive sense to both those educators and learners who used it and it was easily represented in the metadata. Though it is intended to explore the potential of VARK and other learning styles as selection criteria in future studies. At the outset of designing for a AHS medium, the instructional designer should strive to consider all the variables of the instructional environment would result in more effective instruction. It is not sufficient to just know what content is suited for learners; it is equally necessary to know how to present this content in an appropriate way. To do this the preparation of content involves selecting and organizing data, i.e. defining a planned structure consisting of subsections, itself able to be broken down to its most basic level (Labour et al.). Or in this authors case, it meant examining the existing content and investigating how the current models (content, learner and narrative) could be adapted for individual learners. The current metadata will be adapted so that all the models will be more focused on pedagogical elements. This pertains to how the Adaptive Engine can combine the models to provide effective and coherent course material to the learner (Conlan et al, 2002). For the online paradigm, as in traditional classroom situations, there is no consensus on how best to model the learner's preferred approaches to learning. There tends to be a clearer separation of the learner model and content model in AHSs (as opposed to the integrated approach of ITSs), and the narrative (or pedagogical) model is usually either embedded in the content or into the adaptive engine. This means that applying new or different pedagogical models, e.g. case based learning, simulations etc., to the content model is more difficult and involves a re-authoring of the content model. This results in learning content that is difficult to reuse or an engine that is domain specific. But the AHS in question has a multi-model approach, there is a clear separation of content, learner and narrative models, and a generic adaptive engine that employs a multi-tiered Artificial Intelligence model to achieve effective adaptation to the learner's requirements (Conlan et al, 2002). This separation improves the possibilities of reusing a piece of learning content as the learning object (LO) is no longer specific to a given implementation or narrative model. The second goal and advantage (with respect to content) of this approach is to allow course designers to easily discover appropriate learning content in the content repository. This is facilitated by two mechanisms:

- Creating the appropriate descriptive metadata for the various chosen learning styles.
- Free text searching, i.e. enabling the author to search the raw learning objects.

BEST COPY AVAILABLE

The approach is to have no semantics actually embedded in the adaptive engine itself. Therefore the pedagogic semantics that govern the narrative sequence of the learning experience are contained in a separate model. The adaptive engine then reconciles the three models to compose, at runtime, the personalized course. This approach enables multiple narrative models to be constructed to fulfil different learning goals, while these goals may be achieved from a common repository of content. The current AHS (called the Personal Learning Service) produces dynamic content (content created on the fly) for the learner based on run-time properties (the way the learner is connected to the network, prior knowledge). The intended outcome of the study is to provide a descriptive framework or mechanism for describing content already produced. The population and execution of the amended PLS is currently being completed with the assistance of the original innovation team that created the PLS. This author's role (from the Instructional developer's perspective) was to manipulate or rearrange the content of each pagelets for the Learning Model, Content Model and the Narrative Model in an a attempt to create a framework for re-useable learning resources to support personalized learning based on the learning style of a learner. By modelling the information to allow for Learning Style specific content the PLS can then use the extra knowledge provided to enhance learning. The necessary metadata information for describing both the learner and course model was identified after examination of the literature available. A descriptive framework based on pedagogical rationale was created to justify the metadata chosen to represent the attribute. Various learning styles and preferences as well as instruments for testing were examined. They were considered on two accounts; firstly, could they make a pedagogical impact on the narrative selection (Gregorc) and Content (VARK) and secondly, it was examined to what extent could they be represented in metadata. The decision was made to use the VARK identification system as a candidate selector for the content model, though after more thorough testing it should be more apparent whether any identification system could be used. The rules and narrative structures were investigated for how they would support the Gregorc model for the Narrative model, (but it was not intended at this stage to extend the narrative model). From the examination of the literature available, decisions were made for the optimum metadata attributes best used for determining course content for VARK. There was a need for a descriptive framework to render the structure or layout in which the content is placed (Narrative model) and the type (or format) of content displayed (Content Model). It was also needed to assist the computer engineering team involved to re-use the present learning resources and extend the models for visual (V), auditory (A), read/ write (R), and kinaesthetic (K) learners (see Appendix A, D and E). The architecture models – content, learning, narrative were modified according to this descriptive framework, so that the AH engine could use the extra knowledge to enhance learning. Throughout the process, the author considered how difficult it could be for the non-technical person (for an educator) to create such a descriptive framework for any kind of learning style, and adapt or develop content for a model-based AHS, and then populate it and execute it. The PLS enables many candidate narratives, (supporting different pedagogical approaches to structuring the content), to be associated with a single course. This association and an appropriate selection mechanism enables the PLS to deliver a personalized course that, while dealing with the same subject matter, can be structured in a way that best engages the learner's preferred learning styles. The subject matter, however, is not referred to directly in the narratives, but rather through the mechanism of candidate content groups. The instructional designer used this mechanism to implement several candidate pieces of content. Each candidate can be designed (against a set of informed criteria/rationale based on pedagogical considerations and outlined in the descriptive framework) to best support a learner's preference for how the content is presented. At runtime the PLS can determine which candidate is most suitable. Such factors under consideration were how the Instructional designer could decide upon specific content and then develop it for a model-based approach and how this rationale could be interpreted by both the AHS designer and instructional designer. The learning model determines the narrative model, and sets of narrative model content determine the content model. Also a solution has to be found whereby content suitable for a combination of learning styles could be produced for the "multi - modal" learner. A flexible Narrative model would allow for the learners content to veer into each of the styles. A series of problems are posed: How does one express the drift between various learning styles and what logic or rules can be used to describe or define this i.e. how to define A pure, B pure, C pure or a combination of AB, BC, AC. How can the midpoints of learning styles AB, BC, AC be identified for the narrative model or having identified the fixed points, how to focus on the way that A drifts towards each other learning style (B, C, D). Currently there are no guidelines in existence to aid the instructional designer in developing such a framework.

Imagine the learner with a VARK of V=2, A=1 R=1, K=3. This represents a learner who is quite strong visually and enjoys interacting w/ L material to learn. The descriptive framework (see Appendix D), developed as the artefact, has been used to describe a number of pre existing learning objects. These objects both deal with the same learning concept using different rendering. In this case the concept is the for loop in Java and is rep by a flash animation in one learning object (candidate A) and example code and explanatory text in the other (Candidate B). Their respective VARK values are :

Candidates	V	A	R	K
A	3	1	1	1
B	1	0	2	1

Candidate A is characterised by a strong V score. It also has A and K scores that rep a small amount of audio feedback accompanied with some basic user interactions (such as stepping through facility). Candidate B has a strong R score representing the material in varying forms: code and accompanying textual explanation. It has a zero score for A, as it does not contain auditory content. Its V and K score rep the interaction the learner may have w/ the material as they re-read the concept too understand it.
The AHS must determine, at runtime, which candidate is the most appropriate for the learner. As stated in (see 2.5) one of the advantages of VARK is that it is an intuitive representation. This intuitive knowledge, however, must be expressed in a way that the AHS can make a qualitative decision. This expression is rep as a subset of rules that the system uses to compare the candidates and the learner. The algorithm used for this comparison is based on "Pearsons' correlation" and compares the highest Two VARK values of the learner [http://davidmlane.com/hyperstat/A34739.html]. Where there are more than two values that are the same or higher, the top two are selected in the precedence order RVKA. THIS IS due to the fact that online education systems, and the content they deliver, are traditionally stronger in the delivery of visual and textual content. This precedence order may be adjusted for systems with more auditory and kinaesthetic content, for example. In this case a Pearson's algorithm selects candidate A for the learner. This process can be repeated for as many candidates that exist for a given concept. The key to this process is not the selection algorithm, but the criteria used (according descriptive framework, see appendix IV) to describe the content.

BEST COPY AVAILABLE

Conclusion

This paper examines the pertinent pedagogical principles that influence both structuring of courses and the selection of learning resources. The artefact produced from this work is an instantiation of those principles with respect to the VARK learning preference. The methodologies employed can be transferred to other learning style and preference considerations. The two most important aspects of these methodologies are that the instructional designer can maintain pedagogical integrity and integrate those principles with the existing adaptive educational system (in this case the PLS).

The artefact developed, coupled with the model based architecture of the PLS, provide a framework in which the instructional designer and HS developer can produce pedagogically sound personalised educational systems that maximise content and structure re-use. The key aspect of this work is that the technology is supported by re-useable pedagogical components – be they alternative narrative sequences or different renderings of learning concepts.

References

Alexander, J. O. (1999). "Collaborative Design, Constructivist Learning, Information Technology Immersion, & Electronic Communities: a Case Study", in Interpersonal Computing and Technology: An Electronic Journal for the 21st Century, October 1999 - Volume 7, Number 1-2 (IR541351).

Blanton, B. (1998). "The application of the cognitive learning theory to instructional design", in Journal of International Instructional Media, 1998, 25, 171-175.

Brandt, D. S. (1997). Teaching the net: Innovative techniques in Internet training, in Paper presented at the 11th Annual Computers in Business Conference, Washington, DC. (1996, February 27) (ERIC No. ED 412 975)

Clark, R. E., (1983). Reconsidering research on learning from media. Review of Educational Research, 1983, 53(4), 445-459.

Conlan, O., (2000). Novel Components for supporting Adaptivity in Education Systems – Model-based Integration Approach, Trinity College, 2000.

Conlan, O., Wade, V. P., Gargan, M., & Bruen, C., (2002). Multi-Model, Metadata Driven Approach to Adaptive Hypermedia Services for Personalized eLearning, (awarded best student paper at 2nd International Conference on Adaptive Hypermedia and Adaptive Web Based Systems 29 - 31/5/2002, Malaga, Spain).

Cross, R. C., & Steadman, M. H. (1996). Classroom research: Implementing the scholarship of teaching, 1996, San Francisco: Jossey-Bass Publishers.

Duffy and Jonassen, 1992: Duffy, T.M., & Jonassen, D.H., (1992). "Constructivism: New implications for instructional technology" in T.M. Duffy & D.H. Jonassen (Eds.), Constructivism and the technology of instruction: A conversation, 1992, pp. 1-16). Hillsdale, NJ: Lawrence Erlbaum.

Felder, R.M., K.D. Forrest, L. Baker-Ward, E.J. Dietz, and P.H. Mohr, (1993). "A Longitudinal Study of Engineering Student Performance and Retention: I. Success and Failure in the Introductory Course", in Journal of Engineering Education, Jan. 1995, pp. 15-21,.

Fetherston, T. (2001). Pedagogical Challenges for the World Wide Web, in Educational Technology Review, Vol. 9, No. 1, 2001.

Kirkwood, A., (1998). 'New Media Mania: Can Information and Communication technologies enhance the quality of open and distance learning?" in Distance Education – An International Journal, Vol.19, No.2, 1998, p.229.

Laurilard, D., (1993). "Rethinking University Teaching: A Framework for the Effective Use of Educational Technology", Routledge, 1993.

Parson, R. (1998). An investigation into instruction available on the World Wide Web, 1998.
http://www.oise.utoronto.ca/~rparson/abstract.html

Pintrich, P.R. (1995). "Understanding self-regulated learning", in R. J. Menges & M. D. Svinicki (Eds.) Understanding self-regulated learning, New directions for teaching and learning, 1995, (No. 63, pp. 3-12). San Francisco, CA: Jossey-Bass Publishers.

Riding, R., and Rayner, S., (1998). Cognitive Styles and Learning Strategies: Understanding Style Differences in Learning and Behaviour. London: David Fulton Publishers,1998.

Zimmerman, B.J. (1989). A social cognitive view of self-regulated academic learning. Journal of Educational Psychology, 1989, 81(3), 329-339.

Online Communication: A Success Factor for Blended Learning

Hans Georg Brunn
Decision Support & OR Lab
University of Paderborn,
Warburger Straße 100, D - 33098 Paderborn,
Germany
email: hbrunn@notes.upb.de
phone: +49 5251 605244

Christine Frank
Decision Support & OR Lab
University of Paderborn,
Warburger Straße 100, D - 33098 Paderborn,
Germany
email: cfrank@notes.upb.de
phone: +49 5251 602416

Introduction

This contribution is mainly based on our research, evaluation and experience within the project "Virtual Operations Research/Management Science" – "VORMS". The virtual learning environment (VLE) VORMS is still in development by a consortium of six German Universities. The VORMS consortium works together closely with the European project "Operations Research World" – "OR-World", which involves Universities as well as enterprises from three different countries.

Within VORMS the educational institutes work together sharing multimedia learning elements over the Internet. These learning elements have a very detailed granularity and can be put together in various combinations, e.g. to build a full online course. They can also partially be integrated into traditional presence courses. Within this context they extend the traditional course over barriers set by time, place and interaction capacities of teachers, e.g. within a lecture.

Learning experiences and didactical settings within VORMS can be diverse, depending on which approach the student chooses. Learning online most frequently implies communication – varying from synchronous to asynchronous and from group settings to single person settings. A main goal of VORMS is to enhance technology-supported collaborative learning by designing and evaluating structures, which enable *effective* synchronous and asynchronous communication within a VLE.

Communication –a variable within a learning process

Studies evaluating the role of technology and technological support in learning processes have resulted in conflicting results. It is almost impossible to connect benefits in the learning process to one single variable. Usually, results specify diverse variables, such as educational strategy, technology used, content selection, qualities of the persons in the learning process and didactical style used (see [Hesse 1997] and [Keil-Slawik et al. 1996]). Research within VORMS does not add another study to the already conflicting results, trying to isolate one variable, e.g. online communication, and prove its importance. We assume that collaborative learning is a substantial part of a blended learning approach. Collaboration can only take place, if communication takes place (see [Siebert 2000]). This demonstrates the importance of communication as an aspect of learning.

Online learning – online communication

Didactical beliefs concerning learning settings are changing over time. These changes often result out of innovative, new technologies. Besides offering time and place independent learning possibilities, technologies are focusing on customizing learning material as well as integrating new communication possibilities specifically designed for use within virtual environments.

Currently, the trend which can be observed within electronically enhanced learning is moving towards the direction of blended learning. Blended learning implies that already known components of virtual and traditional methods, concepts, and didactical beliefs, both used in isolation or in group work, are being put together to offer a holistic learning experience to the students. This typically integrates virtual study phases, traditional presence phases and settings where students learn alone or in groups – both virtually and/or traditionally. A holistic learning experience, when looking at it from a moderately constructivist angle (see [Siebert 2000]), substantially builds on collaborative learning. When promoting collaborative/cooperative learning, it is important to integrate research on communication theories, to evaluate if models designed for traditional settings are still applicable within web based settings or if they need to be adjusted or rebuilt completely. While ICTs continue to develop and grow, they capture more and more areas of our everyday life also influencing traditional communication. Current communication settings are changing at a tremendous pace. Communicating face to face is still done by almost all of us, but the use of email, chat, short message system, electronic discussion boards, white boards and the internet in general are expanding rapidly. Being reachable almost everywhere synchronously with cellular phones has become just as self-evident as asynchronous communication possibilities e.g. emails to persons on a different continent, arriving within seconds. Discussions within newsgroups also facilitate asynchronous discussion possibilities, and due to the nature of the medium complete discussion threads are traceable as long as they are online.

Defining success and defecting factors of communication online within technologies require the use of communication theories. The communication model of Friedemann Schulz von Thun (see [Schulz von Thun 2001]) describes that each message sent, and each message received is enriched with usually one of four aspects. These four aspects are:

- Content
- Relationship
- Appeal
- Self revelation

A sender encodes a message into verbal speech. He sends it, and the receiver decodes and interprets it. During a communication process between sender and receiver disturbances may take place while the message is en- and decoded. Disturbances can occur both on the sending and receiving side – and are due to the fact, that sender and receiver can give messages more than just one single meaning.

As our research shows, defective communication frequently occurs within online communication. Success factors for effective communication can be derived and generated when analyzing these disturbances. Conducting qualitative research, e.g. with a guideline interview within this area is extremely generative to receive empirical data describing success and disturbance factors. This qualitative, empirical method gives the interviewees the freedom to express what they really mean, describing it in their own words, without being pressed into predefined categories (see [Koenig 1999]).

Success factors for communication online – results of an evaluation

The evaluation was conducted qualitatively, by interviewing students. They had taken part in a course, where virtual communication possibilities were used to supplement the presence phases. The empirical method of the guideline interview was used to ensure the assessed data is reliable and valid (see [Koenig 1999]). Some aspects were also assessed quantitatively through questionnaires.

Natural communication

Our evaluation shows, that offering communication possibilities to students which seem "natural" to them is a key success factor for communication online. Natural electronic communication seems to be a contradiction itself. How people use technologies and if they accept them as being "natural" depends on their prior experiences with the medium. While some groups of persons, mainly older generations, may have difficulties getting used to the use of e.g. cellular phones, e-mail, or internet in general it seems that the younger generations make use of many of these possibilities. Accepting new technologies as being "natural" can be stated, when an integration into everyday life has taken place.

Knowing who the VLE is being developed for is essential when deciding which communication possibilities are going to be integrated. Analyzing the target group concerning their affective, situative and cognitive affilitiations (see [Euler 1992]) towards the use and acceptance of new technologies, and communication, is a main success factor when developing a VLE.

Analyzing the target group of VORMS shows that there is no student who does not have an e-mail address. In a questionnaire passed out to them, the majority stated, that they have made prior experiences with doing researching on the internet. Most of our students have been involved in a discussion database and most all of them have chatted before. These technological standards which were assessed in the questionnaire were also mentioned in the interviews to be natural electronic communication for our target group.

Mobility

Our students visit our website frequently, which can be seen in the number of visitors, but also in the online registrations for courses. Almost all of our students own cellular phones. These prerequisites make it clear that mobility is a factor, our students don't want to miss out on. This can also be seen in the desire to learn independent of time and place. Offering mobile communication possibilities is important for the success of our VLE. Additionally we offer our students the possibility to work on different computers and when logging on to a file server, their customized learning environment, including personnel notes and bookmarks is retrieved. Students want to increasingly learn where they want and when they want. Integrating asynchronous communication possibilities is another way to support these aspects. Synchronous communication e.g. a chat function makes it possible for learners to see which other learners are currently online, and if they wish, they can get in contact with each other.

Communication rules

Integrating communication rules into a virtual setting enhances the communication within a VLE. When students communicate with each other traditionally, certain rules are internalised and applied. Online communication does not have a history long enough so that there are general rules everyone knows. Students described that depending on prior experiences rules may also vary. To avoid misunderstandings resulting from unclear rules VORMS integrates a phase into the presence courses, where the students make up their own rules and guidelines for discussion on the web. Some groups make more rules than others, some make no rules at all – it all depends on the students and the group dynamics involved.

Goals

The students studying with learning elements constructed in VORMS prefer a learning setting where all students involved in the learning process have one common goal, preferably also the same time schedule to realise this goal. Communicating with each other is enhanced, e.g. if there is a test coming up for all of them at the same time. Our evaluation has shown, and the students interviewed approve of this fact, that communication intensity increases as the test comes nearer.

Personnel contact

Our students state, that when being personally acquainted to the people on the web, misunderstandings do not take place as often, as if they did not know each other. This is another reason, why we are combining presence phases and virtual study phases to supplement each other. Difficulties with encoding and decoding messages (see [Schulz von Thun 2001]) seem to be even larger in VLEs than in traditional communication settings.

Conclusion

Continuously developing online communication is a new approach towards the extension of traditional hypertext systems. Communicating effectively within VLEs creates new didactic and design conflicts, which have to be handled in a systematical and well-founded way to gain from their inherent creative potential. Empirical research is needed to describe the momentary circumstances encountered, when trying to communicate online. The main goal of our research is to acquire the necessary knowledge and to develop a theoretical foundation. We have the basic architecture for this within VORMS, which allows us to realize and evaluate a variety of different types of communication possibilities.

References

[Euler 1992] Euler, E. Didaktik des computerunterstuetzten Lernens. BW, Bildung und Wissen, Verl. und Software, Nuernberg, 1992

[Hesse 1997] Hesse, F.W. Konzeption und Realisierung virtueller Wissensvermittlung. In: Hamm, I. and Müller-Böling, D. (eds), Hochschulentwicklung durch neue Medien, Gütersloh, 1997.

[Keil-Slawik et al. 1996] Keil-Slawik, R., Klemme M. and Selke H. Information and Communication Technologies in Education and Training (Part A). STOA Programme, European Parliament, Directorate General for Research, PE: 165.710., Luxembourg, 1996.

[Koenig 1999] Koenig E. & Volmer G. Systemische Organisationsberatung. Dt. Studien-Verlag, Weinheim. 1999

[Schulz von Thun 2001] Schulz von Thun, F. Miteinander reden: Kommunikationspychologie für Führungskräfte. Rowohlt, Reinbek, 2001.

[Siebert 2000] Siebert, H. Didaktisches Handeln in der Erwachsenenbildung: Didaktik aus konstruktivistischer Sicht. Luchterhand Verlag, Neuwied, 2000.

Shifting the Unit of Analysis from the Individual to Action: Socio-cultural Approaches to Computer-mediated Communication

Eva Mary Bures
Education Department
Concordia University
buresc@alcor.concordia.ca

Steven Shaw
Education Department
Concordia University
shaws@vax2.concordia.ca

Abstract: Socio-cultural approaches to research and design in computer-mediated communication and education suggest a unifying framework. Overall, research and practice in the area has suffered from a lack of coherency and usability, despite brilliant individual contributions. Socio-cultural approaches focus on action as the unit of analysis, uniting individual and social processes, and on how artifacts mediate between individuals/communities and their goals. They take into account the distributed nature of communication, knowledge, and communities, and have the potential to unite many in CMC from diverse disciplines with a range of interests, from the individual to the social, from the theoretical to the applied.

Introduction

Computer-mediated communication (CMC) holds promise to support distributed knowledge- and community-building in education, but research and practice in the area has tended to lack coherency and usability overall, despite brilliant individual contributions. Research and design influenced by socio-cultural perspectives offers a unifying framework. This paper presents a literature review highlighting work helpful in that pursuit.

Perspectives

Problem: Critique of CMC Research and Practice in Education

Research and practice applied to education has tended to lack both coherency and usability on broad levels. The boundaries of the area have not been defined. For example, how does the area of CMC relate to that of distance education (DE) or cyber-culture studies? Researchers and practitioners have emphasized the unique nature of CMC and the need for new methodologies. Relevant research in related areas has been largely ignored. For similar criticisms see Burge 1994 and Gunawardena 1997. The study of CMC and education encompasses many from vastly different disciplines, yet there is little debate concerning methodological stance.

Researchers in the area rarely synthesize the literature in an interpretable way that pays respect to the relationship between research and practice. Those syntheses that exist tend to be either purely quantitative, excluding the majority of work in the area or, in contrast, are practitioner-oriented syntheses of best practices drawn from disparate 'research'. This latter critique is applicable to even well-conceived syntheses that provide admirable guidance to the practitioner (i.e. Harasim, Hiltz, Teles & Turoff 1995; Palloff & Pratt 1999).

To some extent, these problems reflect the early times in studying CMC, and the inter-disciplinary nature of the pursuit. Nonetheless, they indicate a need to reflect systemically upon our approach. Silver (2001) suggests that the study of cyberspace has only recently entered a more thoughtful, less enthusiastic stage. He links the recent more tempered, critical approach with a consideration of methodological approaches, and a return to tried-and-true methods rather than re-invention of the wheel. Efforts by researchers to modify methodologies to suit the information age may facilitate the development of integrated approaches to CMC research and practice in education. Eisenhart (2001) suggests that ethnographic methods applied to education will have to be modified to suit the information age. For example, the definitions of community and of participant observation will have to evolve to allow for sites that are distributed across place and time. Contrast this perspective with early criticisms of Rheingold's use of the term virtual community in 1993 (see Rheingold 2000).

Socio-cultural Perspectives: a Possible Solution

Recent research in CMC and education demonstrates that socio-cultural perspectives (cf. Vygotsky 1978; and also Cole 1996; Engestrom 1987; Wertsh 1995) hold some promise as a unifying framework. A socio-cultural framework shifts the unit of analysis from the individual to action (acts within context), uniting individual and social processes. Socio-cultural approaches can encompass diverse multiple perspectives, making room for individual and social processes, and how they inter-relate within the context of an activity system. Salomon (1993) argues eloquently that an analysis of the individual remains important in distributed, socio-cultural views. They try to account for the role of mediating tools between individuals and their goals, and for the distributed nature of knowledge, communication, and communities. They focus on artifacts and their role in activity. Socio-cultural approaches appear especially suited to the unique characteristics of CMC, which has the potential to support distributed relationships, community, and learning.

Vygotsky (cf. 1978) focused on an analysis of the mutually constitutive relationship between humans and their world through mediated action. He believed that thinking and memory develop through a dialectic process where the child is affected by the world, but also changes the world, through cultural signs and tools. Higher psychological functions do not develop simply as the organism matures biologically, but rather depend on the dialectical process of change that the child engages in through mediated action. Cultural tools and signs (artifacts) mediate human action. These ideas permeate socio-cultural perspectives: Cole (1996) suggests that the idea that artifacts mediate action is related to Geertz's argument that culture acts as a controlling mechanism.

Just as Vygotsky applied a dialectical approach to history to his study of the higher psychological processes, he applied it to his research methodology. His research methodology focused on process rather than performance, since the focus of study is on change, that is, it is *historical*. Also, he focused on observation of subjects. As in experiments he would intervene in order to allow one to see processes normally invisible.

Wertsch notes that an important question has been where to give analytic primacy, to the individual or society? He believes that socio-cultural researchers must transcend the individual-society antimony debate, taking action as the object to be described and interpreted; action is the context in which individual and society are each understood to be "interrelated moments" (p. 60). A focus on action unites the study of individual and social processes. Several approaches to analyzing action exist (Cole 1996; Engestrom 1987).

Applications of socio-cultural perspectives to CMC design

Brown and Duguid (1991) suggest that CMC may function as an artifact that supports organizational learning. The mutually constitutive relationship between artifacts and the users is key. CMC systems can be used to bring newcomers into the community (tools affecting users) as well as provide users with the means to adapt the tool systems themselves to match their own values and goals (users affecting tools). Old-timers may have previous conversations or products that newcomers can view. Newcomers will themselves provide content eventually.

Viewing CMC systems as artifacts might help designers support a mutually constitutive relationship between the students and the system. Participants in online discussions naturally construct much of the content of the learning environment. Designers can make more explicit students' natural contributions to the online environment. Participants can also be enabled to contribute to the environment in a myriad of ways, including: summarizing class discussions (i.e. Hara, Bonk & Angeli 2000), creating personal links between messages, collecting resources for class use, and contributing finished projects for future classes (i.e. Giordano 1998).

Some (i.e. Clancey 1997) have focused on more direct involvement of participants in the design process to promote their feeling of responsibility for the building of artifacts in the learning community. Clancey argues that an activity-based perspective places the emphasis upon the social ("activites are inherently social") making it important to address issues of membership, participation in a community, and identity. (p. 284) He promotes participatory design of computer-based environments, where tool designers, workers and researchers collaborate together, and it is the practice of the users that provides orientation.

Knowledge Forum was developed following situative perspectives (Hewitt & Scardamalia 1998). A variety of interface features aim to support knowledge-building. Students directly contribute to the artifacts that the community is building by contributing online. Students can build on other messages or annotate messages. When referencing other participants' messages, they can choose from a pull-down list that includes all messages. Students can mark notes as potentially for publication. They are able to view messages from multiple perspectives, and to choose different types of scaffolds to support their communication.

Applications of socio-cultural perspectives to CMC research

Gunawardena, Lowe and Anderson (1997) take an interesting methodological approach to studying asynchronous online debates amongst professionals. They advocate analyzing each online activity as its own totality. They analyze two online debates by examining the changes underwent by each 'community of learners.' They describe key phases each group experiences in the co-construction of knowledge over two weeks of online discussion. Their approach is radical in not providing room for an analysis of individual processes. Its strenghts are its potential to measure learning of a distributed nature, and the contextualizing of the methodological approach with reference to that of others in the field.

Giordano (1998) applies socio-cultural perspectives to her design and methodology. Students viewed design projects produced by prior students, and any attached comments and/or reviews, in an electronic repository built in Lotus Notes and accessible through the Web. They added their own projects, while documenting the ways in which they adapted or adopted design precedents. They also contributed reviews or comments. Methodologically, the shared design memory created through this sharing of cases and discussion is viewed as part of a distributed system. To explore the impact of the shared memory on individual and organizational learning Giordano considered dimensions related to three elements: the community of learners, the shared design memory, and the design artifacts. To explore trends across the whole community of learners specifically related to the shared design memory, final designs were compared across three cohorts of learners.

Possible Frameworks for CMC research and design

Lewis (1997) presents a framework for exploring technology-mediated distributed communities. He draws on Engestrom's (1987) description of the structure of an activity: a triangle joins three elements – an individual who is helped by tools to achieve an object. This triangle expands to the community level by adding rules and division of labour. Lewis takes the nodes of this figure as a structure for his analysis, considering in turn various triads of nodes. For example, the triad of subject-tools-community encompasses issues of choice of media and collaborative tools, and the design of groupware.

Rogoff's (1995) framework of three levels of focus for socio-cultural activity could help frame CMC research and design issues. The community plane focuses on the institutional context and the role of cultural technologies. It would include explorations into the inherent and potential constraints of CMC systems in general and the role of CMC in the wider community in which the student is participating. The interpersonal plane focuses on the learning that occurs among people, so would include the learning experienced by groups or entire classes. The individual level focuses on how individuals are transformed through participation, so would encompass the kind of research most common in education.

Conclusion

Design and research influenced by socio-cultural perspectives suggests a unifying framework for the area of CMC and education Socio-cultural perspectives focus on action as the unit of analysis. They focus on artifacts and how they mediate between individuals/communities and their goals. They appear especially suited to the unique characteristics of CMC. Each application to CMC presented in this literature review provides some hope for the future of CMC applied to education, suggesting ways a researcher or designer can meet the challenges facing us as we explore and build distributed knowledge communities.

References

Brown, J.S., & Duguid, P. (1991). Organizational learning and communities-of-practice: Toward a unified view of working, learning, and innovation. *Organization Science*, 2(1), 40-57.

Burge, E. (1994). Learning in computer conferenced contexts: The learners' perspective. *Journal of Distance Education*, 9 (1), 19-43.

Clancey, W. (1997). The Conceptual nature of knowledge, situations, and activity. In P. Feltovich, K. Ford, & R. Hoffman (Eds.), *Expertise in context* (pp. 247-291). Menlo Park, CA; Cambridge, MA: AAAI Press & MIT Press.

Cole, M. (1996). *Cultural psychology: A Once and future discipline*. Cambridge, MA; London: The Belknap Press of Harvard University Press.

Eisenhart, M. (2001). Educational ethnography past, present and future: Ideas to think with. *Educational Researcher, 30*(8), 16-27.

Engestrom, Y. (1987). *Learning by expanding*. Orieta-konsultit, Helsinki.

Giordano, D. (1998). *Contributing to and using a shared design memory: Effects on learning analysis and design skills*. Ph.D. Dissertation, Concordia University, Montreal, Canada.

Gunawardena, C., Lowe, , & Anderson, T. (1997). Analysis of a global online debate and the development of an interaction analysis model for examining social construction of knowledge in computer conferencing. *Journal of Educational Computing Research*, 17(4), 397-431.

Hara, N., Bonk, C. J., & Angeli, C. (2000). Content analysis of an on-line discussion in an applied educational psychology course. *Instructional Science*, 28: 115-152.

Harasim, L., Hiltz, S.R., Teles, L., & Turoff, M. (1995). *Learning networks: A Field guide to teaching and learning online*. Cambridge, Mass: MIT Press.

Hewitt, J., & Scardamalia, M. (1998). Design principles for distributed knowledge processes. *Educational Psychology Review*, 10(1), 75-96.

Lewis, R. (1997). An Activity theory framework to explore distributed communities. *Journal of Computer Assisted Learning*, 13, 210-218.

Palloff, R., & Pratt, K. (1999). *Building learning communities in cyberspace: Effective strategies for the online classroom*. San Francisco: Jossey-Bass.

Rheingold, H. (2000). The Virtual Community: Homesteading on the electronic frontier (Revised). Cambridge, MA: The MIT Press.

Rogoff, B. (1995). Observing sociocultural activity on three planes: participatory appropriate, guided participation and apprenticeship. In J.V. Wertsch, P. del Rio, A Alvarez (Eds.), *Sociocultural studies of mind* (pp. 139-164).

Salomon, G. (1993). No distribution without individuals' cognition: A Dynamic interactional view. In G. Salomon (Ed.), *Distributed Cognitions* (pp. 111-138).

Silver, D. (2000). Looking backwards, looking forward: Cyberculture studies 1999-2000. In D. Gauntlett (Ed.), *Web.studies: Re-wiring media studies for the digital age* (pp. 19-30). Oxford University Press.

Vygotsky, L. (1978). *Mind in society*. Cambridge, MA: The MIT Press.

Wertsch, J. (1995). The need for action in sociocultural research. In J.V. Wertsch, P. del Rio, A Alvarez (Eds.) *Sociocultural studies of mind* (pp. 56-74). Cambridge, MA: Cambridge University Press.

Using Virtual Web-Enabled Technologies and Design at Accenture to Enhance Entry Level New Joiner Training.

By Sandra Burke (sandra.m.burke@accenture.com) & Melissa Noonan (Melissa.noonan@accenture.com), Accenture.

In a company where human capital and expertise, and retention and cultivation of this expertise, is strategically imperative to its long term success, Accenture is charged with training up its entry level new joiners in the skills needed to be successful in their work with clients on engagements. The Professional Development Program (PDP) - Client Engagement Readiness program is tasked with training up these new joiners. Delivering effective training is a challenge considering Accenture has offices in 47 countries worldwide with new Joiners coming on board throughout the year. The program itself consists of 2 weeks training in local offices and two weeks classroom training in the U.S. Implementation of the local portion of the program varies. Traditionally, the local office portion of the program was delivered using binders and CD ROM self-study programs. There may or may not be faculty facilitators for the course depending on the number of participants and faculty availability. In a local office, there may just be one to two people joining the program, or a large start group. And skills and educational backgrounds of New Joiners can range greatly.

Today, however, a new local office training approach is being piloted using the capability of the web, e-learning, collaborative technologies, virtual coaching and event driven personalization to customize and improve the learning and user experience during the local portion of the program. The new program: 1) Provides access to expert coaching support synchronously and asynchronously via a number of delivery methods – like instant messenger, phone, email etc 2) Encourages peer-to-peer connectivity, communication and support across offices – using contact list information garnered from learner, and coach intervention to encourage individuals to work together 3) Customizes learning experience through use of self-assessments\diagnostics – to determine where to start in a self-study for example, or determine what path through a self-study to follow 4) Offers a broader range of learning experiences\training product options\opportunities depending on learner's needs\diagnostic results – for example offering additional training options for those needing more baseline skills, or those needing to stretch their learning 5) Improves content delivery – providing learner with recent content updates, status of issues \errors, and additional content materials like answers to frequently asked questions, and presentation materials with faculty notes etc to overview of reinforce key concepts etc and 6) Enables program sponsors to craft and deliver customized communications to learners based on their program enrollment status.

This paper discusses these new program features and the findings from recent piloting\testing of these features with learners. Future directions of the program are also discussed. These include: 1) Self serve download of key course software (self studies), 2) Introduction of self check questions and tracking to monitor performance and learners location in program 3) Use of that information to offer coaching feedback and remediation and finally, 4) the potential to extend the coaching role to provide local faculty with support to ensure consistent delivery of the course.

BEST COPY AVAILABLE

Independent Study based on the Strategy of Online Workshops to Develop Professional Abilities (TDHP) of UNITEC

Abstract: The present study reports an analysis of a procedure to develop online workshops for undergraduate students. Furthermore a methodology to generate specific interaction between the participants and a previously prepared content, as well as specific student-tutor, student-student interactions that favor adequate attitudes towards online education is proposed. The result conclusively show that the strategy accomplished a fluid and effective learning experience for the participants with regards to the workshop's contents. Additionally, the workshop promotes a favorable interaction between all members of the online community. Of special importance is the fact that students developed a life long attitude of continuing self-education. We conclude that the proposed methodology for the online workshops effectively complements educational processes for undergraduate students in Mexico and that it is an excellent tool to enable continuous education.

Alfonso Bustos Sánchez, Beatriz Yolanda Jiménez González, José Ignacio García-Santamarina Vite
Instituto de Investigación de Tecnología Educativa
Universidad Tecnológica de México
abustoss@mail.unitec.mx

Introduction

The INITE (Instituto de Investigación de Tecnología Educativa de la Universidad Tecnológica de México) has developed during the past years an educational program called Talleres de Desarrollo de Habilidades Profesionales (Development of Professional Abilities Workshops) aimed at undergraduate students. Some of the topics presented at the workshops include: Business Consulting, Interpersonal Relations, and Self-Education, among others. This last workshop has been defined as a workshop that reinforces the educational process in the college years and creates a motivation to continue this process through life. For three years, our experience with the workshops has been enriching and satisfactory. The results have been constantly monitored and evaluated and a progressive improvement has been carried out with the workshop activities and the student and tutor manuals. The communication with the participants has been both vigorous and constants, resulting in a steady stream of suggestions that helps us mature the workshop format, the time frames related to the different activities schedule and even some interesting suggestions related to the flexibility of the educational model used in the workshop.
Using these suggestions combined with our continuous research, and as a first step to explore the uses of Internet in UNITEC we decided to create a program that initially was thought of as complementary to the existing workshops. This program became the online format of the THDP being taught at campus. From the nine workshops that already existed on campus, we selected the Self-ed workshop and developed an online version. We took into consideration the following elements to support our decision:

1. The contents generate a significant learning environment that is highly motivational and self directed to "…fomenting the self- educating process directed to the forging of autonomous abilities and attitudes to achieve the optimal academic and professional performance (Autoeducación, 2000)." This said environment could be favored by an independent dynamic studying experience. One that promotes autonomy, self-regulation, collaboration, team work and, according to certain authors a studying model that more seems to favor the life long process of education: online off campus education (Abués and Tarín, 2000).
2. Another argument, supported by certain authors (Aretio, 1996; Duart, 200), is that last course students have possibly developed a better discipline, self- regulatory strategies and the necessary self-motivation to successfully participate in an independent training program than those students from the early studying cycles.
3. The Self- Education workshop is studied by ninth (last) quatrimester students. One of the mayor concerns regarding the online workshops had to do with the students' possibility of accessing the web. We discovered that last quatrimester students had a better chance of having both the adequate hardware and internet access due to the fact that most of the student population at UNITEC work and so have the hardware and internet access at their workplace and/or the economic means to afford one for home use. This increased the expectancy of studying and online workshop.
4. Finally the fact that most last quatrimester students are working was considered. Therefore an online workshop would have a huge appeal due to the fact that they could do the work from their own work places, and/or their home during their spare time.

Methodology of the Online Workshops

To speak of online education is evermore frequent. However, when an institution of higher education is analyzing the possibilities and implications of participating with this model, several issues have to be considered. Among the most important are:

- The type, amount and quality of technology that has to be incorporated into such programs.
- The processes of instruction of the faculty members and the selection of which faculty member should be incorporated.
- The different stages in which the technology and instruction of the faculty members should coincide to develop the educational program. The different stages into which technology is going to be incorporated.
- The institutional changes than this process bring on: First the impact on the faculty, the student body, the research bodies, the administrative staff. Secondly, the different regulatory, proceedings processes that have to be implemented.

Methodology

Based on this outlook, the strategy we outline, concentrated on the development of a methodology for online workshops that seek to establish itself as a complementary modality to the workshops taught at campus and to become the starting point to introduce new strategies and forms to the teaching-learning model.

Online Workshops Strategy

The THDP en Línea (Online Development of Professional Abilities Workshops) was defined as an asynchronous environment. This means that the Tutor-student, student-student, student-tutor is not simultaneous but parallel and/or syncopated. It is achieved by means of email and electronic forums that become debate centers on web pages. This facilitates the reading-learning process associated with the specific needs of the student at a particular time. Simultaneously, each student has the possibility, based on his/her access frames, progression rhythm and interests, to review the contents of the online forum and to participate when she/he considers pertinent.
The student has to provide an online activity that is also compulsory and that must be concluded with a written participation and/or essay in a forum. A certain complexity is inevitable regarding the student interaction in sending the information and revising existing and future participations of the other members of the community.
If a virtual community of 60 students has to develop (x) number of activities and as a final activity, each student has to write an essay with his/her point of view and recommendations for the workshop which is then submitted so that the rest of the members of the community can revise it, the complexity and amplitude of this process is so much more time consuming, enriching and formal than the same exercise in a classroom in a traditional sense, in which the opinions are often more punctual and less structured. An online community that promotes constant written production, we believe, favors the involvement of all members of the community and facilitates the interaction.
Activities that follow the **reading-opinion-reading-final essay** strategy, characteristically used in the first internet related experiences have proven their value generating and developing the online educational process. However the strategy no longer responds to the current virtual students and/or the potential in the new generation of web pages in which dynamic menus, interactive data bases and streaming multimedia have tap new limits of educational processes. A new strategy that combines the mentioned elements is more in the way of **reading-interaction with concepts-opinion-interaction with other members of the web community-reading-closing activity**. In this strategy, the reading can be a multi-platform, dynamic sequence of events that includes video, audio, reviewing and/or creating concept maps, crossword puzzles, and many more diverse didactic activities available on the web. This is the new strategy that defines the characteristics of the methodology in our online workshops.

Methodology

We developed the workshop on a LINUX platform, using as a primary tool for the student-student, tutor-student Hypernews ver.2.0. We also generated a system that would automatically register the student interactions (RAP-registro de alumnos participantes) using Posgress and PERL. This registry system links what our students are doing in Hypernews and tags an ID to the delivered assignments. Through this method, we have an accurate automatic report of the homework or papers the student is completing, facilitating the tutorial process and allows the tutor to concentrate on a quality interaction with the students. The tutors received special training sessions to gather in depth knowledge of the process and an online manual is also available to the students.

Javascript and Flash movies and in some cases digital video (.mov Quicktime) to generate the interaction thru concept maps, crossword puzzles, etc.. Most activities we drawn directly from the student's manual and then enriched with activities and contents from the tutor's manual. However, some activities were modified for the online modality based on two arguments: the activity could be modified favorably by online interaction through the addition of visual resources, data processing, immediate responses or the activity suggested by the workshop was too complex to be taken literally to the online process. The tools required were structured taking into consideration FACS, videos, two types of forums (exercises and essay), RAPs, interactive exercises and links to the web. (http://www.eva.com/Autoeduc/herramientas.htm)

The use of asynchronous forums was defined as the central axis so that each student could present his/her work and could receive feedback by the tutor and/or other students regarding his/her work. The primary task of the tutor was to review the topics discussed in the forums and to provide at least one participation to guide the discussion. A reading of the first and last essay submitted buy each student should also be read by the tutor and a personalize message sent to that student with specific comments regarding his/her work.

The online workshop consists of 4 modules, each with two forums, one containing exercises and a second forum for essays as a final practice. In total, each student should incorporate into his/her portfolio 17 papers: 4 short essays, as a conclusion for each of the 4 modules, and 13 obligatory exercises stating opinions on the forum for activities regarding the work done in each module. There are 5 other optional exercises. The workshop lasts two weeks in which no specific time frame is considered. The students can log on at any time and carry out any number of exercises depending on their time limitations, as long as they follow general considerations (http://www.eva.com.mx/Autoeduc/Recomendaciones.htm). To ensure this, the access system would not allow the passwords to open the workshop after a certain date.

Participants

The workshop was carried out with UNITEC students, structured around two groups, each one with its own tutor and its own time frame. A total of 92 participated out of which 19.5% belonged to the morning schedule, 54.3% to the evening schedule and 25% to the night schedule. 50% were female and 50% were male. 32% were students only, while 68% reported having a job besides their school activity. Most of the workshop population (64%) were majoring in Accounting, Law or Business Administration. Out of the remaining percentile, 36% were Economics, Marketing, Computing Administration, Finance and a variety of engineers (Chemistry, Electronics, Mechanical, Computer Systems).

Results

After a two week period, 84 students successfully completed the workshop, while 8 failed to do so. 41% of the students handed in 100% of the required work, 48.9% handed in between 9 and 12 exercises and only the 10.1% handed in less than 9 exercises. Regarding the essays, 73% of the students delivered 100% of the work required, 15% between 1 and 3 essays and 12% did not hand in any.

Regarding the tutelage done, several types of interaction were found to be developing:

Student-student: participants oriented themselves.
    Date: Feb. 21, 2002. 11:14
    Author: Isis Marlene Canto Flores *mcantof*
Do you think that the next generations will adopt this Self-education strategy?

1. Answer. Silvia Atescanco Pineda, Feb24, 16:23
    1. Marlene for Mariela Ramírez Uribe, Feb. 26, 11:15
    2. I agree Bladimir Peñafiel Campaña, Feb. 26, 18:31
    3. Answer: Juan Carlos San Miguel Ayala, Mar 01, 23:34

Student-Tutor: The student requests help from the tutor by e-mail.
Date: Feb. 19, 09:53
Author: Luis Rubén Espejel Parra *reparra*

"I study about a half hour every day and that has been enough for me, because I read what we do in class and even though it is very little (reading), I have certain practice already so it works for me and it allows me to know how much I need to (really) study. "

Forum: Module 1 – Topic 1
RE: Activity 1 (Luis Rubén Espejel Parra)
Date: Feb. 19, 10:19
Author: Tutor Frida Guerrero *fridagro*

"I think that in your particular case, studying is a habit which is very good and gives your learning continuity and when an exam approaches, you only have to review the acquired knowledge, facilitating your learning ability. Congratulations!"

Tutor-Group: The tutor sends group messages through the forums and by e-mail to provide information or to provide a single answer to a discussion line.

Question/Answers
Date: Mar. 08, 16:42
Author: Tutor Jaime Huerta *huerta*

"I would like to make public my appreciation regarding the participation, especially since it is so productive regarding the good quality of your contributions. (I) would like to exhort those of you that have not participated in the group discussions to do so as quickly as possible.

Regarding the questions and answers (I would like to say)..that the elements are directed mostly the professional need for constant self-education and training. This will give you the edge in an ever increasing competitive world."

Finally, we used a Likert type instrument to retrieve the students' opinions and we found that: 92% considered the feedback quick, 95% considered it more clear than confusing and 61% considered it to be very broad. 90% considered the exercises to be varied and broad. The tutor's response time was considered as quick by 89%. The forums were cataloged as user friendly (96%), useful (94%) and broad (95%). The essay forums were considered broad (95%) and user-friendly (97%).

Conclusion

The interaction between the students' and the self guided contents of the online workshop proved to be an adequate strategy to develop a self –education process. The high turn-in rate of the exercises and the high participation in the forums, indicates that the students could follow the planned sequence: reading-interaction with concepts -opinion-interaction with other members of the web community-reading-closing activity favorably. We can state that the exercises with specific, self interacting content allowed a focused activity, generated a process of opinion regarding the contents and finally developed a working space between peers and student tutor relations. At the same time, the high number of hand-ins regarding the final essays for each module show that the activity is an excellent option to comment on the learning experience for each module. This learning strategy, along with the contents of the online workshop and the asynchronous workspace shows the advantages of the tutoring process, thus guiding the student to an appropriation process of the knowledge from the online source. The social interaction accomplishes a significant role by focusing the learning-teaching experience in tutoring where the students' peers and the tutor serve as a guide more than a teacher.

Finally those that answered the pole, support our idea that the aforementioned work strategy does promote a favorable attitude towards a self-education processes mediated by computer hardware and software. Additionally it does generate easy to regulate, process and participate in a virtual community of self-education activities. Some aspects that need to be improved include automatic processes that feedback information to allow students to move at their own pace with a more efficient use of their resources (time, higher levels of participation in forums), the definition of evaluation processes that can truly measure the academic reach of the online workshops and a punctual follow up of the tutoring process.

The Impact of Learner Feedback on Program Redesign

Overview

T-PLUS (Technology for Principals Leading Utah Schools) is a technology-based professional development program for Utah principals and superintendents. Participants who complete the program receive the Advanced Certificate in Technology Leadership from Western Governors University and earn 144 relicensure points from the Utah State Office of Education. The $2,000,000 grant, funded by the Bill and Melinda Gates Foundation and the State of Utah, allows for 70 percent, or about 670 members of Utah's 949 public and private district and school leaders, to participate.

The purpose of the T-PLUS project is to support Utah's K-12 technology goals through a well-defined, state-coordinated technology leadership initiative that promotes integration of technology in district- and school-wide curricula to promote increased student achievement.

T-PLUS is designed around four primary goals:

- *GOAL I:* Identify and critique technology-supported learning environments that address instructional or performance improvement goals.
- *GOAL II:* Oversee and manage a technology-integration project team and its process, including providing for relationships among all stakeholders.
- *GOAL III:* Develop and justify strategies and tactics for introducing and integrating new technology tools and techniques based on change theory or a change model.
- *GOAL IV:* Design and complete an action research project either individually or collaboratively with one or more other participants. The project will be field-based, data-driven, and reflective of outcomes based on a technological intervention.

Design of the Pilot

During the pilot phase of the project, which began in January 2002, participants were given several options.

- Go directly to final assessments and take no coursework
- Take three instructor-led online courses based on the T-PLUS goals and objectives
- Take final assessments for some of the competencies while completing the remaining competencies via instructor-led courses

Since WGU does not offer courses itself, it contracted with other universities for three graduate courses to support the certificate program. Development entailed customizing the content of a similar course at the hosting institution to the goals and objectives outlined above and converting it to a format deliverable via the Web. . The synchronous courses were instructor facilitated and adhered to a standard academic calendar and format. Participants were required to complete assigned readings in a text and submit weekly assignments base on the readings. They were also required to take part in regularly scheduled online group activities.

Learner Feedback for the Pilot Phase

Within three weeks after the beginning of the online courses, participants began to fall behind or drop out completely. For the duration of the courses, participants expressed concerns about the amount of time needed to complete the weekly activities; lack of feedback from instructors on completed assignments; course content not relevant to their needs; technology issues; scheduling problems for participation in scheduled online activities; and overall frustration with their inability to successfully complete the program. By the end of the courses in May, the drop out rate had reached 60% and the end of course evaluations were extremely negative.

As a result of the increasing drop rate and participant feedback, in March the decision was made to redesign the courses for the Implementation Phase. The new design was based on participant input and lessons learned from the failure of the pilot.

Design of the Implementation Phase

The online course developed for the Implementation Phase is based on the four primary goals identified for the pilot. However, the design and delivery have changed dramatically. All academic content and scheduling are removed from the competency-based course. Delivery of the course is asynchronous and completely learner-directed. The participants are given a three-month window to complete the two modules, each of which can be completed in less than 10 hours.

The support materials for the modules include a CD-ROM, ***Principal Connections***; a practical guide to technology implementation, ***Planning into Practice***; and several websites related to the topics of the course. All of the materials have been reviewed by principals to ensure the relevancy of the content to the participants.

Access to the course has been simplified and the navigation has been designed to be user friendly. WGU mentors are assigned to each participant to ensure immediate response to problems or issues related to the course.

Learner Feedback for the Implementation Phase

Initial participant feedback to the redesign of the course has been extremely positive. Participants are now enthusiastic about participating in the program. They report fewer technology problems, timely feedback from mentors, highly relevant content; and realistic time requirements for completion of the courses. Participants have voiced their appreciation for the willingness of WGU to listen to their input and to carry out extensive revisions to meet the specific needs of principals and superintendents..

Combining Classroom and Online Approaches for Maximum Learning

Celina Byers, Ph. D.
Oakland University
byers@oakland.edu

Abstract: Working students attending long night classes are often unable to concentrate as the night progresses. An online course management system like WebCT can provide such students with resources that permit self-scheduled, interactive study to replace some class time. Online discussions, like classroom discussions, can be assigned, monitored, and participated in by the instructor, effectively creating a traditional course with a distance-learning component. Although this innovation meets strong initial resistance, students become engaged and declare it rewarding.

Introduction

Web-based instructional environments provided by course management systems (e. g., WebCT) can offer unique opportunities to design and deliver Web-enhanced courses, where we can practice what Owston (1997) suggests: "the Web can help us re-focus our institutions from teaching to learning, from teacher to student" (p. 27). Web-enhanced courses, because of combining face-to-face teaching and learning with Web-based activities, do not have the problems caused by the lack of a person-centered model reported by Miller & Mazur (2001). The instructional designer's major role, especially when designing and preparing courses for adult learners, is to provide an environment that stimulates active learning. However, having well designed material and well planned class activities is not enough when teaching night classes for students who have had a full day of work. There are many aspects to consider in order to extend active learning and nurture effective collaboration among students. Clear guidelines, specific due dates, constant monitoring by the instructor, and immediate feedback are some of these aspects (Horton, 2000). This paper reports on a successful attempt to replace the last 50 minutes of a 3-hour-and-20-minute classroom-based night class with online learning.

Scenario

Introduction to Instructional Design, in our Master's Program in Training and Development at Oakland University in Michigan, is a four-credit-hour course. The class meets once a week from 6:30 to 9:50 pm. Deciding what to include and how to deliver it so that the students will have acquired the necessary skills at the end of an introductory course of instructional design is always an interesting task because the elements necessary to be included fill every minute that the time frame of the course allows. Learning theories, for example, form a large portion of content that is an essential complement of Introduction to Instructional Design.

Because the introductory course of instructional design is four credit hours, it should allow enough time to cover all the necessary elements that need to be addressed. However, I realized early on that the students had a difficult time concentrating and participating in class activity after 9:00 pm. To solve this problem, I decided to replace the final hour or so of class time with activities that vary from the usual class discussion format.

Implementation

I was already using a course management system to make available for the students the course syllabus, the course assignment rubrics, class agenda, and presentations. We also used it for student-student and student-instructor communications. The decision to move the discussion of learning theories from face-to-face

BEST COPY AVAILABLE

to online seemed logical and easy to implement. We finished the class by 9:00 and complemented the instruction with online activities, activities the students could complete according to their own schedule.

To model the online assignment expectations for the students, I proposed and monitored the activities for the first three weeks. After that the students had the option of working in small groups or individually to propose and monitor the weekly activities. To set the stage, I made the first learning theory assignment active learning. The students were divided in groups of three and assigned to read three online articles on the subject. Then they held discussions within their group and defined the student and instructor roles in an active learning environment. They had available a private bulletin board forum, e-mail, and synchronous chat features to complete their group tasks. They had to compile and publish their group results for the rest of the class. The entire class then had a common online forum to discuss the results.

For each subsequent week they made a different selection from a list of learning theories that was made available for them to work on. The online activities varied for each weekly discussion. The students were given discretion to follow my lead in terms of the kind and format of activity or come up with something new.

At the end of each week an electronic evaluation form was made available so the students could evaluate their peers' performance. The grade for the activity was the average of everybody's input.

To evaluate the course development and intervene if necessary, the students were asked to answer weekly surveys with objective questions. They were also asked to provide a weekly journal in which they had to respond to three points and could make open comments. Close to the end of the course, they completed a capstone evaluation form, evaluating diverse aspects of the course.

Results

At first there was a negative reaction from some of the students. These people felt overwhelmed with the technology component of the course (which was not focused on technology). They brought their point of view to our question-and-answer time at the beginning of each class and voiced their concerns in the bulletin board discussions as well as any class moment that was possible. I was open to discuss any and all alternatives they could suggest. Each discussion about the use of the course management tool ended with the majority of the students agreeing either that they liked the class setup or were willing to keep trying to get more comfortable with the use of technology.

Before the middle of the semester, in fact, I had each of the initially reluctant students coming to me during class to say that they regretted their resistance because they were learning so much more and better since they did not have to force themselves to stay late to the end of the class period. Many of them told me that they were sure that would not be possible to have the same quality of learning if the same activities were performed in class.

The weekly survey results in which the technology use was assessed provided a quantitative measure that the majority of the group was in favor of the continuation of its use. The cumulative results of the survey showed that 80% of the group rated the use of technology positive, 17% rated it neutral, and 3% rated it negative.

Students also commented positively about their learning: "In terms of the learning behavior theories, I learned a lot. At first, I thought that the theory assignments were a necessary evil class requirement. However, I have changed my opinion of the value of the behavior theories. They can be very helpful to an instructional design. I think that this would be a very interesting class by itself. I understand why we need the Webct to finish the theories. Class time is too important for the instruction design concepts;" "Overall, I really enjoyed this class and support Oakland University using this course as a model of what all the courses should look like!;" "I absolutely loved this class. I have actually found it hard to focus on my other class as every time I sit down to homework I want to work on this project!. I will be spending the next two weeks playing catch up in there, because instructional design has stolen my attention for the past several weeks!"

On the capstone evaluation form, students were asked to indicate on a scale of 1 (lowest) to 5 (highest) their knowledge level, before and after taking the course, on some major constructs that were covered. Familiarity with learning theories (FLT) and with instructional strategies (FIS) were the two major focuses of the on-line discussion. On FLT, 58% rated their previous knowledge 1 and 42% as 2; 33% rated their after-course knowledge as 3, 50% as 4, and 17% as 5. On FIS, 100% rated their previous knowledge 1; 25% rated their after-course knowledge as 2, 42% as 3, and 33% as 4.

Discussion

In long evening classes that meet once a week, the concentration of students who are also full-time employees begins to lag before the end of the class period. An online course management tool can be a resource that permits self-scheduled study in diverse, interactive formats. Once the students have achieved the necessary technological skills, this approach appears to produce generally positive results.

To overcome the strong initial resistance to this approach, I recommend that instructors stimulate full discussions of problems students are having, engaging the entire class both in raising complaints and in proposing alternative solutions. Mature and open-minded treatment of students' difficulties, coupled with willingness to experiment with suggested changes, seems to lead to success. Above all, maintain a sustained course assessment process and be ready to undertake course intervention as soon as necessary.

Reference

Horton, W. (2000). *Designing Web-based training*. New York, NY: John Wiley Et Sons, Inc.

Owston, R. O. (1997, March). The World Wide Web: A technology to enhance teaching and learning. *Educational Researcher*, 26 (2), 27-33.

Miller, C., & Mazur, J. (2001). Towards a person-centered model of instruction. *The Quarterly Review of Distance Education*, 2 (3), 193-207

Assessing Sense of Classroom Community in an Urban Community College Online Setting

Cynthia P. Cadieux, PhD
Tidewater Community College
United States
ccadieux@tcc.edu

Robert A. Lucking, PhD
Old Dominion University
United States
rlucking@odu.edu

Abstract: A self-report survey was used to investigate the sense of classroom community in an urban online community college classroom. Sense of classroom community scores were obtained as well as scores on four subscales of spirit, trust, interaction, and learning within the Sense of Classroom Community Index (SCCI). Differences between these five dependent variables and type of classroom setting (face-to-face or online) were ascertained by utilizing MANCOVA and ANOVA. It was concluded that sense of community was affected by classroom setting (face-to-face or online) and that learning may be enhanced by increased interactions within the classroom.

Introduction

This study investigated how classroom setting (face-to-face or online) affected student sense of classroom community in the online urban community college classroom. McMillan and Chavis (1996) state that community consists of four dimensions: (a) spirit - feeling that there is a community, emotional safety, feeling connected to others; (b) trust - feeling that the community can be trusted, and it is safe to tell the truth; (c) interaction - feeling that it is mutually beneficial to be in the community, one has a sense of shared values and those values are reinforced; and (d) learning - feeling a shared emotional connection in time and space arising from contact between the members of the community. A body of evidence suggests that a strong feeling of sense of classroom community is related to a more positive student learning experience and achievement gains (Bryk & Driscoll, 1988). These positive outcomes translate into lower drop-out rates, an increase in student-to-student referrals, and a deeper commitment on the part of the student to the institution and program of study (Biner, Dean, & Mellinger, 1994; Tallman, 1994). Rovai, Lucking and Cristol (2000) developed the Sense of Classroom Index (SCCI) to measure sense of classroom community as theorized by McMillan and Chavis (1996).

It is important to provide a positive learning experience in the online classroom setting as well. Asynchronous Internet instruction was among the top three technologies employed to offer distance education during the 1997/98 academic school year (U.S. Department of Education, 2002) and has grown steadily since, so the implications of providing a positive learning experience in the online classroom are great.

The Study

This study sought to answer the following questions using quasi-experimental methodologies:

1. How does the online classroom setting, utilizing a course web page, threaded discussion, and a course listserv, affect student perceptions of spirit, trust, interaction, and learning in an urban community college semester course?
2. How does overall sense of classroom community differ between students who drop out and those who do not drop out of courses in an online urban community college semester course, which utilizes a course web page, threaded discussion, and a course listserv?
3. How does age affect sense of classroom community of students enrolled in courses in an urban community college semester course, which utilizes a course web page, threaded discussion, and a course listserv?
4. Is there a relationship between overall sense of classroom community and academic performance in an online urban community college semester course, which utilizes a course web page, threaded discussion, and a course listserv?

Three hundred and twenty-one students from the two groups were included in the final statistical analysis, 248 in the face-to-face group and 78 in the online group. In addition, 42 students were classified as dropouts. The SCCI surveys were administered to both groups three times throughout the semester in which the student was enrolled. Surveys were administered to students enrolled in College Algebra and Statistics courses. A total of three face-to-face Algebra courses and three online Algebra courses were surveyed. A total of seven face-to-face Statistics courses and three online Statistics courses were surveyed. The same instructor taught all courses over three semesters. Online courses had the same course number as their face-to-face counterparts. Participants were those students who completed the course, received a numerical grade and completed the three surveys throughout the semester.

The Findings

BEST COPY AVAILABLE

The research questions were studied under the null hypotheses as follows:

($H_0$1) There will be no significant difference in perception of spirit between students enrolled in face-to-face and in online classes

($H_0$2) There will be no significant difference in perception of trust between students enrolled in face-to-face and in online classes.

($H_0$3) There will be no significant difference in perception of interaction between students enrolled in face-to-face and in online classes.

($H_0$4) There will be no significant difference in perception of learning between students enrolled in face-to-face and in online classes.

($H_0$5) There will be no significant difference in sense of classroom community between students who are classified as dropouts versus non-dropouts.

($H_0$6) There will be no significant relationship between sense of classroom community and subject age.

Course outcome was studied under the following null hypothesis:

($H_0$7) There will be no significant relationship in course grade between students who feel a strong sense of classroom community and those who do not.

The two groups (face-to-face and online) were made equal for all dependent variables using prescores as covariates. The MANCOVA model was utilized for statistical testing of hypotheses one through four. The researcher sought to discern whether the classroom setting (face-to-face or online) might have caused differing perceptions of the dependent variables. The independent variable was group (face-to-face or online) and the dependent variables were post-spirit, post-trust, post-interaction, and post-learning. The co-variables were pre-spirit, pre-trust, pre-interaction, and pre-learning. Results indicated that the main effect of group was significant for post-spirit, post-trust, and post-interaction. Due to significantly higher scores in the face-to-face group, the null hypotheses of no significant differences among the two groups were not supported for post-spirit, post-trust, and post-interaction.

The face-to-face group experienced stronger feelings of spirit, trust, and interaction at the end of the course than the online group. This finding may imply that the flexibility of the online environment might not lead to greater student satisfaction as suggested by some (Leidner & Jarvenpaa, 1995; Brandon & Hollingshead, 1999). The following explanations could be given for the lower scores in the online group: (1) Some students may define community as something that requires face-to-face communication. Defining community was not a focus of this research. However, the online students may not have even been thinking about values associated with a traditional sense of community during the course of the class. The reason for enrollment for these students could have been only for obtaining academic credit in a way that was convenient. (2) Perhaps some students enrolled in the online classes to avoid being part of a classroom community. Students may have participated only in those activities required for a grade and remained relatively silent throughout the course. (3) Students generally enroll in online courses due to the convenience of obtaining an education around a busy personal and professional life. Perhaps the students in the online courses were too over-committed to fully engage in the course. Therefore, the students could not or would not devote the time necessary for community building. (4) Building spirit, trust and interaction in the online environment relies heavily on technology in order to allow the students to interact via E-mail, a threaded discussion, web board or other communication technology. Students in the online environment may have been hindered by the technology or have been frustrated by the technology available at the community college, which might have contributed to a lower sense of spirit, trust, and interaction. Further research will be needed to explain fully the differences observed between the face-to-face and online groups. The null hypothesis that no significant difference existed between perception of learning and group was upheld. In other words, the students felt that learning occurred equally in the face-to-face and online settings. The finding supports the literature showing that classroom setting has no effect on student success (Hyatt, 1992; Nixon, 1992; Easterday, 1997; Russell, 1999; Wegner, Holloway & Garton, 1999). This is a positive finding for those who offer online classes.

Results of the univariate ANOVA indicated that the main effects of type (face-to-face or online), status (dropout or non-dropout) or type-status were not significant to the prescore. Sense of community was measured only once in the dropout group, at the very beginning of the course. Therefore, the null hypothesis that there will be no significant difference in sense of community between dropouts and non-dropouts was upheld. Consistent with the research (Phipps & Merisotis, 1999), the dropout rate was higher in the online group (12.6%) versus the face-to-face group (9.5%). Data on persistence must be gathered in order to establish reasons for the higher dropout rate in online courses in an effort to reverse the trend. Due to the limited sample size of dropouts, further research needs to be conducted in order to determine whether or not sense of community is compromised at the time the students drop out of a course.

Correlation analysis was undertaken to discern how the predictor variables varied in their inter-relationships between the two groups. Based upon the Pearson's product-moment correlation (Pearson's r) matrix, no significant relationship was found to exist between sense of community and age. This finding supports the research by Stokes (2001) who did not find age to be a predictor of student satisfaction of a digital learning environment. Although not investigated in this study, age has been found to be related to achievement and feelings of social distance with the instructor (Fiebert, 1971). Older and higher achieving students related better to instructors of similar age. Fiebert related this to the possibility that people of similar ages have more in common, find it easier to approach one another, and have a shared set of academic values. Fiebert also felt that older students might have a higher self-esteem, allowing them to overcome social distance barriers more easily.

Due to a non-normal distribution in course grades, Spearman's rho was utilized to analyze the relationship between sense of community and course grade (George & Mallery, 2001). No significant relationship was found to exist between sense of community and course grade. However, a slightly positive correlation was found between the sub-scale of interaction and course grade in the face-to-face group. This finding supports the literature suggesting that developing social ties from interaction is more difficult without face-to-face interaction (Flaherty, Pearce, & Rubin, 1998; Warkentin, Sayeed, & Hightower, 1997). McMillan and Chavis (1986) suggest that real learning does not take place until spirit, trust, and interaction occur. It is interesting to note that the group of students who scored highest on sense of community in the online environment was those students earning a grade of C, which may

BEST COPY AVAILABLE

support the McMillan and Chavis view that spirit, trust, and interaction have to take place before learning can occur. The online group scored lower on the four domains of spirit, trust, interaction, and learning.

Conclusions

The results of this study have important implications for urban community college educators as online courses continue to be developed and offered. Educators need to organize courses to ensure that the most effective type of interaction is taking place and that the interaction is suitable for the content area and students with different learning styles. The research suggests that instructors matter in the online setting and may have complete control over interaction and classroom dynamics (Arbaugh, 2000). Therefore, instructors need to learn skills necessary to promoting effective interaction. Perhaps large online classes will need to be divided into smaller groups in order to foster intimacy and trust among the students. The instructor might need to develop interesting, applicable discussion questions to aid the group in cultivating interacting skills. Study findings suggest that the face-to-face group of students experienced a higher sense of spirit, trust, and interaction than their online counterparts. If one agrees with the research that suggests that developing a sense of community will lead to a more positive course outcome and experience for those students enrolled (Dumont, 1996; Grossman, 1999; Rovai, 2001) then those instructors who teach online courses would benefit from building community in their online classroom. Instructor efforts, combined with pedagogical strategies that increase students' interactions may increase student satisfaction. Theoretically, curriculum-driven dropout rates might decrease, enrollments might increase, and satisfied students would be more likely to speak positively of their experience thus effectively promoting the online option within the institution. The positive experiences of students could translate into enhanced economic stability for the institution because those students who enjoy the educational experience may continue to pursue their education at the institution. Appropriate monitoring and evaluation of online courses by curriculum and assessment specialists would be imperative.

Classroom setting did not appear to have a significant effect on the subscale of learning. The face-to-face and online groups scored equally as high on the subscale of learning. This might suggest that pedagogical approaches could be more important at this time than the technology in determining the effectiveness of these courses. Those institutions utilizing technology to offer courses online need to be aware of such findings. However, use of technology plays an integral part in the online course and can have a beneficial or non-beneficial effect. The instructor needs to be familiar with the technology and be able to use course software to enhance, not detract, from the course. Technologies such as video, audio, and Web links can help to enhance the classroom experience by fostering more communication among students and between students and instructors. Communication based on these technologies might lead to an accelerated establishing of sense of community that previously was only based on textual input.

In this study, the online students who experienced the greatest sense of community earned a grade of C in the course. These students may have enjoyed the experience but earning a grade of C might preclude them from repeating the online experience. This could have both positive and negative implications for urban community college educators. If students do not continue to enroll in online courses a significant investment of resources are wasted. If students enroll in online courses, but are academically weak, faculty will need to be trained on how to optimize the learning experience. On the other hand, these "C" students, perhaps academically weak, sought out others for support and assistance, thus contributing to sense of community. Instructors of online courses need tools to help them evaluate the experiences the students may be having and how these relate to course outcome and students need to learn how to become effective consumers of educational experiences.

References

Arbaugh, J. B. (2000). How classroom environment and student engagement affect learning in Internet-based MBA courses. *Business Communication Quarterly, 63*(4), 9.

Biner, P. M., Dean, R. S., & Mellinger, A. E. (1994). Factors underlying distance learner satisfaction with televised college-level courses. *The American Journal of Distance Learning, 8*(1), 60-71.

Brandon, D. P., & Hollingshead, A. B. (1999). Collaborative learning and computer-supported groups. *Communication Education, 48*(2), 109-126.

Bryk, A. S., & Driscoll, M. E. (1988). *The high school as community: Contextual influences and consequences for students and teachers.* Madison, WI: National Center on Effective Secondary Schools, University of Wisconsin.

Dumont, R. A. (1996). Teaching and learning in cyberspace. *IEEE Transactions on Professional Communication, 39*(4), 192-204.

Easterday, N. (1997). Distance education and two-year colleges. *Community College Journal of Research and Practice, 21*, 23-36.

Fiebert, M. S. (1971). A scale to measure the social distance between college students and faculty. *The Journal of Psychology, 77*, 3-7.

Flaherty, L. M., Pearce, K. J., & Rubin, R. R. (1998). Internet and face-to-face communication: Not functional alternatives. *Communication Quarterly, 46*(3), 250-268.

George, D. & Mallery, P. (2001). *SPSS for Windows Step by Step: A Simple Guide and Reference, 10.0 update.* Boston: Allyn and Bacon.

Grossman, W. M. (1999). Online U. *Scientific American, 281*(July), 41.

Hyatt, S. Y. (1992). *Developing and managing a multi-modal distance learning program in the two-year college.* Paper presented at the 14th Annual International Conference of the National Institute for Staff and Organizational Development of Teaching Excellence and Conference of Administrators, Austin, TX.

Leidner, D. E., & Jarvenpaa, S. L. (1995). The use of information technology to enhance management school education: A theoretical view. *MIS Quarterly, 19,* 265-291.

McMillan, D. W., & Chavis, D. M. (1986). Sense of Community: A Definition and theory. *Journal of Community Psychology, 14*(January), 6-23.

Nixon, D. E. (1992). Simulteaching: Access to learning by means of interactive television. *Community/Junior College Quarterly of Research and Practice, 16,* 167-175.

Phipps, R., & Merisotis, J. (1999). *What's the difference? A review of contemporary research on the effectiveness of distance learning in higher education.* Washington, D.C.: The Institute for Higher Education Policy.

Rovai, A. P., Lucking, R., & Cristol, D. (2000). Sense of Classroom Community Index (SCCI). Unpublished.

Rovai, A. P. (2001). Building classroom community at a distance: A case study. *Educational Technology Research and Development Journal, 49*(4), 33-49.

Russell, T. L. (1999). *The no significant difference phenomenon as reported in 355 research reports, summaries and papers: A comparative research annotated bibliography on technology for distance education.* Raleigh: North Carolina State University.

Stokes, S. P. (2001). Satisfaction of college students with the digital learning environment: Do learners' temperaments make a difference? *The Internet and Higher Education, 4,* 31-44.

Tallman, F.D. (1994). Satisfaction and completion in correspondence study: the influence of instructional and student-support services. *The American Journal of Distance Education, 8*(2), 43-57.

U.S. Department of Education (2002). *The Digest of Education Statistics: Projections of Education Statistics to 2008.* National Center for Education Statistics. Retrieved February 1, 2002 from http://nces.ed.gov.

Warkentin, M. E., Sayeed, L., & Hightower, R. (1997). Virtual teams versus face-to-face teams: An exploratory study of a web-based conference system. *Decision Sciences, 28*(4), 975-996.

Wegner, S. B., Holloway, D. C., & Garton, E., M. (1999). The effects of Internet-based instruction on student learning. *Journal of Asynchronous Learning Networks, 3*(2), 98-106.

"Acquiring, Storing, and Sharing Research Datasets: Policies that Save Resources, Improve Collaboration and Research Activities using IT"

(This paper is currently a work-in-progress and will be completed by July 15, 2002)

Kemal Cakici
Multimedia, Networks, and Systems Specialist
Department of Management Science
The George Washington University
Washington, DC, USA

Jodi Felberg
Research Technology Coordinator
Center for Instructional Design & Development
The George Washington University
Washington, DC, USA

Abstract:

When university departments acquire, store, and share research datasets, IT support often finds itself struggling to reconcile several critical issues. Who pays for research datasets? Where are they stored? Who has access to them? How are they shared? How are they organized? What are the IT hardware and software requirements? Who supports the technology? Who makes dataset decisions, who provides funding, and who enforces the rules?

In this paper, we will examine the technical, financial, administrative, and political issues that surround research datasets and propose policies and procedures that aim to accomplish two important goals: (1) save limited resources such as money, storage space, and time, and (2) improve intradepartmental communication, academic research and dataset collaboration.

In an effort to address these issues, the Center for Instructional Design and Development at the George Washington University is actively involved in collaborating with, and forming permanent relationships with several Academic Departments, Information Systems and Services, Center for Academic Technologies, Gelman Library, and the Washington, DC area consortium libraries. This project was initiated in the summer of 2001 and we seek to have a strategic plan with milestones and major outcomes in place by July 2002.

We will present and discuss the challenges we faced, solutions we implemented, and our initial results from this project. We hope to outline the process in detail and explain how our experience can be used to enrich essential research activities, improve collaboration while decreasing the replication of research efforts, share the knowledgebase, and reduce the costs of data acquisition and storage at other universities.

Our presentation will be comprised of three parts: an examination of the problem and our proposed policy solutions; two case studies from our own experience that demonstrate how the dataset problems we encountered could have been minimized with the proposed policies; and an open discussion period where we invite feedback from participants and learn how other universities are dealing with this issue. Final paper will detail all these parts and relate their corresponding importance to a successful implementation of a collaborative knowledge management system in research activities of a higher education institute.

Proposed Policy Solutions: (work-in-progress)

(1) institute on-going meetings with IT specialists, academics, librarians, and administrators to open the lines of communication and dialogue in order to minimize political conflicts and power struggles;

(2) determine the number of replicated datasets as well as the critical datasets that are necessary for quality research but have not yet been purchased due to cost constraints or lack of information;

(3) setting ground rules and policies for ownership and funding of the datasets and access to these datasets

(4) determine the technical requirements and computer resources for instituting a centralized resource for datasets and research collaboration center

Other discussion points will include faculty perspective through interviews and brainstorming; computer software and hardware issues; managing and accessing library resources; setting the groundwork for collaboration with faculty and administrators through open communication and dialogue; networking and creating an effective working community among the IT department, academics, and administrators – the biggest challenge that all universities face.

Authors' Information:

Kemal Cakici was the interim Research Technology Coordinator and is now the Multimedia, Networks, and Systems Specialist for the George Washington University's Center for Instructional Design and Development and adjunct faculty in the Department of Management Science and Department of Civil and Environmental Engineering.

Jodi Felberg is the Research Technology Coordinator for the George Washington University's Center for Instructional Design and Development.

Intercampus: Administration and Teaching shared between eight Catalan universities through Internet

Francisco Calviño (francisco.calvino@upc.es),
Elena Añaños (Universitat Autònoma de Barcelona: Elena.ananos@uab.es
Nati Cabrera (Universitat Oberta de Catalunya: ncabrera@campus.uoc.es)
José Cela (Universitat de Lleida: jcela@itaca.UdL.es)
Dolors Folch (Universitat Pompeu Fabra: dolors.folch@huma.upf.es)
Mercè Gisbert (Universitat Rovira i Virgili: mgc@correu.urv.es)
Felipe Izquierdo (Universitat de Barcelona: felipe@angel.qui.ub.es)
Quim Pèlach (Universitat de Girona: quim.pelach@udg.es)

Abstract: Intercampus is a pilot project of eight Catalan Universities whit the support of the Department of Universities, Research and Information Society of the Generalitat de Catalunya (Autonomous Government of Catalonia). Intercampus deals with the share of processes ranging from administration (Open Administration) to the teaching of subjects (Shared-Teaching between universities) through the net. Its objective is the exchange of free electives to be taught via the Internet. Students from a particular university, involved in the project, are able to study virtual subjects from any of the eight universities, it makes communication and information easier for these students and it coordinates service and administrative support between their own university and the university where the course is taught. The universities that take part in the project are: Universitat Autonòma de Barcelona, Universitat de Barcelona, Universitat de Girona, Universitat de Lleida, Universitat Oberta de Catalunya, Universitat Politècnica de Catalunya, Universitat Pompeu Fabra and Universitat Rovira i Virgili. Intercampus began in the second semester of the year 1999-2000. Up to now more than 1800 students from the universities involved have registered. There are 32 virtual subjects offered every year. The functioning of the project, the quantitative and qualitative results achieved throughout these five semesters as well as the evaluation carried out by the students that have taken part in the project will be presented. The information about Intercampus can be found in http://www.catcampus.org.

Introduction

The ICT are introducing changes in the current university model, they allow the fostering of new pedagogical methodologies and they make possible new ways of learning and communication between teacher and student and between students themselves. One of the applications derived from the use of the ICT in higher education is the possibility of distance teaching and learning through Internet.

Regarding the teaching/learning process, teaching through the Internet allows the student to solve the lack of time when learning the contents of the subjects and to take these subjects in a personalized way where and when it suits them best, as for their personal situation (time-space flexibility) and the immediacy in the access to the contents.

Intercampus is an example of how the use of the Information and Communication Technologies (ICT) in university teaching makes possible to share university processes ranging from administration (Open administration) to subject teaching (Shared-Teaching between universities) in a virtual way. The characteristics of this projects are developed below.

What is Intercampus?

BEST COPY AVAILABLE

It is a pilot experience consisting of the exchange of free electives (they allow students to take subjects which are not necessarily related to their studies) to be taught via the Internet. Intercampus allows students from any of the universities involved in the project to study virtual subjects from a specific university, it makes communication and information easier for these students and it coordinates service and administrative support between their own university and the university that gives the subject
Intercampus provides students new ways of information and learning: it allows the access to subjects which would be otherwise not available in their own university and it trains them in the acquisition of new abilities in communication and in the access to telematic information in a virtual teaching-learning environment.

The Teaching and Administrative areas of Intercampus

The main goal of Intercampus is to create academic and management mechanisms that allow the coordination between the universities involved in order to share and give access to their students to free electives via Internet.

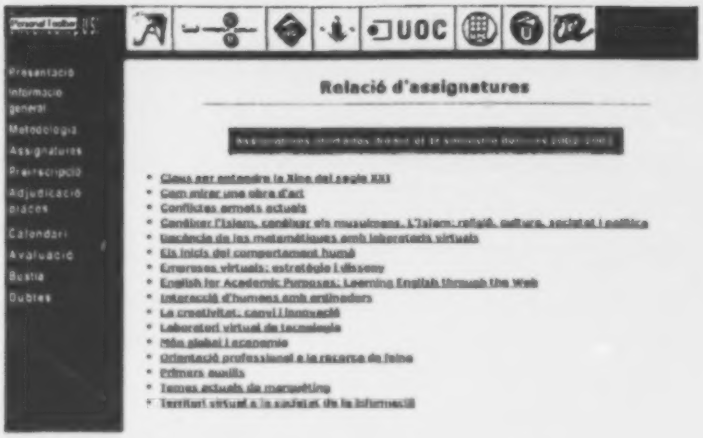
In order to achieve these objectives, Intercampus has prepared two platforms interconnected to each other:

- Information platform: This free access platform informs about the general characteristics of Intercampus, its objectives, methodology and contents. It also has got information on the teaching that is offered (courses of each semester, their programs and specific requirements, the system of assessment, etc.). This platform is linked to the virtual-campus of the participating universities where distance teaching takes place.
  From this platform students can pre-enroll in the subjects and communicate with the Intercampus management. They can also have access to all the information concerning the adjudication of vacancies, the academic schedule and the evaluation of subjects.

- Management platform: This platform, which only the universities involved in the project can have access to, provides the academic and organizational support necessary for real time student management and for the evaluation systems to be carried out. The system has got the students' database that allows the elaboration of coordinated exams, the insertion of marks, the generation of the students' achievement records, and so on.

The Intercampus academic management is carried out by a general academic coordinator and the Intercampus academic coordinator from each university, with the collaboration of the respective academic management staff. Each university offers two subjects per semester, to be taught in their own virtual space. Intercampus acts as an infrastructure that gives support and allows the access to the universities' virtual spaces and coordinates the administrative and teaching aspects that are shared by the universities. Every year 32 subjects are given (16 per semester).

The following figures shows one screen shot of the general information platform, the 16 free electives offered through Intercampus in spring 2002-2003 are shown.



Presentació
Informació general
Metodologia
Assignatures
Preinscripció
Adjudicació places
Calendari
Avaluació
Bustia
Dubtes

Relació d'assignatures

- Claus per entendre la Xina del segle XXI
- Com mirar una obra d'art
- Conflictes armats actuals
- Conèixer l'Islam, conèixer els musulmans. L'Islam: religió, cultura, societat i política
- Docència de les matemàtiques amb laboratoris virtuals
- Els inicis del comportament humà
- Empreses virtuals: estratègia i disseny
- English for Academic Purposes: Learning English through the Web
- Interacció d'humans amb ordinadors
- La creativitat: canvi i innovació
- Laboratori virtual de tecnologia
- Món global i economia
- Orientació professional a la recerca de feina
- Primers auxilis
- Temes actuals de marquèting
- Territori virtual a la societat de la informació

The offer ranges over several fields in education from humanities to technology or those related to learning of information and communication technologies, as well as foreign language (English).

Results

Intercampus began in the second semester of the year 1999-2000. Up to now more than 1800 students from the universities involved have registered. Intercampus offers 32 virtual subjects every year. We must highlight the fact that in every semestre the number of pre-enrollments always exceeds the offer of vacancies.

As for the participation of students, the number of preenrolled and enrolled students throughout these five semestres can be seen in the following table (table 1).

Table 1.Number of preenrolled and enrolled Intercampus students throughout the five semestres.

		Pre-enrolled	Enrolled
Year 1999-2000	**Semester 2**	645	264
Year 2000-2001	**Semester 1**	607	321
	Semester 2	952	369
Year 2001-2002	**Semester 1**	803	410
	Semester 2	1084	500
Total		**4091**	**1863**

The participation of students has increased throughout the years, which corroborates the success of the project. Regarding the evaluation of the project by the students enrolled in Intercampus subjects, every semester the project carries out a survey to these students in which they are asked to value from 1 to 5 they degree of agreeability in a series of questions related to academic aspects (programs, contents, materials, and so on), technical aspects (quality of the materials used through the net), virtual communication aspects (the supporting role of the teacher, how long it takes to answer virtual enquiries, forums, and so on) and general aspects (new learning and communication strategies as well as general satisfaction with the course) within Intercampus.

The reasults of the global evaluation are positive (most of the questions have got more than 3); in general, students are satisfied with their participation in Intercampus and they think that being involved in a project that provides them with strategies to study in a virtual learning environment is very positive. The detailed results will be presented in the announcement.

BEST COPY AVAILABLE

Conclusions

Intercampus – an example of the application of the ICT in university teaching- has overcome barriers that were immovable up to now, such as the stagnation of students in the contents and attendance requirements of their own universities. Perhaps the most important contribution made by Intercampus is the creation of an Open Administration shared by the universities involved in the project and the sharing of administrative processes as well as the contents (the subjects) that are taught through the net.

Intercampus is an innovative proposal which is closely linked to the offer and the needs of our society. This project fosters the use of new information technologies and shows how the Internet can be used to shorten distances, both academic and administrative, between universities.
The positive evaluation by the students and universities involved in Intercampus make possible the way to the consolidation of the project, so that it becomes part of the normalized offer of the free choice subjects given by the universities involved.
A new path is open. The university overcomes time and space barriers as well as those barriers related to the processes of administration and to the contents given. There are new possibilities of collaborating between universities.

Acknowledgements

Intercampus is supported by the Department of Universities, Research and Information Society of the Generalitat de Catalunya (Autonomous Government of Catalonia)

WEB PORTALS: A DIFFERENT VIEW FOR FACULTY DEVELOPMENT

Patricia A. Carlson
Department of Humanities and Social Sciences
Rose-Hulman Institute of Technology
United States
Patricia.Carlson@rose-hulman.edu

Abstract: Accomplishing change in education starts where learning begins: with the classroom teacher. Rose-Hulman Institute of Technology (with support from the Lilly Endowment) is constructing a Web portal dedicated to improving middle school science, mathematics, and technology (SMT) instruction. Essentially, this gateway emulates emerging corporate practices of knowledge management and process re-invention through information technology (IT). We expand the notion of "professional development" to include not only training in computer competency (explicit knowledge) but also mentoring in the higher-order understanding (tacit knowledge) necessary for meaningful integration of instructional technologies into the classroom. Our portal creates a "community of practice" for middle school teachers across Indiana to share experiences and to harvest the remarkable opportunities for improved SMT learning through Web-delivered simulations, visualization, modeling, access to live data, *and* to enable new collaborations, interactive learning, and alternative pedagogical approaches. Rose-Hulman faculty and digital media specialists serve as partners by providing ongoing advice, hosting special Web-conferences, and helping to author classroom modules.

Connecting with the Future

Our goal is to improve learning in middle school SMT by helping to improve teaching. Certainly, we are not unique in declaring such a goal. We realize that national concern in the past decade alone has created significant opportunities for improvement in SMT instruction. For example, the reform guidelines given in the National Science Education Standards (1996) call for more inquiry-based classroom activities and more effective use of instructional technology. Additionally, Web-delivered instructional media -- many developed through substantial investment from NSF or NASA -- now abound. These digital resources have the potential to redefine the traditional roles of student, teacher, and classroom in the near future. But harvesting this potential requires that classroom teachers have more than just entry-level proficiency with basic categories of instructional software. Teachers must be both encouraged and supported in coming to understand computers as powerful devices for expanding their own dynamic presence in the classroom.

The Knowledge Gap

Examining the challenges for workforce modernization in education, we isolated two critical hurdles that must be surmounted in order to improve middle school SMT instruction.

- The ever-widening gap between the production of quality, Web-delivered instructional new media and most middle school teachers' ability to meaningful integrate these advancements into their curriculum and their classroom activities; and
- The demands placed on teachers by new reform guidelines -- both state and national -- that call for less dependence on textbooks, lectures, and de-contextualized lab work and more emphasis on inquiry-based learning containing real-world contexts that combine science and mathematics "to solve a human problem, met a societal need, or develop a product" (National Research Council, 1996, p. 161).

Focusing on these two needs in planning our portal, we started by taking a look at how information technology (IT) addresses the perennial issue of professional renewal in an academic context. In defining the challenges for professional development in education, we went beyond baseline competency in instructional technology and worked toward a more comprehensive view. We used emerging concepts in *knowledge management* (KM) as a framework for defining "professional development." In our high-level design, we paid specific attention to the distinction between *explicit* knowledge and *tacit* knowledge (Ryle, 1984; Reber, 1995). This distinction between types of cognitive growth (i.e., knowing *that* and knowing *how*) appears widely in discussions of student learning but seems to be less prevalent in planning for an instructor's continuing education.

A cogent explanation of the differences between explicit and tacit knowledge in an organizational context is given in Kidwell, Vander Linde, and Johnson (2000). Explicit knowledge is easily codified and can be embedded in readily transferable artifacts, such as rules, procedures, policy statements, databases, books, and other forms of concrete representation. Tacit knowledge, on the other hand, is less definable, less manageable, and more fragile. Typically, it resides in human minds in the form of insights, complex decision-making abilities, judgment, situational awareness, and know-how drawn from experience. Because it is not easily formalized, tacit knowledge is difficult to transfer using the traditional training channels currently available (p. 29).

Applying this framework to education, we concluded that teachers (at any level) can be overwhelmed by the sheer amount of instructional applications coming both from commercial and from research-funding developers. Thus, we structured our portal to address our specific concerns about the *ever-widening gap* between top-down, systemic opportunities/changes and the individual teacher's ability to incorporate these new ideas or items into a coherent plan that can be enacted in his or her classroom on a daily basis. In short, we address the classic organizational problem of a *knowledge gap*: what to do when new methods of operating advance more rapidly than members of the organization can meaningfully assimilate and implement.

A Community of Practice

While the technology for all portals is basically the same, their underlying philosophy and purpose vary. The portal we are building -- tentatively called **SMART** (**S**cience and **M**athematics **A**ccess to **R**esources for **T**eachers) -- creates a community of practice for a large, geographically dispersed group of educators who now have only a few state-wide forums and perhaps even fewer opportunities to forge working relationships with kindred spirits. Models for this type of "virtual community" are abundant, and reliable studies of their efficacy indicate that the approach has merit. Additionally, well-thought-out computer supported collaborative work environments (CSCW) that nurture group collegiality and facilitate sharing of talents have a relatively long history of success in the corporate workplace

Our Web portal aims to capture some of this power in order to achieve four specific objectives.

- **Reinforcing Collaboration and Collegiality:** Teachers from one end of Indiana to the other can share ideas, collaborate on projects, disseminate best practices, and network expertise. This "community of practice" aspect of the portal promotes the sharing of tacit knowledge and provides the virtual context that sustains professional renewal on a daily basis and motivates the use of advanced technology in the classroom.

- **Reducing Disparities between School Districts:** Although state educational systems work hard to maintain standards and to ensure equity, certain variables (for example size, socio-economic profile, rural or high-risk urban environment, and local demographics) create disparities that make it more difficult for some schools to achieve the quality of instruction all citizens of Indiana should have. As an enabler, our Web-portal delivers access and opportunity to all. Additionally, its "virtual environment" works to marginalize some of the constraints imposed by the physical world.

- **Providing Expert __Human__ Intervention**: Just as large, complex, traditional libraries are best used in conjunction with a trained reference librarian or special collections librarian, so too are the vast information spaces of the Web best explored with the help of an expert guide. Our digital librarian will set up a clearinghouse for existing materials. More importantly, s/he will be available (initially via email and later using video conferencing) to offer "real-time" advice and guidance. Designated Rose-Hulman faculty/partners will also help to mentor and facilitate in a variety of ways.

- **Facilitating Professional Development:** A variety of training modules – featuring new pedagogy, curriculum design, and classroom innovations as well as teaching various aspects of computer/advanced educational technology competency – accommodate all levels of ability, from novice to advanced learner. Also, online workshops will be developed by Rose-Hulman faculty showing how to integrate engineering and design projects into the middle school. Availability and ease-of-use encourage the continuous reinvestment in human talent necessary for quality teaching.

Portal Features

SMART is conceptualized as a highly interactive, highly mediated gateway where Indiana middle school SMT teachers can browse timely content, download instructional software, and retain a customized account that will automatically alert them to items of interest (as determined by their user profile). Additionally, teachers can submit materials for posting, can host their own "homepage" on the portal's server, as well as enter into synchronous and asynchronous discussions on topics of interest, and can take part in vital professional development/in-service training through distance education capabilities. We emphasize that SMART is a well-designed workspace (emulating an integrated desktop) that seamlessly combines the four types of learning and management tools delineated by Eisler (2001, p. 6):

1. A *gateway* that helps to manage the overabundance and discontinuity of information on the Internet.
2. *Points of access* for "internal information" (databases of lessons/activities and best practices submitting by individual teachers or participating professional groups), configurable for constituent groups (e.g. grade level, subject matter, special interests, geographic area, and the like).
3. *Communication channels* facilitating various types of information flow (e.g. "pushed" information such as time-critical announcements and "pulled" information such as bulletin boards and online special events or public forums).
4. *Communities of practice* and *learning hubs* (e.g. tools for collaboration – beyond the traditional file transfer and chat room capabilities -- including interactive, collaborative learning support systems).

Faculty Development and Process Re-invention

Organizational researchers such as Tom Davenport (1993), Michael Hammer (1996), and Peter Senge (1990) stress fundamental workplace change through re-invention or reengineering. Though their exact terminology differs, the commonality for all the "new paradigm" thinkers hinges on the transition from an industrial model to an information model.

Basically, core business practices in the former are viewed as an assembly line, with tasks being partitioned into small segments and passed from worker to worker. Heavy emphasis is placed on explicit knowledge (procedures) and very little on tacit knowledge (individual variations). In contrast, work in an information age is seen from a process orientation. The consequences of this new model are dramatic. Workflow is no longer strictly linear. Workers are encouraged to take on more responsibility in self-managing their tasks. Ideally, within the modern workplace, employees should feel more confident and grow in self-esteem. Emphasis is on creative problem solving, mindful engagement in the task, and greater participation in decision-making. In short, a larger commitment is now made to developing tacit knowledge in the workforce, and collaboration has become a major enabler for nurturing and transferring wisdom in an organization. Within this context, the enterprise information portal holds great promise for establishing strategic alliances, mentoring employees at all levels, and exchanging experience and information (Collins, 2001).

"Reinventing" has mandated a fundamental change in the meaning of "professional development." That much of the U. S. workforce is making a profound transition from employee to knowledge worker is widely acknowledged. Peter Senge's *The Fifth Discipline* (1990) describes private sector organizations that have become "learning companies" through a continuous reinvestment in their human resources because the worker in the 21st century will need to be flexible, tolerant, and highly adaptive. Like business and industry, dramatic changes in education appear to be "re-inventing" the process of teaching. In all likelihood, tomorrow's teachers will enact a pedagogy that is open-ended and requires complex problem solving using "best judgment" to navigate through choices. While explicit knowledge (subject matter, task procedures, and classroom practice) will still be foundational to teaching, tacit knowledge (creativity, reflective judgment, and context awareness) will become the *sine qua non* for excellence in teaching.

To facilitate the type of ongoing professional development needed in education today, we have looked to the corporate world, where rapid change necessitates computer-enabled models for workforce enhancement. The appropriateness of making comparisons between business and education may be debatable; however, both enterprises do face the same challenge of needing to re-invest heavily in their human talent in a time of rapid change. In fact, finding ways to sustain the constant renewal of competencies necessary for the modern-day knowledge workers has occupied the private sector for some time now.

Interestingly, corporate America has had to relearn some fundamental principles about the value of individual insight and initiative as well as the need to reward commitment and to foster collaboration. In the search for methods of renewal, information technologies that enable and empower have been instrumental in re-inventing the process by which many companies and corporations accomplish their mission (Davenport, 1993). At the forefront are networking applications because they (1) keep a constant flow of knowledge moving through the enterprise (2) make possible a "community of practice" among individuals and groups no matter what geographic or organizational boundaries separate them. For models of *process re-invention*, education might well borrow some of the lessons learned by private enterprise in the last decade.

Acknowledgment

We express gratitude to the Lilly Endowment for its generous grant to fund the project described in this article.

References

Collins, H. (2001). *Corporate portals: Revolutionizing information access to increase productivity.* New York, NY: American Management Association.

Davenport, T. H. (1993). *Process innovation: Reengineering work through information technology.* Boston, MA: Harvard Business School Press.

Eisler, D. L. (2001). Campus portals: Supportive mechanisms for university communication, collaboration, and organizational change. *Journal of Computing in Higher Education*, 13(1), 3-24.

Hammer, M. (1996). *Beyond reengineering: How the process-centered organization is changing our work and our lives.* New York, NY: Harper.

Kidwell, J., Vander Linde, K. & Johnson, S. (2000). Applying corporate knowledge management practices in higher education, *Educause Quarterly*, 4. [Online] Available: http://www.educasue.edu/ir/library/pdf/EQM0044.pdf.

National Research Council (1996). *National science education standards.* Washington, D.C.: National Academy Press.

Reber, A. (1995). *Implicit learning and tacit knowledge: An essay on the cognitive unconscious.* New York, NY: Oxford University Press.

Ryle, G. (1984). *The concept of mind.* Chicago: University of Chicago Press.

Senge, P. (1990). *The fifth discipline: The art and practice of the learning organization.* New York, NY: Doubleday.

Veterinary Multimedia Repository: An Example of a Web-Based Collaborative Tool for Organizing, Archiving and Retrieving Pedagogical Chunks.

Project Background

The dual mandate of clinical teaching and research activities at the Faculté de médecine vétérinaire of Montreal University (FMV) is being traduced by a huge production of original multimedia content. With time, faculties and searchers at the FMV accumulated a significant amount of analogical multimedia documents: 30 to 40,000 slides (with 16,000 slides in pathology alone), hundreds of surgery video clips (small animal or large animal clinics, ambulatory clinics) and clinical procedures (anesthesiology, gait exams, neurologic exams), dozens of echography, more than 40,000 x-ray films and thousands of medical files. The digital shift started a few years ago in the clinical activities and technological integration has cause an augmentation of digital multimedia material to be spread on many different FMV computers.

It rapidly became a priority, primarily, to digitize all of these analogical documents for preservation and availability purposes; and secondly, to integrate all of the different aspects of digital information management (production, treatment, archiving and distribution) in a one-stop location that is widely available for everyone to meet all of the end user needs. The Laboratoire d'intégration des technologies informatiques en enseignement médical or laboratory for information technologies integration in medical teaching (LITIEM) has established a data repository project with those specifics aims:

1. Achieving actual analogical material scanning (slides, audio-visual documents, medical imaging and papers),
2. Archiving material via on-line databases (data entry and inquiry), and
3. Organizing the material to maximize its potential utilization.

Content Organization

Content Organization is a prerequisite for an effective inquiry in any database. That's why it is an essential aspect of this project. A digital database effectively designed is no longer a simple data archiving system as it has become a powerful training tool. A database of this kind may be used; as an example, for fast creation of a clinical demo case on disease affecting a particular system (respiratory, digestive, etc.), for a specific species (dog, cow, etc.) and in the context of a precise specialty (internal medicine, surgery, hematology, medical imaging, etc.) or to create virtual clinical rounds.

The main challenge was to develop a series of protocols and tools intended to limit the direct interventions of the faculties and the technical staff in the data entry, the treatment, the archiving and the distribution of the multimedia material. It was also necessary to decentralize the points of access of the information because the clinical activities take place in remote physical places. We have questioned the strategies of management on the information necessary for the optimization and the automation of the processes required between the production and the broadcasting of the digital material. To facilitate the appropriation of the digital technologies by the unexperienced users, the LITIEM created a vast accessible media library via dynamic web pages in ASP language and the engine that is a SQL database. The simple interface allows the content specialist to organize and to index the multimedia contents produced by its clinical and teaching activities without possessing knowledge in programming or in web pages construction. The media library is a flexible platform that allows to bind together the contents that are similar in an unlimited number of distinct libraries to satisfy the needs and criteria of the classification appropriate for the various veterinary fields (ex: companion animals, farm animals, pathology, bacteriology, etc.). Conversely, a unique and common research interface to the various libraries assures the end user to locate all the relevant documents they require without having to question the libraries where to make the search.

Collaborative Workflow

Scanning analogical materials

The scanning of analogic material for the project is under request by specific faculty members and is accomplished by student or clerical staff with equipment provided by the LITIEM. Simplifying and automating procedures has been the goal of the project team to minimize training time and the error rate. Each slide scan creates 1024 x 1500 pixels 600 DPI 32-bit color JPEG images. After this process, images are treated as digital documents.

Data Entry Module

To archive the new material in the media library, a faculty member or his deputy has to first of all download the digital files in a secured virtual directory without caring about characteristics of the file (name, size, file format, etc.). Once the documents are gathered on the central server, the clerical staff is capable of creating an index file for every multimedia document produced. This descriptive index file is unique in the database and it always accompanies a document archived in the media library. This index file contains all the descriptive fields such as the specie, race, age or the diagnosis of which are essential to retrieving and locating documents. To avoid disturbing the contents specialist in this early stage, the only necessary keys to create an index file is basic information that can be identified by a non-specialist: the specie (dog, cow, etc.), the implied system (respiratory, digestive, etc.) and the type of media (photos, videos, 3D animations, sounds, etc.). It's possible to include several documents of the same nature in a series to illustrate the various stages of the same procedure or the various states of the same disease. When the index file is created, it passes in transit towards the audiovisual technician responsible for the digital treatment of the multimedia documents.

Technical Module

This module allows various specialized technicians (images, sounds or videos) to download every document archived in the database directly to their workstation for treating and optimizing the data. In the case of the images, cropping, filtering or certain adjustments are often necessary. For the audiovisual documents, some editing or effects can be required. At first, the technician manipulates the raw data of the document without precise directions. It is possible that a faculty member will return a document with a demand of precise modifications via one comment field of the index file, which may be only viewable by the owner of the documents and the technician. In the case of the images, it is at this time that the technician re-samples the images to create the four (4) sizes used in the media library: 1024 x 1500 pixels with 600 DPI of resolution for the printing, 640 x 480 pixels maximum with 96 DPI of resolution for the electronic presentations (PowerPoint for example), 320 x 240 pixels with 96 DPI of resolution for the web applications and 100 x 100 pixels with 96 DPI of resolution for thumbnails used in the search interface. As soon as the treatment of the document is completed, the index file is returned to the faculty owner for final approval.

Validation Module

When the faculty member is ready to validate the multimedia documents, he simply has to connect the database via an Internet browser. The access is personalized and secured with a log-in and a password. Once identified, the faculty member can easily observe the list of the documents that belong to him and which are waiting for his validation. He simply selects the unique document or a series of documents and can then begin his work of validation. He verifies, first of all, that the document is relevant and if he considers it necessary, he can simply delete it. He then has to verify the technical quality of the document and if need be, he can re-direct the document to the audiovisual technician for specific treatments. Finally, he completes the index file with the clinical data associated to the multimedia document. It takes less than two (2) minutes to complete an index file because it is constituted by interdependent rollover menus. For example, a list of the diagnosis is directly connected with the selected system and with the chosen specie. As soon as the owner is satisfied with the contents of the index file, he can validate it and it becomes then available for the consultation. All the power of this module lies in its ample flexibility at the collaborative level. Indeed, a faculty member may decide to ask for a second opinion of another specialist, he can delegate the validation to a student or to another specialist, he can include documents in a series or extract a document of a series and he can also modify or complete an index file at any time.

Consultation and Visualization Module

Although documents are archived and classified in different libraries, it's always possible to make a single search that crosses among all the libraries. There are three (3) levels of consultation: open to the public for the images accessible without limitations, Intranet for the images intended for internal usage and private viewing for the images that belong to one particular person. To be able to see the Intranets and privates images, it's necessary to log-in with a password. The results of the search are presented as thumbnails and they are grouped together by document types (images, videos, etc.). When a user clicks on a thumbnail, it shows a web format image with its descriptive index file. It's then possible to save the image for later use. The high-resolution formats are only accessible via the Intranet to avoid the non-compliance red tape with copyrights.

Future Directions

Teaching in a medical context benefits two fold from an integration of information technologies in the learning strategies because of the highly multimedia character of the various topics (videos, photos, illustrations, sounds, medical imaging, etc.), of the existence of numerous abstract patho-physiological concepts and the necessity of creating simulators intended to enhance problems solving by learners. For all these reasons, sharing resources between faculties favours the realization of didactic quality material. It's easier to coordinate the available documents via a unique source and so promote the creation of original material while avoiding to the faculties the recreation of already existing material. The continuation of the project consists by connecting the media library to a direct link with our applications of off-site learning and our clinical case simulators by decreasing the time of creation for the pedagogical tools by the content specialists.

URLs of Interest

Veterinary multimedia repository: http://www.medvet.umontreal.ca/mediatheque/
LITIEM: http://www.litiem.umontreal.ca

Acknowledgments

The authors would like to acknowledge Canarie, Inc (www.canarie.ca) and the Quebec government «Fonds de l'autoroute de l'information» (www.autoroute.gouv.qc.ca/fai/str_fai.html) for their financial support of this project. We would like to give special thanks to the computer programmer, Ms. Isabelle Langlois. We would also like to thank Mr. Norman Carmel for his support and correction of this report.

Enduring change: technological management in education

by

Bruce Carter & V. Mistry

Sheffield Hallam University
School of Computing & Management Sciences
Stoddart Building
City Campus
Howard Street
Sheffield S1 1WB

Telephone +44 (0)114 225 3790
Fax +44 (0)114 225 5178

E-mail b.carter@shu.ac.uk
v.mistry@shu.ac.uk

Abstract

The Changing Technology in Management Project, at Sheffield Hallam University in the UK, has been investigating the issues surrounding the integration of technology into teaching and learning. This is a preliminary report which identifies the limitations of prescriptive methodologies, such as the North American Teaching, Learning and Technology Roundtables, in three diverse institutions in England. The authors posit that cultural sensitivity to the organisation is the vital base upon which to build meaningful and enduring technological change.

Introduction

There is a general consensus that change is an ever present dynamic and, according to some, this has been particularly resonant in higher education (*cf.* Halsey, 1995). The shift from elite to mass higher education (HE) has forced English institutions to re-evaluate their provision. This has been distilled into a single policy question: How can institutions deliver a high quality product, to a greater population, with diminishing resources? Since the mid-1990s critiques began to appear which heralded the potential of information and communication technologies (ICT) as a solution to these concerns (*cf.* Ehrmann, 1996). As we are becoming conversant with the integration of ICT into teaching and learning, we have found that both the underlying trends of change in HE and in ICT have combined to shape the way we manage technology. These can be summarised in the following key areas:

- macropolitico-economic change and, specifically, the transition towards a knowledge economy. The Council of the European Union (2001) described a vision whereby Europe becomes "the most competitive and dynamic knowledge-based economy in the world capable of sustainable economic growth with more and better jobs and greater social cohesion" (p. 2);
- the changing face of accountability, where institutions are increasingly tightly controlled by governmental agencies (such as the Quality Assurance Agency in England) and the increasing demands of students as consumers heightened by the recent introduction of the undergraduate tuition fees;
- the nature of technological developments mean that change is uncertain and unquantifiable: because one cannot predict the form of the challenges that lie ahead, in a real sense, it is difficult to manage strategically; and, incongruously,
- as funding has generally fallen in the sector more has been spent by institutions on technology in the hope of reducing long term costs (reducing tutor-student contact hours) and also generating income through the commercial possibilities of e-learning.

The Changing Technological Management Project

The Changing Technological Management Project was established to investigate how technological management in education can be made more effective. This study was an eighteen month project which began in September 2000

BEST COPY AVAILABLE

funded by the Joint Information Systems Committee (JISC). The original focus was to trial the North American Teaching Learning and Technology Roundtable (TLTR) methodology. However we quickly learnt that there were wider issues to be considered, particularly those relating to institutional culture, which will be detailed during the course of this paper.

For many in higher and further education, the experience of integrating technological innovation with teaching and learning has been haphazard and uncoordinated. Even where specific groups or individuals have been established to manage this process, there have been charges that they have focused narrowly on either the 'technology' or the 'teaching' and 'learning'. As a result, TLTRs were developed by the TLT Group (an affiliate of the American Association for Higher Education) as a methodology for integrating teaching and learning with technology. Roundtables have been defined as "a diverse group representing those who can and should work together to improve teaching and learning with information and communication technologies" (TLT Group, 2000).

Specifically, within the context of English higher education, the project was charged with three main aims:

- to discover how roundtables are used;
- to investigate their effectiveness and value, and
- to identify strategies for the successful management of technological change.

Overview of the Research Methodology

The investigation was primarily qualitative in nature and the specific features of the research methodology were as follows:

- case studies in three principal sites: an 'old' research led university (Institution A); a former polytechnic (Institution B); and a community FE college (Institution C). The key methods employed were structured observation and interviews;
- informal visits to other UK institutions;
- semi-structured surveys of UK experiences (followed up by a series of telephone interviews); and
- face-to-face and telephone interviews with North American institutions who have experience of TLTRs.

It should be stressed that the investigation is still continuing but very illuminating data has already been elicited. The remainder of this paper reports these findings.

Experiences in the Institutions

As one would expect, a very different culture and management system was in place at each institution. This can be explained by their vastly different traditions. Institution A could be characterised as a conservative, collegial university with a high research income and somewhat traditional values. Institution B has more modest income from research and is heavily reliant on student tuition fees as a source of income. It is assumed to be more managerial than its older counterpart and perceives itself to be more dynamic. Institution C, on the other hand, is operating within much tighter financial constraints than its university counterparts. It is highly managerial as evidenced by, for example, the existence of a "Chief Executive Officer" rather than a Principal. All three institutions enjoy close ties owing to their geographical proximity to each other. While a second common denominator for all the institutions was that each was interested in the development of some form of e-learning.

The first task of the project was the identification and recruitment of dedicated champions who would be charged with the responsibility of promoting and implementing the TLTR methodology in their respective institutions. The TLTR methodology encompasses a series of prescribed activities in sub groups (Gilbert, 2000) that seek to establish:

- clear objectives and agreed goals *vis-à-vis* technological management;
- develop a climate of openness;
- develop appropriate leadership; and
- reviewing team processes.

At this stage there were three immediate issues, namely: the influence that the champions could bring to bear on the institution; the appropriateness of the methodology itself; and time needed to establish the roundtables. First, if the champions were to have any chance of establishing the groups they needed to fulfil a number of criteria, which are to be found in other lessons from change management (Goulding *et al.*, 1999). As the *de facto* leaders of the group they needed to have enough seniority to be able to inspire commitment from senior management whilst also being a 'respected insider' to gain the confidence of teaching staff. Additionally we found that they needed to be imbued with enough political acumen to know how to use their influence to keep the roundtable vibrant. Our experiences are in keeping with Baldridge *et al*'s (2000) depiction of the "strategic ambassador" approach to leadership, which places the leader at the centre of concentric social circles rather than the peak of the organisational pyramid.

As far as the appropriateness of the methodology was concerned, more fundamental problems arose when the prescribed tasks were first introduced to the roundtables. At two of the three institutions the membership treated the tasks as being entirely inappropriate. Only Institution A considered the use of the workbook but even here it was at a much lower level (i.e. in a sub-group with minimal influence on institutional strategy) than had originally been envisaged. We have found that all the institutions' receptivity to the methodology was inhibited by two key factors: the prescriptive thrust of the workbook was alien to the organisational cultures of the institutions investigated; and the workbook was not sufficiently sophisticated for roundtable members to feel they would benefit (deriving from their assertions that similar thinking had already been completed). This assumption was corroborated by survey data and informal visits by the researchers to other institutions. In conclusion, the prescriptive thrust and lack of sophistication conspired to condemn the methodology to be viewed as just another 'bolt on' programme that would be peripheral to the institutional culture and soon forgotten.

It was noted that all the roundtables needed considerable time to establish themselves and be subsequently incorporated into the institutional decision-making process. There was a correlation between institutional type and the speed of establishment. Institution C, the most managerial institution, established their roundtables within weeks: Institution A, the 'old' research-led university, established theirs after many months' negotiation. In general, our experiences substantiate the conclusions reached by a US study which verified that the lead up time in American institutions was between twelve and eighteen months (Nardick, 2000).

Interestingly respondents at all the institutions distinguished between 'roundtables as an approach' as opposed to 'the roundtable methodology'. While the latter has connotations of directiveness, the former was recognised by many an opportunity to articulate aspirations of collegiality. The drive of managerialism in England (Deem, 1998) has all but eradicated any meaningful collegial systems (Ramsden, 1999). The 'roundtable approach' which has elements of dispersed leadership, representatives from the campus community and ownership over decision-making, appears to map well onto the sense of community that is embodied in highly valued concepts of collegiality. It may well be a reaction against the endless tide of managerialism, which makes this allusion to legitimacy all the more persuasive and seductive. At Institution C we found that while the development of policy was more time consuming, as one may expect from such a democratic model, the consideration of multiple viewpoints has led to a perception that policy making is more robust than it had been previously. Whether this is a correct interpretation, or replicated in the universities, will be uncovered by future research.

Conclusion: Points for Discussion

We present a set of discussion points rather than concrete conclusions. This is based on our stated depiction of the project as one in progress. Three pertinent questions, which we feel may be applicable to the management of technology in any organisation, emerge from our experiences:

- can methodologies developed for one education system ever be transferred to another?
- can prescriptive methods secure palatable and enduring change? and, having identified these two questions,
- where does one start the process of change?

It is evident that a constant theme in our investigation is one of 'ideology'; the ideological underpinnings of the culture of the institution and of the methodology. While technology creates a stimulus for accelerating change we need to be ever more sensitive to the cultures of the organisation.

References

Baldridge, J.V., Julius, D.J. & Pfeffer, J. (2000) 'Power failure in administrative environments' in *Academic Leadership* **11** (1) [on-line] at http://www.academicleadership.org
Council of the European Union (2001) *The European eLearning Summit: Declaration May 2001* Brussels
Deem, R. (1998) 'What is the new managerialism?' in *The Times Higher Education Supplement* 24 July, p. 28

Ehrmann, S.C. (1996) 'Responding to the triple challenges facing post-secondary education: accessibility, quality, costs' in *Information Technology and the Future of Post-Secondary Education* Paris/Washington: OECD

Gilbert, S.W. (2000) *Achieving Connected and Collaborative Change, Improving Teaching and Learning with Information Technology, Summer Institute July 13-17 2000, Phoenix, Arizona* Washington DC: The TLT Group

Goulding, A., Mistry, V., Kinnell, M., Procter, R. and Usherwood, B. (1999) *Investing in LIS People: the Impact of the Investors in People Initiative on the Library and Information Sector* (British Library Research and Innovation Report 141), London: British Library Research and Innovation Centre

Halsey, A.H. (1995) *Decline of Donnish Dominion: The British Academic Professions in the Twentieth Century* Oxford: Oxford University Press

Nardick, D. (2000) *An Analysis of the Teaching, Learning and Technology Roundtable in Higher Education* (Unpublished PhD thesis), Washington, DC: Georgetown University

Ramsden, P. (1998) *Learning to Lead in Higher Education* London: Routledge

The TLT Group (2000) 'Learn about the TLT Group' [on-line] at http://www.tltgroup.org/about/index.html

BEST COPY AVAILABLE

SUPPORTING THE DEVELOPMENT OF STUDENTS' VIRTUAL ENTERPRISES: AN E-LEARNING ENVIRONMENT

Alessandro D'Atri, Francesco Barbini, Nunzio Casalino, Oleg Missikoff
{datri,fbarbini,ncasalino,omissikoff}@luiss.it
CERSI - Centro di Ricerca sui Sistemi Informativi
Luiss Guido Carli University – Roma – Italy

Abstract: This paper describes a research in progress, aiming to develop and evaluate an innovative on-line training support system for students attending the Young Enterprise Europe (YEE) "learning-by-doing" formative method. The main goal of the research is to develop, starting from the results of the FAIRWIS research project, described in the paper, a new environment enabling student-managed laboratory enterprises to efficiently set-up and exploit inter-organizational cooperation, while assisted by an on-the-job training/learning support system. The paper presents the ongoing research activities and depicts foreseen evolutions. In particular, it is proposed to apply an innovative training system able to enhance present training methods adopted by YEE. This system would also allow YEE students to improve their managerial skills and let laboratory enterprises work in a more realistic, yet simulated, environment.

1. Introduction

This paper describes the use of a web environment implemented for managing real and virtual trade fairs as an educational tool for helping "laboratory enterprises" of students from European High Schools and Universities to follow the educational method proposed by the no-profit association Young Enterprise Europe (YEE, see web site at www.young-enterprise-europe.com).

The validity of this environment as an educational tool has emerged during the FAIRWIS (IST-1999-12641 Trade Fair Web-based Information Services) EU-funded project thanks to the tight cooperation between the IGstudents Foundation (the Italian branch of YEE) and the Centre of Research on Information Systems (CeRSI) of Luiss Guido Carli University in Rome (D'Atri 2002b).

The main goal of FAIRWIS was indeed to develop technological services for simplifying contacts among companies during trade fairs, and therefore looked ideal as a support system for students micro enterprises following the IGstudents training process (D'Atri 2001) (Pauselli 2001). This enterprises network was one of the pilot validation contexts for the system prototype.

The next section is devoted to a thorough analysis of the IGstudents training programme. Section 3 will sketch the foreseeable developments of FAIRWIS. The application of FAIRWIS system to support inter-organizational cooperation among laboratory virtual enterprises is described on Section 4, while the Section 5 will analyze the educational support necessary this innovative environment. A discussion will follow.

2. Young Enterprise Europe Training Programme

The motto *"Studying for job creation, not for job searching"*, introduces the method developed by YEE (Young Enterprise Europe), and applied in Italy by IGstudents, based on the learning-by-doing approach.

The aim of the YEE Programme is in fact to create a bridge between the worlds of education and employment, develop entrepreneurship capabilities and produce the cultural and professional premises to ensure that young people achieve a sense of independence and alternative means of employment.

The exemplarity resides in the innovative aspects of the proposed educational system that represents, in fact, the first such experience realized in Europe, for what concerns both the number of students involved and the formative plan, in terms of contents, modality and training method.

The system, co-ordinated in Italy by the IGstudents Foundation, is at its third year of realization and it is integral part of the YEE international circuit gathering 19 European and Mediterranean organizations that carry on in the respective countries the formative program. The validity of the methodological formulation is guaranteed by the fact that such program has been used since the years '60 in England, and has progressively spread to other countries achieving the involvement of around 600 thousand students every year.

The general objectives for the users of this system are:

- Acquire awareness of his/her own personal abilities and professional potential for the future working life;
- Develop enterprise culture;
- Study and experiment a European education model;
- Create and manage laboratory micro enterprises with financial resources;
- Acquire and develop transversal competences: from the ability to work in groups to communication, to work for objectives, to decision making and solving of complex organization problems, to the management of emotions;
- Create skills by means of an integrated system of actions, from orientation to training and stages, from tutoring to accompanying measures, from the laboratory to the market;
- Acquire the culture of "working and living with equal opportunities", valorising the potential of diversities and preventing phenomena of isolation and disparity;
- Exchange experiences at local, national and international level.

Trade fairs have a special relevance in the IGstudents training programme as they are the moment of confrontation for students having worked on their enterprise throughout the academic year. During those events students have a chance of seeing real enterprises managing their own business, and are stimulated to make constructive comparisons between the way they have carried out their business idea and the way this activity is managed by organizations working in the open market.

3. Virtual Vs. Traditional Trade Fairs

Trade fair events, in fact, play a central role both in the commercial and in the industrial business because all participants to such events, both visitors and exhibitors, have access to great opportunities for expanding their activity.

Relevant characteristics of these events are:

- they are limited in time (one or few days) and usually periodically scheduled (every week, month or year);
- fairs are usually oriented to a particular market sector (e.g., agriculture, information technology, tourism) or specialized in a thematic field (e.g., wedding, cartoons, Xmas presents).

BEST COPY AVAILABLE

Even if trade fair activities often include selling products, more important goals for the participants are:

- exhibit and advertise new products' features;
- train professional operators;
- reduce the distance between enterprises and customers.

In fact, people attending fairs can access knowledge about emerging markets, innovative products and services. Furthermore, a trade fair event can be considered as an important opportunity to meet and aggregate people having similar interests and to establish business contacts among partners, concurrent enterprises, customers, suppliers and professional workers, as it happens in other kinds of events as conferences or workshops. Due to this similarity, some large conferences have industrial exhibitions which run in parallel and, often, a "meeting program", based on workshops or seminars, is included in a trade fair agenda.

The above described benefits are particularly important for micro and small enterprises and even more for students enterprises. In fact, it is not easy for small enterprises to have direct contacts with other companies in their field, especially those in larger (European or international) markets. The main problems are:

- poor financial resources;
- limited knowledge of foreign markets;
- different languages and cultures.

However, for obtaining these advantages, the organizations have to devote a large share of their resources to fair activities and, obviously, the smaller is the enterprise the greater are the difficulties for participating to these events. When these organizations are exhibitors, they have to face high costs (e.g. to rent an exhibition area, design and set up the stand, transport goods, pay exhibition staff, and so on). When they participate as visitors, and the trade fair location is far, they have similar (travel and accommodation) cost problems, together with a strong reduction of normal daily activities, before, during, and after the event. For these reasons micro and small enterprises participation to these events is often restricted to the (minor) ones held in their geographical area.

Only recently it has become possible to find specialized web sites that support trade fairs events. These sites offer new kinds of services (though still limited in number) oriented to trade fairs organizers, exhibitors, and visitors. Until now they are unfortunately not organized in a homogeneous or comprehensive way, and are usually presented in a rigid pre-designed company oriented way.

For that reason a new Internet based e-commerce solution for trade fairs has been the subject of the FAIRWIS project, carried out by a heterogeneous group of organizations (software companies, universities, research centres, and fair organizers).

4. FAIRWIS Evolution

The "laboratory enterprises" participate to a competition and so, after having gone through a mechanism of progressive selection, the most interesting and well implemented projects end up taking part to regional, national and international trade fairs. The possibility provided by virtual, web based, trade fairs management systems such as FAIRWIS, allows a relevant increase in the number of enterprises participating to such events (Muscogiuri 2002).

The analysis of the training programme applied by the YEE/IGstudents, has stimulated a proposal for an enhancement that could widen up the perspectives of the educational method. In fact the laboratory enterprises are developed not only independently but, moreover, in competition among them for climbing up the ranking ladder and possibly winning the final contest. This makes it impossible, or even counter productive, any contact between enterprises until they start the final stage of the learning process when the best performers go to regional and national finals.

On the other hand, the contemporary real market, competitive, complex and dynamic, is forcing enterprises to overcome traditional economics of scale, emphasizing instead the competitive importance of specialized competencies and inter-organizational cooperation. Dynamic networks of Small and Medium Enterprises (SMEs) are becoming the most promising model both in terms of technical possibility to link autonomous information systems and in terms of benefits (Ba 1999).

Thanks to the progress of tools and technologies seen in the recent past, it is now possible to achieve a concrete integration between different organizations (Nayak 2001). The prerequisites for the implementation of this model lie in the achievement of a thorough integration in terms of both information systems and business processes (Rockart 1991) (Wigand 1999).

This model, often referred to as "virtual enterprise", is more complex than the traditional one. Although the most recent information technologies can provide useful supports for allowing interoperability, there are still mental resistances that make the transition to this new model slow and difficult.

In this perspective, the introduction of this new element in FAIRWIS (Barbini 2001) and, in the near future, in its educational model could be of great help for forming more open minded future SMEs managers, ready to apply state-of-art organizational methods.

5. Towards a Laboratory Virtual Enterprise

The evolution of FAIRWIS will rely on the virtual organization paradigm mainly because of two reasons:

1) It is the emerging organization model in the new, complex and competitive market. It will foster youths to acquire a state-of-art entrepreneurship skill.
2) It is particularly suitable for learning/training and to manage knowledge in a wide, social context. This because the virtual organization is a learning context: at any given moment can be considered as a collection of skills, talents, and experiences that reside in the minds of its managers and workers, and a body of information relating to its products, its internal structure, and its business relationships.

Even though we are experiencing strong enhancements in business-to-business, business-to-resource and business-to-customer on-line interaction possibilities, none of the proposed solutions seems to be suitable for developing, organizing, and integrating, i.e., "incubating" virtual enterprise organizations. Indeed, virtual enterprise organizations may flourish only if appropriate humus is established, by providing added value services enabling to overcome the inhibitor factors. However, this can only be achieved if a sufficient degree of scientific insight, education, and practical experience with respect to the concepts and methodologies of virtual enterprises could be considered as given. Therefore, YEE, by means of FAIRWIS, will develop an environment suitable for the experimental development of flexible, dynamic, and inter-organizational business ventures for simulation and training purposes.

This means setting up a laboratory marketplace where supply and demand could meet and develop activities to exploit emerging business opportunities in a domain-oriented and seamlessly integrated knowledge sharing and collaboration space. Therefore, the FAIRWIS business integrator prototype would be applied to a virtual forum having an audience of many laboratory SMEs.

FAIRWIS would be in charge of the design and management of the on-line environment aimed at supporting the development of dynamic cooperation among laboratory enterprises. It would create the humus to enable the development of laboratory virtual enterprises, an environment similar to a holonic system. In this simulated competitive environment, enterprises (having competitive and complementary competencies) would be able to efficiently and effectively integrate themselves.

By means of FAIRWIS, YEE would be able to set the rules and the standards for any cooperation and to provide added value services (Barbini 2001). It would, in addition to managing the environment, propose customizable methods and tools to efficiently set-up a virtual enterprise (e.g. communication protocols, data sharing methods, workflow design schemas, best practices).

The resulting system can function as an incubator for new virtual organizations and to generally allow an environment based on mutual trust and common values by combining "human contact" and Internet technologies. However, this is not sufficient for incubating virtual organizations. Therefore the FAIRWIS business integrator will furthermore supply a full range of high value services to support the creation, management, and dissolution of the cooperation venture [Porter, 2001].

6. Educational Platform

Today, students are "passive" (tutors "push" contents to learners); present learning paradigm is mainly a teaching paradigm, learners having a passive role. FAIRWIS will allow a major shift toward a learning paradigm: it will be a system supporting and allowing distributed cognition, articulate learners, peer-to-peer learning, and incremental enhancement of information spaces by a community of practice (Fischer 2001) (Mason 1999).

The proposed system would:

- Provide high quality, i.e., peer reviewed professional business publications and education support utilizing existing explicitly published professional business materials, business textbooks, business tutorials etc. It will support professional business authors and business learners to publish in and learn from the collections of professional business communities and organizations (universities, research institutes etc), where young and potential future business professionals can learn from traditionally published material as well as ad hoc acquired or late breaking professional business knowledge.
- Support multi-lingual and semantic access to collection of materials. This means that students would be enabled to utilize their familiar native language as well as the semantic to search and browse the content of professional business publications and business learning materials. The system will therefore generally support access, i.e., information retrieval searching, filtering, and browsing activities on both the semantic and the syntactical level. This means professional business authors, teachers, trainers, and students will be enabled to utilize content-oriented business subject classifications, business thesauri, and business ontologies to search and browse the content of professional business publications and business learning materials.
- Support professional business publishing and learning communities based on the user's roles in their communities and organizations, so that individual students would find themselves naturally supported by both their peers and by the accumulated knowledge of their professional business community via applications of various advanced knowledge management techniques.
- Support the basic education management functions, such as checking which materials a learner has studied, mastered etc. as well as helping learners to find experts, peers, and teachers that can answer his/her questions, as well as allow individuals to track and manage their own personal and professional development.
- Support the modeling and simulated execution of virtual enterprise training scenarios. This means students would be enabled to utilize virtual enterprise modeling and configuration functions to set up laboratory virtual enterprise. The FAIRWIS virtual enterprise simulation and training environment will provide support for semantically modeled and represented domain construction, business process modeling and simulation both on the operational layers of enterprise organization and operation as well as on tactical and strategic layers of general Enterprise management, business development and business integration.

In addition, the foreseen system would allow the creation of a European network of laboratory enterprises belonging to national YEE branches.

6.1 System Functionality

The final version of the software prototype will be developed adopting dynamical web technologies and the most advanced provisioning and security solutions. In particular, the server side of the web application will be implemented through the use of java and perl–based back-office technique. The client side of the application will take advantage of java script controls in order to help the user to type in the correct information. Data regarding the tests and the users will be stored in a database placed in the server itself. Information about users will be kept cryptic in the database in order to fulfill the standard privacy requirements. Data exchange between client and server during the test will be managed using https secure protocol (D'Atri 2002a).

The system is expected to work from the beginning in the expectance of 1000 simultaneous connections. As for content quality and certification, the system is expected to be conform to the certified YEE criteria. A management system will be able of identifying all user's pathways, using a personal ID and password as well as of elaborating statistical data and results to allow individual credit grants.

YEE would take care of the guidelines for the management of the International Property Rights (IPR) on the published contents.

Moreover the exploitation and the diffusion of this long-distance education, training and accreditation project will allow tutors to monitor students' training and competencies acquisition quality.

The usage aspects and advanced content and knowledge management methods must be supported. Thus we will focus on the development of a comfortable working environment for administrators and the companies which are customers of the virtual enterprise environment. Moreover, the use of XML and RDF as the underlying content and knowledge representation languages, will both ensure the complete scalability of the system and contribute to the standardization as the principal aim of international organizations. The framework will be designed to be generic, i.e. to be applicable to other content domains, types of applications and users. Hence, special emphasis will be placed on the scalability of the system, the development of generic tools and portability of the project results (models and software) for other types of applications in the area of XML and RDF based Content/Knowledge Management.

6.2 Benefits

The proposed system will represent a major shift learning/training support by:

- Supporting active learning and training. The FAIRWIS learning approach will be very learner-oriented: instead of teaching pre-defined contents, the system will allow learners to specify their own needs, objectives and commitments in order to receive true just-in-time, customized and personalized training. Hence, learning will be much more self-directed, answering individual education needs, and avoiding the limitations of current systems, based mainly on pre-defined options. In this framework, teachers role shifts from being the conduit through which information is transmitted into being a tutor, a facilitator, or a coach.
- Providing ICT -related training, in order to enhance the usage of these technologies and, hence, youth employability.
- Enabling laboratory organization to effectively manage their knowledge. Knowledge is as more organizational as more it is shared and distributed within the organization. FAIRWIS will allow each user to find what he/she is looking for and will deliver him the knowledge

formatted and "packaged" in the way he can better recognize and learn it. The system will enable users even to found what they don't know but might be helpful for them.

7. Conclusion and Further Research

FAIRWIS, by using and exploiting the potential of ICT in the context of laboratory virtual enterprise will deliver an innovative learning/training service to YEE students. The way to reach the goal is to enhance the existing electronic publishing frameworks with respect to professional business knowledge acquisition, annotation, indexing, access, and assistance services of already existing digital library technologies to support professional business teaching and training material publication, distribution, and usage, i.e. learning and training scenarios based on the knowledge acquisition, reviewing, annotation, indexing, publishing, distribution and reuse techniques developed in the domain of information technology supported knowledge management.

Although the present goal of the FAIRWIS project is to help young and future European business professionals to start their initial as well as their life long self learning and training for working in professional business domains, the system may also be applied in the near future to the life-long learning needs of Small and Medium Enterprise managers.

Indeed, SMEs internal flexibility and the rapid evolution of the environment in which they operate force the managers to continuously update their professional skills and to develop new competencies, adequate to the role and the activities they have to perform. Hence, SMEs need to have flexible staff able to take on a variety of roles depending on the circumstances. This allows them to ensure that all tasks can be covered when different needs arise, and also ensure that labour costs – probably a high percentage of their overhead – are employed efficiently. This also puts a time pressure on anyone wishing to learn in work time, and results in the desire to spend only as much time as is truly necessary on learning. To summarize SME's learning needs, it is possible to say that they need specialized and customized contents, just in time and just enough.

FAIRWIS is supposed to offer to SMEs a learning/training environment which is scalable, modular and highly customizable. In addition, it would allow SMEs to manage in a more efficient way their knowledge and to make explicit and reuse it. The flexibility and high customizability of the proposed system would make of it a state-of-the-art solution for all SMEs willing to improve their managers and workers skills.

In addition, the FAIRWIS resulting system prototype is expected to become an added-value integrator for SMEs over the Internet and would therefore foster advanced business intelligence behaviours of SMEs.

REFERENCES

Ba S., Whinston A.B., Zahng H. (1999), "Small Business in the Digital Economy: Digital Economy of the Future", *Proceeding of the Conference Understanding the Digital: Data, Tools and Research*, Washington D.C.

Barbini F.M., "FAIRWIS: a Virtual Organization Enabler" (2001), *Proceedings of the International Workshop OES-SEO 2001*, Roma.

D'Atri A., Pauselli E. (2001), "Web Virtual Fair: a New Educational Environment", *Proceedings International Conference Telematica 2001*, St. Petersburg.

D'Atri A., Casalino N., Pauselli E., Zini G., Foà R. (2002), "Web-Based European Education, Training and Accreditation in Hematology", *IASTED CATE Conference*, Cancoon.

D'Atri A., Missikoff O., Pauselli E. (2002), "FairsNet: a virtual environment to support business education", Proc *IASTED CATE Conference*, Cancoon.

Fischer G. (2001), "Social Creativity: Bringing Different Points of View Together", *Working Paper*, Center for LifeLong Learning & Design (L3D), University of Colorado.

Mason R. (1998), *Globalising Education. Trends and Applications*, Routledge, London.

Muscogiuri C., Hemmje M., Hua O., Jäschke G. (January 2002), "Toward Supporting Evolutionary Design and Development within Web-based Collaborative e-Business Solutions", *Proceedings of HICSS'02*, Hawaii.

Nayak N. (2001), "Role of Technology in Enabling Dynamic Virtual Enterprises". In D'ATRI, A. et al. (eds.), *Open Enterprise Solutions: Systems, Experiences, and Organizations*. Luiss Edizioni, Roma.

Pauselli E., D'Atri A., Buono P., Costabile M.F., Hemmje M., Jaeschke G., Muscogiuri C. (2001), "FAIRWIS Usage for Virtual Learning in Student Micro Enterprises", *Proceedings International Conference ED-MEDIA*, Tampere.

Porter M.E. (March 2001), "Internet Strategy", *Harvard Business Review*,, pp.63-78.

Rockart J.F., Short J.E. (1991), "The Networked Organization". In Scott Morton, S.M. (ed.) *The Corporation of the 1990s*. Oxford University Press, New York, 189-219.

Wigand R, Picot A., Reichwald R. (1999), *Information Organization and Management*. John Wiley and Sons, New York.

BEST COPY AVAILABLE

Education Web Site Review and Redesign

Dr. Cathy Cavanaugh, Curriculum and Instruction, University of North Florida, USA. ccavanau@unf.edu

Abstract: Web sites are important for schools to support teachers, administrators, counselors, students, parents, and the community. Redesigning a school's web site can become a complex process and requires careful planning. Studies with web users (Yale Style Guide, Nielsen, Siegel) have produced work that informs school web site revisers of ways to make a site more usable and enjoyable. The US government and the W3C consortium have accessibility guidelines for web sites to assist site reviewers in adapting their site so users of all abilities have equitable access. A school must reconcile time and budget limitations with the need to serve a diverse audience. This paper offers guidelines and tools for streamlining the process of web site review and redesign. Recommendations address the web site redesign team and their roles, supporting the process, identifying the site's purposes, user surveys, content audits, task lists, storyboards, color palettes, style guide, usability and accessibility.

Web sites are becoming increasingly important for schools as support for teachers, administrators, counselors, students, parents, and the community. According to the Webb66 online school web site directory, over 13,000 of the nation's 108,000 schools have web sites. Jamie Mackenzie (1997) offers four reasons for maintaining effective school web sites. Reasons include introducing visitors to the school, pointing students to useful web resources, publishing student work, and collecting data on curriculum projects. Developing or redeveloping a school's web site can become a complex process and it requires careful planning. Judi Harris (1997) suggests exploring who will use the site, what information users will require or appreciate, and maximally useful ways to present the information. Years of study with web users (Yale Style Guide, Nielsen, Siegel) have produced an extensive body of work that informs school web site revisers of ways to make a site more usable and enjoyable. The US government and the W3C consortium recently released accessibility guidelines for web sites that will assist school web site reviewers in adapting their site so users of all abilities have equitable access. School web site review and redesign may be a limited, target process for making basic improvements and updates, or it may be an ambitious complete overhaul. Extensive web redesign projects can be facilitated using summer writing teams, grants, and class projects done by high school or college web design students.

The following tools are presented sequentially as guidelines to assist in the school web site redesign process. Schools have unique needs, capabilities, and characters, and each school's uniqueness is reflected in its web site, as it is in the redesign process. Schools have widely varying resources to commit to web site redesign. Therefore the tools presented here should be considered a menu of options, any of which can be used to streamline the process.

1. Site redesign team

1.1 Menu of site revision team members

School/district tech coordinators	Technical aspects of changing and adding files, server support for interactive elements, permissions, presence of tech support pages
Graphic artists/designers	New logo or navigation elements, layout of pages
Teachers	Design of class pages, curriculum pages, teacher info pages
Students of various levels	Interest in look and feel of site, success I navigating site
Parents	Rating usefulness
Club/sport sponsors	Design of club, team and group areas

Administrator	Approvals and permissions, design of admin area
Clerical/secretarial	Design of pages related to policies, procedures, updating handbooks, menus, schedules, news
Partners in education	Design of appreciation pages
Businesses, organizations	

1.2 Support needed by revision team:

Support includes: time and place to meet together and with groups for focus discussion and testing, flexibility in releasing students and staff to assist, access to networked computers, method of making changes on test server, budget for new software, cameras, and paper.

2. Site purposes

2.1 Identify purposes of our school web site: decide who uses the site and why, then design for them.

Purposes may include: recognizing student achievement, posting collaborative student projects, organizing curriculum resources for teachers and students, organizing information for staff, introducing visitors to the school, introducing prospective students to the school, providing information to parents, providing information to businesses and families new to the area.

2.2 Survey users about their needs and preferences:

Ask "What do you like most about using the web?" and "What do you like least?" Use a questionnaire to gauge the importance of different web features, or to judge the current school site. Consider: What's good and what's not working about the current site? Who are typical users and their age, ability, and technology? What actions do users take at the site? How should users perceive the site: fun, friendly, professional? How can the school show its uniqueness? What sites do users like and why? What current content will be kept? How will the content be structured (information design)? What would be the first 3 things you would change about the site? What aspects of the current look do you want to keep? (Goto & Cotler, 2002)

Design principles relate to the visual elements, layout, and navigation. The following general principles lead to a more user-centered site (ED's Oasis, 2002). Pages are clearly titled. Graphics and art are functional/relevant. Icons clearly represent what is intended. Alternate navigation methods are present. The online resource accommodates multiple modalities and learning styles. Extensive scrolling is not required. Advertising is absent, minimal or is useful if present. A link back to the home page is provided. Text and colors are legible. There is a site map available for easy navigation. The site employs consistent design elements throughout. Pages are free from logical and language errors. There are useful headings and subheadings on the page.

Usability standards increase a site's readability, ease of use, and user satisfaction. Most sites and their users benefit from adhering to these standards. The site is easy to navigate. Information is available in more than one format. The pages load quickly. Text is easy to read, and simply written. Site organization is logical. Links are current and descriptive. Links to additional resources provide related information or examples and support learning objectives. Pages are free from frames requiring scrolling. The page does not require special plug-ins or programs to run. The site limits elements that might create accessibility issues (sound without text, graphics, buttons screen reader can't read) (ED's Oasis, 2002).

The educational value of a school website is judged in terms of appropriate content for its purpose and audience. The purpose of the site is evident and appropriate. The author/sponsor of the site is indicated. The author/sponsor of the site has adequate authority/credentials. The author/sponsor can be contacted. Information is educational, objective and true with limited bias. Is there a date that tells you when the page was made? Links to more information are provided. The site clearly guides users as what they can do there and how. Student communications and contributions are screened before being posted to the site. The arguments are supported and the sources of information are documented.

Give all users opportunities for input by asking questions such as: What information is present in the site that is not needed? How should information be grouped or organized better? What information is missing from the site that would be useful to users? What other suggestions do you have for improving the site?

3. Web Site Redesign Profile

Create a redesign profile for the web site to guide the redesign work. Include the site goals, the needs and preferences of the audience, the main redesign issues and goals, the tone desired for the site, the technical and time scope possible for the redesign, the long term site maintenance plan, and the abilities of the project team (Goto & Cotler, 2002).

4. Learn about other school web sites

Use a web search to study the web sites of other schools similar to yours. Choose a few sites for users to rate in comparison to yours: What do these do better or worse than ours? What is easier and harder at these sites?

Audit of existing site content (Goto & Cotler, 2002)

Section: Home page *index.htm*			
Item	Description	Importance (1=low, 5=high)	Action (+ to keep, – to delete)
Intro text	2-3 lines of school overview	1	
Principal message	1 paragraph of welcome	5	Incorporate into overview or move to principal page
Mascot logo	Black line drawing of school symbol	2	Improve quality
Navigation buttons	Graphical links to grades, reading, sports, calendar	1	Revise to reflect new theme and content
Contact	3 lines of address, phone and email	1	
Animated message	GIF animation of seasonal image	5	Increases maintenance and load time

5. Task list

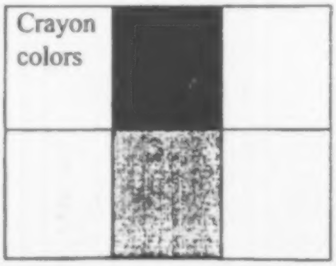
Develop a task list, showing priority items, responsible people, deadlines, and completion. Items to include: poll users about needs and preferences, periodically report changes to users, demo at staff meeting or Open House, add screen capture to newsletter, update images and logos, add interactivity or a feedback form, add common school forms, create form for teachers to add class news and assignments and sport scores, add student gallery, update links to curriculum resources, add VR/panorama of new media center and nature center, test new features, or add PTA newsletters.

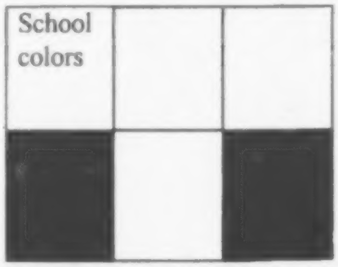
6. Site planning

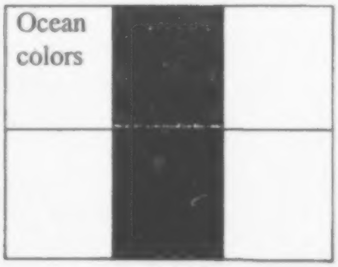
6.1 Site map

Create a site map using diagramming software or graphics software such as Inspiration, Visio, or Freehand. Plot out the pages and links. Ask for feedback, additions.

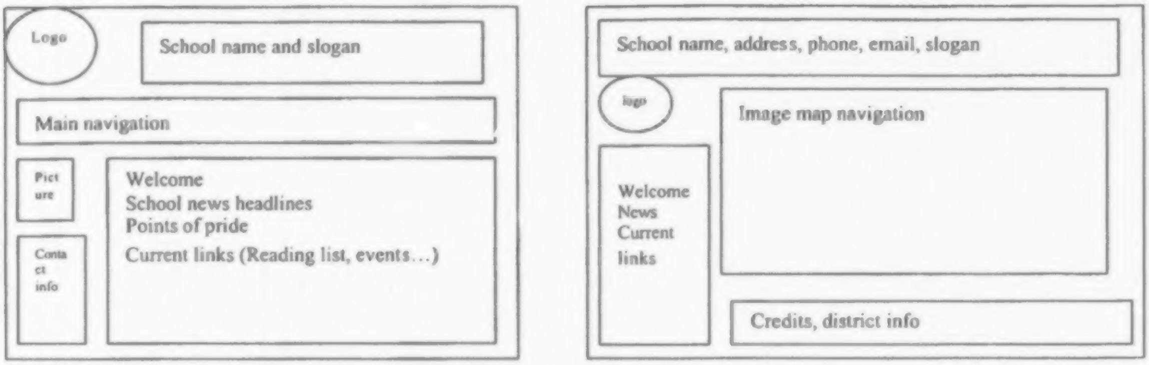
6.2 Compare color palettes







6.3 Storyboard possible page designs


Logo
School name and slogan
Main navigation
Picture
Welcome
School news headlines
Points of pride
Current links (Reading list, events…)
Contact info
School name, address, phone, email, slogan
logo
Image map navigation
Welcome
News
Current
links
Credits, district info

7. Style guide

Develop specifications for common aspects of pages.

- Colors for titles, text links, backgrounds, borders
- Text: use of formatting such as bold, quotations, heading sizes, fonts
- Images: file formats, padding, school and district guidelines for students and student work
- Content: copyrights, permissions, requirements and prohibitions

References

ED's Oasis. 2002. Evaluation Guidelines. http://www.classroom.com/edsoasis/guide2.html

Goto, K. & Cotler, E. 2002. *Web ReDesign*. Indianapolis: New Riders.

Harris, J. 2001. *Virtual Architecture*. http://ccwf.cc.utexas.edu/~jbharris/Virtual-Architecture/

Krug, S. 2000. *Don't Make Me Think*. Indianapolis: Circle.com.

Lynch, P. & Horton, S. 1997. *Web Style Guide*. Yale University.

MacKenzie, J. *Designing School Web Sites to Deliver*. http://www.fno.org/webdesign.html

Nielsen, J. & Tahir, M. 2002. *Homepage Usability*. Indianapolis: New Riders.

World Wide Web Consortium. 1999. *Web Content Accessibility Guidelines*. http://www.w3.org/TR/WAI-WEBCONTENT/

College Website Review and Revision for Accessibility

Terence W. Cavanaugh, Ph.D. Curriculum and Instruction, University of North Florida, Jacksonville, FL USA.
tcavanau@unf.edu

Abstract: Websites are becoming increasingly important for colleges as support for faculty, administrators, counselors, students, parents, and the community. A primary factor when restructuring, updating, or creating a college site should be making sure that the site will be fully accessible. Restructuring a college's website to ensure accessibility can become a complex process and it requires careful planning and knowledge of accessibility issues. The US government and the W3C consortium has accessibility guidelines for websites that will assist website reviewers and designers in adapting their sites so all users have equitable access.

Need

An education college website should have as its mission to recruit, support, and inform current and future students and faculty about the college and the profession, while at the same time modeling educational design concepts and ethical educational behaviors. An analysis of a local College of Education website determined that the site had become outdated, did not fulfill its mission effectively, and was not compliant with accessibility guidelines. For a college that has deaf studies and special education programs, a priority was expressed that the college's site be accessible to disabled users. To that end the college wanted to ensure that its website would model proper application of accessibility guidelines as promoted by the W3 Commission and the US government's Section 508 of the Rehabilitation Act concerning Electronic and Information Technology.

Guidelines

Currently there are two major "players" in the structuring of accessibility guidelines for web-based materials in the US, the United States government itself with section 508 of the 1998 Rehabilitation Act, and the World Wide Web Consortium's Web Accessibility Initiative.

Section 508 of the Rehabilitation Act was put into place to help eliminate the barriers in accessing information technology, to make all such information available for people with disabilities. While this law currently only applies to Federal agencies when they develop, procure, maintain, or use electronic and information technology, it is to a school's advantage to make information about that school as accessible as possible. Additionally while not currently required, it is not beyond expectations that state governments will also make these guidelines a requirement for state web sites as well as public schools, colleges, and universities. A web site will be in compliance with the 508 standards if it meets paragraphs (a) through (p) of Section 1194.22 (see Appendix A). The World Wide Web Consortium has developed its own fourteen guidelines (see Appendix B) concerning web accessibility. Within each of these guidelines are a number of checkpoints, which have priority ratings from One to Three. Each checkpoint has a priority level assigned by the W3C Working Group based on the checkpoint's impact on accessibility. According to the W3C at a minimum, for accessibility, a web site *must* be designed to meet all Priority One elements or some groups of people will find the site impossible to access. Satisfying all Priority Two elements *should* be done to remove the most significant barriers to accessing a web site. The Priority Three elements are an optional set that *may* be addressed to ensure that there is improved access to the web documents. By following the W3C web accessibility guidelines, sites can have an accessibility rating of "A," "AA," or "AAA." This rating system is based on the level of conformance that the site achieves. A conformance level of "A" indicates that all Priority One elements are satisfied, "AA" shows that the site is satisfying all Priority One and Two elements, and "AAA," being the highest level, with all Priority One, Two, and Three checkpoints in compliance. As an example, to achieve the minimum conformance level of "A," a site must meet all of the following priority one guidelines:

- Provide content that conveys essentially the same function or purpose as auditory or visual content;
- Ensure that text and graphics are understandable when viewed without color;

BEST COPY AVAILABLE

- Clearly identify changes in the natural language of a document's text and any text equivalents;
- Ensure that tables have necessary markup to be transformed by accessible browsers;
- Ensure that pages are accessible even when newer technologies are not supported or are turned off;
- Ensure that moving, blinking, scrolling, or auto-updating objects or pages may be paused or stopped;
- Ensure that the user interface follows principles of accessible design: device-independent access to functionality, keyboard operability, self-voicing, etc.;
- Use features that enable activation of page elements via a variety of input devices; Provide context and orientation information to help users understand complex pages or elements; and
- Ensure that documents are clear and simple so they may be more easily understood (Web Content Accessibility Guidelines 1.0, 1999).

Self Evaluation

The next step in the college's web site revision process was to find out specific ways that users felt the site was not fulfilling its mission. The initial part of this investigation included a series of interviews with faculty members and students to find out what they found useful about the current site, problems they had, how they felt the site could be improved, and where the college's web site was not following accessibility guidelines. From the initial analysis concerning accessability of the site it was determined that improvement was needed in alternative text tags, use of framesets, and identification concerning the languages and html formats on the individual web pages. Each phase of the redesign was reviewed and approved by the college's technology committee using mock up web pages, navigational concept maps, survey and interview results, and accessibility needs. As professional educational institutions all colleges of education should achieve accessibility by meeting W3C and ADA compliance standards to reach at least the "A" rating put forth by the W3C commission for accessibility.

Accessibility Tools

Research was undertaken in finding tools to evaluate the site to improve accessibility. There are several tools available, many of which have no cost, and as we had a limited budget we limited the choice of tools to the no-cost options. Some of the free tools that were examined included Bobby from CAST, HTML & CSS Validator from W3C, A-Prompt from the University of Toronto, and the 508 Accessibility Suite for Dreamweaver. An excellent listing of over thirty different tools to assist in evaluating and repairing sites for accessibility is the Evaluation, Repair, and Transformation Tools for Web Content Accessibility from the W3C Web Accessibility Initiative at http://www.w3.org/WAI/ER/existingtools.html.

While each of the tools reviewed had their own advantages, A-Prompt was chosen as the evaluation tool, because of ease of use and because of its assistance in identification of accessiblity issues, as well as in guiding and assisting in their correction. A-Prompt (for Accessibility Prompt) is a software tool designed by University of Toronto's Adaptive Technology Resource Centre (ATRC) and the TRACE Center at the University of Wisconsin to assist web authors in improving the accessibiltiy and usability of HTML documents by evaluating Web pages for accessibility barriers and then providing developers with simple methods to make the needed changes to ensure accessiblity. A-Prompt makes its evaluation and repair based on accessibility guidelines created by the Web Access Initiative of the World Wide Web Consortium or the US Rehabilitaion Act 508 guidelines. Users of A-Prompt can set which guideline they would prefer to follow and to what level.

Restructure

The actual design change for accessibility of the college site was done at the end of the restructure process. It was done at the end because of the number of persons who were working on and evaluating the site concerning structure and content. Since the focus, at that time, was on content, the authors did not need special training to make sure that their changes were following compliance standards. To assist in the development of new pages, web page templates were created that were already compliant for accessibility. Once all the college's pages had been checked for content and design, and all new pages created the entire site was evaluated using the A-Prompt software. In discussions between the site designers and the administration, the W3C guidelines were used and the site was restructured to achieve the "AAA" rating.

Once all pages had been filtered through the A-Prompt tool and the site was compliant a series of tests were undertaken to ensure that accessibility had been achieved. These tests included using a variety of standard monitors and browsers, then again checking the site using specialized accessibility tools such as screen readers, screen enlargers, and accessing the site through a universal access station. The final phase of the evaluation involved requesting students with disabilities to access and evaluate the site.

Conclusions

College sites should provide information to *all* prospective users. This information can include the programs that are available and the number of hours and courses required for programs, images or photographs of students and facilities, and any other relative information. But a college must also make sure that its information is accessible by all. While a committee of the college may direct the maintenance and structure of the college's website, that committee needs to have someone who is aware of online accessibility issues, to ensure that the college's site either achieves or maintains accessibility compliance. Also since at many colleges numerous persons can post or change web pages, the college site should periodically be reassessed for accessibility compliance and training made available for all college web authors.

References:

Ridpath, C (2002) A-Prompt last accessed online at http://aprompt.snow.utoronto.ca/

Section 508 (2002) last accessed online at http://www.section508.gov/ .

US Government (2000) Electronic and Information Technology Accessibility Standards. Last accessed online at http://www.access-board.gov/sec508/508standards.htm.

W3C Web Accessibility Initiative (2002) Evaluation, Repair, and Transformation Tools for Web Content Accessibility last accessed online at http://www.w3c.org/WAI/ER/existingtools.html .

Web Able Inc. (2002) Section 508 Accessibility Requirements for Web Sites http://www.webable.com/508_guidelines.html

World Wide Web Consortium (1999) Checklist of Checkpoints for Web Content Accessibility Guidelines 1.0. Last accessed online at http://www.w3.org/TR/WCAG10/full-checklist.html .

Appendix A

508 Standards: Section 1194.22 Web-based intranet and internet information and applications.

(a) A text equivalent for every non-text element shall be provided (e.g., via "alt", "longdesc", or in element content).

(b) Equivalent alternatives for any multimedia presentation shall be synchronized with the presentation.

(c) Web pages shall be designed so that all information conveyed with color is also available without color, for example from context or markup.

(d) Documents shall be organized so they are readable without requiring an associated style sheet.

(e) Redundant text links shall be provided for each active region of a server-side image map.

(f) Client-side image maps shall be provided instead of server-side image maps except where the regions cannot be defined with an available geometric shape.

(g) Row and column headers shall be identified for data tables.

(h) Markup shall be used to associate data cells and header cells for data tables that have two or more logical levels of row or column headers.

(i) Frames shall be titled with text that facilitates frame identification and navigation.

(j) Pages shall be designed to avoid causing the screen to flicker with a frequency greater than 2 Hz and lower than 55 Hz.

(k) A text-only page, with equivalent information or functionality, shall be provided to make a web site comply with the provisions of this part, when compliance cannot be accomplished in any other way. The content of the text-only page shall be updated whenever the primary page changes.

(l) When pages utilize scripting languages to display content, or to create interface elements, the information provided by the script shall be identified with functional text that can be read by assistive technology.

(m) When a web page requires that an applet, plug-in or other application be present on the client system to interpret page content, the page must provide a link to a plug-in or applet that complies with §1194.21(a) through (l).

(n) When electronic forms are designed to be completed on-line, the form shall allow people using assistive technology to access the information, field elements, and functionality required for completion and submission of the form, including all directions and cues.

(o) A method shall be provided that permits users to skip repetitive navigation links.

(p) When a timed response is required, the user shall be alerted and given sufficient time to indicate more time is required.

Appendix B

W3C Accessibility Guidelines

1. Provide equivalent alternatives to auditory and visual content. Provide content that, when presented to the user, conveys essentially the same function or purpose as auditory or visual content.
2. Don't rely on color alone. Ensure that text and graphics are understandable when viewed without color.
3. Use markup and style sheets and do so properly. Mark up documents with the proper structural elements. Control presentation with style sheets rather than with presentation elements and attributes.
4. Clarify natural language usage. Use markup that facilitates pronunciation or interpretation of abbreviated or foreign text.
5. Create tables that transform gracefully. Ensure that tables have necessary markup to be transformed by accessible browsers and other user agents.
6. Ensure that pages featuring new technologies transform gracefully. Ensure that pages are accessible even when newer technologies are not supported or are turned off.
7. Ensure user control of time-sensitive content changes. Ensure that moving, blinking, scrolling, or auto-updating objects or pages may be paused or stopped.
8. Ensure direct accessibility of embedded user interfaces. Ensure that the user interface follows principles of accessible design: device-independent access to functionality, keyboard operability, self-voicing, etc.
9. Design for device-independence. Use features that enable activation of page elements via a variety of input devices.
10. Use interim solutions. Use interim accessibility solutions so that assistive technologies and older browsers will operate correctly.
11. Use W3C technologies and guidelines. Use W3C technologies (according to specification) and follow accessibility guidelines. Where it is not possible to use a W3C technology, or doing so results in material that does not transform gracefully, provide an alternative version of the content that is accessible.
12. Provide context and orientation information. Provide context and orientation information to help users understand complex pages or elements.
13. Provide clear navigation mechanisms. Provide clear and consistent navigation mechanisms – orientation information, navigation bars, a site map, etc. -- to increase the likelihood that a person will find what they are looking for at a site.
14. Ensure that documents are clear and simple. Ensure that documents are clear and simple so they may be more easily understood.

Web/CD Hybrid model for the Distance Learning Environment

Terence W. Cavanaugh, Ph.D. Curriculum and Instruction, University of North Florida, Jacksonville, FL USA.
tcavanau@unf.edu

Abstract: The limited bandwidth available, slow modems, and connection issues hamper the delivery of software and multimedia in the online class environment. A possible solution is adjusting from a web-based distance learning class to a Web/CD hybrid delivery method, which uses the advantages of each separate delivery format. Creating a Web/CD hybrid course not much different than creating a distance learning course. The online course component can access the CD for audio, video, and other large files to eliminate download times. The Web/CD hybrid format has some of its own issues such as computer platforms, CD development, and distribution.

Web/CD Hybrid model for the Distance Learning Environment

The goal of this paper is to provide distance education instructors with an alternative or adaptation to the delivery format that should assist in overcoming one of the greater problems with distance learning, that of bandwidth. The use of the web and with supporting interactive CD delivery format is one that can alleviate many connection and bandwidth issues while at the same time providing better instructional materials for students. In most course environments it is possible to effectively integrate quality CD ROM materials into the online learning environment.

It seems that all schools and colleges across the nation are adding distance learning courses. Many state university systems are under the directive to encourage institutions and their faculty to embrace distance learning. However, the problem that exists at the forefront is that many institutions do not have access to a reasonable range of technologies (Hurst, 1997). While it would be ideal to acquire all the needed technology for all institutions, there still currently is not acceptable telecommunications bandwidth for voice, video, and data with a strategy to increase bandwidth as demand requires. The problem is that these types of digital files are very large, and they require connections with tremendous capacity to transmit quickly and effectively. The transmission capacity of the connection is referred to as the bandwidth (Barron, 2002). It is the technological issue of bandwidth that placed many of the limitations on the distance learning experience (Hernandez and others, 1998). The limited bandwidth available, slow modems, and connection issues hamper the delivery of sound, video, and graphics (Kerka, 1996). This bandwidth issue remains today, with no quick solution in sight, but through the use of alternative deliveries and integrating technologies it is possible to overcome many of the bandwidth issues that prevent the delivery of multimedia and other bandwidth intensive technologies.

In assessing my own students in distance learning and web enhanced classes I find that the students access the internet based materia l through one of three standard methods, either through the campus network if they live on campus or by cable or dial up modem. One of the multimedia elements that I was trying to include with these courses was a video that when converted to digital format became a 147 megabyte mpeg video. While accessing this video through the network was usually not an issue, except during peak network time, accessing and downloading the video through the internet can vary from about 30 seconds on a cable modem to up to 400 times that for a standard dial up modem but took less than 2 seconds to start from a CD (Daniels et.al. 2000, National Academy of Sciences 2002 and Barron 2002).

In Hurst's 1997 "Assuring Equitable Access: A Distance Learning Vision for Florida" the authors sate that it is important to remember that technologies are merely tools, and that these tools must be adjusted for the "content, the teaching/learning style of the instructor and the learning style of the student," and that this " argues for multiple methods, both low-tech and high-tech, of delivering instruction for distance learning." For some learners this can be text (such as books), for others, such as visual or aural learners, courses need to support and make available options like video, video and audio conferencing, and other image or sound based delivery options.

As an ideal case, distance learning educators would like to be able to deliver high quality and high impact multimedia, incorporating digital audio and video, and software to students. Currently in the US there are over 6 million homes with broadband access, but that actually only accounts for about nine percent of the households, leaving the rest accessing as slower speeds (NCTA, 2001 & Cisco, 2001). When downloading high bandwidth files, the students find that the time it takes to download becomes excessive or while downloading they have line errors or their internet service provider cuts them off because of the amount of "inactive" time. Another problem that commonly occurs is that when downloading or playing such media, more students will attempt to access the files than the server can handle. The question then develops, is it possible to add such "high bandwidth" media without adding burdens to the student's connection speed or the colleges local course web server? One possible solution is adjusting a distance learning class from being totally web-based delivery to a Web/CD hybrid delivery method. While streaming video and audio are available, they often don't provide the quality desired or needed for the intended educational use. Streaming media also still depend on the connection speed and the bandwidth available to the user, and require specialized servers which may be limited on access and space. Through the application of web delivery with CD ROM enhancement it is possible to overcome most problems while providing students with better access to the educational materials. An additional feature of this format is that it allows instructors to make certain materials, such as videos, presentations, and readings, available off line, so students can have access to the material even when they don't have internet access.

Each delivery format, web only or CD, has its own advantages. An online web environment allows instructors to have a course space that can be easily updated, it can track where and how long students used it, and it can allow students to input information into discussion boards, online tests, or whiteboards to which the instructor can respond. A course based CD can provide full screen, non-delayed extended video and audio, and it can provide students with material that can be access and reviewed offline, or played on devices other than a computer, such as a DVD or CD player. The Web/CD hybrid environment by melding the two delivery formats, is taking the advantages of both systems, while eliminating many of each formats shortcomings.

The process of creating a Web/CD hybrid course is no different than creating a distance learning course, with the exception of perhaps fewer limitations. One method would be to take an existing distance learning course and determine which components are "high-bandwidth," large file size, or complex components. Transfer these high-bandwidth files off the web server and place them on a CD, which is distributed to the students. Another method would be to take a course which is currently supported by a CD and determine where it could use online support for interactivity, assessment, or currency. Then create an online course site to support those gaps and put links onto the course's CD that directs students to the online environment. The last method would involve designing the course from the beginning with the hybrid model in mind. With the hybrid design instructors would be placing the material that needs updating for currency online along with other material such as assessments, outside readings, assignments, and discussions. The CD for the course could contain continually used readings, audio and video files, and other large files such as software and tutorial programs. The online course environment then has links that call up the files on the user's local computer CD drive and to play or run the files at that computer.

Most of the online course space environments, such as BlackBoard and WebCT, support the use of local CDs. It is even possible to get software that allows instructors to create the necessary code to give students interactive access from regular web pages. On the instructor side, when creating a course page in the online environment, the course instructor sets up a link in the course management system to access the material offline. The link from the course management system to the file on the CD, includes the path to the file on the CD that is to be accessed offline. The course management system creates a link to that file and indicates, usually with a CD icon, that a CD will be necessary in the computer to access the file. A student then moving within the course site clicks on the link to the CD's file like any other link in the environment to gain access to the file. This process requires the students to identify the name or letter for their CD drive to the course management system, and to place the course CD into the local computer's CD drive.

The Web/CD hybrid format does have some of its own issues. There is an additional set of instructional steps necessary for the environment to work. Students will need additional instruction concerning how to set their personal preferences for their computer's CD drive. For many instructors, the CD itself will be an issue, especially if he/she has never created one before. Once all the files have been gathered, keeping in mind there is still a 650 megabyte limit for file space, a disc master must be created. If students will access the material on more than one computer platform, a cross platform CD will have to be created. The CD will then need to be duplicated and distributed to the entire online class. Most courses will not have enough students to justify copying the master CD at a CD pressing plant, so it will be necessary to duplicate the CDs on campus using a standard CD burning drive or small scale CD duplicating machine. It is important that students have access to the files on the CD from the beginning of the course. Therefore the CDs must be created before the course begins. If the course's students don't have an initial face-to-face meeting a distribution system will need to be developed.

I have been using the Web/CD hybrid for both my distance learning courses and my web enhanced courses over the past few years. As an example I have my online students accessing a video file that is over ten minutes long, without download time issues. They can play the video in their computers or watch on their DVD players. I have made improved use of other programs such as PowerPoint. Web based PowerPoint presentations often are unable to use the full features of the program, such as interactivity or associated files. When the students use the program and file locally they are able to fully interact with tutorials I created that include interactive elements with video supports. Another example that worked very well was when I included FrontPage Express as a program on the course CD. The software program itself required other files to run, so it would not work if I put the executable file in the course web space. The program file and its other required files were put on the CD in the same directory. All students then were able to have the necessary software, working with the same version (often important for directions and to help with support), whether they were working online or offline. Another advantage that I have found of the Web/CD hybrid delivery is including other programs such as viewers like Word viewer, PowerPoint viewer, and Adobe Acrobat Reader, and sample software programs for students to review or use. This way if a student didn't have a specific reader to access the web or CD distributed file he or she could go to an online "programs" page and click the link to the CD to install the necessary programs from the CD on the local computer.

The application of the Web/CD hybrid design can not only help the students, it can also assist us as educational professionals to meet our own standards. By adapting the distance learning courses we as teachers are meeting the ISTE teacher standards for Planning and Designing Learning Environments and Experiences, and Teaching, Learning, and Curriculum (ISTE, 2000). We would be meeting these standards because by using the Web/CD Hybrid model we would be developing resources to support effective learning opportunities for online instruction for various learning styles, and would be implementing technology-enhanced plans, as the process assists in overcoming issues in application of technology, due to bandwidth and connectivity. The Web/CD hybrid process also supports the administrator standards of Productivity and Professional Practice, and Learning and Teaching (ISTE, 2001) by enhancing and supporting curriculum with multimedia and other high bandwidth technologies, and providing technology tools that can increase the capacity of existing online educational systems. This hybrid model also supports the NCATE standards by providing an answer to their distance learning question, by providing a technology support that helps prevents breakdowns and interferences with distance learning delivery (NCATE, 2002).

References:

Barron, A (2002). A Teacher's Guide to Distance Learning. Last accessed online on at http://fcit.coedu.usf.edu/DISTANCE/.
Cisco Systems (2001) Broadband Deployment. Available online at http://www.cisco.com/warp/public/779/govtaffs/factsNStats/broadbanddeployment.html.
Daniels, A., Davis, C., Rex, T., and Ruff, B. (2000) Cable Modem vs. DSL. Available online at http://dmsweb.badm.sc.edu/mgsc890/trex/comparison.htm
Francisco Hernandez and others, (1998). VHS Feasibility Study

Hurst, F. M. and others (1997). Assuring Equitable Access: A Distance Learning Vision for Florida,. Available online at http://www.state.fl.us/institute/finvis.htm

ISTE (International Society for Technology in Education). (2000) National Educational Technology Standards for Teachers (NETS•T). Available online at http://cnets.iste.org/index3.html.

ISTE (International Society for Technology in Education). (2001). Technology Standards for School Administrators TSSA Draft (v4.0). available online at http://cnets.iste.org/tssa/view_standards.html.

Kerka, S. (1996). Distance Learning, the Internet, and the World Wide Web. ERIC document ED395214 available online at http://www.ed.gov/databases/ERIC_Digests/ed395214.html.

National Academy of Sciences. (2002) Broadband: Bringing Home the Bits. National Academy Press. Washington DC

NCATE (National Council for the Accreditation of Teacher Education). (2002). "Questions Developed for Assistance in Evaluation of Distance Learning Programs" part of the Board of Examiners Materials for On-Site Visits. Available online at http://www.ncate.org/accred/boevisit/m_ncate2000boevisit.htm.

NCTA (National Cable and Telecommunications Association). (2001). Consumers Continue To Opt For Advanced Cable Services. Available online at http://www.ncta.com/press/press.cfm?PRid=233&showArticles=ok .

National Effort Goes to Support E-Learning: An Example In Taiwan's Academic Learning Paradigm

Chiping Chan, Ching-Heng Ku
National Center for High-performance Computing
7, R&D Rd. VI, Science-based Industrial Park
Hsinchu, Taiwan
a00jcc00@nchc.gov.tw, a00chk00@nchc.gov.tw

Abstract: This paper discuss the changing paradigms in Taiwan's Academic learning, with the advanced network that has been implemented for the broadband application, e-learning has been taking advantage to utilize the network to demonstrate the demands. The success of the National Broadband Experimental Network infrastructure that Taiwan government has sponsored was the key factor that made all applications possible. Various methodologies were deployed to help strengthen the network architecture. GigaPOPs and universities helped to manage the operation as well as implement specific technology that support specific needs. The evolution of the broadband network in Taiwan was a success after different phases of deployment; the changing paradigms not only apply to the application but also apply to the network as well. The recent research work has been conducted on NBEN included: Web-based circuit provisioning; Traffic management, measurement, analysis & reporting; Routing registry, proxy hierarchy & maintenance; QoS, DiffServ & IPv6 and Multicast, video conferencing & showcase. These successful research results demonstrated the infrastructure capable of supporting advanced research and educational applications which is the ultimate goal for this broadband network.

Introduction

The idea of e-learning is nothing new, which has been implemented in many different education institutions, ranging from elementary schools to universities. Some use interactive multimedia to attract attentions from youngsters; some upload the instruction materials to the web so students can preview before the class and review after lectures. They all have one thing in common, that is to utilize the newest technology to deliver educational contents.

One advanced network that origins from National Science Council in Taiwan is National Broadband Experimental Network which has been established since 1999, it includes most of the major universities as GigaPop sites to support the continues effort on education. This network serves an important role as platform to host various experiments; also it provides multiple experimental broadband applications.

This paper discusses the deployment of the network, its structure, its phases of integrations to achieve high bandwidth and the current activities.

The motivation of the experimental net

This project started in 1999, the goal was to establish a broadband network that can support all the experiment that needs to be conduct on, with proper management, the experiment can interrupt the operation on the network, the reason behind this is that normally some experiment can only conduct in a lab, due to the unknown impact happened to the network. Some experiments, however needs extensive challenge that may cause the unstable of the network. This project was designed so different experiment can be conduct with proper procedure so all can expect without concern of the network operation.

One application that was serious take advantage was the e-learning, unlike the research experiment that fully use the network that cause the downtime of the network, we need a broadband network to experiment the impact of the multimedia teaching, this included the effective of material transfer, the effect on the receiving end, these apply to all the level understanding between the different ages of students.

The Development of NBEN

NBEN is a project of continuation to promote the backbone network bandwidth and provide an experimental platform for broadband network technology. It aims to perform research for institutions and industries, in addition, it seeks to support service providers and compete for long distance broadband network for fiber optics, linking each region with high-speed network.

In addition, it is a platform for advanced technologies such as Multicast, Differentiated Service, Ipv6. This project is a unit under National Telecommunication Program to work with 'wireless network' and 'broadband network' to mutually support and actively educate and train for the needed talents.

In order to provide quality services for the support of National Telecom Development Program, this project also work with National Science Council to promote the applications as well as assisting the neighboring higher educational institutes in each region to have better access to the networks. Currently the coverage includes most major areas in Taiwan including Taipei, Tao-Yuan, Hsin-Chu, Cha-Yi, Tai-Nan and Kao-Shoung. National Broadband Experiment Network has the purpose to serves the upper hierarchy; it provided direct connection to the network.

The backbone and the equipment of this network completed its testing period in June 1999. Since then, GigaPOP has been made available on the experimental platform for research use. The recent research work has been conducted on NBEN included: Web-based circuit provisioning; Traffic management, measurement, analysis & reporting; Routing registry, proxy hierarchy & maintenance; QoS, DiffServ & IPv6 and Multicast, video conferencing & showcase. These successful research results demonstrated the infrastructure capable of supporting advanced research and educational application, which is the ultimate goal.

Current Status

The National Broadband Experimental Network has completed its earlier phase of deployment and currently put the effort on getting the eastern side of the nation up to the speed. Generally speaking, most of the network traffic was generated from the northern part of Taiwan due to the well establish and development in the past years. Currently we have complete building the STM1 to the eastern GigaPop to balance the flow, also to serve as an alternate route. The southern area also has the similar problem due to the lower usage so this current phase will complete the STM1 to the major university in the southern part of Taiwan.

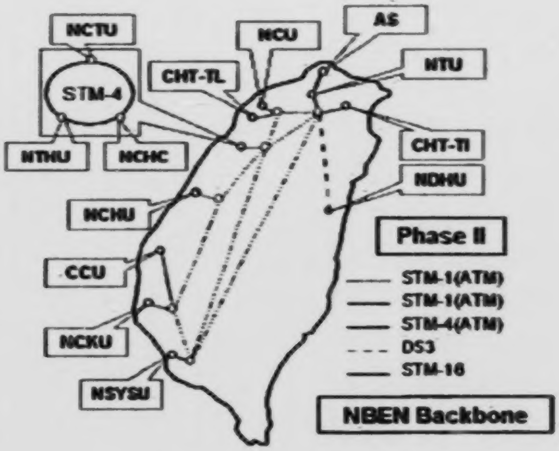


Figure 1 – NBEN Backbone

Active Projects on NBEN

National Broadband Experimental Network not only serves as a platform for the various applications but also

BEST COPY AVAILABLE

support research project that can be carries out on the network. A task force was formed to study the most needed technology that can be placed on the network and six projects were selected to execute under National Science Council grants, the following is a simple summary of the six projects:

Web-based circuit provisioning project: After the completion of the network, it is necessary to develop a web based system to have the technical management team operate. This project is to have the support team at any time to inquiry the network status, also to have automatically configuration to set the ATM switches, mainly the VP/VC setting.

Traffic management, measurement, analysis & reporting system: This is also a developing system to implement an Active Web based Network Monitor – AW-NETMON. This monitor has the coverage of the wide area network, proactive, alert, and service oriented function. For the wide area coverage, its goal is to cover all the Fore ASX1000 ATM Switch. It also does the monitor on a dynamic basis. For any abnormal activity, it will notify the technical staff, it does some degree of data analysis. Since all the data were capture, this project will build a database to analysis further hopefully to apply the model on the data mining techniques. Once the pattern can be formed, this will prevent many problems, some of the record that has been kept is traffic trace, and abnormal events. The relationship between the monitor stations can be shown on the figure below.

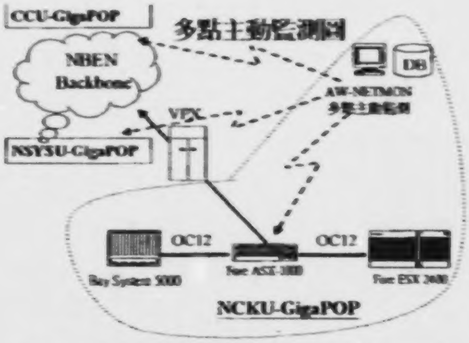


Figure 2 - AW-NETMON conceptive diagram

National Broadband Experimental Network not only serves as a platform for the various applications but also support research project that can be carries out on the network. A task force was formed to study the most needed technology that can be placed on the network and six projects were selected to execute under National Science Council grants, the following is a simple summary of the six projects:

Web-based circuit provisioning project: After the completion of the network, it is necessary to develop a web based system to have the technical management team operate. This project is to have the support team at any time to inquiry the network status, also to have automatically configuration to set the ATM switches, mainly the VP/VC setting.

Routing registry, proxy hierarchy & maintenance project: The goal for this project is to have a complete service plan for all the GigaPop, currently there are more than one network meets at the GigaPop and the routing registry, proxy hierarchy become complicate. By complete this project, research organization can utilize the result to improve network, increases productivity and also have some good control on the traffic usage. Also in this project, some integration was done to simplify the network management methodology between schools.

QoS, DiffServ & IPv6 project: This is a project to better manages the broadband network utilize the techniques of quality of service and others. The basic idea is to satisfy the real time application, the best effort traffic and bandwidth sharing were the idea to be carry out on a PC-based QoS router prototype, hopefully to achieve classification, policy and scheduler functions, the following is the diagram to show the uniqueness of the environment and the expected result.

BEST COPY AVAILABLE

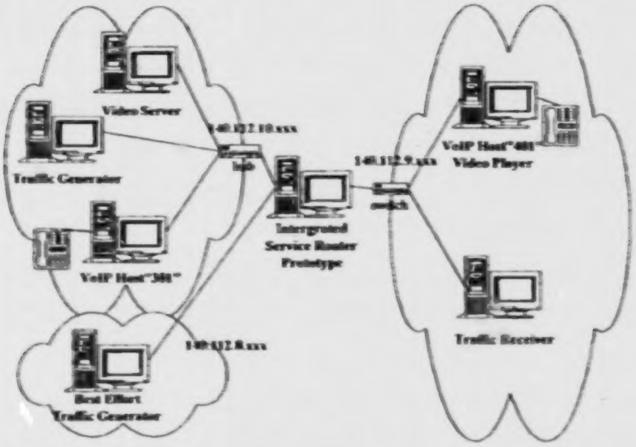


Figure 3 - Differentiated Services Provisioning – the integrated environment

Multicast, video conferencing & showcase project: This is a pilot project to implement H.323 videoconference platform, utilize the high bandwidth, high quality network to benefit all education institutes. The idea of videoconference is common and the effect was not very convincing due to the lower bandwidth in Taiwan. To better satisfy the greater user, this broadband network is a platform to implement. Hosting some of the major domestic conferences as well as international Mega Conference II did some example. Also the same setting has supported to many government-sponsored events all around Taiwan to demonstrate the complexity of the project.

Conclusions

National Broadband Experimental Network has shown the various network technologies and applications that can be done and expend. The future trend has indicated that we need a bigger bandwidth network with higher quality of service to satisfy the demand of education communities. In order to keep this network with the name, National Broadband Experimental Network needs to always increase the bandwidth and expend the user group. Currently the user group has targeted the research and academic organizations, which can be expend to a greater communities. The different regional GigaPop also need to integrate to form high performance network platform with dark fiber. Many newer techniques should also be considered such as multicast; differentiated service to be more of regular service in order to better serves the education communities.

References

http://www.nben.net.tw
Minolii & Golway (1997). Planning & Managing ATM networks. Manning Publication
Stallings, W. (1998). High Speed network TCP/IP and ATM design principles. Prentice-Hall
Oram, A. (2001). Peer-to-Peer: Harnessing the benefits of a disruptive technology. O'Reilly
Kercheval, B. (1997). TCP/IP Over ATM. Prentice-Hall
NBEN Development strategy and plan report (2001). National Science Council, Taiwan
Fang, K.C, (2000). A Web-based Circuit Provisioning System for National Broadband Experimental Networks, Tanet'2000 Conference, Taiwan
Lai, H.S, (2000). AW-NETMON: Active Web based NETwork MONitor. Tanet'2000 Conference, Taiwan
Chen, N.S. (2000), H.323 videoconference system planning and implementation on NBEN, Tanet2000 conference, Taiwan.
Lin, S. (2000) Policy, planning and Budget Allocation, Tanet'2000 Conference, Taiwan
Semi Annual Report: NBEN under National Telecom Project (2001). National Center for High Performance Computing, Taiwan

BEST COPY AVAILABLE

Eclectic “E” Learning– A Knowledge Management Perspective

Ivy Chan
School of Business
Faculty of Business and Economics
The University of Hong Kong
Pokfulam, Hong Kong
icircuit@business.hku.hk

Naubahar Sharif,
Department of Science and Technology Studies
Cornell University
630 Clark Hall, Ithaca
NY 14853, USA.
ns89@cornell.edu

Abstract: The notions of organizational learning and knowledge management share similar lines of thought in leveraging individuals' development to create value for overall organizational intelligence. Although both notions have gained growing attention and interest from academics and practitioners, there have been few attempts in recent studies to collate both notions in order to portray enterprises' intelligent behavior. This study aims to provide a starting point to address the issue of E-learning from a knowledge management perspective, specifically to embrace learning endeavors with knowledge management initiatives. The discussion is expected to achieve three aims: to provide a frame of reference of effective E-learning – for academics to synthesize learning with knowledge management initiatives; for business practitioners to improve the effectiveness of existing E-learning projects with the proposed KM-based aspects; and for national innovations systems theory to be furthered by focusing on the micro learning initiatives at the firm level.

“In a knowledge-based economy, the new coin of the realm is learning.” Robert Reich *(cited in Von Krogh et al. 2000)*

Introduction

There is emerging attention and interests from academics and practitioners for organizational learning which addresses the promising results in organizational change and development (Kim 1993, Winfield and Kerrin 1994). With the advancement of technology such as the Internet and network communications, the endeavors of organizational learning have been transformed into E-learning activities that accentuate a wide range of electronic-driven contexts / web-based technologies to enhance the individual's skills and expertise (Burd and Dejnaronk 2000, Honey 2001). In parallel, the issue of knowledge management (KM) is referenced in business agenda that addresses the deployment of knowledge resources to sustain a firm's competitive advantages (Drucker 1995, Kougt and Zander 1992). With respect to the strategic role of information systems in the KM context, it is found that organizations undertake systematic processes in the acquisition, storage, dissemination, and creation of knowledge resources to enhance the individual's innovativeness and creativity (Alavi and Leidner 2001, Nonaka and Takeuchi 1995, Wiig 1994).

Though both notions of organizational learning and knowledge management share similar lines of thought in leveraging the individual's development and creating value to organizational intelligence, efforts to collate both notions are currently scant. Therefore, the objective of this study is to provide a starting point to address the issue of E-learning from a knowledge management perspective, specifically to embrace learning endeavors with knowledge management initiatives. Throughout the discussion, it is expected to provide a frame of reference for effective E-learning for academics to synthesize learning with knowledge management initiatives, and for business practitioners to improve the effectiveness of existing E-learning projects with the proposed KM-based aspects. Finally, the discussion will be able to inform national innovations systems theory – as the firm firmly falls in the center of innovation systems literature as the unit in which the bulk of innovation takes place in the whole system – by focusing on a key micro learning initiative at the firm level. This is important to understand the various influences that can impact a firm's level of innovativeness.

E-Learning Scope

Organizations recognize E-learning as an effective means to leverage the individual's skills and expertise that accomplish organizational goals (Lytras and Pouloudi 2001). Additionally, organizations generally concur the eclectic “e” is mainly associated with electronic means to deliver learning opportunities to their employees (Hamid 2002, Honey 2001). However, studies show that E-learning is enabled not only by the electronic medium / technology driven approaches but also other “soft” factors. For example, Hamid (2002) lists out the essential elements for effective Elearning with user acceptance towards content presentation, information architecture, interface design and deployment of learning styles. Johnson (2001) exemplifies interpersonal interaction and collaboration as the success factors that enable individuals to learn through web based communication and virtual communities. Lytras and Pouloudi (2001) allege that E-learning in higher education is more than just a learning platform using computer technology, it is a functionality of teachers, students, learning processes and technology adoption propensity.) Therefore, an examination of E-learning should not be restricted to technology driven or electronic mediated applications.

Knowledge Management Scope

KM is contemplated as a systemic and organizational process for acquiring, storing, and communicating knowledge resources to create new capabilities for superior performance and innovation (Alavi and Leidner 1999, Grover and Davenport 2001). Contemporary surveys show that improved learning with better customer handling and decision making is a result of effective KM programs (KPMG 2000, Ruggles 1998). In particular, studies pertinent to KM best practices or prescriptive frameworks which suggest that knowledge types / taxonomy (e.g., Allee 1997, Holsapple and Joshi 1999), knowers types (e.g. Markus 2001, Pan and Scarbrough 1999) and knowledge creation processes (Nonaka and Takeuchi 1995) are crucial elements to enlarge and reconfigure knowledge repositories through justification, learning and reflection. These three elements will be discussed in the following sections.

Knowledge Management with Eclectic "E" Learning

Knowledge Types and Learning

Knowledge is discerned and widely adopted with the tacit-explicit taxonomy advocated by Polanyi (1967). The taxonomy is a multi-faceted concept and denotes knowledge as a spectrum with a fluid mixture of ideas, experience, skills and states of mind that exist inside and outside of humans (Alavi and Leidner 1999, Allee 1997, Leonard and Sensiper 1998). On one end of the spectrum, knowledge is tacit and ingrained in the human mindset e.g. personal beliefs, judgment or applied subconsciously and embodied in actions e.g. experience and skills. On the other end of the spectrum, knowledge is explicit and codified in structured and transmittable forms that can be comprehended by others e.g. words, numbers or manuals.

The three forms of knowledge, adapt and put forth the notion of tacit-explicit taxonomy suggests knowledge dynamism (Figure 1) instigated from *self-transcending knowledge* such as intuition and fragmentary memory emerge in tacit form; and externalize in explicit form through human inquiry process with justification and reflection (Scharmers 2001). Organizational learning takes place with the evolution of knowledge as individuals alert their sticky knowledge, associate among fragmentary memories, form intuitive ideas, embody in action, reflect in reality and comprehend in externalized forms. Putting knowledge types in E-learning context, "E" can mean *Exploration* that provoke extensive search of unrealized knowledge and new thoughts.

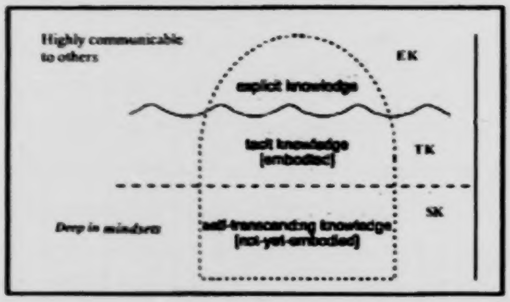

Highly communicable to others
EK
explicit knowledge
tacit knowledge [embodied]
TK
SK
Deep in mindsets
self-transcending knowledge [not-yet-embodied]

Figure 1. Three Forms of Knowledge (Source: Scharmer 2001)

Knowers Types and Learning

Knowers (or knowledge workers) are regarded as key agents who see, use, transfer and interpret knowledge, which contribute to organizational memory and creation (Davenport et al.1998, Huang et al. 2000). Knowers are alleged to demonstrate various roles in knowledge requirements, reuse applications and transfer

BEST COPY AVAILABLE

impediments that influence their learning with knowledge absorption and combination (Markus 2001, Szulanski 1996). In particular, creative problem solving is a subtle basis that influence an individual's learning inclinations and cognitive thinking in response to knowledge resources (Puccio 1999).

The creative problem solving preferences exemplify four possible styles, namely the *clarifier* who defines problems in depth; the *ideator* who stretches possible alternatives; the *developer* who puts workable solutions together; and the *implementer* who acts upon solution for realization. Organizational learning crops up during problem solving processes. Creative problem solvers who are influenced by their prevailing preferences interact with other creative problem solvers such that their knowledge and mental thoughts are amplified, compared, shared and exchanged in collective stances. Relating knower types with Elearning, "E" can be perceived as *Ego* and is the entity that provokes continual development of creativity and innovativeness.

Knowledge Creation and Learning

Knowledge creation is contented as a crucial KM endeavor to drive value-added processes where individuals deploy knowledge stored in their minds, share it within communities, produce it by discovery in new paradigms and embedded in organizational products or services (Ezingeard et al. 2000, Holsapple and Joshi 2000, McDermott 1999). Four interrelated processes – socialization, externalization, combination and internalization (Nonaka and Takeuchi 1995) – which encapsulate tacit-explicit knowledge conversion are adapted to portray learning across knowledge-creating individuals (Figure 2).

Socialization includes sharing and exchanging tacit knowledge among individuals. Typical methods of sharing are experience dissemination through apprenticeship, observation and imitation. *Externalization* involves articulating and conceptualization of tacit knowledge into an explicit form. Typical activities are induction or deduction of thoughts from dialogue, metaphors and analogies. *Combination* concentrates systemizing different bodies of explicit knowledge through sorting, adding, filtering, and combining to reconfigure the knowledge repository, e.g. integrating documents for a shared database. *Internalization* entails embodying explicit knowledge into tacit knowledge through learning and action. A typical activity is 'experimenting acquired knowledge in new problems Organizational learning results from each conversion mode where individuals engage in interpersonal interaction to acquire, elicit, combine, disseminate and implant new knowledge with their knowledge repositories. E-learning with knowledge creation can construe "E" as *Eternity* that underpins learning is undertaken at any time, in any place and by any person.

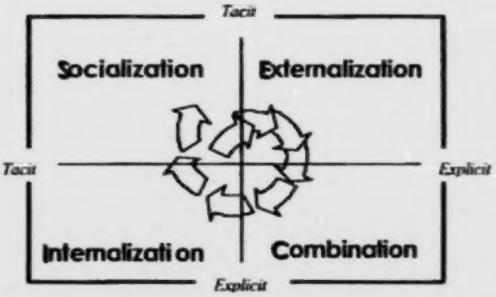


Figure 2. Four Modes of Knowledge Creation (Source: Nonaka and Takeuchi 1995)

Future Work

Based on the previous discussion, the eclectic "E" of learning is portrayed in Figure 3, which presents E-learning from a KM perspective. The discussion of Elearning from a knowledge management perspective, entailing Exploration, Ego and Eternity, is more a conceptual allegation to extend the consideration factors of E-learning than a pure technological undertaking. It is expected that future empirical work will focus on gaining a better understanding with learning endeavors to be influenced by knowledge types, knowers types and knowledge creation processes, together with the technology moderating effect in holism. This empirical work will enable light to be shed specifically on how inter-organizational alliances can be achieved so as to better a society's innovation system, and also how individual firms may adopt a variety of learning endeavors to improve the innovation system as a whole. As firms lie at the heart of any innovation system, efforts to understand learning endeavors related to institutionalizing innovative activity in a firm would be of value towards understanding any innovation system in its entirety.

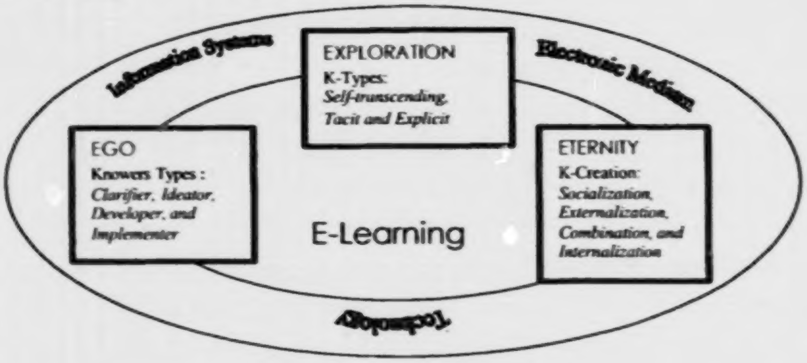


Figure 3. E-Learning from Knowledge Management Perspective

References

Alavi, M., & Leidner, D. E. (2001). Review: Knowledge Management and Knowledge Management Systems: Conceptual Foundations and Research Issues. *MIS Quarterly*, 25 (1), 107-136.

Allee, V. (1997). *The Knowledge Evolution: Expanding Organizational Intelligence*. Boston: Butterworth-Heinemann.

Burd, S. D., & Dejnaronk, A. (2000). Web-Based Learning and Training. *Proceedings of the Americas Conference on Information Systems 2000*, Long Beach, California. 2033-2039.

Ezingeard, J. N., Liegh, S., & Chandler-Wilde, R. (2000). Knowledge Management at Ernst & Young UK: Getting Value Through Knowledge Flows. *Proceedings of the International Conference on Information Systems 2000*, Brisbane, Australia. 807-822.

Hamid, A. A. (2002). e-Learning: Is it the"e" or the Learning that Matters? *The Intern et and Higher Education*, 4 (3/4), 311-316.

Johnson, C. M. (2002). A Survey of Current Research on Online Communities of Practice. *The Internet and Higher Education*, 4 (1), 45-60.

Kogut, B., & Zander, U. (1992). Knowledge of the Firm, Combinative Capabilities and the Replication of Technology. *Organization Science*, 3 (3), 383-397

KPMG Consulting, *Knowledge Management Research Report 2000* (pp. 1-24).

Lytras, M. D. & Pouloudi, A. (2001). E-Learning: Just a Waste of Time. *Proceedings of the Americas Conference on Information Systems 2001*, Boston, Massachusetts. 216-222.

Markus, M. L. (2001). Toward a Theory of Knowledge Reuse: Types of Knowledge Reuse Situations and Factors in Reuse Success. *Journal of Management Information Systems*, 18 (1), 53-97.

Nonaka, I., & Takeuchi H. (1995). *The Knowledge-Creating Company, How Japanese Companies Create the Dynamics of Innovation*. New York: Oxford University Press.

Polanyi, M. (1966). *The Tacit Dimension*. London: Routledge.

Puccio, G. J. (1999). Creative Problem Solving Preferences: Their Identification and Implications. *Individual Approaches to Creative Problem Solving*, 8 (3), 171-178.

Scharmer, C. O. (2001). Self-transcending Knowledge: Sensing in and Organizing around Emerging Opportunities. *Journal of Knowledge Management*, 5 (2), 137-150.

Von Krogh, G., Ichijo, K., & Nonaka, I. (2000). From Managing to Enabling Knowledge-*Enabling Knowledge Creation: How to Unlock the Mystery of Tacit Knowledge and Release the Power of Innovation*. New York: Oxford University Press.

Winfield, I. J., & Kerrin, M. (1994). Catalyst for Organizational Learning. *The Learning Organization*, 1 (3), 4-9.

Full references are available upon request.

BEST COPY AVAILABLE

An exploration of virtual community in Macau

Abstract

With the help of available technology, more channels are created to form a learning community. Although technology provides convenience to communicate, little is known about the actual utilization of it in educational settings by stakeholders such as teachers and students. This paper reports on the case of virtual learning community for teachers and students in Macau based on the observation of dialogue in online forum and the surfing of web pages. It shows that focused learning community has not been established and participation rate is still low.

Introduction

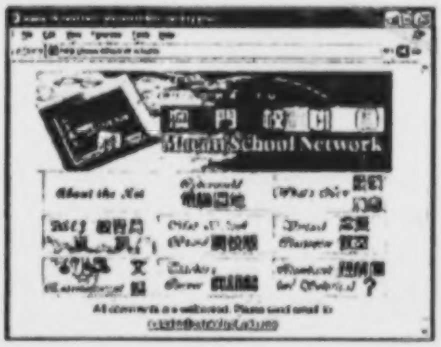
With the advent of Internet and related technology, various forms of communication platform such as discussion groups, ICQ, mailing lists, real-time interactive conferencing etc., in addition to traditional ones, are available for people to exchange their opinions and ideas. The more obvious advantages of these new ways of exchange channels for teachers are time and place flexibility. One can distribute an idea to others and gets a response in seconds at any location with Internet connection. However, it cannot be as direct as the face-to-face contact. It is even argued that the Internet allows each user an equal voice, or at least an equal right to speak (Foster, 1996). Communication barriers are reduced for people working at different levels within organizations (Sproull & Kiesler, 1996). This leads to the creation of new forms of social interactions and relations. According to Rheingold, virtual communities are defined as "the social aggregations that emerge from the Net when enough people carry on those public discussions long enough, with sufficient human feeling, to form webs of personal relationships in cyberspace" (Rheingold, 1993, p. 5).

Virtual communities arise in both asynchronous and synchronous mode. For asynchronous community such as email lists and bulletins, participants can post messages to all other subscribers to the group that can then be responded to over a period of time. This will usually lead to the emergence of threads, or discussion topics, where a number of contributors will provide comments which support or disagree to an original posting, thus forming a dialogue of interaction. For synchronous mode, the only difference is that participants must be present in discussion. This takes place in chat room of multi user domain.

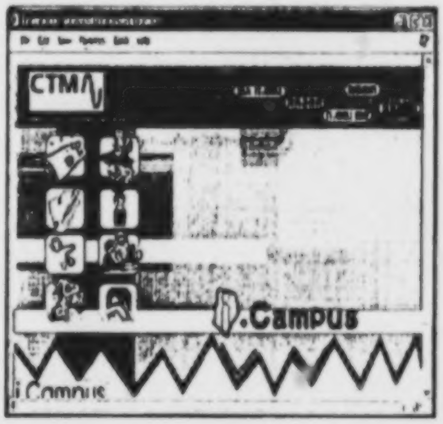
The author wants to know if there is any leaning community which focused on teaching and learning issues formed with the establishment of online environments such as web pages and discussion forum. Besides, can online environment widen the participation of teachers and students? The study will try to answer these questions by visiting web sites and discussion forum in Macau.

Overview of educational web sites in Macau

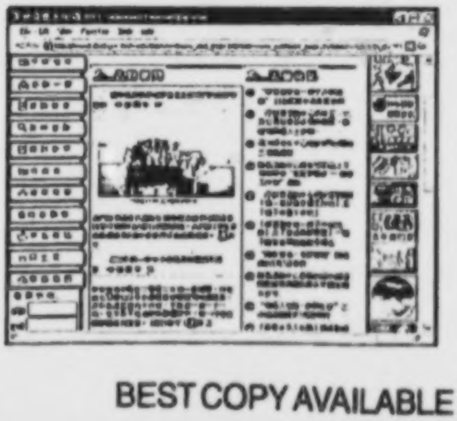
As information and communications technology (ICT) becomes more commonplace in educational settings the use of computer mediated communication between teachers is increasingly being seen as a valid form of professional dialogue and support. Macau government and other educational organizations recognize the application of ICT to promote online educational resources as virtual meeting places for teachers and students. The number of web sites in Macau is increasing each year either for public or internal use. However, most web sites for public use are for enquiry purpose. Online resources especially prepared for teachers and students are still very limited in Macau. The three major web sites are Macau School Network , i.Campus and web site of Education and Youth Affair Department . A brief description of each web site is given as follows:



Macau School Network (http://www.schoolnet.edu.mo) was first established in 1997 by a group of IT professionals and educators with sponsor from local organizations. Its goal is to form a local network for sharing resources. There are 9 sections in this web site including schools in Macau, virtual classroom, item banks and teacher's corner where teachers are encouraged to send their articles or workto the editorial board before presentingto the public.



i.Campus was a project held by a commercial company in 1999. Its aim is to promote the ICT in education. Schools are invited to join the project by having free basic equipments, Internet service and technical support. Many schools in Macau join the project as well. A web site (http://i.campus.ctm.net) for this project was launched as well. Its aim is to serve as resources center for teachers and students to use There are various sections in this web site and the most special one is a discussion forum. It allows teachers to share issues and good practice from one another



The official web site of Education and Youth Affair Department is http://ww.dsej.gov.mo It contains diversified information regarding education such as news, educational laws, educational activities, school and student statistic.

BEST COPY AVAILABLE

The three web sites described have their own features. Macau School Network web site is a place where teachers can obtain relevant academic articles and courseware At i.Campus web site, teachers can discuss with their peers and students on various topics on teaching and learning while they obtain official information about schools in Macau from the government web site. Despite the difference in the above web sites, the ultimate aim of these sites is to provide a platform for teachers, students and parents to form a virtual learning community.

Study and Finding

In order to gain a picture of virtual community for teaching and learning in Macau setting, the author collected data by visiting the web pages and participated in discussion forum mentioned in the above web sites periodically for half a year. Data was analyzed by reading the content of the topics in discussion forum dated, the number of threads posted, the number of active participants etc.

From the posting content in the discussion forum at i.Campus web site, it can be found that most participants are students with little teachers. The topic discussed is rarely concerned with learning let alone teaching. The environment becomes a place for students to express their feeling but not for discussions of lessons. The number of active participants is about ten. The level of usage is low as compared to the size of postings in general discussion forum (Burkhalter, 1999). The teacher's corner in Macau School Network web site is a place where teachers are encouraged to present their ideas. However, the number of papers available remains unchanged as compared to that at the launch of this web site. One positive fact about the usage of these educational resources is the reading rate by examining the counter provided in the web site.

The actual justification to the above situation needs an in-depth exploration by questionnaire and interview. The barriers of virtual community mentioned in Selwyn, 1999 provide a good reference to reason the above situation. There is no doubt that ICT will continue to provide significance to the learning community yet the more effort should be made to provide the community a sense of belonging and development so as to increase the coherence of the community.

Conclusion

This study shows that the atmosphere of sharing information or problems relating to teaching and learning is still quite low. A learning community, which fosters dialogue and collaboration, has not been formed yet. Sustaining virtual community is even harder. As data is collected by visiting web pages and joining the discussion, it is an indicator only. An in-depth study on the perceptions of teachers and students about web-based educational resources should be studied in future.

Reference

Burkhalter, B. (1999). Reading race online: Discovering racial identity in usenet discussions. In M. A. Smith & P. Kollock (Eds.), Communities in cyberspace. London: Routledge.

Foster, D. (1996). Community and identity in the electronic village. In D. Porter (Ed.), Internet culture. London: Routledge.

Rheingold, H. (1993). The virtual community: Homesteading on the electronic frontier. Reading, MA: Addison Wesley.

Selwyn, Neil.(1999) Can technology really widen participation? Adults Learning, Feb99, Vol. 10 Issue 6, p27

Sproull, L., & Kiesler, S. (1996). Increasing personal connections. In R. Kling (Ed.), Computerisation and controversy: Value conflicts and social choices. New York: Academic Press.

Learning Systems Modeling with PDA,
a Case Study

Tom S. Chan, Southern New Hampshire University

We are living in a digital age that revolutionizes the way we learn and teach. The digital world has brought forth the portable technology. Portability has a great advantage over static technology as it enables knowledge to be taken anywhere. Classrooms tend to be more interactive and collaborative. Students become more confident, creative and expressive learners. Teachers are re-energized. Work quality and quantity increases as does school attendance. Pedagogical practices also become more learner-centered (Albion, 1999).

The numbers of school where laptops are adapted in classroom are steady on the rise. For example, Massachusetts could become the first education authority in the United States to require university students to provide their own laptop computer (Olsen, 2001). Laptops imply the shift of the traditional computer lab expense to a parent-student responsibility. A laptop can be expected to cost at about 30% more than an equivalent desktop computer, and the entry-level laptop is at about $1000. Financing a laptop program is therefore, a major obstacle to its adaptation.

Released in 1996, Personal Digital Assistants (PDA) are full computers, but tiny enough to be held in the hand. Most models are approximately 3 by 4.5 by 3/4 inches. Instead of a keyboard, there's an area where a special kind of handwriting, "Graffiti," is used. In addition to this, there are four "soft" buttons for "Home," "Menu," "Calc," and "Search." Lastly, there are physical buttons for "Calendar," "Phone List," "Lists," and "Memos," plus scrolling and power buttons. Palm Organizers now enjoy the dominant position with almost 80% of the market. There are a wide range of Palms, each targeted for a slightly different audience, the cheapest and thus the most popular with 8 megabytes of RAM, can be found for about $150 (emTech, 2001).

As educational tools, PDAs are used mainly to read, write, collect, share and exchange information. However, computing requirements in the Information Technology curriculum goes beyond these general functionalities. Apart from being productivity and collaboration tools, computers are used for both systems analysis and design, and as platform for software and database systems construction (ACM, 1997). Recently, there are experimental uses of PDA as platform for database (Avanzato, Warms & Drobish, 2001) and software (Battig, 2002) systems. In this study, we are interested in the feasibility of PDA as systems modeling tools. Participants for the study are students in "Object-Oriented Systems Analysis & Design" class. This is a three-semester credits course taken during the junior year of a traditional undergraduate IT program. A significant component of the course is a term project that requires students to work collaboratively in groups to analyze and define requirements, specify design, implement, test and demonstrate a video rental system prototype; seeing the project through typical phases of a software lifecycle collaboratively as a team.

The heart of object-oriented analysis and design is the construction of a system model. A model is an abstraction of reality, constructed to understand details of the underlying problem domain. Most modeling techniques involve graphical languages or notations. Several modeling tools are wrapped under the heading of UML (Unified Modeling Language). UML is a general-purpose modeling language for specifying, visualizing, constructing and documenting the artifacts of software systems, as well as for business modeling. Models make it easier to express and communicate complex ideas. For example, an architect builds a model to communicate ideas more easily to his or her clients. During this course, the analysis and design phases require the use of Microsoft VISIO 2002, and the implementation and demonstration phases require the use of the Microsoft ACCESS 2000.

This study is currently in planning stage. Funding has been obtained for a dozen of Palm m105. Data for the study will be collected and analyzed in the fall of 2002. The course typically has an enrollment of 20 students working in four to five groups of three to four students per group. Approximately half of the randomly selected groups will be provided with PDAs. Group members are required to analyze and design their project using PDAs. In addition, they are required to complete the formal specification with UML drawings using VISIO and implement a demonstration prototype using ACCESS. All students are required to keep a weekly journal documenting their group efforts. At the end of term, a questionnaire will be collected to survey students' level of collaboration and motivation. Naturally, the quality of project prototypes will also be compared and examined.

Systems Analysis and Design (SAD) is an established area of teaching in the IT curriculum. Compared with teaching other fields, e.g., programming, SAD is notably more difficult. Creating software models is a task that requires certain level of experience. One requires not only technical skills, but also a lot of knowledge that goes beyond the technical boundaries. Practices gain such knowledge by gaining hands-on experience while dealing with problems in systems development, by interacting with users, managers and developers, and by sharing experience with others. Traditionally, SAD is taught by means of lectures, laboratory and tutorials. In lectures, instructor communicates substantial amount of information in a short time by presenting slides and explaining materials while students listen and take notes. In laboratory, students put their knowledge and skills to practice, by using CASE tools such as VISIO to model solutions to problems introduced during lectures. Outside scheduled classes, instructor also provides additional help to students experiencing difficulties.

Unfortunately, the traditional approach is quite passive and ineffective. During lectures, students listen and make very limited contribution to the discussion of presented materials. During laboratory session, students create models of more or less complicated systems given to them as assignments. There is little interaction between students and the instructor. The instructor can often only comment the effects of students' work, but not the way, which lead to the solution. Furthermore, typical computer labs with desktops are designed for lecture not conference. The rigidity physical structure impedes information sharing not only between students and instructor, and also amongst students. We often find students are not collaborated sufficiently. Instead of working on various modeling tasks together as a team, students often partition the modeling tasks to individual team member, resulting often in incoherent and disjointed system designs of inferior quality.

We need ways of involving the students into active participation in the modeling process. During such active sessions, the instructor could offer his or her guidance in applying specific modeling techniques. Students can also work and learn together as a team. Because of the portable nature of the technology, PDA should enhance active learning allowing students to engage in hands-on activity even in a lecture setting. The PDA device with an infrared beaming capability also allows students and instructor to electronically exchange software applications and data in any setting. Naturally, not all instructors will want to use their classroom as a lab, nor need they do so. A full range of teaching methods is needed in the university, and not all classes are appropriate for computer integration. In the discipline of engineering, it traditionally places great premiums on learn by doing. While PDA is convenient, the current technology cannot support specialized simulation and modeling software such as VISIO, and we are unsure of students' attitude and reaction to PDA's current graphic usability in systems modeling. Furthermore, students will have the added burden of eventually transcribing their design into formal UML drawings using VISIO.

Technology is affecting education in revolutionary ways, and the momentum toward these changes is irreversible. Universities need to become leaders in applying technology to education for learning and for collaboration. Colleges of education need to become leaders in applying computational and information technology for the K-12 community, and university administrators need to begin to chart the 21st century vision of their institutions, a journey that will include information technology and collaborative learning and teaching. Computer is important in education both for providing an employment skill and for benefiting directly the quality of instruction. The greatest single disadvantage of laptops is probably its cost as portability attracts a premium in pricing. Programs, whether mandatory or voluntary, require funding by parent and may subject families to considerable financial pressure, either increase burden of debt or deter poorer students from entering higher education (BBC, 2001). PDA as an alternative to laptop in education does warrant serious examination for it is mutually beneficial to the academic and business communities. It can provide an affordable tool for teaching and learning, and enabling the manufactures to design a user-friendly PDA interface.

Reference:

ACM, AIS & AITP (1997) IS'97 Model Curriculum and Guidelines for Undergraduate Degree Programs in Information Systems.

Albion, Peter (1999) Laptop Orthodoxy: Is Portable Computing the Answer for Education? Australian Educational Computing 14(1), pp 5-9

Avanzato, R. & Warms, T. (2001) Handheld Computers in an Information Sciences and Technology Program, Syllabus Fall 2001 Conference, Boston, MA

Battig, Micheal (2002) Utilizing the PDA as a Vehicle for User Interface Design Pedagogy, EdMedia 2002 Conference, Denver, CO

BBC NEWS (Feb, 2001) Students protest at compulsory laptops URL: news.bbc.co.uk/hi/English/education/

emTech (2001) Emerging Technologies Resources. URL: http://www.emtech.net/laptops.htm#Palms

Olsen, Florence (2001) Laptop Proposal Stalls in Massachusetts, Chronicle of Higher Education

Using e-learning to scaffold reflection and to support collaborative learning: A case study

Christina C. Chao
Penn State University
cchao@comcast.net

Abstract: This paper is a report on the preliminary findings of a study conducted on a graduate level student-teaching course in a large research university in the United States. Both quantitative and qualitative data analysis techniques were used to examine the resulting transcript of texts for evidence of reflection and collaborative learning within a community of learners in an e-learning environment.

Objective

The objectives of the presentations are as follows:

1) to share presenter's experience of developing a support system using e-learning approach to foster students' collaborative learning during their practice teaching experiences.
2) to share the results of the study on students' reactions of participating in computer-mediated communication in an e-learning environment.
3) to contribute the filed of online education through presenting the result of an empirical study.

Introduction

Learning is a social collaborative activity, and it occurs most effectively in context (Vygotsky, 1962). Student teachers often encounter a feeling of isolation and stress during their teaching practicum experience (D'Rozario & Wong, 1996). They were isolated from their peers and stationed in unfamiliar surroundings and had no opportunities to learn together and share their experiences. The social isolation can complicate the learning process for student teachers and thus hinder their professional development. The e-learning technologies – Internet and computer network hold great promise for extending opportunities for interaction, expression, inquiry, reflective thinking, information access, and collaboration among student teachers and thus reduce the sense of teacher isolation and also fostering learning (Reilly, 1992). E-learning environments can offer student teachers a social and learning context through which they can exchange electronic communications with each other and share their student teaching experiences.

The Study

This is a work-in-progress project. The purpose of the study is twofold. First, it examines the immediate benefits of using computer-mediated communication in e-learning by a group of elementary student teachers during their practicum experiences. Second, it examines the relationship between the goals of this computer network and the kinds of messages that student teachers exchanged. The student teachers received Internet training to perform their computer-mediated communication tasks successfully before student teaching began. They volunteered to participate in this study and they were not given requirements, and were not evaluated. The researcher was a participant-observer in the study and served the roles of network coordinator and mentor. Both quantitative and qualitative data, including student teachers' messages (mailing list postings), survey and interview data, are being collected and analyzed.

Findings

Data are being analyzed by the investigator and more detailed preliminary findings on these issues will be provided later when time comes to submit proceedings.

Conclusions

This session will benefit professionals in other application settings in the following way: The results of the study can be used to help educators who would like to use the e-learning approach to develop a support system for higher education student in general and for student teachers in teacher education programs in particular. Conclusions of the study will be provided in details later when time comes to submit proceedings.

BEST COPY AVAILABLE

Measuring the Digital Divide: Liberal Arts Students' IT Skills

Tracy Chao
Faculty of Arts Technologies for Learning Centre
University of Alberta
Canada
tracy.chao@ualberta.ca

Abstract: This paper reports the results from a survey on undergraduate students' information technology (IT) skill competency. The study is part of a project which is centred on the issue of the digital divide between liberal arts and non-arts students, and how that difference affects students' employability. The findings suggest that arts students are indeed behind non-arts students in terms of their IT skills and aptitude, but not uniformly or extremely. Arts students highly value IT skills and consider them important for their career. The survey results also show that arts students are as confident as others in mastering new IT skills and that formal IT training in the undergraduate curriculum is wanted.

Introduction

There is a widely held view that graduates in liberal arts are at a disadvantage upon first entering the workforce: one of the reasons being that they lack noticeable employability skills. Nowadays, Information Technology (IT) skill is becoming one of the pivotal employability skills in the workplace and liberal arts sudents seem to be the laggard when it comes to IT. The perception of an "IT skill deficiency" was documented in the Canadian National Graduates Survey "Education-Job Skills Match" (Krahn & Bowlby, 2000). The survey indicated that liberal arts graduates acquire strong writing and communication skills through their university education, but were deficient in "new technology" skills and felt their studies had not contributed very much in providing them with these critical IT skills. This viewpoint and sentiment was echoed by Robert Martin and Samuel Fee, who argued that IT skills could increase the employability and competitiveness of liberal arts students (Martin & Fee, 2002).

To further understand the issue of IT skill deficiency, Faculty of Arts at the University of Alberta conducted a survey between March and April 2002, targeted at undergraduate students' IT competencies and their attitudes toward developing IT skills during the course of their academic studies. This survey is one of the needs assessment components of a two-year project entitled "Providing a Technology Edge for Liberal Arts Students". It uses the "digital divide" as a frame of reference to contrast the discrepancies of IT skills and attitudes that may exist between arts and non-arts students. The results will form the basis for the endeavours in the development and implementation phases throughout the project.

Employability and IT skills

Many authors have written about the value of liberal arts education in the technology age and the necessity of information literacy as an integral part of liberal arts training (Breivik & Jones, 1993; Lyman, 1996; Lyman, 2001; Shapiro & Huges, 1996; Herman, 2000; Conroy, 2001). The vision of liberal arts graduates thriving in the knowledge-based economy was articulated by economist Robert Allen. He argued that liberal arts graduates have the intellectual and interpersonal abilities to cope with organizational changes and to solve problems in the rapidly changing environment brought by the revolution of information technology. Contrary to the conventional belief that an arts degree does not lead to a good job, there is evidence showing that liberal arts students do perform well in the long run (Allen, 1999). Therefore, the discussion around arts students' employability should steer away from "whether or not" arts students are employable and focus more on "what" makes them more employable.

The Technology Edge survey attempted to tackle the "what" issues along the axis of information technology competency. Several studies have made similar attempts to assess arts students' IT skills and to incorporate IT into undergraduate curriculum. Students were found to be equipped with basic skills such as word-processing, Internet, and e-mail, yet lacked the conceptual knowledge of computers and technology (McEuen, 2001). Their attitudes were generally positive and they felt confident in learning technology skills (McEuen, 2001). However, most students claimed that they do not learn IT skills through their academic studies. They learn by trial and error, and rely mostly on peer support, especially those who consider themselves computer shy (McEuen, 2001; Davis, 1999; Selwyn, 1997).

Being early adopters of IT, libraries in many colleges and universities are often involved in surveying students' IT skills and become the driving force for integrating information literacy into curriculum (Snavely & Cooper, 1997; Hepworth, 1999). Libraries' definition of information literacy is usually very broad, including practical computer skills as well as higher order abilities to think critically, to solve problems and to achieve life-long learning. Their instructional approaches range from one-time workshops to substantial on-going support (Spitzer, Eisenber, & Loew, 1998), and/or academic courses. (Urban-Lurain, 2001). However, the challenge remains in the discipline-specific integration: how to make IT relevant to the study of literature, history, drama or political science, for example.

There is little doubt that IT skills will enhance arts students' employability (Jeffcote, 1997) as IT permeates more and more into the workplace and changes the way people and organizations think and interact. Our survey builds upon the current knowledge about arts students' IT skills and attitudes, and deepens our understanding of the nature and detail of the skill sets and attitudes they possess. First of all, a comparison between arts and non-arts students is needed to determine if a digital divide exists - if so, in what shapes and forms. Secondly, how well prepared for work are arts students with regards to IT skills? Thirdly, are there differences among various arts discipline so the IT training can be tailored to be discipline relevant? Last but not least, what are the best ways to cultivate arts students IT skills during their undergraduate academic years?

Survey Methodology

Fourth year students at the University of Alberta were randomly selected to participate in the study via telephone: 408 arts students and 196 non-arts students completed it. Arts students were sampled at approximately 1:3 ratio, while non-arts students were sampled at about 1: 20 ratio. This stratified sampling allowed us to examine the differences in various arts disciplines in detail, yet have sufficient sample size to form a comparison

BEST COPY AVAILABLE

base. The arts population came from humanities, social sciences and fine arts, which are the disciplinary divisions at the University of Alberta. Non-arts students were defined as those in technology -oriented programs such as science, agriculture, engineering, or professional programs such as education, physical education and business.

Questions in the survey were designed to measure skills (an inventory of the actual skills), attitudes toward IT, and preferred ways of acquiring those IT skills. Skill inventory were further broken down into twelve categories (Table 1). Each category contained 3 to 7 questions, ranging from basic skills to more advanced, sophisticated skills pertaining to that category. For example, if students said they knew how to send and receive e-mail, they were then asked if they knew how to use an electronic address book, attach a file, and configure an e-mail program, etc. The "yes" and "no" answers to these probing questions were then coded into scores at the scale from 0 to 1 (0 being not at all competent and 1 being very competent) to reflect the skill level in that particular category.

In addition, there were three open-ended, scenario -based questions to assess students' use of IT in higher-level activities such as evaluation, teamwork and decision-making. Attitudinal measures included students' perception of the importance of the skill to their career (again recoded to the scale of 0 to 1, 0 being very negative and 1 being very positive), their IT learning experience, and their self-efficacy for skill improvement. They were also asked to identify ways and resources for them to acquire IT skills.

Survey Results

The results indicated that arts students have sufficient skills in communicating electronically, using word-processing and Internet. Their skill levels were lower on the data-related applications such as bibliographic program, spreadsheet, database and statistical program. Novel skills such as web design and conceptual understanding of how computers work seemed lacking in both populations, but the arts population was significantly lower on these skills compared to non-arts population. Overall, statistical significances were found in eight of the twelve categories between the two populations. (Table 1)

Skill categories	Arts (n=408)	Non-Arts (n=196)	X^2 P<
Basic computer tasks	S= .75	S= .85	.004
	A= .95	A= .97	n.s.
E-communication	S= .80	S= .76	n.s.
	A= .93	A= .96	n.s.
Word Processing	S= .90	S= .97	.002
	A= .98	A= .97	n.s.
Bibliographic program	S= .17	S= .19	n.s.
	A= .54	A= .43	.001
Spreadsheet program	S= .40	S= .66	.001
	A= .67	A= .88	.001
Database program	S= .56	S= .64	.042
	A= .62	A= .71	.049
Statistical program	S= .42	S= .46	n.s.
	A= .59	A= .68	.028
Presentation program	S= .67	S= .87	.001
	A= .87	A= .90	n.s.
Graphic or illustration programs	S= .38	S= .58	.001
	A= .60	A= .63	n.s.
Internet	S= .88	S= .91	n.s.
	A= .94	A= .94	n.s.
Web site creation	S= .28	S= .54	.001
	A= .31	A= .20	.002
Conceptual understanding of how computers work	S= .28	S= .37	.028
	A= .62	A= .66	n.s.

Table 1: Summary of students' IT skill and attitude by Faculty (s=skill, a=attitude, df=1, significant at the 0.05 level)

Arts and non-arts populations did not exhibit much difference when responding to the scenario questions, although arts students seemed to be more resourceful, using a mix of IT and non-IT approaches. It was obvious that the Internet (or the WWW) has become a dominant channel for seeking information. E-mail was the only IT tool students used frequently for team collaboration although majority of students still relied on face-to-face meetings since they were on campus. Discussion boards and other communication technology were not commonly used for such purpose. E-mail and other first-hand experiences (e.g. seeking advice from others, personal visits) were common when the task involves personal decision-making. Searching on the Web becomes secondary or only used as an initial entry point to find contact information.

Overall, arts students valued IT skills and thought they were important for their career. The generic skills categories, i.e. basic computer tasks, e-communication, word-processing and internet, came higher on the list, while more specialized skills categories, i.e. bibliographic program, spreadsheet, database, statistical program, graphic program and web creation were perceived to be less important. Of these specialized skill sets, interestingly, most of them exhibited statistical significance on the attitudinal measures between arts and non-arts populations. (Table 1)

Table 2 summarizes students' aptitude towards IT. Arts students scored significantly lower on all measures except self-efficacy and IT for advancing one's career.

	Arts (n=407)	Non-Arts (n=196)	X^2 P<
Enjoy working with computers	.89	.96	.007

BEST COPY AVAILABLE

Feel comfortable talking about computers	.77	.88	.001
Learn new computer skills easily	.91	.96	.022
Feel confident to master IT skills	.96	.97	n.s.
IT skills are useful in advancing one's career	.94	.98	n.s.

Table 2: Students' aptitude towards IT by Faculty (df=1, significant at .05 level)

When questions about current methods of acquiring IT skills, arts students and non-arts students did not demonstrate much difference in their responses. The difference, however, lay in the "current methods" and "preferred methods" of acquiring IT skills. A majority of students said they currently learned IT by asking people informally or on their own. Their preferred methods were courses or work experience that would allow them to acquire the skills.

75% of arts students felt that the academic program did not provide IT skills they need for workplace: significantly higher than the 51% of non-arts students who expressed that view. In terms of the preparedness for work, 63% of arts student thought that they have sufficient IT skills entering the workplace; while 83% of non-arts students felt that way. Over 90% of arts students thought IT should be part of the academic curriculum.

We also compared three disciplines within the arts population. Not surprisingly, students were equally competent in generic skill categories. Social science students demonstrated significantly higher competency in the data-related programs and fine arts students were stronger in the graphic program. On the attitudinal measures, we found discrepancies in many categories. For example, for computer basic tasks, social science students and fine arts students showed mush more positive attitude than the humanities students. Similar pattern can be found in word-processing, bibliographic program, database, and web site creation (with different groups having the positive attitude). For data-related programs, both skill level and attitude had statistical significance. (Table 3)

Skill categories	Fine Arts (n=51)	Humanities (n=85)	Social Sci (n=271)	F P≤
Basic computer tasks	S= .86	S= .73	S= .73	n.s.
	A= .96	A= .89	A= .97	.014
E-communication	S=.75	S=.78	S=.82	n.s.
	A= .94	A= .88	A= .95	n.s.
Word Processing	S=.94	S=.87	S= .90	n.s.
	A= .98	A= .93	A= .99	.008
Bibliographic program	S= .20	S= .21	S= .18	n.s.
	A= .35	A= .60	A= .55	.015
Spreadsheet program	S= .18	S= .38	S= .46	.001
	A= .33	A= .59	A= .76	.001
Database program	S= .47	S= .53	S= .58	n.s.
	A= .33	A= .55	A= .70	.001
Statistical program	S= .10	S=.27	S= .52	.001
	A= .16	A= .40	A= .73	.001
Presentation program	S= .73	S= .64	S= .67	n.s.
	A= .94	A= .84	A= .87	n.s.
Graphic or illustration programs	S= .65	S= .36	S= .34	.001
	A= .78	A= .56	A= .58	.01
Internet	S= .94	S= .84	S= .89	n.s.
	A= .94	A= .93	A= .95	n.s.
Web site creation	S= .39	S= .25	S= .27	n.s.
	A= .43	A= .31	A= .30	.029
Conceptual understanding of how computers work	S= .37	S= .32	S= .25	n.s.
	A= .65	A= .58	A= .63	n.s.

Table 3: Skill and attitude comparison among three disciplines (s=skill, a=attitude, df=2, significant at .05 level)

Discussion and conclusion

The survey results drew a fairly complete picture concerning the IT skill gap between arts and non-arts students. There is no doubt that arts students were quite competent in many basic and generic IT skills. However, comparison revealed that the "digital divide" does exist: two third of the skill categories had statistical significance between the two populations. One possible explanation is that since majority of the students learned IT informally or on their own, non-arts students developed more IT skills through more exposure to IT during their studies. Our statistics further confirmed this: 58% of arts students and 68% of non-arts students reported using IT in their courses. Although we did not know how much exposure students may have outside their studies and how IT was used in those courses, we can speculate that IT in an academic environment provided students with the opportunity to learn even though they often had to resort to informal and self-directed learning. Students' preference for credited training speaks in part to the strong demand for skills development in a formal setting. However, the need for learning support in general and in close connection to academic courses is also crucial.

Arts students had significantly lower aptitude for IT, which may well stem from the assessment of their own IT competency. Nevertheless, there were some encouraging, positive results. Overall arts students thought IT is important for their career; their attitude towards each skill category was also high and always higher than their actual skill levels. That means they recognized the need for skill improvement. Most importantly, there is no difference in terms of arts and non-arts students' self-efficacy. Arts students are just as confident as non-arts students if they are to learn and master new IT skills.

The evidence supported the claim that arts students value IT skills but current academic programs did not provide sufficient training. Based on the comparison among the three disciplinary groups within arts population, we think the instructional strategies for the IT training should include:

BEST COPY AVAILABLE

(1)in-class reinforcement of generic skills that students already have: basic computer tasks, ecommunication, word-processing and Internet, (2)credited training on generic skills that students do not have but need in their career: presentation program and conceptual understanding of how computers work, (3)integration of all the generic skills into discipline-based curriculum, (4)specialized courses for discipline-specific skills: bibliographic program for humanists, statistical program for social scientists, and graphic program for artists.

This survey has confirmed that there is a digital divide between arts and non-arts students, but a simple dichotomous description would be misleading and serves no purpose in improving the educational offerings in the higher education. In fact, arts students are competent in many skill categories. The comparisons between arts and non-arts and among three arts disciplines brought more meaningful discussion to the digital divide phenomenon. It helped us not only understand the issue better but also devise well-rounded strategies to address the issue in the next phase of the Tech Edge Project.

References

Allen, R. C. (1999). Education and Technological Revolutions: The Role of the Social Sciences and the Humanities in the Knowledge Based Economy. Vancouver, B.C.

Breivik, P. S., & Jones, D. L. (1993). Information literacy: Liberal education for the information age. *Liberal Education*, 79(1), 6.

Conroy, F. (2001). In a technocratic age, study of the liberal arts is even more important. *Christian Science Monitor*, 93(163).

Davis, P. (1999). How undergraduates learn computer skills: results of a survey and focus group. *T H E Journal Online*, 26(9), 68-71.

Hepworth, M. (1999). A study of undergraduate information literacy and skills: The inclusion of information literacy and skills in the undergraduate curriculum. *65th IFLA Council and General Conference 1999*. Bangkok, Thailand.

Herman, R. E. (2000). Liberal arts the key to the future. *USA Today Magazine, 129* (26), 34-41.

Jeffcote, R. (1997). Vocational computing skills and social science students - Do they mix? Some evidence from an interdisciplinary degree programme. *Journal of Vocational Education and Training*, 49(2), 253-265.

Krahn, H., & Bowlby, J. W. (2000). *Education-job skills match: an analysis of the 1990 and 1995 National Graduates Surveys*. Hull, Quebec: Applied Research Branch, Human Resources Development Canada.

Lyman, P. (1996). Technology and computer literacy. In N. H. Farnham, & A. Yarmolinksy (Eds.), *Rethinking Liberal Education* (pp. 109-123). New York: Oxford University Press.

Lyman, P. (2001). Information literacy. *Liberal Education*, 87(1), 28-37.

Martin, R. E., & Fee, S. B. (2002). IT for the liberal arts college: A window of opportunity. *Educause Quarterly*, (1), 39-42.

McEuen, S. F. (2001). How fluent with information technology are our students? *Educause Quarterly*, (4), 8-17.

Selwyn, N. (1997). Teaching information technology to the "computer shy": A theoretical perspective on a practical problem. *Journal of Vocational Education and Training*, 49(3), 395-408.

Shapiro, J. J., & Huges, S. K. (1996). Information literacy as a liberal art: Enlightenment proposals for a new curriculum. *Educom Review*, 31(2).

Snavely, L., & Cooper, N. (1997). Competing agendas in higher education: Finding a place for information literacy. *Reference and User Services Quarterly*, 37(1), 53-62.

Spitzer, K. L., Eisenber, M. B., & Loew, C. A. (1998). *Information literacy: Essential skills for the information age*. Syracuse University: ERIC.

Urban-Lurain, M. (2001). Teaching FITness for conceptual understanding: A computer science course for non-computer science majors. *AERA 2001*.

BEST COPY AVAILABLE

Computer-Assisted Collaborative Learning in Art Education: An Experimental Study

Wei-Fan Chen
Instructional Systems
The Pennsylvania State University
United States
weifan@psu.edu

Chung-Pei Chuang
Curriculum and Instruction
The Pennsylvania State University
United States
cic3@psu.edu

Abstract: The purpose of this study is to investigate the impact of various computer-assisted collaborative learning environments on children's art education, as well as to further extend our understanding in this field, which previously received little attention. This proposed study should be initiated because it raises the level of awareness of the importance of collaboration in a computer-assisted learning process, and determines whether self-learning and varied collaborative learning are equally effective for young art learners. Also, it will explore whether there is an interaction between learners' prior knowledge and various types of computer-assisted collaborative learning environments.

Introduction

In the field of education, technology and teamwork have been playing an essential role in various types of educational practices, and expectedly will be continued to the next generations. It is becoming commonplace for children to learn new technologies in their young ages. Therefore, the issue of how children learn using technologies, more specifically, how they work together with technologies, is gaining much attention to investigate in current research agenda.

Many existing computer-assisted learning (CAL) systems are often used in a teacher's role in classrooms for students' individualized learning. However, opposing researchers claim that a learning process is not only from the interaction with the computer alone, but also from the interactions with companions, such as peers and tutors. In the past decades, psychologists and educators have long established the principle that children can have a powerful influence upon one another's intellectual development.

Since Smith and colleagues (1993) define the goal of art education as "to help children increase their capacities to create meaning and make sense of themselves and the world around them" (p.3), early childhood art educators are aware of being responsible for encouraging children to express themselves and to enjoy the world surrounding them. We all agree that art appreciation is essentially of an individual experience; however, the origin and the process of appreciation cannot exist outside of a social context. Based on this assumption, combining technological learning environments can offer great potential for the enhancement of collaborative aspects of children in art education (Milekic, 2000).

Therefore, the aim of this study is to investigate the effect of prior knowledge and teamwork process on individual learning achievements of art appreciation for third grade students, as well as to further extend our understanding in this field, which previously received little attention.

Research Questions

Research questions in the study include: (1) Does computer-assisted collaborative learning (CACL) benefit students' learning in art appreciation? (2) Are CACL with open discussion and problem-based discussion significantly effective in facilitating third graders' achievement in learning art appreciation? (3) Are different levels of students' prior knowledge equally effective in students' leaning achievements when they use CACL?

Literature Review

Collaborative Learning

Collaboration is an essential part of human social life. Moreover, in the classroom, collaboration is both skill necessary for the accomplishment of learning activities and a general norm to be learned. Since 1970s, collaborative learning techniques have been employed and developed successfully in classrooms worldwide at all age levels and for most major subject areas, as a strategy for improving learning achievements, such as, the development of higher order thinking/problem-solving ability (Slavin, 1996), pro-social behavior/social problems (Johnson & Johnson, 1989; Lohman & Finkelstein, 2000) and as a way to manage academic heterogeneity in classrooms with a wide range of achievement in basic skills (Bossert, 1988; Cohen, 1994).

Computers In Educational Settings

There can be no doubt that technology will increasingly be utilized in instructional environments. However, several studies have questioned whether computers would change early childhood education and whether computers can fit in the early childhood practice and facilitate young children's learning. Those studies addressed such major issues as children's development (Cuffaro, 1984; Samaras, 1996), cognitive gains (Papert, 1980; Piestrup, 1981), and social interactions with peers (Natasi, Clements & Battista, 1987).

Even though a few educators, such as Elkind (1996), claim that computers need to be used only on offering drill-and-practice activities, because a child's cognitive development cannot rely on some open-end software programs, other researchers have found that using computers with children was completed developmentally appropriate (Dublin et al., 1994; Samaras, 1996). Although the debate around the use of computers in children's constructive acquisition of knowledge is still underway, many childhood educators agree that computers can help enrich children's learning if the approaches to using computers are appropriate (Alloway, 1994; Clements & Nastasi, 1993; Haugland & Wright, 1997). Thus, computers should "support and extend children's learning, not just entertain or occupy them" (Samaras, 1996, p.133).

Learning of Young Learners

There has been extensive research on early learning that is organized as an interaction among peers. Although peer-based work is encouraged by theories in developmental psychology and classroom interventions, there are grounds for recognizing that young pupils find collaborative learning hard to sustain (Crook, 1998). Gauvain and Rogoff (1989) report that "...children as young as five years of age are not skilled at collaborating...." (p. 48). Thus Piaget's theorizing suggests that cognitive change occurs within peer interaction on one hand, but on the other hand, during the early school years, children lack the necessary socio-cognitive resources to learn effectively in collaborative arrangements (Crook, 1998). Since Brownell and Carriger (1991) commented that " As they get older, children become able to comprehend the behavior and intentions of another... Age related social and cognitive skills contributing to peer collaborations influence what and how children learn from these collaborations." (p. 381), many studies more focus on children in the upper primary grades. For example, Gillies (2000) report that positive interactions were observed among second- and third-grade students in collaborative learning.

Research Design

Participants

One hundred and twenty third-grade students will be recruited from middle/high social-economic status school district. The learning prerequisite for participants is to have capability to use basic computer tools and Internet-browsing resources.

Procedures

Pilot Study

One pilot study was conducted to test the instruction and test items before the formal study begins. The purpose of this study was to test the instruction designed by the researcher in order to gain qualitative data. Participants were required to browse the instruction individually and then take a quiz. The qualitative results observed by the researcher provide several future suggestions that include: (1) The instruction should be simple, easy to follow, and user-friendly for children; (2) Children who are under eight years old had difficulties to browse a hypertext-format instruction without learner support (such as teachers, tutors and peers); (3) Children were losing interest in about fifteen minutes.

Formal Study

The target population will first be divided into two groups (high prior knowledge and low prior knowledge) based on their previous art scores. For each group, students are randomly assigned to one control group and two other treatment groups. Before students start using the CACL, the researcher will conduct a face-to-face interview with them asking about their prior learning experiences and some other background information. The qualitative data gained in this study will be analyzed to support or question the quantitative results of the experimental study.

Conducting Experiment

The control group will work with one unit of computer-assisted art instruction individually. The treatment-1 group will be given the same computer-assisted art instruction. Instead of working individually, they will be required to work with a team of four students. Each team has two high-knowledge and two low-knowledge students. They do not have guidelines for leading their discussion on the topic to learn. The arrangement of the treament-2 group is similar to the second group, except that its participants will be given a problem to discuss. Students will be asked to complete this study in no more than forty minutes.

Assessment

After receiving the various instructional treatments, each student will be required to write down a reflective report to express her/his thoughts based upon her/his understandings on the subject matter. Two independent evaluators (art teachers) will be hired to grade students' learning performances according to the assigned standard rubrics.

Method

This study has two independent variables—different types of CACL learning strategies in learning art appreciation (open discussion versus problem-based discussion), and prior art skill (high score versus low score); and one dependent variable—outcome of students' art appreciation. As Gall, Borg, and Gall (1996) explain that a factorial experiment is "an experiment in which the researcher determines the effect of two or more independent variables (i.e., factors)—both singly and interaction with each other—on a dependent variable" (p. 508). Therefore, a two-way Analysis of Variance (ANOVA) is employed to analyze the results.

Conclusion

Collaborative learning has been widely recommended in the classroom. Understanding the potential benefits and limitations of collaborative learning from the variety of perspectives is complex, but essential. Most researchers speculate that peer learning is effective because it fosters constructive student interaction and active involvement through communication, intellectual exchange, and task-oriented cooperation. When students work on discovery-based activities, and where there are no clear solutions, it could be expected that they would demonstrate high levels of cooperative engagement. Therefore, outcomes from cooperation are more likely to include broader and deeper understandings of concepts. Based on this assumption, art is suitable for comprehension and critical discussion, and requires the learner to naturally work collaboratively. Also, computers can be superb teaching tools for a variety of art learning tasks. Especially, they are uniquely designed for delivering problem-based instruction because they lead users to interactive learning. As such, computer-assisted instruction is a potential method for small-group peer learning featuring conceptual tasks that engage in children's art learning.

References

Alloway, N. (1994). Young children's preferred option and efficiency of use of input devices. *Journal of Research on Computing in Education, 27*(1), 104-110.

Brownell, C., & Carriger, M. (1991). Collaborations among toddler peers: Individual contributions to social context. In L.B. Resnick, J.M. Levine, & S.D. Teasley (Eds.), *Perspectives on socially shared cognition* (pp.365-383). Washington, DC: American Psychological Association.

Clements, D. H., & Nastasi, B. K. (1993). Electronic media and early childhood education. In B. Spodek (Ed.), *In the handbook of research on the education of young children*. New York: Macmillan Publishing.

Crook, C. (1998). Children as computer users: The case of collaborative learning. *Computers Education, 30*(3/4), 237-247.

Cuffaro, N.K. (1984). Microcomputers in education: Why is earlier better? *Teachers College Record*, 85(4), 561-568.

Elkind, D. (1996). Young children and technology: A cautionary note. *Young Children, 51*, 22-23.

Gall, M.D., Borg, W.R., & Gall, J.P. (1996). *Educational research: An introduction*. (6th Ed.), New York: Longman.

Gauvain, M., & Rogoff, B. (1989). Collaborative problem solving and children's planning skills, *Developmental Psychology, 25*, 139-151.

Haugland, S. W. & Wright, J. L. (1997). *Young Children and Technology: A World of Discovery*. Boston: Allyn and Bacon.

Johnson, D., & Johnson, R. (1989). *Cooperation and competition: Theory and research*. Edina, MN: Interaction Book.

Lohman, M., & Finkelstein, M. (2000). Designing groups in problem-based learning to promote problem-solving skill and self-directedness. *Instructional Science, 28*, 291-307.

Milekic, S. (2000). Designing digital environments for art education/exploration. *Journal of the American Society for Information Science, 51*(1), 49-56.

Piestrup, A. (1981). *Preschool children use Apple II to test reading skills program*.

Portola Valley, CA: Advanced Learning Technology. (ERIC Document Reproduction Service No. ED 202476).

Samaras, A. (1996). Children's computers. *Childhood Education, 72*(3), 133-136.

Slavin, R. (1996). Research in cooperative learning and achievement: What we know, what we need to know. *Contemporary Educational Psychology 21*, 43-69.

Smith, N.R., Fucigna, C., Kennedy, M., & Lord, L. (1993). *Experience and art: Teaching children to paint* (2nd ed.). New York: Teachers College Press.

Quality Management Systems for Distance Learning

Business, and commerce have widely adopted organized systems to manage quality of products and services. Terms like Total Quality Management, Continuous Quality Improvement, Six Sigma, and Baldrige are commonly accepted means of assuring adherence to quality standards. Colleges, universities and other higher education institutions have continued to rely on overall reputation and "accreditation" to convey an image or level of quality.

Distance learning and the rapid application of technology to teaching and learning processes is quickly changing the face and competition for education. Non-traditional, for-profit, and expanding programs of traditional institutions are creating global pressure on all and introducing the need for accountability and quality of outputs.

Application of ISO 9000-2000 developed by the International Organization for Standards can become a useful tool to manage the process of developing, delivering, and improving distance learning efforts. It provides a way to measure and assure appropriate leaning outcomes. This paper discussed some of the applications and implications of ISO 9000:2000 in the distance setting.

Throughout the world, it is becoming increasingly commonplace for students in undergraduate and graduate curricula to take courses and even enroll in degree programs via distance education. The competition for quality courses is increasing as higher education institutions offer broader menus of pedagogical approaches that attract students who are already in the workplace and need a flexible program to meet their career demands and schedules. This progress, however, has triggered significant issues of quality and quality management.

One college has begun to adapt and use contemporary quality tools to begin to get an indication of effectiveness and efficiency of teaching, as well as student satisfaction with distance learning initiatives. A further goal of these initiatives has been to embrace principles of quality management, and to consider quality certification under the terms of ISO-9000 of the International Standards Organization. Focus groups, comparative test results, student feedback, online surveys to measure satisfaction and inclusiveness, or community in the learning experience have been used. These tools provide a means to refine and improve on distance design, development and delivery efforts.

The targets in distance learning are quickly evolving and are fast moving; there is an ever-escalating zero-point. Customer bases are changing, and the technology advances make the effort more challenging. Yet we are trying to bring them all together for more effective learning experiences. This paper brings together the design elements, measurement activities, lessons learned and suggestions for application in the future for quality, quality management, and potential recognition through ISO 9000 certification.

Academic Underpinnings – Recent Publications

IHEP (2000). Quality on the Line: Benchmarks for Success in Internet-Based Distance Education. Washington, Institute of Higher Education Policy: 45.

Izadi, M. (1966). "Quality in Higher Education: Lessons from the Baldridge Award, Deming Prize, and ISO 9000 Registration." Journal of Industrial Teacher Education **33**(2): 60-76.

McNeil, S. G., W. N. Chernish, et al. (2000). Multifaceted Approach to Designing an Online Masters Program. WebNet2000, Nashville, AACE.

Von Zharen, W. M. and W. N. Chernish (2002). Quality in Distance Learning: Developing a Management Standard. Proceedings of Distance Education Conference 2002, January 22-25, 2002, Austin Texas.

Bill Chernish has been an early adopter of technology in a broad range of settings. He has been instrumental in the development of ITV and online global distance learning programs at the undergraduate and masters level. His recent academic -- and practical -- research has been on the improvement of distance learning activities at all levels. His education included engineering, business and economics, and his work has been in the private sector, university teaching, and continuing education.

Communication Preferences and Distance Learning

Mark Chignell, Mechanical & Industrial Engineering, University of Toronto, Collaborative Effectiveness Laboratory, Bell University Laboratories, Canada; chignell@mie.utoronto.ca

Heather Parker, Mechanical & Industrial Engineering, University of Toronto, Collaborative Effectiveness Laboratory, Bell University Laboratories, Canada, hparker@mie.utoronto.ca

Leonardo Ruppenthal, Mechanical & Industrial Engineering, University of Toronto, Collaborative Effectiveness Laboratory, Bell University Laboratories, Canada, leonardo@mie.utoronto.ca

Mei Leung, Mechanical & Industrial Engineering, University of Toronto, Collaborative Effectiveness Laboratory, Bell University Laboratories Canada, meidleung@yahoo.com

Abstract

E-Learning requires students to use technologies for mediated communication and collaboration. If there are individual differences with respect to how people prefer to communicate and collaborate, then E-Learning tools and technologies should take those differences into account. In this paper we describe an inventory that we have developed for measuring communication preferences and we report on the use of that inventory in predicting newsgroup and email behaviour in a class that included an E-Learning component.

Introduction

E-Learning requires students to use technologies for mediated communication and collaboration. E-Learning tools and technologies should take individual differences with respect to how people prefer to communicate and collaborate into account. Communication preferences may be thought of as a component of personality that reflects dispositions towards performing communication tasks in certain ways, in contrast to traditional measures of personality which tend to focus on general (non-task-oriented) dispositions. Personality has been shown to have an impact on a range of human behaviours including sociability and attitudes to work and relaxation. A wide variety of personality inventories have been developed, with notable examples including the EPI, the 16PF, the MBTI and the Guilford-Zimmerman Temperament scale. In recent years progress has been made in distilling the various measures of personality into a core set of factors that seem to capture most of the variance in the basic personality distinctions. Costa and McRae (1992) have argued in particular for five stable factors of personality, which have come to be known as the Big Five factors. These factors have been labelled in a number of ways, with one set of labels leading to the mnemonic O-C-E-A-N (i.e., openness, conscientiousness, extraversion, agreeableness, and neuroticism).

Most if not all of the Big Five personality factors appear to be relevant to communication styles. For example, extraversion may be an important determinant of the degree to which a person wishes to stay in contact with others. It might be expected that certain characteristics, such as using a cell phone and interrupting meetings to take calls might be more associated with extraversion. Similarly, adhering to meeting times and emphasising schedules might be more likely associated with neuroticism.

While the Big Five personality factors should have important relationships to certain aspects of communication style it seems likely that there are other stable traits or communication preferences that are distinct from general personality factors. Our research interest is in developing behaviourally referenced measures of communication style

BEST COPY AVAILABLE

and preference. This work is motivated in particular by the increasing availability of new communication devices (such as the RIM Blackberry pager), which allow people to express their communication preferences in new ways.

Some recent studies have looked at how people communicate and interact with information technology, specifically in a virtual classroom/community and in terms of Internet use in households (Neal, 1997; Kraut, Kiesler, Mukhopadhya, Scherlis, Patterson, 1998). In a preliminary study of a well delivered and well supported distance learning class that used a variety of technologies (videoconferencing, email, internet relay chat, NetMeeting and Virtual Worlds) to mediate learning, the instructor and the students felt that they were able to create a sense of community and that they were surprised at how comfortable they felt with each other and the instructor by the end of the class (Kraut et al., 1998). It seems that given adequate support (technical, monetary and enthusiastic) community oriented communications and interactions can take place eliminating the need for face-to-face interactions and diminishing the distance barrier.

In a study that examined the use of the Internet in ordinary American households Kraut et al (1998) found that more time is spent communicating and interacting with people online via email than is spent seeking information or using the Internet for entertainment purposes. They suggest that interpersonal communication does and will continue to dominate residential use of the Internet (Kraut et al., 1998). In light of this research, Kraut et al. claim that the commercial development of Internet services and public policy initiatives to date have probably over-emphasized information and entertainment and under-emphasized interpersonal communication. Our personality influences how we communicate. Thus, investigating how personality affects our online communications and our attitudes to information technology is of particular interest in further understanding peoples' communication and interaction styles.

Based on similar motivation to understand how different people used new technologies we identified the need for a CPI (Communication Preferences Inventory) in 1999. In subsequent studies with Bell Canada and with Bell Mobility we explored relationships between communication preferences and service preferences and usage, with a focus on unified messaging and unified communications (e.g., receiving email on a phone). We then developed a draft version of the CPI that contained 24 questions (shown in Table 1). In this paper we report on a study that examined the factor structure of an initial version of the CPI, and review recent evidence of how the CPI may be a useful predictor of E-Learning behaviour.

Communication Preference Factors

A 24 item version of the CPI was placed on the Web with the questionnaire statements presented using a Likert response scale (Strongly Disagree, Disagree, Neutral, Agree, Strongly Agree). Responses to the questionnaire were then solicited from a number of people associated with the Department of Mechanical and Industrial Engineering at the University of Toronto. A total of 77 completed responses were collected. Shortly after soliciting responses to the CPI survey, we created a Web version of a short form questionnaire on the Big Five factors consisting of 44 items. Respondents were also requested to fill in this Big Five inventory. We received 40 completed responses for the Big Five questionnaire (from the set of 77 respondents who had completed the draft CPI).

In general the correlations between the CPI items and the Big Five personality factors were low, with none being greater than .5. There were however six questions that had statistically significant correlations with one or more of the Big Five factors. A factor analysis was then carried out to determine the factor structure of the questionnaire. We removed five of the six questions that had shown a relationship with the Big Five factors but kept Question 13 (which had a correlation of .316 with Neuroticism) because it dealt with scheduling which was a construct that we think is important to the CPI. Thus the factor analysis utilized 19 questions that generally had little if any relationship with the Big Five factors. The factor analysis consisted of a principal components analysis followed by Varimax rotation with Kaiser normalization (these and other analyses reported here were carried out using the SPSS statistical package). Based on a scree test, the first four factors were chosen for interpretation, with these factors accounting for 43% of the variance. The first factor was interpreted as a collaboration factor, while the second factor seemed to reflect a propensity to schedule. The third factor suggested a tendency to preview received messages. The fourth factor can be interpreted as availability (i.e., willingness to be available to take calls or communicate in various situations).

Communication Preferences in E-Learning

Based on the Communication Preference Factors uncovered using the 24-item draft version of the CPI, and a review of the literature on communication theory (Shannon, 1948; Weaver and Shannon, 1963), a 62-item revised version of the Communication Preferences Inventory (CPI) was constructed and placed on the Web with password protection. The questionnaire statements were presented using a Likert response scale (strongly disagree, disagree, neutral, agree, strongly agree). A demographics questionnaire and a personality questionnaire were also included, along with a short form 44 item (John and Srivastava, 1999) version of the Big Five personality measures (Costa and McCrae, 1992).

44 undergraduate engineering students participated in the study. In addition to filling out the questionnaires as described in the preceding paragraph, the students also participated in a class newsgroup from September to December 2001, and all messages included in the newsgroup were saved for analysis. All instructor-bound email messages from this class were also saved for analysis.

A discriminant analysis was then carried out to examine possible relationships between the CPI and email and newsgroup participation in the class. Values for communication on the newsgroup, and communication via email with the instructor, were tabulated based on those who had sent or replied to newsgroup messages or instructor emails. For each type of communication (email or newsgroup), two groups were identified: those who communicated vs. those that did not communicate. In the following discussion, numbered questionnaire items refer to the corresponding items listed in the appendix. For instance, C6 corresponds to item 6 in the appendix ("I prefer to communicate with only one person at a time"). Six items (C6, C22, C42, C44, C49 and C55) significantly (t-test, $p<.05$) between those who did and those who did not communicate via email with the instructor. Five items (C15, C25, C32, C42 and C43) significantly discriminated (t-test, $p<.05$)between those who did and those who did not communicate on the newsgroup (CPI items that differed significantly are listed in Table 1).

CPI Item	
C6	I prefer to communicate with only one person at a time.
C15	I enjoy frequenting chat rooms or engaging in instant messaging with friends over the Internet.
C22	I prefer to schedule when I will make telephone calls.
C25	I always try to keep my mobile telephone with me so I can make calls at anytime.
C32	I feel it is important for me to be able to contact fellow coworkers/students outside working/school hours for work/school related communications.
C42	I prefer to be notified of new messages immediately.
C43	I often interrupt other tasks to take telephone calls.
C44	I frequently take business/school related calls after I have retired for the evening.
C49	I feel it is important for people to be able to contact me outside of working/school hours for working/school related issues.
C55	The emotional content of my communications governs the choice of medium (i.e. telephone versus email).

Table 1. CPI significantly different between email or newsgroup users versus non-users.

These results suggest that CPI items can discriminate between relevant aspects of E-Learning behaviour. Other significant relationships were found (using stepwise regression analysis with forward entry) between CPI items (C20-C5, R^2= .207) and number of newsgroup messages sent, and between CPI items and reported number of hours spent per week on the mobile phone (C37 + C51- C29 - C52, $R^2 = 0.184$).

Discussion

The research reported in this paper shows that the CPI is relevant to the task of understanding individual differences in E-Learning. Work on the CPI is ongoing and we hope that as the research basis behind it grows it will develop into a useful tool for design and marketing. We are greatly encouraged by the preliminary evidence that the CPI has an identifiable factor structure that is well differentiated from the Big Five personality factors. Researchers who would like a copy of the latest version of the CPI should contact Mark Chignell by email (chignell@mie.utoronto.ca).

It is hoped that other researchers will also administer the CPI in their studies (and provide their results to us) as part of the process of broadening the base of respondents, leading to a standardized and normalized version of the inventory at some point in the future. We are particularly interested in studies that examine the relationship between communication preferences and E-Learning behaviour.

Acknowledgments

We would like to acknowledge the Bell University Laboratories and CITO for their support of this research. We would also like to thank Colin DeYoung for his assistance in interpreting the results, and Anna Malandrino for helping with editing of this paper.

References

Costa, P. T., and McCrae, R. R. Four ways five factors are basic. Personality and Individual Differences 13, no. 6 (1992): 653-665.

John, O. P., and Srivastava, S. The Big Five Trait Taxonomy: History, measurement, and theoretical perspectives. In Handbook of Personality: Theory and Research, edited by L. A. Pervin and O. P. John. New York: Guilford Press, (1999): 102-138.

Kraut, R., Kiesler, S., Mukhopadhya, T., Scherlis, W., Patterson, M. (1997). Social Impact of the Internet. Communications of the ACM December 1998 Volume 41 Issue 12.

Neal, L. (1997). Using Multiple Technologies for Distance Learning. Proceedings of the HCI International '97 Conference.

Parker, H. Chignell, M.H. and Ruppenthal, L. Measurement of Technology Mediated Communication Style: The Communication Preferences Inventory (CPI). Technical Report #IML-2002-05, Department of Mechanical and Industrial Engineering, University of Toronto.

Ruppenthal, L and Chignell, M. (2002). Profiling Users of a Unified Communication Service; Understanding Communication Traits and Styles. Technical Report #IML-2002-01, Department of Mechanical and Industrial Engineering, University of Toronto.

Shannon, C. E. (1948) "A mathematical theory of communication". *Bell System Technical Journal*, vol. 27, pp. 379-423 and 623-656, July and October, 1948.
http://cm.bell-labs.com/cm/ms/what/shannonday/paper.html

Weaver, W. and Shannon, C. E. (1963). *The Mathematical Theory of Communication*, Urbana, Illinois: University of Illinois Press, 1949, republished in paperback 1963.

Organizational Considerations for Designing Fully Online Learning Environments: The Royal Roads Experience

Doug Hamilton
Organizational Leadership and Learning Division, Royal Roads University
doug.hamilton@royalroads.ca

Elizabeth Childs
Organizational Leadership and Learning Division, Royal Roads University
elizabeth.childs@royalroads.ca

Tammy Dewar
Organizational Leadership and Learning Division, Royal Roads University
tammy.dewar@royalroads.ca

Dave Whittington
Organizational Leadership and Learning Division, Royal Roads University
dave.whittington@royalroads.ca

Abstract: This paper is intended to promote further understanding about effective practices in creating fully online programs and learning environments by sharing the experiences of a faculty team which currently is responsible for converting an existing blended model into a fully online program. This presentation will address the organizational issues that facilitated and challenged the development of the first fully online degree program – the M.A. in Distributed Learning – at Royal Roads University. By October 2002, the first cohort of learners will have completed the first three courses in the program. Lessons learned from this experience are presented.

Background

Royal Roads University is a publicly funded university in the province of British Columbia that focuses on addressing the needs of the mid-career learner. All of its undergraduate and graduate programs combine short-term residency stays with more extended internet-delivered courseware. This blended model strives to ensure that educational opportunities for the working professional are accessible and flexible. Royal Roads University prides itself on achieving high graduation rates (over 90%) in all program areas. Learners also rate the programs very high in terms of quality and instructor effectiveness. Surveys and interviews with current learners and graduates confirm that the cohort-based blended learning model, with its emphasis on building an integrated and mutually-supportive learning community is a significant factor in achieving these high success and satisfaction rates.

Within this larger context, the Master of Arts Program in Distributed Learning (MADL) prepares educational professionals, training specialists, and human performance consultants to use innovative learning technologies to enhance workplace performance. MADL is an outcomes-based degree designed around a robust, program-wide competency framework. The MADL program features an initial six-week orientation, followed by a three-week residency, and then five successive terms of online coursework which culminates in the preparation of an applied thesis.

In the winter of 2002, program planners decided to create a separate fully online version of the program that would respond to the needs of potential learners who were unable to attend the three-week residency version. This variant of the program would admit its first cohort of learners in September, 2002.

This was the first experience for faculty and staff at Royal Roads University to design a fully online program in spite of the extensive collective experience in designing blended programs. There were several anticipated benefits for this initiative. First, the new program variant would meet a demonstrated demand for this format of program in an identified market. Secondly, its online format would be attractive to both domestic and international markets, and therefore, meet the university's goals for attracting international learners. Thirdly, it provided an opportunity to make linkages between North American-based learners and learners in other parts of the world. Finally, it made sense that a program that focuses on the effective use of learning technologies would be the "test case" for the development of a completely online program that might serve as an example for other programs to follow.

Facilitators, Challenges and Opportunities Within the Program Development Process

During the conversion of the face-to-face components into online courses, this design team recognized that there were critical issues that needed to be addressed in order to make the conversion process a success for learners. This brief paper presentation explores these critical issues as they pertain to the organizational dimensions related to designing and implementing an online program. These organizational dimensions are stressed in this paper because they are critical to the success of many ICT projects (Farrell, 1999).

Our experience in making the transition from a blended to a fully online model suggests that assuming that an online model is merely another learning technology for delivering courses significantly limits the opportunities for maximizing its effectiveness (Singh and Reed, 2001). We have learned that the fully online model provides a testing ground for developing and promoting new ways of learning. Reflecting on our experience with this project, there were several key organizational processes that facilitated the transformative potential of the online model. These included:

(a) *A focus on learning outcomes* – Thinking initially about the competencies that learners need to attain regardless of the program model freed the design team to consider the development of learning activities that were not necessarily based on face-to-face antecedents. The competency framework gave the design team a series of clear learning objectives that would guide course development This enabled the team to consider the design process as an opportunity to create new learning strategies beyond solely re-purposing the face-to-face activities into parallel online components.

(b) *Continuous quality improvement initiatives* – The MADL program, like all programs at Royal Roads, relies heavily on faculty and learner feedback to ensure that courses and, by extension, programs, are regularly being improved to meet learner needs. Pre-established performance goals for faculty and institutional staff reinforce the importance of delivering quality programs. This culture reinforces the importance of viewing the goal of the development of a fully online model as strengthening the program further and not just duplicating the successes of the existing blended model.

(c) *Learner-centred university philosophy* – Royal Roads University has a well-developed client-centered approach to serving learners. This is evident, not only in the design of programs, but also in the organization of critical support services such as registrarial services, IT training, IT Help Desk, and academic advising. The mandate of the university is to find ways to provide effective support to learners regardless of whether they actually reside on campus. Latchem and Hanna (2001a) suggest that this customer-focused orientation is critical to the development of organizational systems that are more responsive to the new needs of learners. At Royal Roads, this learner-centred mandate allowed the various support services to consider the development of a fully online program as an opportunity to re-think and explore alternative ways of delivering certain support services such as the creation and use of physical identification cards, learner advising, textbook distribution, and technology training. Key support services in the university viewed the MADL fully-online model as a test case for thinking creatively and differently about supporting learners.

(d) *Existing program infrastructure* – Because the blended MADL program model already featured an extensive online component, there were already elements of the program infrastructure in place that facilitated the conversion process. These included well-developed online course design models, experienced course designers, an established learning platform, and team-based course development processes.

(e) *Associate faculty model* – The majority of instructors at Royal Roads University are Associate Faculty who have a combination of academic credentials and extensive professional experience in the field. Most of the Associate Faculty are working full-time in senior leadership and consulting positions. The affiliation with Royal Roads allows them to share their experiences with learners and help them develop the necessary skills and knowledge to succeed as a distributed learning professional. As well, many Associate Faculty serve as course developers. Therefore, the Associate Faculty model provided considerable flexibility in deploying resources in order to meet the short timelines for program development.

Notwithstanding the benefits, we discovered some significant challenges and constraints that had an impact on the courseware conversion process. Major challenges included:

(a) *Limited advanced planning time* – Royal Roads exhibits many features of what Latchem and Hanna (2001b) refer to an "entrepreneurial culture" (p.33). This opportunistic, responsive, and market-driven environment, however, makes long-term course development timelines somewhat of a luxury. The fully-online program was developed in response to the demands of an emerging market made possible through a partnership with another educational provider. The importance of capitalizing on this opportunity in a timely fashion meant that the fully-online model needed to be developed within a five-month time frame. More time available would have provided us with additional opportunities to anticipate support and logistical issues.

(b) *Strong affinity for a blended model* – For a university that has based its success on blended models, the development of a fully-online program remains somewhat of a departure. Some staff, learners and faculty questioned the logic of tampering with a program model that had proven to be successful. While philosophically the university community supported the online model, operationally, there have been process challenges to be addressed. Ongoing communication has been necessary to help members of a committed learning community recognize that the fully online model exists to meet the demands of specific clientele and to provide options for selecting programs based on learner preference.

(c) *University-wide decisions that affected development processes* – In the midst of the development of the new courseware, the university instructional design team unveiled a new course development and delivery platform. This platform addressed several drawbacks of the current course management and delivery software. The timing of its release provided a short window of opportunity for the new program to adopt the platform. Its adoption, however, meant that additional time and effort under already critical timelines had to be expended in converting work that was already completed into a format readily accepted by the new platform.

(d) *Unclear global market strategy* – Latchem and Hanna (2001a) emphasize the importance of the delivery model, learning strategies, and course content respecting the cultural background of enrolled learners. Faculty made efforts in the course development process to vet the courses through representatives of specific cultural groups to ensure linguistic and cultural appropriateness. Nevertheless, the availability of an accessible, globally-offered program offering does not necessarily mean that members of these cultures will be attracted to the program unless more work need is accomplished on identifying and attracting specific strategic markets.

Summary

The creation of new learning delivery strategies should be viewed as a significant organizational change process (Singh and Reed, 2001). Therefore, by way of summary, here are some key organizational issues that we have considered so far in transitioning from a blended or face-to-face model to a fully online model. We have framed these as questions for readers considering this conversion process:

1. Have you considered the needs of the specific learners you are attempting to serve with the online program? What evidence exists that your online model will meet their needs and expectations? If international learners are being recruited, how is your online program responding to their cultural needs?

2. Have you assessed the institutional impact of developing a fully-online program? Will processes and systems need to be created, changed or re-developed to address the needs of a fully online learner?

3. Do you have an opportunity to develop a pilot process with a smaller cohort of learners to test out the delivery of the online model? Will this process help you address critically short timelines for development and implementation?

4. Are you committed to viewing the development process as a means of discovering and developing new ways of learning? What kinds of supports exist to ensure that this happens?

5. Are your learners prepared for a fully-online learning environment? What supports need to be built into the program to maximize opportunities for their success? Is an orientation to the online learning program necessary to ensure that learners are sufficiently ready to make the transition to an online learning environment.

6. What kinds of evaluation and feedback measures will you put in place to enable ongoing modifications to be made to the program?

7. What kind of professional development is in place to help support faculty and staff fully exploit the opportunities of creating a fully online learning model?

8. Are faculty and program support personnel clearly aware of their roles in supporting student learning in an online environment and how these roles might be different fom those in more traditional learning environments?

Summary

Farrell, G. (2001)(ed.). *The Changing Faces of Virtual Education.* The Commonwealth of Learning (http://www.col.org/virtualed)

Latchem, C. and Hanna, D.E. (2001a). Changes, Challenges, and Choices. In C. Latchem and D.E. Hanna (eds.) *Leadership for 21st Century Learning: Global Perspectives from Educational Innovators.* (pp.15-26). London: Kogan-Page.

Latchem, C. and Hanna, D.E. (2001b). Developing an Entrepreneurial Culture. In C. Latchem and D.E. Hanna (eds.) *Leadership for 21st Century Learning: Global Perspectives from Educational Innovators.* (pp.27-40). London: Kogan-Page.

Singh, H. and Reed, C. (2001). *Achieving Success with Blended Learning.* Centra White Paper. Centra Corp. Lexington, MA. (http://www.centra.com)

Harnessing IT for Learner-centred, Self-directed General Music Education.

Ying Hwee CHUA
IST Department
Indiana University Bloomington
Indiana, USA
(Former Head of Department, Aesthetics
Chung Cheng High (Main) School, Singapore)
ychua@indiana.edu

Abstract: This system of music instruction focus on using technology to enhance secondary general music education. Features include how technology allows students to learn at their own pace and to do musical group performances that leverages on technology.

Introduction

In Chung Cheng High (Main) School, technology is harnessed for music education to promote the belief that everyone can eventually learn to play music from any level of competency. A programme has been created to generate synergy between general music education and niche education for secondary school students. A niche co-curricular activity was first started in 2000 to nurture students interested in both IT and music. The niche programme creates opportunities for students with music background, to explore the use of IT for music arrangement and performance. Subsequently, IT music was introduced in the general music programme a year later, in 2001, where *secondary 2 (K 10 equivalent)* students learned how to play the electronic keyboard through gaming and this made the learning of instrumental playing more exciting. Partnerships were also established to help develop the programmes, train teachers from other schools and provide infrastructure maintenance and support.

The focus of this briefpaper will be on the design, development, implementation and review of the *Instrumental-playing Module*[1] of the general music programme from 2001-2002.

Motivation and Opportunities

The entire project was motivated by the desire firstly to provide all students, regardless of family financial background, with an opportunity to learn to play the piano keyboard and secondly, to identify talents from there.

In 1999, with the support of the cluster schools' funds, 10 computers were purchased to start niche IT music club with a pilot group of students interested in both music and IT.

When *BlasterkeyMP3*[2] was introduced in 2000, there was the possibility of harnessing the new hardware and software to enable 40 students to learn some basic keyboard skills at their own pace and time almost simultaneously. Another budget was sought and granted to purchase the additional 12 computers together with the 22 sets of newly invented equipment on a promotion price of half the normal price. Together with a fellow music teacher, Ms Ng Chuen Yin, the *Instrumental-playing Module* was resttuctured to harness the new technology for learning.

General Music Programme (Instrumental Playing Module)

The restructured *Instrumental Playing Module* was introduced to the Secondary 2 in Terms 3 and 4 of 2001. The focus of the programme shifted from recorder playing to learning to play the midi-keyboard using 22 computer music workstations for a typical class-size of 40. It was a breakthrough achievement when all students could simultaneously learn to play the keyboard on their own, while the teacher could move around to give pointers with regards to choice of pieces and hand-posture.

---

[1] A module of music lessons lasting one semester which is approximately 16 weeks.

[2] A product of Creative Technologies consisting of several software and a midi keyboard controller that can be linked through a game port.

Instructional design for IT Music Lessons

Table 1 below is the scheme of work for the Instrumental Playing Module with technology incorporated to enable and encouraged learner-centred and self-directed learning.

Week	*Lesson/Objectives*	*Activities*	*Resources/Assignments*
1	Blasterkeymp3	Lesson 1 and 2. Those with music background will help classmates. Pairing wok needs to be done. Teacher to assign students to specific workstation.	Computers, Blasterkey, BlasterkeyMP3 software, projector.
2-3	Blasterkeymp3	Lesson 2 and 3. According to pupil's ability.	As above.
4	Rhythmania	Introduction to chords insertions.	Computers, Rhythmania, any music sheet with chords, pupil's diskette.
5	Rhythmania	Introduction to different musical styles.	As above.
6	Issue and clarify performance assignment	Students are to perform on instruments of their choice in groups of 4-5 with a simple sequence of any music arranged by them.	Computers, software, music scores. Assignment handouts.
7-9	Sequencing or rehearsals	Students will bring their scores to sequence or rehearse their performance. (Some students might need to work on their competency with at least one instrument.)	Computers, software, music scores.
10	Buffer Lesson	Some classes may not have this lesson as it might be accounted for by public holidays.	
11	Rehearsal Week	Students are free to ask teachers for advice to further improve their performance.	
12-15	Assignment Presentations	Students will present the performance to the class in their groups.	
16	Post- Assessment Review	Show students video of some excellent examples of the assignment.	Projector, computer.

Table 1: Scheme of work for the Secondary Two Instrumental Module

For the first six weeks, two software i.e. the BlasterkeyMP3 and Rhythmania, were introduced and were to be used throughout the rest of the module:

1. The BlasterkeyMP3 software was introduced to allow the students to learn the keyboard at their own pace. Lessons 1, 2 and 3 of the programme were used. The following is a brief description on each lesson.

- Lesson 1 introduces the piece, students are asked to listen to the tune.
- Lesson 2 guides the students to play the notes of the piece using interactive pointers pointing to the respective keys on the keyboard, with no time or rhythm constraint.
- Lesson 3 requires the students to play in real time. Students may choose from many short pieces of various levels of difficulties to learn. The tempo for each piece may also be altered to suit the ability of each pupil.

The number of pieces are not exhaustive, since new pieces can be also created by the teachers and uploaded into the programme. The gaming feature in the software programme is interesting and fun. It feedbacks the results to the students immediately with both a percentage score as well as with cheers and applause. Thus the students are motivated to try to play better each time.

BEST COPY AVAILABLE

2. The second programme, Rhythmania, is an auto-accompaniment software, which allows the students to create their own sequence to accompany their instrumental playing without much music theory background required. This greatly enhances their instrumental performance experience from playing on their own often in unison to playing with music accompaniment generated from the computers. This also allowed them to practiced individually with the midi-sequences at home and reduces the amount of time needed to rehearse the performance together as the midi-sequence also acts as a kind of metronome that keeps them playing together when they meet. Many students have since created interesting sequences to accompany their recorder or keyboard playing.

Music Assignment Presentation in 2001

Students were required to complete an assignment for the Module. They were to work in groups to perform a piece of music of their choice, given the following guidelines:

- Each group should consist of 3 to 5 members
- Only instrumental performances are allowed.
- The use of either midi arrangement by members of the group is necessary.
- All members of the group are required to give a "live" performance.

The assignment encourages both student collaboration as well as independent learning. Students are engaged in choosing the own piece of music, as well as making decisions with regard to the style and the instrumentation of the music arrangement. They were also given rehearsal time during class lessons, where they can consult the teacher. Through the process of working on these assignments, motivated students were also introduced to other skills, such as MIDI sequencing and editing which helped to enhance their assignments.

As many students do not have the necessary IT equipments and software at home, the music lab was made accessible to them after school two weeks prior to their presentation for groups that were unable to complete their work during lessons. The music laboratory was manned by IT Music Club students. The students were very enthusiastic about the assignment and many stayed back till late afternoon to either rehearse in their groups or practice their individual parts. Many students with no prior keyboard playing knowledge were able to perform simple parts in their groups. Many groups also created sequences to accompany their performances. The assignment was assessed to Techniques (30%), Rhythm (30%), and Expression (40%).

Review and Improvements made in 2002

For 2002, the scheme of work was revised such that students will have sufficient time to complete their assignment during their normal lessons and few will have to stay back late to rehearse or sequence their performance.

The assessment criterion has been revised to include Music Arrangement (20%), Group Rapport (20%), Introduction to performance (10%), Stage Presence (10%) in addition to Techniques (20%) and Expression (20%). Table 2 below shows the summary of improvements made to the programme for 2002.

	2001 Areas for improvements	**2002 Improvements implemented**
1	Students take the soft option to play unpitched percussion.	Students have to play melodic instruments with the exception of one drummer per group.
2	Sequencing is optional, thus some arrangements without sequences would sound inferior to those that have.	Sequencing is made compulsory and achievable.
3	Experimental rubric was designed and used.	An improved version of rubric is used to achieve desired learning outcomes.

Table 2: Summary of improvements for the 2002 Instrumental Playing Module

Conclusion

The general music programme of Chung Cheng High (Main) School with its leverage on technology has been increasingly recognized as a leader of its kind in Singapore together with its other programme for specialized individual students who will continue to explore modern technology for music-making and education. It has opened many new possibilities in terms of how technology can be further integrated in the learning of music and musical instruments and will likely provide inspirations for new innovations in the education of manyother disciplines.

Acknowledgements:

I would like to thank the following people for their tremendous trust and support to make this instructional system move from design to reality:

Miss Ong Pheng Yen, Superintendent / East 5, Ministry of Education, Singapore.

Mr Yang Che Kay, Superintendent / West 5, Ministry of Education, Singapore.
(Principal (1996-2000), Chung Cheng High (Main) School, Singapore)

Mr Yue Lip Sin, Principal, Chung Cheng High (Main) School, Singapore.

Ms Ng Chuen Yin, Music Coordinator, Chung Cheng High (Main) School, Singapore.

Mr Khew Sin Sun, Managing Director, MusicTec Pte Ltd, Singapore.

Web screen design: background color impacts posttest performance

Abstract

This investigation considered the effects of background color in an online vocabulary lesson. In real-world settings, background color used on the lesson screen may not be available when the lesson content must be recalled. Equivalent posttests were designed with or without matching color. Results show different posttest performance when matching color is present at posttest versus when it is not. Results indicate that background color serves more than just a decorative function in screen design.

This investigation considers the effects of background screen color as an over-arching context variable when learning from computer displays. Background color scheme may be only decorative, but sometimes indicates related sections of the web site (Voithofer, 1997). This approach follows from print-based design. However, Misanchuk (1992) says, "This kind of color coding is done on the presumption that it helps orient learners to the tasks at hand, but apparently no research has actually been done regarding its effectiveness for that purpose." (p115).

Dwyer and Lamberski (1982-83) in a review of the effects of color in teaching and learning have reported that color that is used to explicitly associate related content is more effective than not including color, especially for recall learning outcomes (a drawing task), though sometimes color is not more effective, especially for recognition outcomes (Worley & Moore, 2001). Similarly, Winn and Everett (1979) have concluded that when color draws attention to important lesson content, this improves recall of both the important and also irrelevant lesson information (Pett & Wilson, 1996). Dwyer (1978) summarizes the likely encoding effects of color when he says, "...color facilitates information processing by providing structures for the storage of new information and by providing categories by which familiar or already existing information can be more efficiently stored." (p.142)

The present investigation, motivated by the current use of background color in web sites, considers the effects of screen colors across a web site, which would involve associating multiple disparate propositions across many screens, rather than just a few related propositions within only one or a few screens. In this case, the instructional efficacy of color is not as clear (Pett & Wilson, 1996).

In many real-world tasks, the color provided at encoding may not be available at retrieval. Transfer appropriate processing (TAP; Bransford & Franks, 1976; Morris, Bransford, & Franks, 1977) proposes that lesson and retrieval processes should correspond. Thus the use of background color in a lesson may have a negative effect, since the encoding task has color and the retrieval task does not. Such a finding would have serious negative implications for this use of color in screen design. Thus, this investigation examines the effects of the presence or absence of screen color at posttest.

Method

Participants

The participants (N = 34) in this investigation were graduate students. About 78% of the participants are full time employees of local corporations and businesses, and 20% are school teachers; most were female (75%) and all but one are in their late-twenties. (Note: we are adding more participants by November 2002).

Materials

The study task provided the 36 common instructional design terms in multiple-choice format with one term per screen. Knowledge of correct response feedback was provided. The 36 terms were arranged in the order of their occurrence in the introductory instructional design textbook (Dick & Carey, 1996), and were divided into five groups each assigned a color. These groups include: Overview (orange) – items 1 through 9, Instructional Analysis (yellow) – items 10 through 16, Learner Analysis (blue) – items 17 through 22, Objectives and Tests (green) – items 23 through 27, and Development and Evaluation (purple) – items 28 through 36. These color hues are not normally associated with these terms or groups (such as using red to indicate a concept such as "stop"). The color associated with each group was designed to appear as merely decorative. The color was displayed on the screen as a solid column 1.4 inches wide along the left margin.

Posttest

The posttest was designed either with no color, or with color that exactly matched the lesson items. The posttest consisted of the same 36 definitions as before, except that the first 18 items were constructed response format while the second 18 were multiple-choice format. The posttest was partitioned into 9 "easy" and 9 "difficult" items, thus the 36-item posttest has four sections including constructed response with easy items (9), constructed response with difficult items (9), multiple-choice with easy items (9), and multiple-choice with difficult items (9).

Results

Posttest data (see Table 1) were analyzed by 2 (Test Context, color or no color) X 2 (Test Format, constructed-response and multiple-choice) X 2 (Difficulty, Easy and Difficult) mixed ANOVA; the first a between-subjects variable, and the second two, within-subjects variables.

Table 1.
Means and Standard deviations.

Posttest		CR		MC	
	Lesson	difficult	easy	difficult	easy
Color	28.8	4.8	5.6	6.6	7.5
n=17		(2.1)	(2.2)	(1.4)	(1.2)
No color	29.0	4.0	5.9	7.5	8.1
n=17		(2.3)	(1.7)	(1.2)	(1.0)

Four significant findings were observed. The repeated measure Format (CR and MC) was significant, $F(1, 32) = 72.497$, $MSe = 2.500$, $p < .001$, MC scores were greater than CR scores. The repeated measure Difficulty (easy and difficult) was significant, $F(1, 32) = 72.363$, $MSe = 1.432$, $p < .001$, with easy greater than difficult. The interaction of Format and Difficulty, $F(1, 32) = 4.224$, $MSe = 0.921$, $p = .048$, and the 3-way interaction of Context (color or no color), Format, and Difficulty, $F(1, 32) = 4.224$, $MSe = 0.921$, $p = .048$ were both significant. Follow-up analysis of this complex interaction compared color to no color for MC easy, MC difficult, CR easy, and CR difficult posttest subsections. A significant difference was only observed for MC difficult posttest, with the no color mean ($M = 7.5$) greater than the color mean ($M = 6.6$).

Discussion

This investigation considered the cognitive and instructional effects of background screen color. Color impacts posttest performance. Including matching color during posttest reduced multiple-choice posttest performance for TBR content relative to the no-color posttest and improved constructed-response posttest performance for TBR content for difficult items.

Pett and Wilson (1996) note that color is often used by instructional designers without due consideration for what is already known. The use of color in screen (and print) design is common practice, yet much empirical and theoretical work remains to be done in order to guide our practice.

E-LEARNING AS TELEWORKING TRAINING TOOL

Nancy Viviana Clementino
Post-Graduation Program at Production and System Engineering (PPGEP)
Distance Learning Laboratory
Federal University of Santa Catarina (UFSC)
Brazil
nancy@led. br

Diego Alberto Otero
Post-Graduation Program at Production and System Engineering (PPGEP)
Federal University of Santa Catarina (UFSC)
Brazil
diego@eps. ufsc. br

Abstract: This paper describes how it is possible, with the help of innovations in systems and data processing, and relying on more efficient means of communications, performs several work activities outside the traditional office.

Hereby, characteristics of a teleworker profile, skills, and any issue related to success on applying Teleworking will be explained in detail.

E-learning comes to be an essential tool for teleworkers. This new methodology of training has to be incorporated in the organizations who adopt Telworking. Now, flexibility takes a key place in the organization goals.

E-learning as distance training will provide new opportunities to employees and benefits for companies.

Introduction

As a result of multimedia and internet fast expansion a new modality of work appears: *Teleworking* also called *Telecommuting* or long-distance work.

Teleworking is a set of technologies that complement and extend the dynamic ways of work. It is not only work at home instead at the office, it is about to take the office where the worker is (Ryan, 2000). What it matters is what it is done, when it is done and not where the work is done.

E-learning is the key for companies to constantly keep their employees trained in a world where technology advances day by day.

The advantages that distance education presents for teleworkers are even better than the employees who work at office are, because they need this type of training owing to be located in decentralized form.

For employees, Teleworking and distance education (or distance learning) improve life quality, eliminating transfer times which overload with pollution the environment and for the company it brings an enormous amount of benefits.

Terminologies

A vast terminology in the field of Teleworking and Elearning does exist. Now, it will be explained the most common terms:

Telecommuting - Teleworking - Teletrabalho: it is the process to take work to employees instead of taking them to work. The activities can be made outside the company eliminating the obligation to travel to the corporative office.

Telecommuting is the term used in the United States to designate Teleworking. The english word *commuting* means "go to and return from house to work". In Europe the term used for this modality of work is Teleworking and from there the translation to Teletrabalho in portuguese (Mello, 1999).

Home Office: the work place is in the employee's house.

Virtual Office: they are also known as Business Center. These places give services to professionals as Entrepreneurs or Teleworkers. There, is provided and offer everything what it is needed for work: telephone, computer, fax, account assistant, etc (Mello, 1999).

E-learning - Distance Learning. , it is a general term used to cover the broad range of teaching and learning events in which the student is separated (at a distance) from the instructor, or other fellow learners.

Distance education: "the process of extending learning, or delivering instructional resource-sharing opportunities, to locations away from a classroom, building or site, to another classroom, building or site by using video, audio, computer, multimedia communications, or some combination of these with other traditional delivery methods. (ITC, 2002)

Two things are necessary to start with Teleworking. In accordance with Nilles (1997) the first thing to do is mount a domestic office and structuralize a good environment of work. Second, it is essential to act with good sense and reprogram the mind in order to have success in this new labor situation.

Teleworker and Telemanager profiles

According to Talia Besga (Besga, 2000), Teleworking it is not suitable for all work stations nor all employees of the organizations.

One of the most important problems of teleworkers is isolation, both in working tasks as training. The person is alone in front of the computer without having face-to-face contact with colleagues, manager, boss or professor. Moreover, it is exposed to any kind of distractions like: neighbors, children, friends, TV, etc. Consequently, teleworkers have to have an adequate psychological profile for succeed.

Telemanagers (managers supervising teleworkers) or tutors, also do need to have a suitable profile, not all managers or supervisors are apt to *telemanagement*.

Teleworker profile

To be efficient in this context it is necessary to have some characteristics that will be fundamental for a good performance in the loneliness of the house.

Ideal teleworkers must combine the following aptitudes:

- Auto-motivated
- Auto-disciplined
- Capable of work with minimum supervision
- Organized
- Good communicator
- Not addict to work
- Well-disposed to participate in meetings and courses
- Professional Experience in working area (min. 3 years)

Making a test of aptitude facilitates enormously take a decision to name the right candidate to telework.

Telemanager profile

Teleworking forces managers to be better. The telemanagers role has emphasis in leadership and not only in administrative and control tasks.

Therefore, telemanagers will be questioned and required with much more incisive form by employees. It must be remembered that virtual environment levels up hierarchic relationships.

Most important skills that a telemanager must have are: positive attitude in relation with Teleworking, manage by measuring results, delegate assignments among telecommuter, organized, opened to receive new ideas, trust in teleworkers, communicative, etc.

Managers who are best at handling teleworkers and other remote employees tend to be good at scheduling and managing work assignments and identifying workflow problems before they turn critical

Training using E-learning

Teleworker training can be divided in two groups:

- *Teleworking Training:* it is necessary to be a good teleworker (technological tools, motivation, tips, etc)
- *E-learning Training:* the employee needs to acquire new knowledge (abilities for work)

Employees have to be always studying new technologies and trends (specially have basic & advance knowledge in computer and telecommunications). Therefore distance education is perfect for training today's teleworkers.

Training evaluation

Training evaluation could be:

- *Formative*: this type of evaluation is made along the course through auto-evaluation tests or with tutor monitoring.
- *Summative*: final exams or intermediate works are used to evaluate. Generally it required employee presence to guarantee credibility of the process and may be obtain a certificate or diploma.

Normally, in organizations that use E-learning to train their employees, the summative evaluation not exist, since it will be made a "real test" evaluation when abilities acquired have to be implemented during the exercise of the profession.

E-learning system evaluation

The E-learning system must be also evaluated. Evaluate the model, the technologies, the organization where it will be apply to, the type of evaluation offer, the attendance, the services, the duration, the action plan, the interaction systems and management processes.

To evaluate distance learning software executed via internet, it has to take into account the following characteristics:

- Have e-mail, forum, chat and discussion lists
- Automatic generation of reminders to concerning tasks and deadlines
- Automatic generation of statisticians concerning: employee access in the different modules of the course, accomplishment, bulletin boards of tasks, employee evaluations and participation level in group lists, forums, etc.
- Easy visualization of reminders, calendar and bulletin boards
- Easy access to obligatory materials and essential information
- Easy way to send the tutor tasks and evaluations
- Permit access to authorized users, giving password to guarantees the access to all materials and activities

Advantages introducing E-learning

Advantages for the company

Advantages obtained when introducing E-learning in an organization are:

- Allow training without the necessity of leave the place of work to attend presence courses
- Possibility to train a bigger amount of employees more quickly
- Required time to distribute information into the organization can be reduced to few hours
- Can be used as a tool for management of knowledge: it allows in such a way to identify profiles of abilities of employees and of its work stations

Advantages for the employee

Advantages that *E-learning* offer to normal employees and teleworkers are:

- Possibility to learn at any time
- Information is always available, therefore it is not necessary to take days nor hourly fixtures for training
- Contents that already are known or are not needed can be passed quickly while spending more time in those contents that are considered important

Conclusions

Of course, organizations have changes as consequence of Teleworking, it comes to bring more freedom and flexibility to the companies and employees.

Organizations will be able to work in a geographic decentralized way (distributed organization) and have economic, social and cultural improvements. Moreover, the advantages will be transferred to employees and managers.

In a competitive world, speed and autonomy play an important role, so E-learning is the key to get teleworkers trained in state-of-the-art. Today, it is demanded more and more expert and qualify professional so distance learning comes to help in the evolution of this process. Distance learning schedules, education formation modules, access to new technological tools, possibilities to be formed during working hours are vital items nowadays to be present in a competitive market.

E-learning does not embrace only employee's formation; it must be extended to all value chain: managers, suppliers, customers. They all should collaborate in make this new project work, it would be important they contribute and be informed about contents, changes, updates information, etc.

Finally, an implementation of an E-learning platform will be, undoubtedly, the future in training field in the organizations.

References

Besga, Talia. (2000). *El Teletrabajo: ventajas e inconvenientes*.Madrid Available in: http://www.delitosinformaticos.com/trabajos/teletrabajo1.htm

ITC. (2002). *ITC's Definition of Distance Education*. Available in:http://www.itcnetwork.org/definition.htm.

Mello, Alvaro.(1999). *Teletrabalho (Telework). O trabalho em qualquer lugar e a qualquer hora*. Rio de Janeiro, Qualitymark Ed.

Nilles, Jack.(1994). *Making telecommuting happen*. International Thomson Publishing, Inc.

Ryan, Jerry.(2000). *The Business Strategy behind Teleworking*. Natick, United States. Available in: http://www.techguide.com.

Using Virtual Poster Sessions in a Distance Education Course

Patrice Clemson, Pennsylvania State University

ABSTRACT

The poster session is a form of scholarly communication used in many disciplines to present early research findings and works in progress, The poster is easily adapted to the World Wide Web, offering the ability to collect related presentations from researchers at geographically dispersed locations. This presentation will explore the planning and implementation of the poster site developed for a graduate distance education course. Students in the course develop information products for their final project and make 10-minute presentations of the product prototype. Responding to requests for access to current and previous presentations, this instructor has organized these class presentations as virtual poster sessions. The medium provides an electronic publication opportunity for the student during the course and after it has ended. Students have immediate access to their own work to share with colleagues and enhance their own portfolios.

INTRODUCTION

The advent of the World Wide Web has accelerated innovation in the delivery of distance education at all levels. Faculty are developing new teaching methods for this new medium, the likes of which would not be possible before. Instructors are also converting established educational methods into their Web-delivered equivalents.

This paper describes the virtual poster session and permanent collection of final projects in a Masters level course delivered through the University of Illinois Graduate School of Library and Information Science LEEP (Library Education Experimental Program) distance learning program. Over the past few years there have been students in this class from Alaska, California, Oklahoma, New York, Georgia, Mexico, Missouri, Illinois and many other locations. There are also some instructors who live outside of Illinois. Students begin their course of study with a "boot camp" where they are introduced to the synchronous classroom environment, HTML and some of the other tools they use during the term. Then the students and instructors meet on campus for one weekend every term. This is a graduate professional program designed for educating students who are geographically dispersed.

The paper will review the evolution of the idea over several academic terms, present examples of the poster session and permanent collection formats, and explore enhancements that are possible with these media in this educational environment.

ASPECTS OF THE PAPER

There is a strong tradition of the poster session as a form of scholarly communication. Many professional groups, in the sciences and health care, schedule poster sessions at their conferences and meetings. The poster session is especially significant in the library and information sciences. The American Library Association (ALA) and American Society for Information Sciences and Technology (ASIST) hold extensive poster sessions at their annual meetings. This is evidenced by the fact that ALA publishes guidelines for the preparation of posters. This significance is also reflected by ASIST conference scheduling their poster sessions so as not to conflict with other conference events.

The final project presentation exercise in the LIS 315: Network Information Systems course exhibits many of the features of the poster session. The course's final project assignment requires that each student develop an information product related to networking or library automation. The final project presentations are delivered at a scheduled time and place. There is a 10 minute time limit for the presentation, so the content and supporting materials must be concise. Class chat rooms provide colleagues with the opportunity to interact with the author and ask questions. Finally, each presentation has a Web page component to provide print, audio and visual support to the student's discussion.

There are some improvements that could be made to the class sessions where the presentations are made. Time limits must be imposed so that ten presentations may be made within a two-hour class meeting. Additional chat room meetings could be scheduled to allow the presenters to field questions about their posters. Alternately, discussion lists could be set up for the purpose of exchanging ideas.

Another aspect of this paper on virtual poster sessions deals with the preservation of the posters in a permanent Web-based collection. Because the interactive poster sessions are conducted during regular class meetings at the end of an academic term, there are problems with accessing the project materials after the term has ended. It has become desirable to store many of the posters in a stable place.

Some issues related to virtual poster sessions and permanent storage of the presentations in the context of a Master's level distance education course focus on the protection of the student's privacy and intellectual property. Because the project presentations are part of a regular academic course they reside on the GSLIS LEEP server and are accessible by authorized users via user ID and password. Furthermore, all project materials are stored together with others presented on the same date. The LEEP server directory architecture is reconfigured each term. At the end of the course, materials for the permanent collection must be identified and moved to another location on the secure server. Before this is done it is necessary to obtain each student's permission to add his or her poster to the collection. Once permission has been granted there are issues relating to maintaining and updating the Web site. These are technical issues of information architecture, metadata and classification of the web pages.

Future enhancements to the permanent collection are being considered that would enable communication between the audience and the authors of the posters. It may be possible to establish a monitored bulletin board on the Web site or electronic mail links to each author.

CONTEXT AND MOTIVATION

The poster session is perceived as an important vehicle for scholarly communication in many professions and disciplines. This provides ample justification for learning and practicing the use of this medium during the course of graduate studies.

Final project presentations in the Network Information Systems course follow a general format that is quite similar to that of a poster session. With several minor changes this assignment can be enhanced to provide the graduate students with practical experience with a communications form they are likely to use during their professional careers.

During the two years this course has been offered this instructor has received continuing requests from students for access to prior term projects. Once students reviewed previous projects' content and form many of them remark that they understand what is expected. Having the opportunity to see what others have done is often a catalyst for our own creativity. The "poster session" website was implemented on the LEEP server to guarantee that the site and its contents will be accessible only by LEEP students, faculty and staff.

The permanent collection was intended to provide a stable location for student work so it would continue to be available after the course had ended. A student might like to include the project in a portfolio or otherwise share the work with a potential employer. Several student projects were actually part of larger projects. The collection was designed to allow one to revisit the work as it existed at a particular point in time.

This body of project work reflects the intelligence, creativity and hard work of a group of highly motivated individuals. In the past, many of these projects were effectively finished once the presentation had been delivered to the class. This instructor and the students now have the means to share the wealth of creative projects with their colleagues.

PROJECT PROTOTYPE URL:

http://leep.lis.uiuc.edu/seworkspace/pclemson/vps.html

REFERENCES

Aust, C. & Kinnick, K. (1996). Communicating Scholarly Research via the Poster Session: The Experience at a National Convention. Annual Meeting of the Speech Communication Association, 1996, San Diego, CA.

Bourne, J., McMaster, E., Rieger, J., & Campbell, J. (1997). Asynchronous Learning Networks: A Sloan Foundation perspective. Journal of Asynchronous Learning Networks, 1 (2). Retrieved July 12, 2002 from http://www.aln.org/alnweb/journal/issue2/assee.htm

Buckland, M. & Marchionini, G. (2002). Poster sessions at ASIST 2001: A welcome resource. Bulletin of the American Society for Information Science, 28 (4). Retrieved July 12, 2002 from from Proquest database.

Harmon, A. (2001). Cyberclasses in session. The New York Times, November 11, 2001. Retrieved July 12, 2002 from Proquest database.

Heppner, P., Rooney, S., Flores, L., & Tarrant, J. (1999). Salient effects of practice poster session on counselor development: Implications for research training and professional identification. Counselor Education and Supervision, 38 (3). Retrieved July 12, 2002 from Proquest database.

Jenkins, C. (2000). Far out learning. School Library Journal, 46 (2): 46-49.

Mayadas, F. (1997). Asynchronous Learning Networks: A Sloan Foundation perspective. Journal of Asynchronous Learning Networks, 1 (1). Retrieved July 12, 2002 from http://www.aln.org/alnweb/journal/issue1/mayadas.htm

Newman, F. & Scurry, J. (2001). Online technology pushes pedagogy to the forefront. The Chronicle of Higher Education, 47 (44). Retrieved July 12, 2002 from from Proquest database.

O'Neil, C. (2001). A poster session to describe student experiences in community nutrition agencies. Journal of Nutrition Education, 33 (5). Retrieved July 12, 2002 from from Proquest database.

Pineda, R. (1999). Poster sessions: Enhancing interactive learning during student presentations. Journal of Management Education, 23 (5). Retrieved July 12, 2002 from from Proquest database.

AMEE: Annotated, Multi-modal Electronic Evaluation for Dynamic Student Modeling

John W. Coffey and Michael Webb
The Institute for Human and Machine Cognition
The University of West Florida
Pensacola FL 32514

Abstract: This paper contains a description of AMEE – Annotated, Multi-modal, Electronic Evaluation system. AMEE provides capabilities to create evaluation tasks (including tests) that contain annotations indicating the topic areas and dimensions that the task addresses. AMEE is multi-modal in the sense that the student can answer questions that require point and click (true-false or multiple choice questions), keyed essays, or drawing (pictorial answers, solving math problems by hand), etc. The scored results of the evaluation items can be assembled into a visual representation of a student progress model that can be used by the student and instructor.

Introduction

In this work we describe an evaluation tool that is designed to serve the creation and maintenance of a student learning model. The components described here are part of a content recommender subsystem that in turn is part of LEO, a Learning Environment Organizer (Coffey, 2000; Coffey and Cañas, 2001) based upon Assimilation Theory (Ausubel et al. 1978). This work takes its impetus from a variety of research areas including electronic testing and user modeling, and an ontological account of a learning system (Coffey, 2002). The remainder of this paper contains a brief description of relevant literature on electronic testing and student modeling, AMEE's testing component, and the contents and visual representation of the student model provided by the system.

Related Literature

With the proliferation of computers and distance learning, electronic testing is gaining much more widespread use. Kirka and Wonacott (2000) describe benefits of electronic testing such as the ability to carry out continuous assessment of a variety of types. They cite drawbacks such as security issues, the impersonality of computerized testing, uneven access to technology, and potential technical problems such as connections going down in mid-test. Another problematic issue is the fairness of electronic tests. Mason, Patry and Berstein (2001) concluded that computer-based testing led to similar outcomes to those that were attained through traditional testing approaches. On the other hand, Wingenbach (2000) concluded that students taking pencil and paper tests scored significantly higher than the group that took electronic versions of the tests.

Researchers have explored and refined methods of creating and maintaining computer user models for decades (Rich, 1979; Finin, 1989). Bull, Brna and Pain (1995) state that each instance of a student model must be domain-specific within the educational context, and must include a characterization of student performance in the domain, sequencing issues, the use of analogy, the employment of varying learning strategies and metacognitive issues such as awareness and reflection. Shute (1995) describes SMART, which models knowledge and skills in a manner that includes diagnostic information, such as the level of assistance the student required on a topic, and remediation information.

Cumming (1991) discusses Intelligent Educational Systems (IES) that provide comments and advice with the student in the role of collaborator rather than the role of someone to be led by the system. A collaborative IES is congruent with current educational theory that emphasizes increased learner control (see, e.g., Lawless and Brown, 1997; Schweir, 1995). Kay (2001) states that, in the broadest sense, the goal of user modeling is to create a representation that indicates user cognition and performance. The quality of a user model lies in the fidelity with which the model represents the actual state of the human. With AMEE, the topic of this work, a student model contains a variety of information including progress information on courses and topics completed and student attainment levels expressed in terms of:

- Areas of study – intuitively, the topics in a course, and
- Dimensions of competence – orthogonal to areas, these are measures of capability within an area.

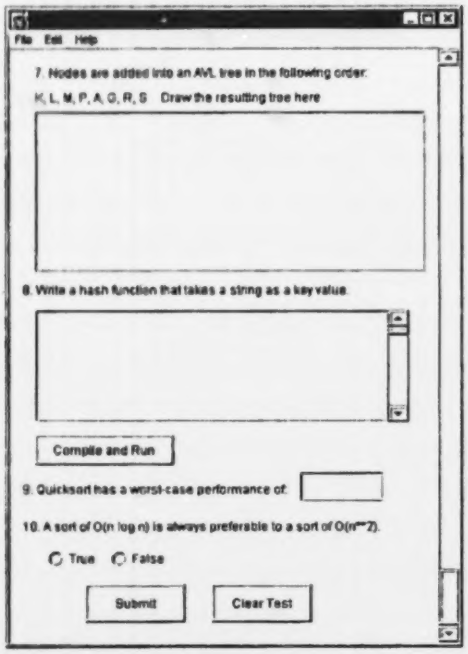
The areas or topics may be in any of four states – completed, current topic, ready or not ready. The names and number of dimensions is domain-specific. Area and dimension descriptions are used to annotate questions.

Annotated Multimodal Electronic Evaluation and User Modeling

AMEE provides an environment in which instructors can create annotated tests and other evaluation vehicles. The evaluation items are annotated with descriptors that can be used to provide a high-resolution representation of student achievement in terms of the areas and dimensions that comprise a course. The evaluation items are annotated further with the instructor's grades and comments attached to individual testing items, thereby becoming a basic part of the student profile.

The evaluation items are multimodal in the sense that responses to questions may be made in a variety of modes. In the case of tests, the student can answer true/false or multiple-choice questions by pointing and clicking as in traditional electronic testing. Test takers can also key in editable answers to essay questions, and use a stylus to draw pictures or to provide hand-written responses, as when working math problems. The electronic drawing scheme provides an eraser that allows students to erase and re-enter work.

Figure 1 presents a depiction of the interface to the testing component. Figure 1a presents the student's view of the test. In question 7, the student is required to draw the picture of an AVL tree, a typical data structure. The student will compose a computer program function in question 8, fill in the blank in question 9, and answer question 10 (the true/false question) with a click of the mouse. Figure 1b illustrates the instructor's view of the test. The student's hand-written answer to question 7, and the code the student wrote in question 8 are visible. The instructor can see the attributes associated with the question – the topic area, and the ratings on the dimensions that are tested.



7. Nodes are added into an AVL tree in the following order:

K, L, M, P, A, G, R, S Draw the resulting tree here

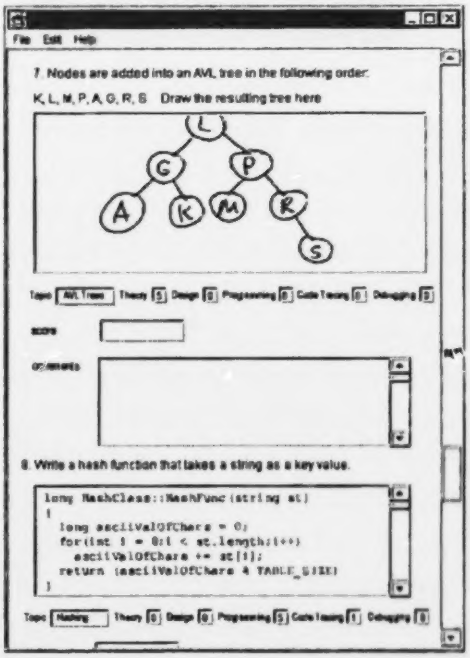
8. Write a hash function that takes a string as a key value.

9. Quicksort has a worst-case performance of:

10. A sort of O(n log n) is always preferable to a sort of O(n**2).

○ True ○ False

Figure 1a. The student's view of the Exam.



7. Nodes are added into an AVL tree in the following order:

K, L, M, P, A, G, R, S Draw the resulting tree here

Topic AVL Trees Theory 5 Design 0 Programming 0 Code Tracing 0 Debugging 0

score

comments

8. Write a hash function that takes a string as a key value.

```
long HashClass::HashFunc(string st)
{
  long asciiValOfChars = 0;
  for(int i = 0;i < st.length;i++)
    asciiValOfChars += st[i];
  return (asciiValOfChars % TABLE_SIZE)
}
```

Topic Hashing Theory 0 Design 0 Programming 5 Code Tracing 1 Debugging 0

Figure 1b. The instructor's view of the exam.

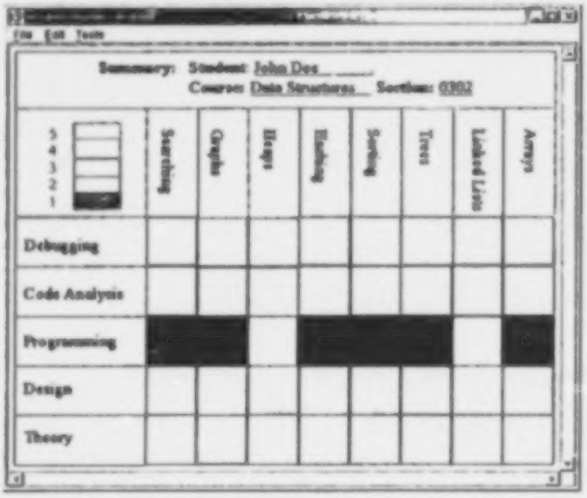
In question 7, the topic area is AVL trees, and the possible dimensions are theory, design. programming, code tracing and debugging. Topics and areas are domain-specific. Question 7 requires that students understand the theory of insertions in an AVL tree. Question 8 requires that the student be able to program a function that is part of the process of hashing. It is possible that more than one dimension might be addressed in a question, in which case there would be more than one non-zero value in the annotations. The instructor is provided with a space to assign the score and to annotate the question with comments in the "score" and "comments" fields. The areas and dimensions associated with the various questions are utilized along with the scores in order to assemble the student profile, which is discussed in the next section.

BEST COPY AVAILABLE

Student Models and Profiles

Figure 2 depicts the visual component of a profile from a course in Data Structures. In conjunction with the testing component, the profile is created automatically. The tool provides further capability to edit the profile manually. In Figure 2, the dimensions appear as the rows and the areas appear as the columns. A Likkert scale is presented for the scores in a given area/dimension combination, with a range of 1 (low) to 5 (high). The visual representation makes it easier for the student and instructor to determine how the student is progressing. For example, Figure 2 illustrates that the student is doing well in the theory component of the course, but poorly in the programming.

Profiles emerge over the duration of the course. Initially, little information is available. If a course is treated on a topic-by-topic basis, the columns fill in as tests, quizzes and homework assignments are evaluated. Profiles can be aggregated over multiple courses if some of the dimensions of achievement are shared between the courses. Individual area or dimension scores can be collapsed to give an overall score for, e.g., "Programming" or "Sorting." Profiles can be viewed for individual students, aggregated for an entire class, presented as comparisons between classes, and aggregated by students who have similar weaknesses or strengths. These aggregations can be used to create a visual representation of how the entire class is doing, to set specific remediation groups, or to group students in a way that has a combination of stronger and weaker students in the same group.



Summary: Student: John Doe
Course: Data Structures Section: 0302

5 4 3 2 1	Searching	Graphs	Heaps	Hashing	Sorting	Trees	Linked Lists	Arrays
Debugging								
Code Analysis								
Programming	■	■		■	■	■		■
Design								
Theory								

Figure 2. A Student profile from a Data Structures course.

Summary

This work describes AMEE, an Annotated Multimodal Electronic Evaluation system that allows the instructor to annotate evaluation items and generate student achievement profiles that can be viewed by both the student and instructor. The motivating idea is to present a visual depiction of student progress in a course. This depiction can be used for face-to-face or distance learning courses. Students can view their profiles to determine the progress they are making in the course.

The system starts with the testing component that allows students to answer traditional computer-based questions such as true/false and multiple choice. Additionally, AMEE allows students to key answers to essay questions and to create hand drawings with a stylus. Questions have annotations that indicate the areas (topics) of the course that the question evaluates, and the dimensions of attainment within an area. The visual tool allows the student and the instructor to see at a glance how the student is performing in the course. Additionally, the instructor can aggregate data on classes to view how the whole class is performing, to identify students with similar strengths and weaknesses, etc.

BEST COPY AVAILABLE

References

Ausubel, D.P., Novak, J.D., & Hanesian, H. (1978). *Educational psychology: A cognitive view*. New York: Rinehart and Winston.

Bull, S., Brna, P., & Pain. H. (1995). Extending the scope of the student model. *User Modeling and User-adapted Interaction*, 5 (1), 45-65.

Coffey, J.W. (2002). *An ontology-guided approach to content adaptation in LEO: A learning environment organizer*. Lecture Notes in Computer Science. New York, NY: Springer-Verlag.

Coffey, J.W. (2000). LEO: *A Learning Environment Organizer to accompany constructivist knowledge models*. Unpublished doctoral dissertation, The University of West Florida, Pensacola, FL.

Coffey, J.W., & Cañas, A.J. (2001). Tools to foster course and content reuse in online instructional systems. *WebNet 2001: World Conference on the WWW and Internet*. Association for the Advancement of Computing in Education. Orlando, FL. 207-213.

Cumming, G., (1991). Learner modeling in collaborative intelligent educational systems. In P. Goodyear (Ed.), *Teaching knowledge and intelligent tutoring*. (pp.85-104). Stamford, CT: Ablex Publishing Corp.

Dahn, I., & Schwabe, G. (2002). Personalizing textbooks with slicing technologies – concepts, tools, architecture, collaborative use. *Proceedings of the 35th Annual Hawaii International Conference on Systems Sciences*. 7-10 Jan, 2002, Big Island, HI.

Finin, T. (1989). A general user modeling system. In A. Kobsa & W. Wahlster (Eds.), User Modeling, Springer Symbolic Computation Series, New York: Springer-Verlag.

Kay, J. (2001) User modeling for adaptation. In C. Stephanidis (Ed.), *User Interfaces for All: Concepts, methods and tools*. (pp.271-294). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Kirka, S., & Wonacott, M.E. (2000). *Assessing learners online*. Practitioner File. Found in ERIC Microfiche, ED448285.

Lawless, K.A., & Brown, S.W. (1997). Multimedia learning environments: Issues of learner control and navigation. *Instructional Science*, 25, 117-131.

Mason, B.J., Patry, M., & Berstein, D.J. (2001). An Examination of the equivalence between non-adaptive computer-based and traditional testing. *Journal of Educational Computing Research*, 24(1), 29-39.

Schweir, R.A. (1995). Multimedia design principles for constructing prescriptive, democratic and cybernetic learning environments. *Proceedings of ED-MEDIA 94 World Conference on Educational Multimedia and Hypermedia*. Vancouver, B.C., Canada, June 25-30.

Rich, E. (1979). User modeling via stereotypes. *Cognitive Science*, 3, pp.329-354.

Shute, V.J. (1995). SMART: Student modeling approach for response tutoring. *User Modeling and User-Adapted Interaction*, 5(1), 1-44.

Simon, H.A., & Kaplan, C.A. (1991). Foundations of cognitive science. In M.I. Posner (Ed.), *Foundations of Cognitive Science*, (pp.1-47). Cambridge, MA: MIT Press.

Wingenbach, G.J. (2000). Agriculture students' computer skills and electronic exams. *Journal of Agricultural Education*, 41(1), 69-78.

Developing a Virtual Community of Learners

Susan M. Colaric, PhD
School of Education
East Carolina University
Greenville, NC, USA

Abstract: People have been gathering in communities for centuries. Initially for protection, then socialization, these groups tended to be small, focused on the villages of an agricultural society. In the 19th century, with the changes in daily lives brought about by the Industrial Revolution, the purpose of communities changed. As we move into the Information Age, virtual communities have formed, including virtual communities for educational purposes. These new communities offer participants an opportunity to move beyond physical location to interact in a global community, yet many people are ill-prepared to meet this new challenge. The modes of communication and social mores of the group are foreign, with both instructors and learners unsure of how to act in the new environment. While the potential exists for online educational communities to fulfill the goal of extending education beyond the walls of the campus, both instructors and learners need assistance in becoming full members.

It is difficult to develop a singular definition of community. In biological terms, community refers to an interacting group of species in a common location. Synecology, in fact, is the study of a group or community of organisms and their relations to each other and to their common environment. So physical existence in a common area (co-location) is the key. However, most dictionary definitions do not stress co-location; the important factor there is the association of interests; communities are formed around a common interest or goal.

Ferdinand Tönnies, an early German sociologist, in *Gemeinschaft und Gesellschaft* (1887; translated as *Community and Society*, 1957), sought to explain the major social problems in the West as a consequence of the transition from the communal, status-based, concentric society of the Middle Ages to the more individualistic, impersonal, and large-scale society of the Industrial Revolution. This was, in fact, a way of differentiating communities based on factors of co-location and communal interests. He explained this through the distinctions between the local community (gemeinschaft) and the larger society (gesellschaft). Gemeinschafts are "small, geographically distinct, kinship-interwoven groupings characterized by intimate, overlapping, and stable relationships" (Hiltz & Wellman, 1997, p. 45). Gesellschafts are formed by a larger, disperse membership who are oriented toward a particular goal. He believed that the duality of these two concepts is present in everyday life and is distinguished by the separation of community and mere association.

Steven Jones in *Virtual Culture: Identity and Communication in Cybersociety* (1997) begins with the biological definition of community but also goes a step further. He believes that community relies on "inhabitance, not just being in the same place at the same time with others but as being a part of that place, as if one is part of the landscape" (Jones, p. 16). He, in fact, removes the idea of interest stating communities are "parallel, rather than serial, groupings of people, which is to say that they are not composed of people who are necessarily connected, even by interest, but are rather groupings of people headed in the same direction, for a time" (Jones, p. 17).

The idea of the university as a community is often expressed: community of scholars; higher education community; the campus community. Ernest Boyer, a prominent researcher investigating the role of higher education in American society, edited a report for the Carnegie Foundation for the Advancement of Teaching and the American Council on Education entitled *Campus Life: In Search of Community* (1990). In it he reported the results of a survey conducted among college and university presidents which focused on social conditions on campuses. The study had as its focus the community aspect of higher education. Boyer distinguishes between six elements of community on campuses:

> First, a college or university is an educationally purposeful community where faculty and students share academic goals and work together to strengthen teaching and learning on campus

> Second, a college or university is an open community where freedom of expression is uncompromisingly protected and where civility is powerfully affirmed
>
> Third, a college or university is a just community where the sacredness of the person is honored and diversity is pursued
>
> Fourth, a college or university is a disciplined community where individuals accept their obligations to the group
>
> Fifth, a college or university is a caring community where the well-being of each member is sensitively supported and service to others is encouraged
>
> Sixth, a college or university is a celebrative community, where the heritage of the institution is remembered and where rituals affirming tradition are widely shared (Boyer, 1990 p. 7-8)

Here, Boyer is using the definition of community which emphasizes a shared interest since there is no mention of co-location.

When the discussion moves to virtual communities the definitions become even less clear because there is the added dimension of co-location being in a virtual space. Virnoche & Marx (1997) define virtual communities as "those encompassing people whose connections to one another are based solely in virtual space or on computer-mediated communications" (Virnoche & Marx p.86) where the members share a virtual space but never a physical one. There is no mention of sharing common goals or interests; the idea of co-location is there but it is a virtual space. So the question becomes, can you share a common space when in fact you are not physically located together? Virnoche & Marx are also very clear in stressing that the members *never* share a physical space. Rheingold (1993), on the other hand has a different perspective as he considers virtual communities to often include an "In Real Life" (IRL) element. He defines virtual communities as "social aggregations that emerge from the Net when enough people carry on those public discussions long enough, with sufficient human feeling, to form webs of personal relationships in cyberspace" (Rheingold, p. 5). So his definition focuses more on the shared interests, with elements of longevity and inter-personal connections added.

Hiltz & Wellman (1997) in their study of Asynchronous Learning Networks (ALNs) also use a definition based on shared interest. They, in fact, view the lack of co-location as a positive element of virtual communities:

> Because they are less constrained by geography (and group solidarity) than traditional communities, spatially dispersed communities in general, and virtual communities in particular, tend to be communities of shared interest. The ease of contacting other people facilitates the growth of relatively large virtual communities and the evolution of densely knit relationships among community members. The lack of traditional spatial and group constraints means that virtual communities are often heterogeneous in social characteristics, such as lifecycle stage, gender, ethnicity, and socioeconomic status. (Hiltz & Wellman, p. 45)

Douglas Scholer in *New Community Networks: Wired for Change* (1996) advocates changing the definition of a community completely. "The old concept of community is obsolete in many ways and needs to be updated to meet today's challenges. The old or "traditional" community was often exclusive, inflexible, isolated, unchanging, monolithic, and homogeneous. A new community ... needs to be fashioned from the remnants of the old" (Scholer, 1996, p.9). He believes communities are strictly goal-oriented and states that "communities are not places to be, to engage in conversation, they are groups of people seeking to achieve particular goals". This is a departure from the contemporary definitions of community because co-location is no longer a concern and a shared interest is not sufficient -- there needs to be a goal that the group is working toward. It does, however, reach back to Tönnies' concept of *gesellschaf.* This definition seems to fit most educators definitions of virtual universities although they are also hoping for the communal feelings of *gemeinschaft*.

As with other definitions of communities there is no consensus on what clearly defines a virtual educational community. Early, some would say idealistic, definitions echoed the sentiments of Rachel Schwartz (1995). "The Virtual University is a university where, with the help of technology, students have access to the world's best instructors and information sources without having to set foot on campus" (Schwartz, 1995, p.26). The definition is a loose one including conversation and probably a shared interest but the concept of co-location is not addressed. Michael Brooks (1997) attempts to operationalize the term in "Beyond Teaching and Learning Paradigms: Trekking into the Virtual University"

> "By virtual education, I mean education that is enhanced by the application of electronic technologies to the processes of teaching and learning. Education becomes virtual to the extent that teachers and learners, who may interact in the traditional classroom mode, are joined in the learning process electronically, possibly across great distances, such that teaching and learning are no longer tethered to a single place, time or pace. Virtual education, therefore, includes traditional modes of learning supplemented by the use of sophisticated technologies, including personal computers, networks, and perhaps the Internet, plus what is known as distance learning, or learning that does not involve a students being physically present on the home campus of the school offering the course. (Brooks, p. 7)

This very broad definition includes the possibility of co-location but doesn't require it; it includes a shared interest (the learning of the subject); and there is an element of interaction. Hiltz and Wellman (1997) appear to share the same concept:

> "A virtual classroom is both an instrumental group – in which students and instructors want to accomplish goals – and a community – in which students exchange emotional support, information, and a sense of belonging. Asynchronous Learning Networks are best at enriching educational options when they serve as a way to create the feeling of a true "class" or group of people learning together and to structure and support carefully planned collaborative learning activities that constitute the assignments of a course. Emphasizing group cooperative efforts among faculty and students, collaborative learning stresses that the educational process occurs through the active participation of students and instructors in an environment that facilitates peer interaction, evaluation, and cooperation." (Hiltz & Wellman p.46)

Jack Wilson, Dean of Continuing Education at Rensselaer Polytechnic Institute also doesn't see the displacement of time and space as incompatible with interaction, "The technology will enhance and allow interactions. They don't necessarily have to be at the same time" (Schwartz, 1995, p.25). But he does suggest that there needs to be an adjustment as to the method of instruction. "The faculty's role is not just telling students information – it's to structure information and structure interactions with that information so students can learn material by suggesting, probing" (Schwartz, p.26).

While the idea of building a virtual community of learners seems possible, today's faculty members do not have a skill set that they can utilize to accomplish this goal. Most higher education faculty members are hired for their content knowledge, not their ability to bring about a new paradigm of learning. Practical skills, to take advantage of new technologies, based on a review of community development will be the focus of this session. Instructional strategies to facilitate both synchronous and asynchronous communication will be included. Perspectives from faculty members who have employed these techniques in various domains and the views of students in the courses will also be presented.

Brooks, J.M. 1997. Beyond teaching and learning paradigms: Trekking into the virtual university. *Teaching Sociology, 27* (Jan) 1-14.

Carnegie Foundation for the Advancement of Teaching. (1990). *Campus Life: In Search of Community*. Lawrenceville, NJ: Princeton University Press.

Hiltz, S.R. & Wellman, B. (1997). Asynchronous learning networks as a virtual classroom. *Communications of the ACM, 40* (9) 44-49.

Jones, S.G. (Ed.). (1997). *Virtual Culture: Identity and Communication in Cybersociety*. Thousand Oaks, CA: Sage Publications.

Rheingold, H. (1993). *The Virtual Community: Homesteading on the Electronic Frontier*. New York: HarperCollins.

Scholer, D. (1996). *New Community Networks: Wired for Change*. Reading, MA: Addison-Wesley Publishing.

Schwartz, R.A. (1995). The virtual university. *ASEE Prism, 5* (Dec) 22-26.

Tönnies, F. (1957). *Community and Society*. New York: Michigan University Press.

How Does A Sales Organization Best Support A Distributed Sales Force From A Learning, Communication And Support Standpoint?

The proliferation and advancement of technology throughout the 90's and into the 21st century, as well as global competition have transformed the way business is conducted in the industrialized world. Sustainable competitive advantage is no longer based on technology or machinery. Corporate leaders are saying, "People are our most important advantage." In Canada specifically, many of the global organizations operate as sales organizations. One of the biggest challenges faced by these organizations is keeping their distributed sales force trained and up to speed on potentially hundreds of complex products that can evolve/change on a regular basis. As well, these organizations are challenged with providing "soft skills" learning such as consultative selling, relationship building and self-management.

Companies have traditionally operated on the centralized event-based training model. This approach to learning has proven to be extremely costly, inflexible in terms of time and place, and often fails to meet the goals of the sales force and ultimately the business goals of the organization. The last two years have seen a movement to a more dynamic learning model. Learning Management Systems and eLearning are providing pieces of this yet unfinished puzzle. The next step is to bring it all together in and end-to-end approach that leverages both technology and people to bring learning and performance support tools to the sales organization in a timely and flexible manner.

This paper and presentation will examine how a leading automotive company has developed a robust learning solution that supports a 19,000 + sales force across Canada in their on-going learning and information needs. Specifically we will examine:

- Performance-centered learning model
- Measuring results - how the learning solution supported the measurable performance outcomes and became the benchmark of success
- Blended learning (mixing facilitated learning, eLearning, satellite and self study) to support specific needs
- Product knowledge strategies for ensuring the sales force are constantly updated and competency is assured
- Certification
- Real-time support – selling processes and product knowledge

David Connal, MBA, B.Ed. B.Sc., Manager, Learning Solutions, Maritz Canada Inc.

David has over 14 years experience as a management and performance consultant, instructional designer, and teacher (high school and university). He has designed a wide variety of instructional and informational products including interactive multimedia courseware, and web based performance support tools. As well he has undertaken evaluation and needs assessment studies including strategic planning initiatives and business case development.

Carlo Pirillo, B.Eng, Director, e-Business Solutions, Maritz Canada

Carlo brings over 20 years of IT experience in various industries such as personal security, logistics, high tech and automotive. He has led a team in the design, development and deployment of a Web-based Training Management System that enabled the client to manage training using real-time data, incorporating on-line certification testing, on-line product knowledge, planning modules and course scheduling, automated tracking of individual training histories and training path management, and reporting functions.

Carlo oversees all e-Commerce initiatives and develops IT and e-Business strategies. Understanding the strategic role of IT and the Internet, he works with clients to formulate the appropriate solution to meet their e-commerce needs.

Accessibility in complex web based learning applications: lessons from the PEARL project

Martyn Cooper, Chetz Colwell
Accessible Educational Media (AEM) group
Institute of Educational Technology
Open University
United Kingdom
m.cooper@open.ac.uk, c.colwell@open.ac.uk

Telmo Amaral
Departamento de Engenharia Electrotécnica e de Computadores (DEEC)
Faculdade de Engenharia da Universidade do Porto
Portugal
tga@fe.up.pt

Abstract: This paper reports approaches promoting accessibility for disabled students to science and engineering practical work, developed in a major European educational technology project PEARL. This project has developed the facilities for conducting a range of teaching experiments in science and engineering subjects at higher education level remotely over the WWW. This paper concentrates on one example of these, based on the remote control of an optical spectrometer. It gives a succinct view of the overall systems architecture and the user interface sub-system. The approaches adopted to promote accessibility for disabled students are outlined. Lessons from this work, which are generalisable to other Web based applications, particularly with JAVA based clients, are highlighted.

Introduction

The PEARL project (Practical Experimentation by Accessible Remote Learning) started in March 2000. Cooper, et. al. (2000) introduced the project in detail; only a brief introduction is included here to set the paper in context. The PEARL project objectives are:

- To develop a flexible system enabling students to conduct real-world experiments remotely over the WWW.
- To research the pedagogic impact of this approach validating its developments in different educational contexts and subject areas in higher education.

Key results of project are four instantiations of the PEARL approach, one at each of the participating universities. These are realized through a systems integration of: a remote controlled lab facility, a control and communications infrastructure working over the Internet, an accessible user interface sub-system and synchronous collaboration tools. A key deliverable, planned for February 2003, is the PEARL Handbook designed to enable other institutions to adopt the PEARL approach in their teaching. PEARL is a major project with a total effort over the 3 years in excess of 30 person years and a budget of about US$2 million.

PEARL, from its conception, was seen to provide significant potential for enabling greater access for disabled students to practical work in science and engineering subjects. This paper describes in particular the instantiation of the PEARL approach developed for the Open University. It is around this prototype that the accessibility work in the project has been concentrated.

The accessibility rationale

Disabled students are grossly underrepresented in the science and engineering disciplines. The reasons for this are complex and include significant factors from primary and secondary level education. However access to experimental work is cited as a key barrier in analysis of this problem both in North America and Europe. Much work has been done over the past 20 years to make computers accessible to people with all kinds of disabilities. Hence the approach in the PEARL project has been to firstly to make practical work computer controlled. It then had to ensure that the computer software and interface design followed well-established design for accessibility principles, as exemplified by the WAI Content Guidelines [URL 1] or various manufacturers' guidelines [e.g. URL 2, URL 3] and that the software was compatible with the available access technologies.

The system developments

The overall approach to the systems architecture has been a modular one so that the different modules can be readily adapted when creating a new experimental facility. It is a CORBA based architecture which means that these modules can be mapped onto physical machines in a flexible fashion as dictated by other design constraints. For the implementation described here there was a Lab Server connected to the remote laboratory equipment, a Web Server that mediated all the communications to/from the students' machines and interacted with the Lab Server and the students' client software over CORBA bridges. The Server application implements the high-level control operations that can be requested remotely. These high-level operations are translated to calls to low-level control methods exposed by the Hardware Access application. The low-level methods are invoked across a local CORBA bridge.

The Remotely Controllable Jig

A simple optical spectrometer has been adapted so that it is motor controlled. An annotated photograph of this is given in **Figure 1**. The spectrometer has been mounted on a moving table so that the students can position it in front of different light sources. Air is bubbled through one of up to 6 different metal salt solutions, as selected by the students, and into the gas feed to the Bunsen burner. Therefore the spectra associated with the chemical in each bubbler can be observed. The slit size and focus of the collimator, used to ensure the light is parallel as it passes into the diffraction grating, have been motorised, as has the rotation of the telescope. The driver circuitry for all the motors, valves and sensors is located together in a dedicated housing. This in turn is interfaced to the Motion Controller Board installed in the Lab Server.

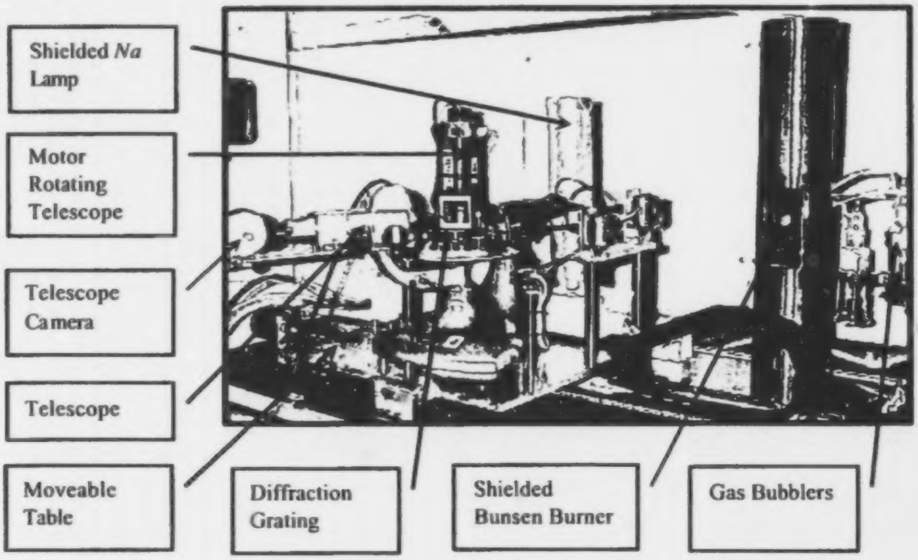


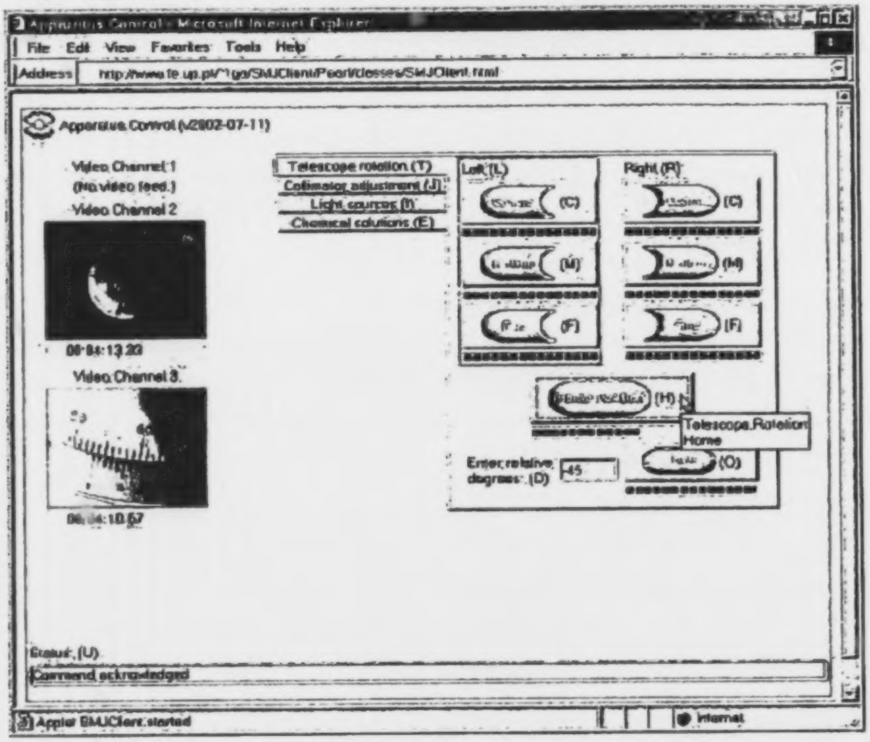
Figure 1: Annotated Photograph of Motorized Optical Spectrometer Jig

User Interface Approach

The user interface design has been conceived in such a way as to promote usability and accessibility and so that it is readily adapted when creating a new PEARL experimental facility. The Client can run either as an application or as an applet within an Internet browser. In fact, to provide support for both formats, only very

BEST COPY AVAILABLE

small portions of the code had to be written differently. **Figure 2** shows the client running as an applet within Microsoft Internet Explorer.


Apparatus Control - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Address
Apparatus Control (v2002-07-11)
Video Channel 1
(No video feed.)
Video Channel 2
Video Channel 3
Telescope rotation (T)
Collimator adjustment (J)
Light sources (I)
Chemical solutions (E)
Left (L)
Right (R)
(C)
(C)
(M)
(M)
(F)
(F)
(H)
Telescope.Rotation Home
Enter relative degrees: (D)
(O)
Status: (U)
Internet

http://www.fe.up.pt/~lgo/SMJClient/Pearl/classes/SMJClient.html

08:04:13.23

08:04:10.67

45

Command acknowledged

Applet SMJClient started

Figure 2 – Screen-capture of the client user interface, running as an applet within Internet Explorer, using Windows Classic display appearance scheme (only 2 video feeds shown)

Approaches to Achieving Usability and Accessibility

There are several complex issues that need to be addressed in the design of a user interface for remote control of apparatus. The main issue is the impact of delays between the user's operation of a control, and the execution of that command in the laboratory, and the feedback, via the video feeds, that the command has been completed. The design therefore includes buttons, rather than knobs or sliders, to support students in making discrete commands. Students may need to operate any one of up to 20 controls at anytime and therefore these controls need to be readily accessible. The design therefore groups the controls for different aspects of the spectrometer into 'tabs' (similar to Windows property sheets).

Accessibility requirements and solutions

The design incorporates several requirements in order to make it accessible to students with disabilities. These are presented in the table below in bold text, along with a description of how they are met in the design. The requirements were based on guidelines for the accessibility of Web content [ibid. URL 1] and the expertise of the researchers and their colleagues. The below table summarises these key accessibility criteria and links these with notes on how these were implemented in the JAVA based client programmes. In most cases these are generalisable to any interactive application implementing its client software in JAVA.

Accessibility Criteria	Implementation Notes
Inheritance of Windows properties: Some disabled users require or prefer specific settings within the operating system in order to use the computer. (E.g. certain colour combinations, font style and size, or utilities such as StickyKeys).	The client's GUI is based on JFC/Swing components from J2SE v1.4.0, which can track user's display preferences in Windows, such as colours, fonts, metrics, etc, and can also respond to dynamic changes made by the user.
Text labels on all controls: The screen-reading software used by visually impaired users for speech output requires all user interface elements to have text labels which can be read out.	All controls have their Java accessible names set in the code. In addition, the Java Runtime Environment (JRE) used to run the client is configured to use version 1.0.2 of the Java Access Bridge for Windows. Thus, JAWS for Windows v4.0.2 is able to read the accessible names of all controls.
Keyboard operable: Many disabled users cannot or prefer not to use a mouse and therefore need to be able to operate all user interface elements via the keyboard. The PEARL application provides two methods of keyboard operation. The Tab and Enter keys respectively can be used to navigate between, and operate, the controls and keyboard shortcuts enable the user to operate all controls	The order in which the controls can be focused using the Tab key is set by the way in which the controls are laid-out on the GUI. In addition, for each control, a keyboard shortcut is associated (via the control's input and action maps) to a global action object. When a shortcut is used, the global action object determines which action should be taken and triggers that action.
Reminders of shortcuts included in labels: Users are supported in learning the keyboard shortcuts with the inclusion of the shortcut in the label of the control.	The accessible names of all controls include the corresponding shortcut key character, so JAWS may read it.
Auditory indication of command progress: To provide visually impaired users with feedback on the progress of commands, on-speech sounds are provided to acknowledge the system's receipt of a command, and that it is completed. This information is also provided visually for other users in the form of progress bars located beneath each control.	Short sounds accompany the changes in state of the progress bars located below each button. The simple support for sound of the Java core APIs is used to read and emit the sounds from files in WAV format. The CORBA connection between the client and the server is bi-directional, so that the intermediate state of a command ('command acknowledged') may be triggered by an asynchronous CORBA call-back.
Status bar: The status information provided in the progress bars is also presented in a status field. The application focus can be temporarily moved to this field using a shortcut. This enables visually impaired users to query the current status in case they missed the auditory indication.	The status bar is a regular label component which accessible name is dynamically updated, every time the command state changes. Pressing the status bar shortcut key simply diverts the input focus momentarily to the status bar, so JAWS may read it, and then returns the focus to the previous component.

Conclusions

The PEARL project has demonstrated the remote control of complex functionality can be achieved across the Internet. The user interface design for the Open University's Optical Spectrometer is a good exemplar of how widespread accessibility for disabled people can be achieved in JAVA based applets or applications and these approaches are applicable to any interactive software package.

Acknowledgements

The PEARL project is funded by the European Commission's Information Society Technologies program (Project reference IST-1999-12550).

References

Cooper M., Scanlon E. and Freake S. L. (2000). Remote Controlled Teaching Experiments, in Science and Engineering Subjects, Accessible over the World-Wide-Web - The PEARL project, *Proc. ED-MEDIA 2000 Conference*, Montreal, Quebec, Canada.

URLs referenced in the text:

URL 1: WAI Content Accessibility Guidelines: http://www.w3.org/TR/WAI-WEBCONTENT/
URL 2: Sun's Accessibility Guidelines: http://www.sun.com/access/developers/index.html
URL 3: IBM's JAVA Accessibility Guidelines: http://www-3.ibm.com/able/accessjava.html

graW: A Web Interactive Environment to Support Undergraduate Courses

Cidorvan dos Santos Leite[1], Evandro de Barros Costa[2],
Marcello Alves de Sales Junior[1], Rodrigo de Barros Paes[1]

Departamento de Tecnologia da Informação (TCI) – Universidade Federal de Alagoas (UFAL)
Campus A. C. Simões BR 101 Norte Km 14 BL 12 – 57072-970, Maceió – AL – Brazil

cidorvan@hotmail.com, ebc@fapeal.br,
masj@tci.ufal.br, r0drigopaes@yahoo.com

[1]CNPq Scholarship Student, [2]Supervisor

Abstract: This paper presents a Web/Internet-based distance learning environment which allows users to form academic communities through Web. The main idea is to provide means to have virtual communities sharing the same space. In order to help the interactions among different users either from the same or different academic institutes, these communities are comprised of their own synchronous and asynchronous communication tools along with their pedagogical resources, in addition to others to support the invitation of guest users other than academic ones. Our goal is the academic communities; academic subjects of a given department of an institute, which are organized to provide the stated extension, taking advantages of the Internet and the tools developed using it. This paper focuses a particular view of the announced system, that is, an instance of environment oriented to support, on the web, undergraduate courses. The architecture and the functional aspects of this environment are presented.

Introduction

The Internet provides researchers possibilities to develop new communication/interaction tools which support learning communities, specially the academic ones. In this context, we present a particular environment which concerns the forming of academic communities through Web. This environment is called graW (Undergraduate Courses on the Web). Essentially, graW is composed of two categories of computational tools regarding an academic environment. One is concerned with pedagogical aspects, providing resources such as synchronous and asynchronous communication tools along with pedagogical resources. The other is concerned with administrative/support aspects such as user and course register/support. The main idea is to provide an extension of the traditional classroom by using the Internet/Web through virtual communities sharing the same space.

graW Architecture and Environment

The proposed environment has been designed to support the traditional learning space – in our case the academic one – using tools offered by the Internet and others developed at UFAL University. It's based on groups of community which represent either each academic course, presented physically at the academic institute, research groups or any extra course like tutorials. Each community has also their own politics and rights applied to each user, who chooses to be associated with it and share knowledge and information. These users may be teachers and students from any academic environment, and external users that represent the guests of each community. The interactions among the users in each community are managed by a personalized interface which controls the presentation of the community for each kind of user. The community has two types of tools: the communication and the authorship one. A group of administrators can manage the entire environment online. The proposed and used architecture is as follows (Figure 1).

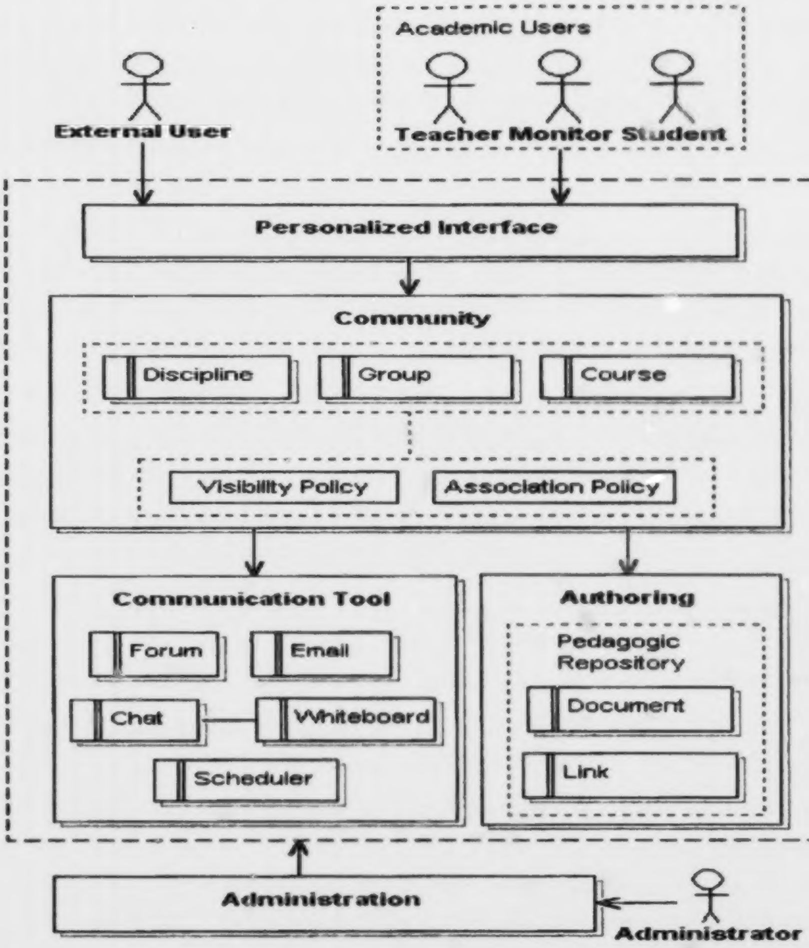

Academic Users
External User
Teacher
Monitor
Student
Personalized Interface
Community
Discipline
Group
Course
Visibility Policy
Association Policy
Communication Tool
Forum
Email
Chat
Whiteboard
Scheduler
Authoring
Pedagogic Repository
Document
Link
Administration
Administrator

Figure 1: The model of the graW Architecture and the interaction of its different types of users.

The ability of doing something by a user is defined in the personalized interface, which stores information about the user and his preferences on the community he is associated with. Indeed, if a user is a teacher, he has the rights, for example, to post any document to the community or even schedule a chat session among the participants. However, a student could only have access to the generated knowledge of the community.

The environment enables different kind of communities, such as academic subjects, courses and research groups, each of them created by a different kind of user. E.g. a teacher can create an academic subject or any other, whereas students can only create research groups or courses. Each community has its own politics which define the association and visibility. The association policy says how the system acts when a user requests an association.

The communities are also composed by tools to help the participants exchange information easily: the synchronous communication tool that is a chat room with a whiteboard for each community and the asynchronous communication ones, which are the use of a list of emails of all participants, a discussion forum to discuss about any kind of categorized information and the integrated/personal schedule to apply a meeting to all community, for instance, or for personal use.

BEST COPY AVAILABLE

Authoring tools here are designed to provide new contents on the web of the interaction during classes. These contents can be links to other sites and any kind of documents; everything shared with all students on the online environment, and later, they can be indexed with the information of the program of a given community.

The administration tool, which is the main source of graW, is used only by administrators in order to provide the initial content of a given department or even the university. These administrators can also delegate others to work along with them, in order to set a new university in the environment.

There are basically three types of users: the academic, the external and the administrator ones. Each of them has its own characteristics. The academic user is a Student, a Teacher or a Monitor which are interacting in the communities. If it is required the presence of a guest, like someone without any link to the academic course or subject, graW enables that an external user has all privileges as teachers have. Finally the administrator delegates other users to help on the configuration and give all permission on the environment. All of them are distributed in groups by academic courses.

Discussion

Teachers are responsible for proposing communities which are the ones taught by him in the institution. After the approval of the community by an administrator, the teacher can populate the community by using tools like the guest center in order to send emails to users who can be interested in the participation of his virtual community. His community will also be seen by users like students who can choose to join it. Besides, Teachers can "elect" Monitors, among the students associated with one of the communities, to help him in the production of resources and the publication of academic resources like documents, links and so on. This means that the Monitors will have the same ability as Teachers have in the environment.

Like in the real world, sometimes students are in doubt about something they didn't understand in a class or they can be shy to express it, for example. For this reason, graW offers these users the chance to join a community of their preference, in order to get their answers using the communication tools, besides exchanging ideas among the others. As a result, students now have conditions to express their ideas with their classmates, in addition to learning with others who are presented in the same community.

Now suppose that a teacher wants to have a guest to show something to his virtual community. graW enables him to invite another teacher, for instance, a business man, in order to present the community something new. Teachers can invite someone to join the community and share his knowledge among the participants, interacting in a chat session or answer question on the discussion forum. This interaction may stimulate free exchange of ideas among different users.

All described type of users will be able to propose communities. These can be tutorials or extra courses, besides gathering other users in an online environment.

The academic subject is intended to allow academic users to discuss specific issues related to it. It's organized by teachers of the subjects that are being proposed. Teachers have administration tools which allow them to upload information like the course description, bibliography and even its program with the indexing to the correct document or link published with the authoring tool.

There are two types of course: course with a link to an academic subject: It allows the creation of extra curricular courses associated with an academic course. It might be like a tutorial or a course given by a guest teacher in the university the community is in; course without a link to an academic Subject allows the creation of extra curricular courses without any association with universities.

The communication tools are responsible for an easier end faster communication among teachers, students and other users. They make use of tools of two known categories: Synchronous tool, which are a *chat* tool associated with each community, where users can have a real time chat session in order to debate anything with the others. Along with the chat tool, there is a *whiteboard* one to help users to explain what they are talking about just drawing on the board; others are Asynchronous tools, which are the most used tools of graW. It is offered a *discussion forum* for every community in order to enable users to expose your doubts and questions in a secure area where teachers, monitors and other users in the community can discuss, answering and making questions about what is being studied. As a consequence, new information is produced by the community. There is also a *list of all users* and their information, including *email*, associated with a particular community to support a discussion list of email. Therefore any user can send an email to another or even to all participants of the community. Another tool in this category is a personal/shared scheduler, where teachers and monitor can schedule an anything like a test time or even the next chat session of a particular community, in addition to being used as a personal calendar/scheduler.

In order to offer different pedagogical resources, graW has an authoring tool which enables teachers and monitors to publish resources on a particular subject oriented to a given community. In each community, teachers and monitors will be able to upload the required resources and group them. There are two types of resources: Documents and Links. The documents can be of any kind of electronic media like MS PowerPoint Presentation and HTML web pages, each one with a detailed description and additional information; the links are intended to be additional resources in the community, like other web sites of research groups, online content that is of interest of the community or any kind Educational games and simulations.

Conclusions

We have presented the design and development of a learning environment named graW. graW supports learning communities, providing extra-class activities related to specific courses, providing online and fast assistance to students and improving management of classes.

Nowadays, the use graW in our department has provided a great extension of the real classroom works in about 13 different academic subjects, and many others research groups and courses, to more than 335 users, from students to teachers from Federal University of Alagoas, UFAL. Preliminary results have pointed out positive aspects and have doing, at the same time, little adjustments concerning user interface. At the moment, there have been developed learning management tools as well as videoconference ones, to be incorporated in the graW environment, available on http://www.graw.tci.ufal.br.

References

BRUSILOVSKY, P. (1998) A Study of User Model Based Link Annotation in Educational Hypermedia. Journal of Universal Computer Science, Berlin, v.4, n.4, p.428-448;

DRAVES, WILLIAM A.(2000) *Teaching Online*. LEARN Books. USA;

DILLENBOURG, P. (1999): Collaborative Learning and Computational Approaches, Oxford: Pergamon Press;

GOLDBERG, M. W. (1997); Communication and collaboration tools in WebCT; Proceedings of the Conference Enabling Network-Based Learning; Espoo, Finland;

LABIDI, S., SILVA, J. C., COUTINHO, L. R., COSTA, E. B. (2000). MATHNET: An Agent-Based Tutoring System for Supporting Cooperative and Distant Learning In: Computer and Advanced Technology in Education, Cancun.

SIMONSON, MICHAEL (2000). *Teaching and Learning at a Distance – Foundations of Distance Education*. Prentice-Hall, Inc;

Supporting Self-Regulation in Student-Centered Web-Based Learning Environments

Nada Dabbagh
George Mason University
Graduate School of Education
4400 University Drive, MS 4B3
Fairfax, VA 22030-4444
E-mail: ndabbagh@gmu.edu

Anastasia Kitsantas
George Mason George Mason University
Graduate School of Education
4400 University Drive, MS 4B3
Fairfax, VA 22030-4444
E-mail: akitsant@gmu.edu

Abstract. Numerous benefits of student-centered web-based learning environments have been documented in the literature; however the effects on student learning are questionable, particularly for low self-regulated learners primarily because these environments require students to exercise a high degree of self-regulation to succeed. Currently few guidelines exist on how college instructors should incorporate self-regulated strategies using web-based pedagogical tools. The scope of this paper is to to (a) discuss the significance of self-regulation in student-centered web-based learning environments; (b) demonstrate how designers and instructors can integrate self-regulation using web-based pedagogical tools; and (c) redefine the role of the instructor to support the development of independent, self-regulated learners through the use of web-based pedagogical tools.

Introduction

In student-centered Web-based learning environments, the physical absence of the of the instructor coupled with the increased responsibility demanded of learners to achieve learning tasks presents additional difficulties for learners, particularly those with low self-regulatory skills. Consequently, the need to promote effective use of web-based pedagogical tools to support self-regulation processes is paramount. It is suggested that web-based pedagogical tools can scaffold the acquisition of metacognitive skills, and knowledge of plans and goals (McLoughlin & Hollingworth, 2001). Additionally, in student-centered Web-based learning environments, content can be customized to meet individual learner needs, abilities, goals, and other individual characteristics, and learning and motivational strategies can be integrated to help students become self-directed learners (McCombs, 2002). Currently however, few guidelines exist on how instructors should incorporate self-regulated processes using Web-based pedagogical tools. Developing such guidelines will provide more effective instructional designs for student-centered Web-based learning environments, and will help define the role of the instructor in supporting the development of independent, self-regulated learners to ensure successful learning experiences.

Processes of Self-Regulation

Among the key self-regulatory processes affecting student achievement and motivational beliefs are goal setting, self-monitoring, self-evaluating, task strategies (e.g. rehearsing and memorizing and organizing and transforming), help seeking, and time planning and management. Goal setting refers to what the student is trying to accomplish (Schunk, 1983). Research indicates that students who set specific as opposed to general goals, and process goals (methods and strategies that can help one master a task), rather than product goals (outcomes of learning efforts), show high skill achievement and motivation in the initial stages of learning a task (Zimmerman & Kitsantas, 1997; Zimmerman, 2000). Self-monitoring which refers to deliberate attention to an aspect of one's behavior (Kanfer, 1971) directs the learners' attention to the task and assists them in evaluating the outcomes of their efforts. For instance, keeping daily records assists the learner in determining how to make appropriate learning adjustments in order to attain his/her goals. Self-evaluation refers to comparing outcomes of performance with a standard or goal (Zimmerman, 2000). Research studies show that students who self-evaluate their progress, display higher skill acquisition and report higher self-efficacy beliefs, intrinsic interest and self-satisfaction about their performance than students who do not self-evaluate. Task strategies during self-regulated learning include strategies that learners believe will enable them to accomplish their goals. These strategies are domain specific and may include (a) deeper processing elaborative and organizational strategies such as, rewriting notes, selecting main ideas, and/or outlining the text to be learned; and (b) rehearsal strategies for basic memory tasks such as using mnemonics to remember the key stages of a theory. Research evidence indicates that use of appropriate strategies is highly correlated with academic achievement in the classroom (Pintrich & De Groot, 1990). Help-seeking, an important self-regulatory process, refers to seeking help from experts or available resources to assist one self to learn. Findings from numerous studies indicate that help seeking significantly predicts performance (Newman, 1990). Finally, time planning and management refers to budgeting time effectively. Effective management of one's study time also contributes to academic achievement (Zimmerman, 2000).

BEST COPY AVAILABLE

Integrating Self-Regulation Processes Using Web-Based Pedagogical Tools

Web-based pedagogical tools can be classified into six broad categories ranging from basic to complex, and from specialized or single purpose tools (e.g. creating a web page), to integrated or multipurpose tools (e.g. creating a web page, uploading a web page, sending email, managing student progress, etc.). We briefly describe each of these categories below and discuss their implications on promoting self-regulation processes.

Web-Based Hypermedia Tools

This category includes the use of browsers, search engines, and information navigation and evaluation. Use of these tools may help learners engage in self-regulated learning by assisting them in obtaining relevant information to complete an assignment, and in seeking help when they encounter task difficulties using the variety of resources and search engines supported through hypermedia technology.

Web-based Multimedia Tools

This category involves downloading and installing plug-ins in order to view video/audio files and various multimedia files including graphics, animations, PowerPoint files, PDF files, etc. These tools support meaningful interaction with content by providing learners with multiple options to view or to access the course material in various multimedia formats resulting in higher intrinsic interest in the material.

WWW Publishing/Programming Tools

This category includes the use of HTML editors and other Web publishing and authoring tools (e.g. Dreamweaver and FrontPage). These tools can serve as powerful learning strategies enabling students to demonstrate their understanding of course content by creating Web pages that synthesize their knowledge, or by designing more complex Web-based applications in a collaborative effort. Acquiring such skills helps learners in selecting appropriate task strategies to accomplish process and outcome goals. Use of these tools also promotes self-monitoring and self-evaluation processes.

Asynchronous/Synchronous Communication Tools

This category includes communication tools such as email, discussion forums and newsgroups, chat programs, audio and videoconferencing tools, electronic whiteboards, groupware, and document sharing tools. Use of these tools helps learners engage in an active and reflective dialog with peers and meaningfully interact with relevant resources and learning objects. These tools also facilitate the establishment and refinement of individual and group learning goals; promote the development of effective time planning and management skills to efficiently carry out the responsibilities associated with being an active and accountable member of a group; and encourage student help seeking behaviors.

Presentation and Visualization Tools

This category includes media creation tools such as PowerPoint, Adobe Photoshop, Adobe Acrobat, Inspiration, Mind Mapper, and MindMan, that allow learners to synthesize content through the creation of multimedia presentations and products, and to organize their learning using concept mapping tools such as Inspiration, Mind Mapper ™ and MindMan[1]. In terms of self-regulation, use of these tools facilitates implementation of task strategies including organizing and transforming, structuring, elaborating and rehearsing.

Web-based Course Management Tools

This category emphasizes the use of Web-based applications that integrate multimedia and hypermedia pedagogical tools, asynchronous and synchronous learning tools, presentation and visualization tools, and WWW publishing and authoring tools. Examples of Web-based course management tools include WebCt, BlackBoard, Lotus LearningSpace, First Class, and WebMentor among others. Due to their integrative nature, Web-based course management tools can support all of the learning activities and associated self-regulation processes discussed above, facilitating student-centered Web-based learning and promoting independent, self-regulated learners. Table 1 shows examples of how each class of Web-based pedagogical tools can be used in a Web-based learning environment to support the processes of self-regulation.

Processes of Self-Regulation	Examples of Instructors' role in Supporting Self-Regulation	Associated Web-based learning Pedagogical tools	Examples of Students' Use of A Technological Tool

---

[1] Inspiration, Mind Mapper and MindMan are computer-based visualization tools that allow users to create concept maps, semantic networks, outlines, graphic organizers and other comprehension monitoring activities. Concept maps are diagrams that represent concepts and relationships structurally.

Goal setting	Help students to identify and set learning goals	Asynchronous & synchronous communication tools	Students use email to communicate goals to instructor and receive feedback
Task strategies (e.g., organizing, transforming)	Help students to select appropriate learning strategies	Presentation and visualization tools	Students use concept mapping software to organize course content
Self-monitoring	Help students to monitor their progress	Web-based course management tools	Students use the "your progress" tool to monitor their progress on learning tasks
Self-evaluating	Help students to evaluate their progress	WWW publishing & programming tools	Students use online rubrics, and evaluation criteria to make a judgment
Time planning and Management	Help students to develop effective time planning and management skills	Asynchronous & synchronous communication tools Web-based course management tools	Students follow posted protocols on how to participate in moderated online discussions to budget their time Students use electronic calendar to plan semester activities
Help-seeking	Help students to identify social and non-social sources	Asynchronous & synchronous learning tools Web-based hypermedia tools	Students use an electronic listserve to post a question Students use a search engine to obtain information
Intrinsic Interest	Help students to interact meaningfully with content material	Web-based multimedia tools	Students use graphics, audio, and video to view and process learning content

Table 1. Mapping Web-based learning Pedagogical tools to Self-Regulatory Processes

Rethinking the Instructor's Role in Supporting the Development of Self-regulated Learners in Student-Centered Web-based learning Environments

The success of any distance education program rests squarely on the shoulders of the faculty (Willis, 1995). Willis believes that instructors in web-based learning environments face a number of challenges. Some of these challenges include difficulty in (a) understanding the characteristics and needs of distant students with limited or no face-to-face contact; (b) adapting teaching styles which take into consideration the needs and expectations of multiple, often diverse, audiences; and (c) developing a working understanding of delivery technology, while remaining focused on the teaching role. Because of these challenges the instructor's role in web-based learning environments must be reconceptualized to meet the needs of student-centered learning, and to support students' use of web-based pedagogical tools to assist them in developing self-regulatory skills. In an effort to identify the roles and competencies of distance education professionals, Thach and Murphy (1995) conducted a review of the distance education research literature. Seven critical competencies or skills emerged that can be used as a framework for rethinking the instructor's role in web-based learning environments. They include (1) interpersonal communication and feedback, (2) promoting interaction, (3) administrative and support service, (4) collaboration and teamwork, (5) knowledge of conducting a needs assessment, (6) understanding new learning pedagogical tools and their impact on learners, and (7) developing a systems perspective of thinking. All of the above competencies require instructors' proficiency in the use of web-based pedagogical tools. The authors however did not provide guidelines on how instructors can implement these competencies using web-based pedagogical tools. Additionally, by encouraging instructors to develop these competencies, particularly those related to communication, feedback, interaction, and knowledge of conducting a needs assessment, instructors will be able to support self-regulated learning in the student-centered web-based learning environment. Due to space limitations we will not be able to describe each of these competencies in detail however we will provide a few examples on how instructors can apply some of those competencies in student-centered web-based learning environments to support students' development of self-regulated learning skills.

For example, regarding the first competency (interpersonal communication and feedback), instructors can use email to discuss individual student goals and expectations at the start of a web-based learning experience. This form of communication establishes a sense of security, direction and purpose that is much needed in the absence of face-to-face instructor-student interactions. With respect to the second competency (promoting interaction), instructors can set up an electronic listserve aimed at supporting students' help-seeking behaviors (see table 1). Students can post technical, pedagogical, or administrative questions to this listserve, andobtain feedback from the instructor, their peers, and technical support staff assigned to assist the instructor in the web-based learning environment. This listserve can also promote collaboration between the instructor and the technical support staff,

BEST COPY AVAILABLE

which was emphasized as an important competency in distance learning programs. Additionally, instructors can promote interaction and collaboration by setting up structured and moderated discussion forums using Web-based course management tools. Structured and moderated discussion forums allow students to engage in meaningful discourse and to test the viability of their ideas and interpretations of content material on others (peers and instructor). Well-defined protocols on how to moderate, post to, and synthesize online discussion forums should be clearly communicated to students using for example the "course assignments" or "course activities" features of the web-based course management tool. Web-based rubrics on how students' contributions will be evaluated should also be provided. Additionally, instructors should plan on facilitating at least one or two discussion forums to model the implementation of such protocols and to demonstrate how to effectively synthesize an online discussion in order to promote meaningful understanding of course content. Conveying appropriate protocols to students and modeling the implementation of protocols and procedures in a web-based learning environment helps students develop effective time planning and management skills (see table 1). Furthermore, the instructor's competent use of presentation and visualization tools (e.g. concept mapping tools, PowerPoint presentations, and the constructing of tables and matrices) to demonstrate how to synthesize an online discussion assists students in selecting appropriate task strategies to organize and structure their learning (see table 1).

Conclusion

The success of any learning environment is based on the careful analysis of learner and instructor skills and the strategies and tools used to deliver and manage effective instruction. This paper examined the interaction between web-based pedagogical tools, learners' processes of self-regulation, and instructor competencies deemed critical in identifying the instructor's role in web-based learning environments. It is suggested that the deliberate orchestration of these three components may lead to the development of independent, self-regulated learners in student-centered web-based learning environments. By carefully mapping the use of web-based pedagogical tools to the processes of self-regulation, and helping instructors develop competencies that promote the implementation of learner-centered instructional and learning activities through the use of such tools, web-based learning environments can become increasingly student-centered and learners will become better prepared to assume responsibility for their own learning and face the changing nature of distance education programs.

References

McLoughlin, C., & Hollingworth, R. (2001). The weakest link: Is web-based learning capable of supporting problem-solving and metacognition? In ASCILITE 2001 proceedings, pp. 117-120. Retrieved from http://www.medfac.unimelb.edu.au/Ascilite2001/pdf/papers/mcloughlinc1.pdf

McCombs, B.L. (2002). The Learner-Centered Framework on Teaching and Learning As a Foundation for Electronically Networked Communities and Cultures. Retrieved February 13, 2002 from http://www.pt3.org/VO/teach_learn.php3

Newman, R.S. (1990). Children's help-seeking in the classroom: Motivational factors and attitudes. *Journal of Educational Pscyhology, 82,* 71-80.

Pintrich, P. & De Groot, E. (1990). Motivational and self-regulated learning components of classroom academic performance. *Journal of Educational Psychology, 82,* 33-40.

Schunk, D. H. (1983). Progress self-monitoring: Effects on children's self-efficacy and achievement. *Journal of Experimental Education, 51,* 89-93.

Thach, E.C. & Murphy, K.L. (1995). Competencies for Distance Education Professionals. *Educational Technology Research and Development, 43, 1,* 57-79.

Willis, B. (1995). Distance Education at a Glance. Retrieved July 5, 2002 from http://www.uidaho.edu/evo/distglan.html

Zimmerman, B. J. (2000). Attaining self-regulation: A social-cognitive perspective. In M. Boekaerts, P. Pintrich, & M. Seidner (Eds.), *Self-regulation: Theory, Research, and Applications* (pp.13-39). Orlando, FL: Academic Press.

Zimmerman, B. J. & Kitsantas, A. (1997). Developmental phases in self-regulation: Shifting from process goals to outcome goals. *Journal of Educational Psychology, 89,* 29-36.

REDI: On-Line Educational Resources for the Development of Professional Multimedia Skills.

Ricardo Dal Farra
National Institute for Technology Education
National Ministry of Education
Buenos Aires - Argentina
ricardo@dalfarra.com.ar

Abstract: The National Institute for Technology Education from the National Ministry of Education in Argentina began a few years ago to work on new educational profiles trying to integrate the complex necessities of the work world of today with the basic concepts that the school should transmit to students. From those profiles were developed a group of modular curriculum structures being applied in our country now, an example being the Technical Vocational Pathway in Multimedia Communication based on a competences learning process. An educational program at the national level focused on the development of professional skills needs to solve several problems to work this out, being faculty training on new areas of knowledge and work a big issue. The answer was REDI, an on line educational database with resources, activities, documents and didactic strategies being produced focusing the technical competences and artistic skills needs for multimedia and related medias.

Introduction

During 1996, the National Institute for Technology Education, part of the National Ministry of Education in Argentina, began to work on new educational profiles trying to integrate the complex necessities of the work world of today with the basic concepts (in a broad sense) that the school should transmit to students.

One of the biggest differences between this and previous programs, was the work over a competences based learning approach. Starting from the identification of real and potential professional competences required for different occupational areas, the next step was to elaborate the educational profiles that looks for the present and prospective needs of a person who is now studying but will be soon working on a medium with highly changeable technological environments.

As soon as new educational profiles began to be developed, several problems arose, and among them were the lack of teachers with both the technical instruction for the work and the pedagogical preparation for the class.

The development of didactic resources is a requirement to help the transformation processes to improve education, and are of special importance if we think on new fields where integrated technical, scientific as well as artistic capabilities needs to be developed.

Multimedia Communication

From those original profiles were developed a group of modular curriculum structures being applied in Argentina since 1999, an example being the Technical Vocational Pathway in **Multimedia Communication,** based on a competences learning process.

The dynamic growing of the multimedia professional field requires to be prepared to integrate art concepts with specific contents and fast changing technologies.

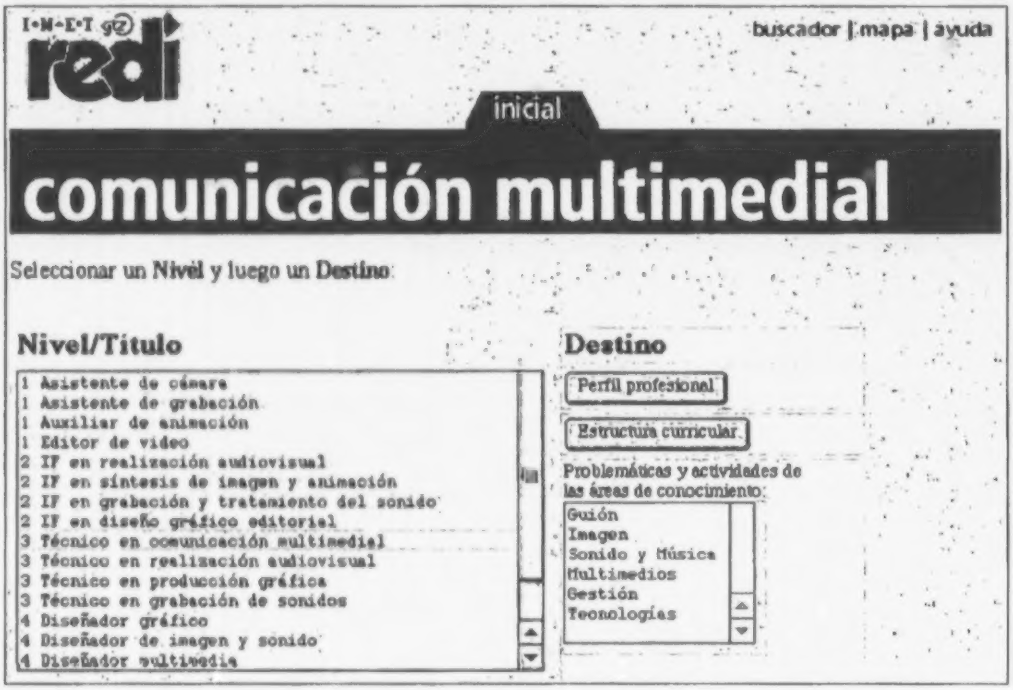
Is not possible to develop a cultural change on the educational system just writing new plans. An educational program at the national level focused on the development of professional multimedia skills needs to solve several problems, being faculty training on new areas of knowledge and work a big issue.

Our answer to this was REDI, an on-line educational database with resources, activities, documents and didactic strategies being produced to focus on the technical competences and artistic skills needed for the multimedia and related media fields (image synthesis and animation, sound editing/processing, video, etc.).

The REDI project

The REDI project (REDI stands for *recursos didácticos* in Spanish = didactic resources in English) is focused on the development of educational materials for the competences based learning process on multimedia and related medias.

On REDI, capabilities, problematic situations, activities, didactic strategies and contents can be accessed selecting a Professional Qualification level, a Professional Profile, or the Knowledge Area related to the specific multimedia subject searched.



comunicación multimedial

Seleccionar un Nivel y luego un Destino:

Nivel/Titulo

1 Asistente de cámara
1 Asistente de grabación
1 Auxiliar de animación
1 Editor de video
2 IF en realización audiovisual
2 IF en síntesis de imagen y animación
2 IF en grabación y tratamiento del sonido
2 IF en diseño gráfico editorial
3 Técnico en comunicación multimedial
3 Técnico en realización audiovisual
3 Técnico en producción gráfica
3 Técnico en grabación de sonidos
4 Diseñador gráfico
4 Diseñador de imagen y sonido
4 Diseñador multimedia

Destino

Problemáticas y actividades de las áreas de conocimiento:

Guión
Imagen
Sonido y Música
Multimedios
Gestión
Tecnologías

Figure 1: REDI have several options to explore and search for its contents. To navigate it, is possible to start choosing a qualifying level or certification/diploma/degree, a professional profile or one curriculum structure. There is also a search engine, as well as a map of the full site structure to help quick findings.

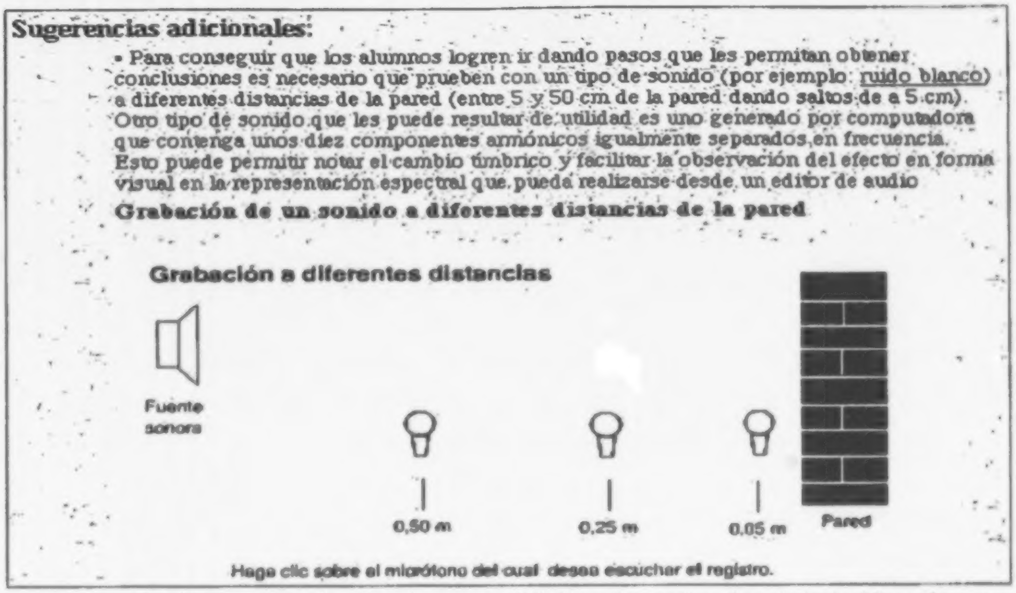
The interactive developments on REDI points to assist teachers or help students to understand problematic situations that can be part of real life practices.

The Knowledge Areas included are: Communication, Multimedia, Script, Image, Sound and Music, Management and Technology.

Ideas and proposals for teachers to work on the class with specific problems on different topics, as well as suggestions for assessments for each area, are going to be included on the final version.

The following figure is a sample of it. Simple but effective, the teacher could use this interactive screen to support a sound recording class. On the example, a sound coming from the speaker is reaching the wall, reflecting, and sounding different when direct and reflected waves are combined. Using REDI this can be easily heard clicking on the speaker to listen to the direct sound source, and then the several microphones placed at 0.05, 0.25 and 0.50 meters from the wall to listen to the different timbres produced by consequence of direct + reflected waves.

BEST COPY AVAILABLE



Sugerencias adicionales:

- Para conseguir que los alumnos logren ir dando pasos que les permitan obtener conclusiones es necesario que prueben con un tipo de sonido (por ejemplo: ruido blanco) a diferentes distancias de la pared (entre 5 y 50 cm de la pared dando saltos de a 5 cm). Otro tipo de sonido que les puede resultar de utilidad es uno generado por computadora que contenga unos diez componentes armónicos igualmente separados en frecuencia. Esto puede permitir notar el cambio tímbrico y facilitar la observación del efecto en forma visual en la representación espectral que pueda realizarse desde un editor de audio

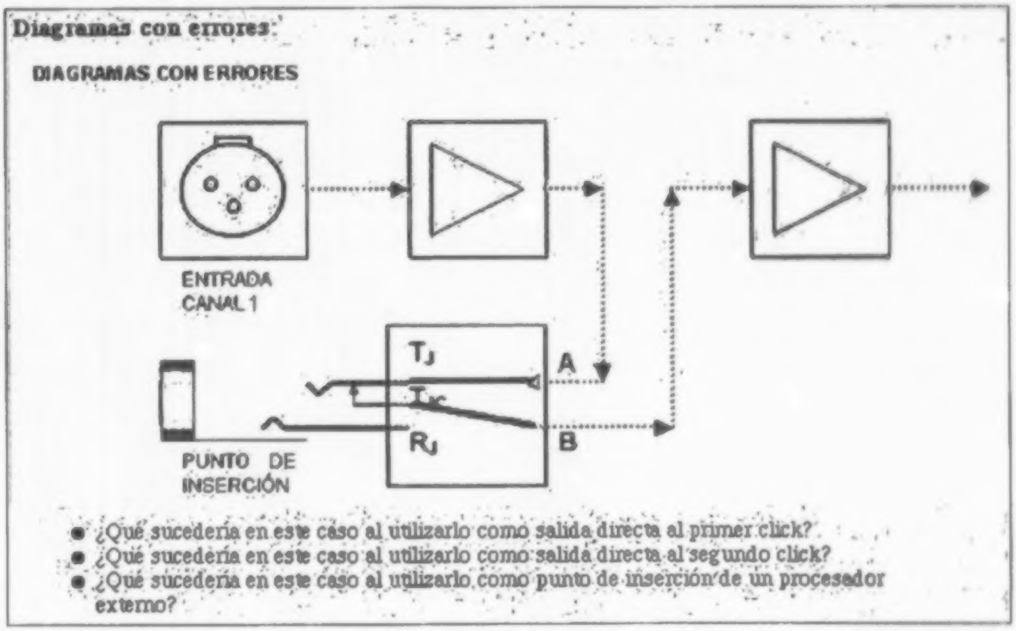
Grabación de un sonido a diferentes distancias de la pared

Haga clic sobre el micrófono del cual desea escuchar el registro.

Figure 2: Sample of interactive educational resource. Clicking the speaker the original white noise source sounds; clicking each microphone the source plus reflected waves sounds (image taken from REDI prototype).

The next sample is a figure presenting part of a problem about interfacing.

Incomplete as well as "wrong" diagrams can be electronically distributed or printed by teachers to their students, who should then fill them and/or explain the correct settings and the consequences on each case.



Diagramas con errores:

DIAGRAMAS CON ERRORES

- ¿Qué sucedería en este caso al utilizarlo como salida directa al primer click?
- ¿Qué sucedería en este caso al utilizarlo como salida directa al segundo click?
- ¿Qué sucedería en este caso al utilizarlo como punto de inserción de un procesador externo?

Figure 3: Sample of a class activity that teachers could print and distribute to the class or students could directly download from the REDI web site (image capture taken from REDI prototype).

BEST COPY AVAILABLE

Additional contents included on REDI are: functional block diagrams, schematics or electronic circuits of typical equipments and systems used in multimedia and related media production, photographs, videos, animations, sound effects, music clips, multi platform freeware and shareware, and even full (free distribution) books.

The development of the first phase of this project, ending with the REDI prototype and evaluation, was possible thanks to the collaboration between the National Institute for Technology Education of Argentina and the German Agency for Technical Cooperation GTZ, with additional support from Apple Computer, Inc.

Conclusions

Tests with teachers and students at schools where the Technical Vocational Pathway in Multimedia Communication are implemented in Argentina are showing very positive results.

This evaluation process of the actual prototype by teachers, students, multimedia experts and industry professionals are helping to improve the different elements of a living system as REDI.

The competences teaching/learning approach adopted to organize the structure of REDI seems to be useful for all educational levels. REDI could be used as a powerful but easy to use database for high school, vocational and higher/university studies as well as for professional training and certifications.

A tool like REDI could help to improve the educational qualities in economically under developed countries where massive access to information, tools, researches and selected medias would be a wonderful help to support the teaching-learning process.

Being today a prototype (originally produced during 1999), we expect to make REDI widely available during 2003 through Intranet/Internet access .

The REDI approach is also triggering international projects being developed now to support education of multimedia and new media art fields.

References

CONOCER. Consejo de Normalización y Certificación de Competencia Laboral (1997). *Antología de Lecturas. Tomo I: Competencia Laboral: Normalización, Certificación, Educación y Capacitación.* Mexico.

Gallart, M. A. & Jacinto, C. (1995). *Competencias Laborales: tema clave en la articulación educación-trabajo.* In: Boletín Educación y Trabajo Nº 2, Año 6. Argentina: CIID-CENEP.

Gonczi, A. & Athanasou, J. (1996). *Instrumentación de la Educación Basada en Competencias. Perspectivas de la Teoría y la Práctica en Australia.* In Argüelles, A. (Ed.): Competencia Laboral y Educación Basada en Normas de Competencia, Mexico.

Mertens, L. (1996). *Competencia Laboral: sistemas, surgimiento y modelos.* CINTERFOR. Uruguay.

Ministerio de Cultura y Educación de la Nación (1997). *Fuentes para la Transformación Curricular. Consulta a la sociedad: La educación desestabilizada por la competitividad. Las demandas del mundo del trabajo al sistema educativo.* Argentina.

Ministerio de Cultura y Educación de la Nación (1999). *Trayecto Técnico Profesional en Comunicación Multimedial. Documento Base.* CFCyE res. No. 86/98. Argentina.

Pozo Municio, J. I. (1999). *La solución de problemas.* Argentina: Santillana, Aula XXI.

Torp, L. & Sage, S. (1999). *El aprendizaje basado en problemas.* Argentina: Amorrortu.

Vargas, F. (1999). *Las 40 preguntas más frecuentes sobre competencia Laboral.* Uruguay: CINTERFOR/OIT, Proyecto CinterNet.

QuikQuiz©: Complementing WebCT Tools for More Learner Interaction

Michael M. Danchak, Computer Science, Rensselaer Polytechnic Institute, USA, danchm@rpi.edu

Joshua T. Pedersen, Computer Science, Rensselaer Polytechnic Institute, USA,
joshua_t_pedersen@yahoo.com

Abstract: In many face-to-face classes, instructors throw out informal questions to students to encourage interactivity and gauge comprehension. Tools to support this technique are not typically available, especially ones that are compatible with WebCT. This paper describes a tool called QuikQuiz© that allows instructors to embed either discussion or multiple-choice type questions in their content and use the results in either asynchronous or synchronous mode.

Introduction

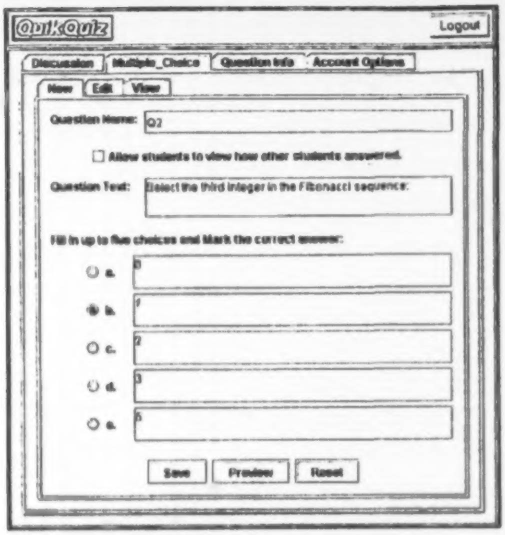
Many times an instructor in a face-to-face class asks questions of students to encourage interactivity and get a sense of learner comprehension. This is especially true in science and engineering courses. However, doing this at a distance is a special challenge. Such functionality is typically not available in current course tools. There are bulletin boards and quizzes, but they lack the informality that is crucial to the purpose of these techniques. These existing course tools also require the learner to go outside the content to answer the question, which is not desirable according to LaRose and Whitten (LaRose & Whitten 2000). To meet this need, we created a tool called "QuikQuiz"©, a simple quizzing tool that can be embedded in any html page and used either synchronously or asynchronously.

QuikQuiz© allows an instructor to ask either multiple-choice or discussion questions using Java applets. After submitting an answer to a question, the student sees the correct answer and may also see how other students responded up to that point. The instructor can review the responses at any time and has summarization/analysis tools to ease the task. The intent was to reduce, not increase, instructor workload.

Architecture

QuikQuiz© uses a client – server architecture and consists of two Java applications (the server) and four client Java applets: the CourseProducerClient, the InstructorClient, and two StudentClients. Server-side QuikQuiz© requires the installation of the Java 2 Platform, Standard Edition (SDK) version 1.3.1 or higher or the Java 2 Runtime Environment (JRE) version 1.3.x or higher. All the clients require the Java Plug-In 1.3 or higher. If either is not installed, the system automatically prompts for a download.

The SystemAdministratorClient allows the System/Network Administrator to create, view, and delete Course Producer accounts. This gives total control for administration of the network software. The CourseProducerClient allows one person to create and delete password-protected courses and assign them to individual instructors. Hence, one person coordinates the creation of courses but the instructor controls the content. This paper will focus on the InstructorClient and StudentClient functionality, since this represents the pedagogical aspects of the tool. Screenshots of both the instructor and student interface are shown in Figures 1 and 2 respectively.



Question Name: Q2

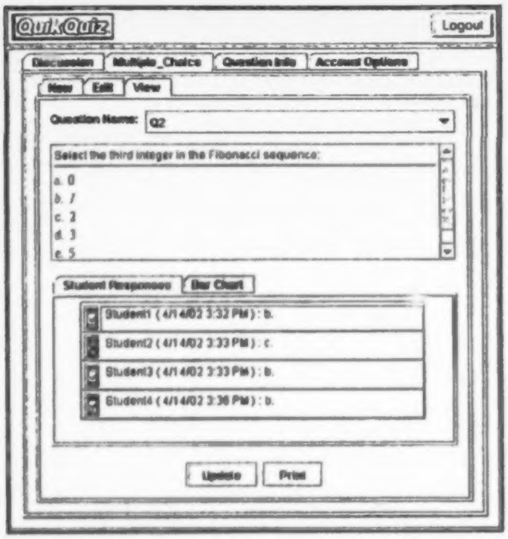
☐ Allow students to view how other students answered.

Question Text: Select the third integer in the Fibonacci sequence:

Fill in up to five choices and Mark the correct answer:

○ a. 0
● b. 1
○ c. 2
○ d. 3
○ e. 5

Figure 1. Instructor's Applet for Multiple-Choice



Question Name: Q2

Select the third integer in the Fibonacci sequence:

a. 0
b. 1
c. 2
d. 3
e. 5

Student1 (4/14/02 3:32 PM) : b.
Student2 (4/14/02 3:33 PM) : c.
Student3 (4/14/02 3:33 PM) : b.
Student4 (4/14/02 3:38 PM) : b.

Figure 2. Instructor's View of M-C Answers

Instructor's Functionality

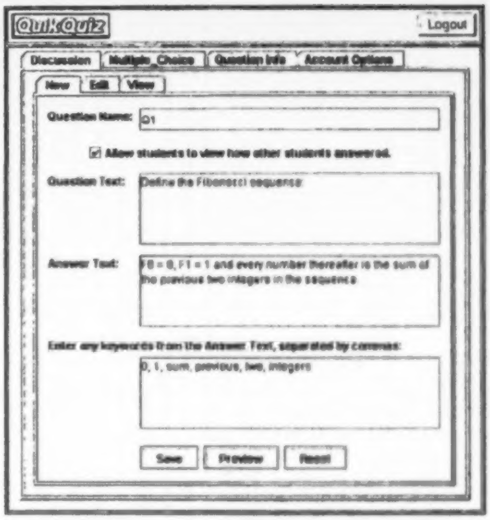
The instructor can work with either discussion or multiple-choice questions. Each question type requires a question name and can be created, edited, deleted, and the individual responses viewed. The instructor also has the option of allowing students to see how other students have answered. In the example in Figure 1, the instructor created a multiple-choice question named QQ1. He /she entered the question and the available answers and also marked the correct answer. The responses to this question will be shared among students. Preview allows the instructor to see the question as seen by the student.

If the instructor clicked on View (Figure 2), she/he would see each student's response (i.e. which choice they selected), along with a time/date stamp. The individual response is color-coded red if incorrect and green if correct. A bar chart summary of all responses is also available. Since these responses are time dependent, meaning that the instructor sees all the responses up to the time the question was accessed from the server, an Update button was added to refresh the data. This allows the instructor to see any responses that may have just come in. If Print is selected, the combined responses are shown in an html window. The instructor can then save the printout using standard browser features. This was necessary because of the security features of Java.

A discussion question (Figure 3) is similar in creation, but differs in response display. The instructor names the question, selects sharing of answers, and enters the question as well as the answer text. A third box asks for answer keywords, separated by commas. This is used in the analysis of the responses, discussed shortly. If no entries are made in the keyword box, the instructor's answer is parsed to derive keywords.

When the instructor Views a discussion question (Figure 4), he/she sees the individual student responses with a date/time stamp. In addition, keywords contained in the students' response are highlighted in green and a summary statistic shows the percentage of keywords contained in that response. These techniques are intended to make analysis quicker and reduce workload without sacrificing accuracy. Update and Print are available, as described previously.

BEST COPY AVAILABLE



Question Name: Q1

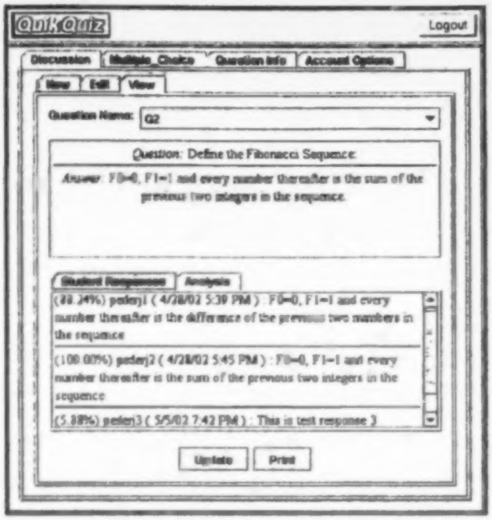
☑ Allow students to view how other students answered.

Question Text: Define the Fibonacci sequence

Answer Text: F0 = 0, F1 = 1 and every number thereafter is the sum of the previous two integers in the sequence

Enter any keywords from the Answer Text, separated by commas: 0, 1, sum, previous, two, integers

Figure 3 Instructor's Applet for Discussion



Question Name: Q2

Question: Define the Fibonacci Sequence

Answer: F0=0, F1=1 and every number thereafter is the sum of the previous two integers in the sequence.

(88.24%) peterj1 (4/28/02 5:39 PM) : F0=0, F1=1 and every number thereafter is the difference of the previous two numbers in the sequence

(100.00%) peterj2 (4/28/02 5:45 PM) : F0=0, F1=1 and every number thereafter is the sum of the previous two integers in the sequence

(5.88%) peterj3 (5/5/02 7:42 PM) : This is test response 3

Figure 4 Instructor's View of Discussion Answers

The Question Info tab depicted in Figures 1 and 3 accesses the entire set of discussion and multiple-choice questions for a course in the familiar directory tree structure. Instructors can open the folder for both question types and view/edit each question and response. Selecting a specific question displays the entire URL for that question. This can be copied and pasted into standard html to create the necessary links to make this work.

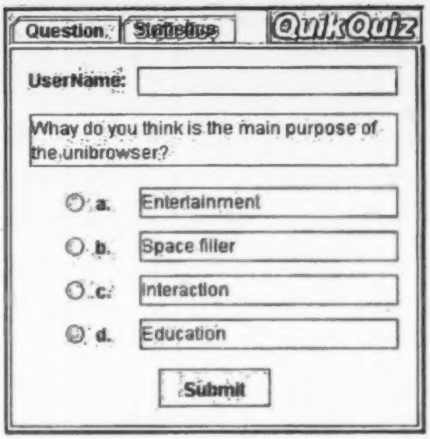
The Account Options panel allows the instructor to set preferences and options that affect the entire course, such as Change Password and Discussion Analysis. Change Password is a standard function, but Discussion Analysis relates to two utilities that require more description. In one utility the instructor can control the keyword-matching threshold. This threshold determines the highlight color of the summary statistic. The Minimum Keyword Length combo box specifies the length of words in the instructor answer that are used to generate keywords if they are not explicitly specified. For instance, if the "5 Characters" entry is selected, all words in the instructor answer that are 5 characters or more are used as keywords.

Student Functionality

A typical student screen for multiple-choice questions is shown in Figure 5. The student is asked to enter a name, which is used in stamping the responses. If the WebCT tool is used, there is a JavaScript that will interrogate the WebCT cookie and automatically insert the user's ID. This is instructor selectable. If privacy is an issue, especially for shared answers, the instructor could assign pseudonyms.

The student either types in their response to the discussion question or selects an answer from those available in the multiple-choice list. When the Submit is clicked, the answer is sent to the server and the instructor's response is displayed, along with the student's response. If shared answers are enabled, the Answers tab shown in Figure 6 is highlighted and students can see how other students have responded up to that point. We had considered an "Update" function for the students, but searching for previous responses increased the complexity beyond that desired. A student can always send in another response to see the newer submissions. This solution does increase the number of responses. A better solution is being worked on.

BEST COPY AVAILABLE

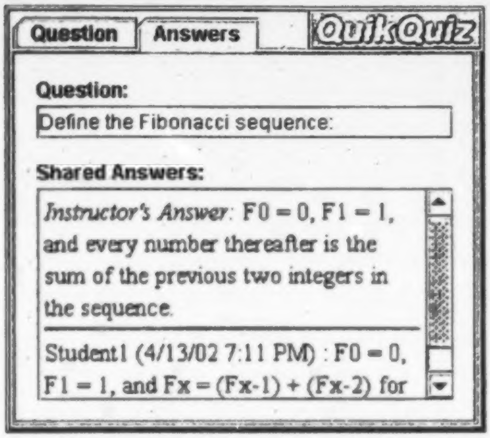


UserName:

Whay do you think is the main purpose of the unibrowser?

○ a. Entertainment
○ b. Space filler
○ c. Interaction
● d. Education

Figure 5 Student View of MC Question



Question:

Define the Fibonacci sequence:

Shared Answers:

Instructor's Answer: F0 = 0, F1 = 1, and every number thereafter is the sum of the previous two integers in the sequence.

Student1 (4/13/02 7:11 PM) : F0 = 0, F1 = 1, and Fx = (Fx-1) + (Fx-2) for

Figure 6 Student View of Discussion Answers

QuikQuiz© Use

At the outset, QuikQuiz© was intended to simulate the interaction of a face-to-face class, but in the asynchronous mode. The instructor could log in at any time and review students responses, save them, or print them as just described. The instructor could also send feedback to the student concerning misunderstanding of concepts, etc. This feedback is crucial for learning and the real reason for the tool, other than interaction.

However, we discovered another positive use of the tool. In all our courses we make use of the Rensselaer 80/20 model (Lister, et al 1999) that has both asynchronous (80%) and synchronous (20%) activities. There is nothing sacred about this distribution and it should be adjusted for instructor, student and content considerations. The important idea is that there *is* a synchronous component to every course, be it videoconferencing or simple text chat.

In a course called GUI Building, offered in the Fall of 2002, we would all meet in a chat room to discuss "administrivia" and answer student questions. Occasionally a guest would join us. Once these activities were completed, the students would adjourn to an on line module we called "Warm up". This module introduced the topic for the week and included a QuikQuiz©. It quickly became evident that if the students stayed in the chat room while doing this module, the instructor could monitor the student responses to the QuikQuiz© in almost real time. Since the chat facility allowed for private messages, the instructor could also give feedback to students immediately. Clarifying misconceptions as soon as possible makes this synchronous meeting much like a face-to-face course. In fact, it is even better because the feedback can be given privately and an exchange between student and instructor can be done without exposing the student to peer ridicule.

References

LaRose, R. and Whitten, P. (2000). "Re-Thinking Instructional Immediacy for Web Courses: A Social Cognitive Exploration", Communication Education, 49 (4), pp. 320 – 338.

Lister, B.C., Danchak, M.M., Scalzo, K.A., Jennings, C.W., Wilson, J. (1999). "The Rensselaer 80/20 Model for Interactive Distance Learning", *EDUCAUSE* '99, Long Beach, CA, October.

BEST COPY AVAILABLE

Using the Internet to Create an Integrated Thematic Unit Across the Curriculum

Terry H. Daniels
Department of Education
St. John's University
United States
crtstringer@pobox.com

Abstract: The problem as it exists in many K-12 classrooms is that computers are in place in schools but not being utilized to their full extent. It was noted that there was a need for a complete course on how to use computers in education rather than learning individual skills in isolation or a particular piece of software. The literature carried strategies for single unit themes, while teachers were asking to be shown multiple strategies. A course of study was developed at two institutes of higher education based upon what teacher-learners should take back to their classrooms. The course that evolved gave teacher-learners the means to use technology to increase access to information, use technology tools to improve communication, use technology tools to enhance reporting of information and use technology tools to more effectively collect, analyze and share data.

Introduction

Today's classroom teachers have the necessary technology in place but have limited skills to integrate instructional technology into their curriculum. "Teachers must be prepared to provide technology supported learning opportunities for their students," according to the National Education Technology Standards for Teachers (ISTE, 2002. p.4). Technology as a teaching tool is an essential skill that teachers should be required to learn and demonstrate competency in its use. A course of study was developed at New York Institute of Technology and St. John's University to prepare graduate education students to infuse technology into their curriculum. The methodology used was generic to all K-12 teachers and covered all curriculum disciplines. To meet the needs of graduate students, information and activities are presented that is relevant the needs of the learners. Inquiry-Based Learning (IBL) emphasizes research, critical thinking and multi-disciplined projects to achieve course outcomes. Students acquire problem-solving skills by developing a learning-centered curriculum. It is authentic learning by identifying real, current, important and practical problems that require a solution. Center to IBL are *Essential Questions* and *Tasks* that allow students to integrate technology into their research, ask meaningful questions, verify research, interpret their research and present it in a meaningful format. Use of the Internet is an essential element in producing the final product.

Discussion

Ely (1996) discusses a direction in education that requires teachers to become technology literate as set forth in 1989 by the U.S. Congress Office of Technology Assessment. Ely found that little had been accomplished in attaining this goal between 1989 and 1995. It is just the last few years that a concerted effort has been set forth led by the International Society for Technology in Education to make educations aware of the value of instructional technology. Tiene and Ingram (2001) emphasize that the World Wide Web contains a vast amount of educational material that today's teachers must learn how to properly convert information found on the Web into well-designed lesson plans. Berg (2002) questions the relationship of the amount of money being invested in technology the impact of teacher training, usage and productivity.

In today's classrooms students are becoming more Internet-savvy. The professors that are teaching these students are finding it more difficult to stay ahead of them (Moore & Engeldinger, 2001). According to Mabogo (2001) in a survey of 34,000 faculty members, only 35 percent reported using the Internet to conduct research, and 38 percent used technology to create class presentations. The National Education Association (NEA, 2001) has stated that technology is changing the classroom in the way faculty teach and how students learn. Administrators, staff and faculty need to understand the role of technology in the classroom and how it complements the educational experience. The International Society for Technology in Education (ISTE, 2000) stresses that it is essential for teachers to create a learning environment through the powerful uses of technology. Technology should not be taught in isolation but combined with traditional methodology to create new approaches to teaching curriculum while addressing individual needs.

Implementation

Ali and Elmahdi (2002) feel that it is difficult for senior teachers to change their teacher-based style of presenting a lesson and are reticent to embrace technology. It is therefore important when teaching technology to engage teacher-learners at all levels in meaningful hands on projects from the onset of instruction. Through the use of project-based building block constructivist methodology a course was designed that gave teacher learners new ideas to infuse technology into their curriculum while learning. The instructor, as required, could adjust the time spent on each module on a needs basis. The course consisted of 15, 2-hour sessions that permitted teacher learners sufficient time to work on projects and develop questions if any problems arose. The course consisted of eight learning objectives and a rubric for expected outcomes for each objective.

The eight learning objectives were as follows:

1. Teachers will be able to incorporate the use of e-mail into their professional lives. This was accomplished by sending a message to the instructor with a graphic attachment contained in a word processing document. Additionally each teacher-learner was required to exchange e-mail messages with their peers and instructor.
2. Teachers will be able to locate and identify five subject area curriculum-based Web sites on the Internet. They will also be able to evaluate and select appropriate technology for specific content areas relevant to their grade level. A brief paragraph was written about each site that included the URL of the site, together with contents that would be of interest to other subject area teachers.
3. Teachers will be able to integrate technology-based instruction and project-based ideas using information obtained from the Internet. Teacher learners were able to complete a distance education module by accessing BlackBoard (2000), the class Web site, to plan a trip to another state via automobile. They used hyperlinks to visit a trip-mapping site for driving instructions, maps, hotels and places of interest. A final report was filed via e mail with an attachment requiring editing and copy and paste to create a two-page report.
4. Teachers will be able to use Inspiration (2000) a semantic mapping program in a curriculum area to reduce complex information into small parts that can easily be understood and learned. Teacher-learners were able to design through visual mapping and/or worksheets classroom materials.
5. Teachers will be able to infuse technology into their curriculum. Teacher-learners were able to design an Inquiry-Based thematic unit that included a Scenario, Tasks, References, Product(s) and Assessment.
6. Teachers will be able to present subject area material using PowerPoint. Teacher-learners were able to present a slide show depicting subject area materials consisting of a constant theme. Storyboarding was used to layout the project.
7. Teachers will be able to incorporate EasyBook Deluxe (1997) into their curriculum. Teacher-learners created a book that consisted of a title page and a minimum of four pages of content using a constant theme predicated upon the level of the class and curriculum.

8. Teachers will be able to create a class or school home page using a Web authoring program. Teacher-learners created a home page consisting of three elements, 1) general interest, 2) graphics and 3) hyperlinks to two other pages fostering a constant theme.

Conclusions

The course of instruction was designed and developed for the implementation of a doctoral applied dissertation. The ideas and curriculum evolved over ten years of training preservice and inservice teachers at the master's level of instructional technology. Students' wants and needs aided in producing a product that can be implemented in the classroom as soon as the teacher-learner has mastered each objective.

There are many competent administrators and instructional technology professionals in place in the school system. What is questionable is how instructional technology is measured and who sets the standards, and are the policy makers knowledgeable enough to make these decisions. Sujo de Montes and Gonzales (2000) contend that while schools are acquiring technology, administrators are not directing sufficient funds into the development of competent technology-based teachers. Computers are in place but teachers don't have a solid instructional technology base from which to teach. Teachers are not adequately trained in the proper integration of technology into the curriculum. There is reluctance from older teachers to change their imbedded ways for fear of losing control of their classes to phobias about using computers. Newer teachers more readily embrace technology. A portion of teacher reluctance toward using instructional technology is availability of lab time and Internet accessibility in a continuous and long-term time frame. Hargrave and Hsu (2000) noted that most undergraduate preservice teacher programs offer one course in use of technology in the classroom. They contend that this single technology course will not adequately prepare future teachers in the infusion of technology into their classrooms. During a two-year study of integrating technology into higher education Vanatta and Beyerbach (2000) drew many conclusions:

1. Lack of interest and expertise among faculty.
2. Poor comfort level regarding planning educational technology activities.
3. Training should facilitate the planning and development of technology-rich lessons and activities.
4. Technology integration should be connected to "course content" objectivities and assignments.

Today's inservice and preservice teachers should be cognizant of the value of technology for research, problem solving and creative expression (Burns, 2002).

References

Ali, A. & Elmahdi, I. (2002). The wired professor. *Journal of Computing in Teacher Education*, 18 (2), 68-73.

Berg, G.A. (2002). Distance learning in higher education. *International Journal on E-Learning*, 1 (2), 5-6.

Blackboard (2000). Technology applications in reading and writing for special and regular education students. http://www.blackboard.com/courses/EDU3280SJU. (Presently under reconstruction)
Burns, M. (2002). From black and white to color: Technology, professional development and changing practice. *T.H.E. Journal, 29*(11), 36-42.

EasyBook Deluxe (1997). NY: Sunburst Communications, Inc.

Ely, D.P. (1996). *Trends in Educational Technology 1995*. Syracuse, NY: Eric Clearinghouse on Information and Technology.

Hargrave, C.P. & Hsu, Y.S. (2000). Survey of instructional technology courses for preservice teachers. *Journal of Technology and Teacher Education, 8* (4), 303-314.

Inspiration (2000). Portland, OR: Inspiration Software, Inc.

International Society for Technology in Education (2002). *National Educational Standards for Teachers.* : Eugene, OR: ISTE

Mabogo, P. (2001). Profs struggle to stay ahead of class, technology speaking. Retrieved June 18, 2001 on the World Wide Web: http://www.studentadvantage.lycos.com.

Moore, P. & Engeldinger, E.A. (2001). Creating technology literate teachers for the 21st century. Retrieved June 18, 2001 on the World Wide Web: http://www.ala.org/acrl/moore.html.

NEA (2001). NEA-hot issues-technology. Retrieved June 18, 2001 on the World Wide Web: http://nea.org/he/techno.html.

Sujo de Montes & Gonzales, C.L. (2000). Been there, done that: Reaching teachers through distance education. *Journal of Technology and Teacher Education, 8* (4), 351-371.

Tiene, D. & Ingram, A. (2001). *Exploring Current Issues in Educational Technology.* NY: McGraw Hill.

Vanatta, R.A. & Beyerbach, B. (2000). Facilitating a constructivist vision of technology integration among educational facility and preservice teachers. *Journal Of Research On Computing In Education, 33* (2), 132-147.

Applying Multi-Intelligent Adaptive Hypermedia to Online Learning

Benay Phyllis Dara-Abrams, Ph.D.
Information Systems
College of Professional Studies
University of San Francisco
and BrainJolt
United States
benay@dara-abrams.com

Abstract: While the Theory of Multiple Intelligences has been applied in classrooms, demonstrating that learners benefit from multiple entry points and multiple representations of material, this study examines whether the Theory of Multiple Intelligences can be applied to online learning. The study was conducted in three stages: user characterization, prototype development, and formative evaluation. Adaptive text presentation and adaptive multimedia presentation modify content based on a stereotype user model, characterizing users by technical background and most developed intelligences. Implementing Entry Point Framework and multiple representations, the prototype uses explanation and page variants for content adaptation. The formative evaluation indicates that further application of the Theory of Multiple Intelligences, Entry Point Framework, and multiple representations will improve the prototype, offering multi-intelligent content presentations, moving toward "anyone, anyhow" learning.

Introduction

Advances in adaptive hypermedia technology and Web-based asynchronous communication provide the technology foundation for online learning environments, which not only deliver content in a time- and distance-independent manner but which also adapt content according to a user model based on cognitive theory and educational methodology. This study addresses the research question: Can the cognitive Theory of Multiple Intelligences be used to support adaptation in an online learning environment?

The research is built on theories of cognition and learning, educational methodologies derived from these theories, and technologies to construct an artifact embodying these methodologies (Fig. 1). The technology foundation is based on user modeling and adaptation technologies in educational hypermedia (Brusilovsky 1998) as well as multimedia technologies and asynchronous, self-directed learning in Web-based environments (Harasim 1999). In addition, prior work in Intelligent Tutoring Systems (ITS) underlies the development of educational adaptive hypermedia applications (Goettl, Halff, Redfield, & Shute 1998).

The cognitive Theory of Multiple Intelligences (Gardner 1983/1993) and the learning theory of constructivism (Bruner 1986) form the theoretical foundation for the study (Fig. 1). The application of the Theory of Multiple Intelligences in classroom environments has demonstrated that individuals with varying sets of most developed intelligences benefit from the use of multiple entry points and multiple representations of material when learning new subject matter (Gardner 1999). The prototype developed for this study forms the basis for an "anyone, anyhow" approach to online learning, seeking to eliminate constraints due to varying development of intellectual faculties through the use of these educational methodologies.

Methodology

In order to answer the research question, the study was conducted in three parts:

1) Development of understanding goals and user characterization based on the three most developed multiple intelligences and technical background of each participant
2) Development of prototype learning framework and two prototype learning modules
3) Formative evaluation of multi-intelligent adaptive hypermedia learning modules

Through online questionnaires, participants were asked to provide data for the development of individual characteristics based on the three intelligences that appear to be the most developed in each individual. A user model was developed based on the most developed intelligences and technical background of each learner.

Learning outcomes were defined for learning modules on Legacy Systems Integration for technical participants and on an Overview of Web and Internet Technology for non-technical participants. The learning modules were then designed based on the understanding goals developed through the Teaching for Understanding Framework (Perkins 1998). Participants were asked to use the online learning modules through the Web-based multi-intelligent adaptive hypermedia learning framework and comment on their learning experience, providing feedback for the improvement of the prototype learning modules and framework.

Prototype Development

In designing the research study to answer the research question of whether the cognitive Theory of Multiple Intelligences can be used to support adaptation in an online learning environment, a prototype was designed for a multi-intelligent adaptive hypermedia learning environment (Fig.1). Two prototype learning modules were developed - one for a technical audience and one for a non-technical audience. In the formative evaluation stage of the research study, participants provided feedback on the prototype learning modules.

A stereotype user model was developed as a database containing the three most developed intelligences and the technical background of each participant. Content and link adaptation methods and techniques from adaptive hypermedia technology are used to deliver content. Through adaptive text presentation and adaptive multimedia presentation, the prototype employs attribute values in the user model to modify the content of the learning module pages so that the content presentations activate each user's three most developed intelligences. The method of explanation variants and the adaptive hypermedia technique of page variants provide support for multiple representations and different entry points, depending on user characteristics.

Formative Evaluation

The study focuses on online learning for an adult population, using research subjects 17 years of age and older. Of the 34 participants in the first stage of user characterization, 33 participants completed the study, using one of the learning modules and providing feedback on areas in which the prototype learning modules can be improved. The feedback received from participants is suggestive of the usefulness of applying the Theory of Multiple Intelligences to online learning. Based on participant feedback, the prototype can be improved by allowing for multiple levels of technical proficiency, adapting to the level of understanding by providing more explanations for novice users and more challenging content for advanced users. To address difficulties in determining the most developed intelligences, the prototype can be improved by making the user model adaptable, allowing users to examine and update their user attributes. This would allow the individual to serve as the authority rather than the questionnaires, as recommended by multiple intelligence theorists (Armstrong 1993/1999).

Participants, particularly those with well-developed Bodily-Kinesthetic Intelligence, requested more interaction and online testing. Other participants, particularly those with highly developed Naturalist Intelligence, suggested the use of metaphors in the presentations. Users, particularly those with well-developed Spatial or Musical Intelligence, found the animated graphical presentations helpful and suggested greater use of graphics, animation, and sound effects in the content presentations. In addition, overview information, upfront instructions, and examples were requested to help users achieve their understanding goals.

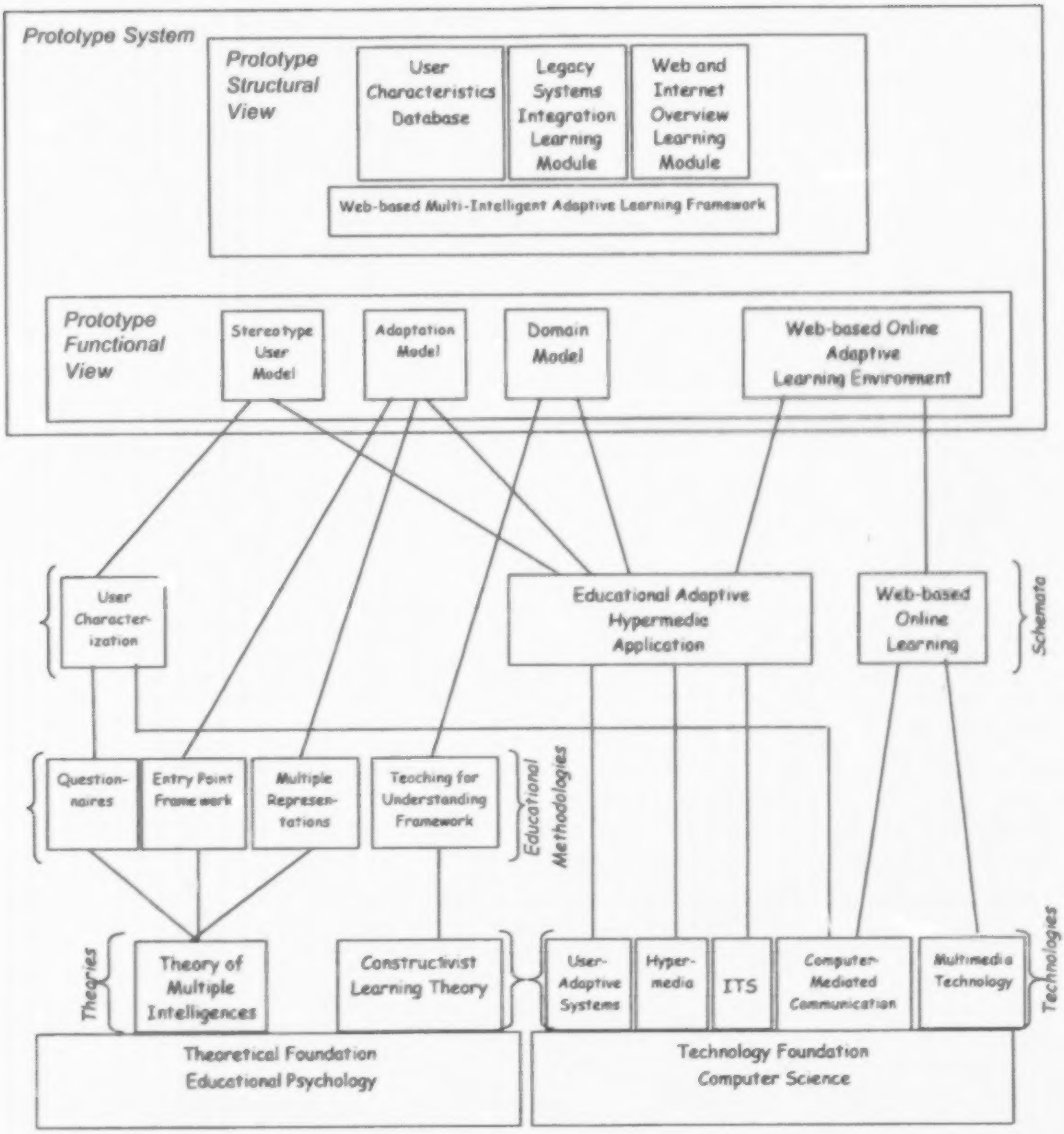

Prototype System
Prototype Structural View
User Characteristics Database
Legacy Systems Integration Learning Module
Web and Internet Overview Learning Module
Web-based Multi-Intelligent Adaptive Learning Framework
Prototype Functional View
Stereotype User Model
Adaptation Model
Domain Model
Web-based Online Adaptive Learning Environment
User Character-ization
Educational Adaptive Hypermedia Application
Web-based Online Learning
Schemata
Question-naires
Entry Point Framework
Multiple Represen-tations
Teaching for Understanding Framework
Educational Methodologies
Theories
Theory of Multiple Intelligences
Constructivist Learning Theory
User-Adaptive Systems
Hyper-media
ITS
Computer-Mediated Communication
Multimedia Technology
Technologies
Theoretical Foundation Educational Psychology
Technology Foundation Computer Science

Figure 1: Foundations and Components of Multi-Intelligent Online Learning

BEST COPY AVAILABLE

Assumptions and Limitations

Questionnaires were used to develop the user characterizations in terms of the three most developed intelligences. These self-report questionnaires make two assumptions:

1) Participants can answer questions with an understanding of their own skills
2) Answers can be used to determine a participant's three most developed intelligences.

The prototype learning modules incorporate only a small subset of the potential representations and entry points that can be used for explanation variants of the subject matter. A limitation of developing a multi-intelligent adaptive hypermedia schema is that each variant must be individually designed by a person knowledgeable in the subject matter, in the educational methodologies of multi-intelligent approaches, and in Web and hypermedia technologies. The prototype is necessarily a simplification of the design for fully multi-intelligent learning modules.

Significance of Study

Feedback from the formative evaluation indicates that improvements can be made to the learning modules and framework by increasing the use of the Entry Point Framework and multiple representations educational methodologies based on the Theory of Multiple Intelligences so that modules embody fully multi-intelligent approaches to content presentation. An affirmative answer to the research question and the instantiation of the Theory of Multiple Intelligences in the prototype user and adaptation models demonstrate the feasibility of building a personalized online learning environment that considers differences among individuals in thinking and learning. The prototype forms the basis for the development of an "anyone, anyhow" approach to online learning, with the study indicating improvements that can be made in the multi-intelligent adaptive hypermedia approach to increase accessibility to "anyone" through greater use of multi-intelligent "anyhow" approaches to content delivery.

Further Information and Demonstration

Prototype multi-intelligent online learning modules are available for demonstration and trial purposes at: http://www.brainjolt.com. Further information on the research study is also available on the website.

References

Armstrong, T. (1993/1999). *7 kinds of smart: identifying and developing your multiple intelligences*. NY: Plume.

Bruner, J. (1986). *Actual Minds, Possible Worlds*. Cambridge, MA: Harvard University Press.

Brusilovsky. P. (1998). Methods and Techniques of Adaptive Hypermedia. In P. Brusilovsky, A. Kobsa, & J. Vassileva (Eds.), *Adaptive Hypertext and Hypermedia*. Dordrecht, NL: Kluwer Academic.

Dara-Abrams, B. (2002). *Applying Multi-Intelligent Adaptive Hypermedia to Online Learning*. Ph.D. Dissertation, Union Institute & University, http://www.brainjolt.com/.

Gardner, H. (1983/1993). *Frames of Mind: The Theory of Multiple Intelligences*. NY: Basic Books.

Gardner, H. (1999). *The Disciplined Mind: What all students should understand*. NY: Simon & Schuster.

Goettl, B., Halff, H., Redfield, C., & Shute, V. (Eds.). (1998, August). *Intelligent Tutoring Systems. 4th International Conference*, San Antonio, TX. Berlin, Germany: Springer-Verlag.

Harasim, L. (1999, September). A Framework for Online Learning: The Virtual-U. *IEEE Computer*. Retrieved June 16, 2001, from the World Wide Web: http://www.telelearn.ca/g_access/news/r9044.pdf

Perkins, D. (1998). What is understanding? In M.S. Wiske (Ed.), *Teaching for understanding: Linking research with practice* (pp. 39-57). San Francisco: Jossey-Bass.

Concept Relationship Types for AHA! 2.0

Paul De Bra, Ad Aerts, Brendan Rousseau
Department of Computer Science
Eindhoven University of Technology (TU/e)
PO Box 513, Eindhoven, The Netherlands
{debra,wsinatma,broussea}@win.tue.nl

Abstract: In adaptive Web-based applications such as on-line course material, virtual museums and shopping sites, there are different types of relationships between objects, pages or high-level concepts. They indicate that some concept is a prerequisite for another concept, that a page or object exemplifies a concept, that a user reading a page gains knowledge of or shows interest in a concept, etc. In AHA! version 2.0 (De Bra,et al, 2002) such relationships are expressed at a very low level through adaptation rules. In this paper we show how to define higher level *concept relationship types* (such as prerequisites) and how to automatically translate instances of these types, called *concept relationships* to adaptation rules for AHA! This work is part of the Adaptive Hypermedia for All project of the NLnet Foundation.

Introduction

When the AHA! system was first built and used for an on-line course (on the subject of hypertext and hypermedia) the relationships between pages and concepts were simple: reading pages contributed knowledge about concepts, and knowledge about certain concepts was a prerequisite for reading other pages (or for the inclusion of fragments with additional explanations). See (De Bra & Calvi, 1998) for a description of an early version. AHA! version 1.0 introduced a bit, and version 2.0 a lot more possibilities for describing the interaction between pages and concepts. In (De Bra et al, 2002) we describe the powerful adaptation rule language used in AHA! 2.0 that lets authors specify how a rich user model should be updated using *condition-action rules*. Early comments we received on these new possibilities indicated that AHA! 2.0 offers what can best be described as an *assembly language for adaptation*. It became clear that higher-level descriptions of the relationships between concepts were necessary. In this paper we describe how the notion of *concept relationship types*, inherited from the AHAM reference model (De Bra et al, 1999), can be incorporated into the AHA! system. We first describe how to define a concept relationship type, using an XML notation that is similar to that of AHA! 2.0. We show how a simple drawing of concept relationship structures (possibly using different relationship types) can be translated automatically to the combined domain/adaptation model of AHA! 2.0. This idea has led to the development of a new authoring tool that aims to bring back to AHA! what was lost through the introduction of the *condition-action rule language*: ease of use for authors.

Defining and Using Concept Relationship Types

Concept relationships are a common notion in adaptive Web-based applications. They can be used to represent *prerequisites* in an adaptive course and to propagate *knowledge* from pages to sections and from sections to chapters. This is essentially how systems like Interbook work (Brusilovsky et al, 1998). In a museum there may be *exemplifies* relationships between paintings and a painting style or a *painted by* relationship between paintings and painters. In an on-line shop products may be *competing with* other products or may be *complementing* other products. The overview papers (Brusilovsky, 1996) and (Brusilovsky, 2001) show the ranges of applications in which adaptive hypermedia techniques are used. The AHA! system is not aimed at one specific application area, but tries to offer general-purpose functionality. It uses a combined domain/adaptation model to indicate how concepts relate to each other and how the system should update the *user model*. In (De Bra et al, 2002) the rule language of AHA! version 2.0 is explained in detail. A drawback of this approach is that *concept relationships* are described through their effect on the *user model* only. Not only are the adaptation rules difficult to write, in applications where different types of relationships play a role it is also difficult for authors to recognize which relationships are expressed by which adaptation rules. We therefore propose a new authoring tool that uses *concept relationship types* and that provides automatic translation from *concept relationships* of a defined type to AHA! adaptation rules. In the terminology of the AHAM reference model (De Bra et al, 1999) this means we create an (at least partial) separation between the *domain model* and the *adaptation model*.

We illustrate the use of concept relationship types through the examples of *prerequisite* and *knowledge propagation relationships*, as used in educational applications. The following figures could represent a few concepts in an imaginary course on Web concepts, how they contribute knowledge to the entire course topic, and how they "depend" on each other:

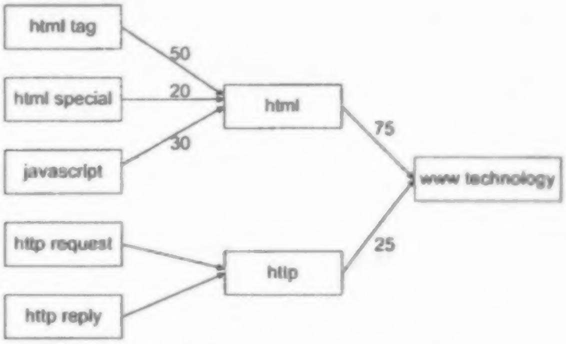


Figure 1: knowledge (update) structure in a course.

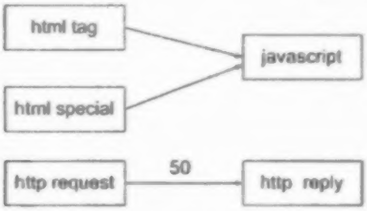


Figure 2: prerequisite relationships in a course.

From the graphs we observe the following properties of these concept relationship types:

- The relationships are all *binary*. We see that we can use two or more relationships with the same (source or) destination, to indicate that several pages contribute knowledge to a concept or that several pages are a prerequisite for a single concept. We shall see below how this affects the generation of the adaptation rules.
- The graphs are both *acyclic*. This may not be true for all imaginable relationship types. An authoring tool can verify whether the property holds, if needed.
- Relationships have an optional value associated with them. For the knowledge this indicates how much knowledge the source concept contributes to the destination. (In terms of a concept *hierarchy* this would be contribution of *child* concepts to *parent* concepts.) For the prerequisites it indicates how much knowledge of the source concept is required before the destination concept becomes "suitable".

In AHA! entering concept relationships becomes as simple as drawing a (labeled) graph. (We do not pretend that *designing* a proper structure of concept relationships is simple.) The new AHA! concept relationship authoring tool can show the graph for each concept relationship type separately or can overlay the graphs using different colors or line styles. Below we show two examples: the definition of *knowledge propagation* and the definition of the *prerequisite relationship type*.

In the first example we show (in a simplified way) how knowledge is propagated. (Note that another concept relationship type is needed to make a page access generate knowledge about a page. The example below only shows how knowledge is transferred from one concept to another.)

```
<concept_relation_type>
  <name>knowledge propagation</name>
  <color>blue</color> <style>full</style> <properties acyclic="true"/>
  <listitems>
    <generatelistItem location="source.knowledge" isPropagating="true">
      <requirement>true</requirement>
      <trueActions> <action combination="DIV_S">
        <concept>destination</concept>
        <attribute>knowledge</attribute>
        <expr>destination.knowledge + var:DIVIDE * _source.knowledge</expr>
      </action> </trueActions>
    </generatelistItem>
  </listitems>
</concept_relation_type>
```

Using this concept relationship type definition the authoring tool can translate the knowledge update edge between "javascript" and "html" (in Figure 1) to the following AHA! code:

```
<concept>
  <name>javascript</name>
  ...
  <attribute name="knowledge" type="true" isPersistent="true" System="false">
  ...
  <generatelistItem isPropagating="true">
    <requirement>true</requirement>
    <trueActions> <action>
      <concept>html</concept>
      <attribute>knowledge</attribute>
      <expr>html.knowledge + 0.3 * _javascript.knowledge</expr>
    </action> </trueActions>
    </generatelistItem>
  </attribute>
  ...
</concept >
```

This example shows the following elements in the translation:

- The generated adaptation rule belongs to the "knowledge" attribute of concept "javascript" (the source), so whenever this attribute value changes the rule is triggered. (This rule has no condition: the "requirement" is simply "true". The condition is translated as well, but here it is just trivial.)
- The action of this rule updates the "knowedge" attribute of the concept "html" (the destination). The *change* in the "knowledge" value of "javascript" is used. This is indicated by the prefix "_".
- When several knowledge propagation relationships have the same destination the fraction of the knowledge value change that is actually propagated is calculated by dividing 1.0 by the number of sources. However, in the example of "javascript" and "html" the divider that would be calculated by default is overridden by the label "30" in the graph. (Allowed because of "`var:DIVIDE`".) This results in the division factor 0.3. (For "http request" and "http reply" the factor is 0.5.) The term "`DIV_S`" indicates division by *source* of the relationship, "`DIV_D`" would mean division by *destination*.

```
<concept_relation_type>
  <name>prerequisite</name>
  <color>red</color> <style>full</style> <properties acyclic="true"/>
  <listitems>
    <generatelistItem location="destination.suitability">
      <requirement>true</requirement>
      <trueActions> <action combination="AND">
        <concept>destination</concept>
        <attribute>suitability</attribute>
        <expr>source.knowledge > var:70</expr>
      </action> </trueActions>
    </generatelistItem>
  </listitems>
</concept_relation_type>
```

The prerequisites "html tag" and "html special" of the concept "javascript" (in Figure 2) result in the following piece of AHA! code:

```
<concept>
  <name>javascript</name>
  ...
  <requirement>
    html_tag.knowledge > 70 && html_special > 70
  </requirement>
  ...
</concept>
```

This example shows the following elements in the translation:

- The prerequisites contribute to the "destination" concept (in this case "javascript").
- The "suitability" attribute mentioned in the rule is actually a pseudo-attribute. Using it in a concept relationship type means that it is the "requirement" of the whole concept that will be created.
- The "source.knowledge > var:70" expression means that the knowledge value of the source concept (html_tag or html_special) is compared with 70 or with a number given as label in the graph. (The real XML representation uses &gt; instead of > because of XML restrictions.)
- The "AND" combination of the action means that the expressions for different prerequisites are combined using the logical *and* operator (represented by && here). It means that all prerequisites for a concept must be satisfied in order for it to be considered suitable. (For other types of relationships the combination may also be "OR", meaning that at least one of the conditions must be satisfied. Combinations of requirements from relationships of different types, having the same destination, are always combined with "AND" (and thus not explicitly written in the definitions).

Conclusions and Future Work

In this paper we have shown how drawings of concept relationships can be translated to AHA! 2.0 concept and adaptation structures. In order to do so an AHA!-like syntax was developed to define concept relationship types and their translation to adaptation rules.

The translation of concept relationships to AHA! is fairly straightforward, even in the presence of relationships of several different types in the same application. A prototype interface enables authors to create concept relationships and have them translated to AHA!. It contains the definition of a number of commonly used relationship types. In the future we will also develop an interface for defining new types and add the ability to author adaptation rules at the presented high level and the low level of AHA! 2.0 at the same time.

References

Brusilovsky, P. (1996). *Methods and Techniques of Adaptive Hypermedia*, User Modeling and User-Adapted Interaction (6), pp. 87-129, Kluwer academic publishers.

Brusilovsky, P. (2001). *Adaptive hypermedia*. User Modeling and User Adapted Interaction, 11, (1/2) pp. 87-110.

Brusilovsky, P., Eklund, J., Schwarz, E. (1998). *Web-based Education for All: A Tool for Developing Adaptive Courseware*, Computer Networks and ISDN Systems (Seventh International World Wide Web Conference), vol. 30, 1-7, pp. 291-300.

De Bra, P. and Calvi, L. (1998). *AHA! An open Adaptive Hypermedia Architecture*, The New Review of Hypermedia and Multimedia, 4, pp. 115-139, Taylor Graham Publishers.

De Bra, P., Aerts, A., Smits, D. and Stash, N. (2002). *AHA! Version 2.0, More Adaptation Flexibility for Authors*, Proceedings of the AACE ELearn'2002 conference, Montreal, Canada.

De Bra, P., Houben, G.J., Wu, H. (1999). *AHAM: A Dexter-based Reference Model for Adaptive Hypermedia*, Proceedings of the ACM Conference on Hypertext and Hypermedia, pp. 147-156, Darmstadt, Germany.

Adaptation of the e-learning web application "Campus Virtual Teledomedia" to obtain an open and accessible information management system

Antonio de Castro Orbea, Cristobal Romero, Carlos de Castro
Departamento de Informatica y Análisis Numérico, Universidad de Cordoba
14071 Campus de Rabanales, Cordoba, España
cdecastro@uco.es

Abstract: In this paper we describe our project of transformation from an elearning web application in stage of production to an open and accessible management information system capable of provide an individualized user experience to overcome a physical or psychological disability from the user and access a common background or particular information source. New features will be added to the system like local domotics system control, cognitive rehabilitation programs or task scheduling support.

Introduction

The last 10 years have witnessed an explosive growth of the new technologies of information through the integration of telecommunication networks with multimedia capabilities. These technologies offer new ways of communication useful in business or private areas. There is no doubt that social relationships are evolving towards a social model based in the interchange of multimedia information. However, there are 37 million people with disabilities in the EU, while the number of older Europeans is steadily increasing. These groups of risk face to severe social exclusion due to a range of technical barriers when using the Internet, specially Web-based services. All citizens have the right to use all benefit from new opportunities that the Information Society offers. People with disabilities and older persons experience sometimes difficulties to access these new technologies and services, as some barriers can be inadvertently created by the Information Society itself. On the other hand Information Technologies and Services can greatly help to overcome other environmental or social barriers, encountered by people with disabilities and older persons.

Our project (in a initial stage of development) tries to provide an elearning web-based site specially oriented to people with a wide spectrum of disabilities or elderly people, guaranteeing a full access to educational programs, rehabilitation programs, collaborative environments or a multimedia contact-center.

Individualized user experience

Due to specials needs of the kind of user that this application aims to, it is necessary to design a full set of mechanisms to provide an individualized user experience, according to their disabilities and interests. It would be possible to access individualized web contents or integrate a full set of interaction devices with the web application, such as properly designed wheelchairs, adaptive switches to control devices, or speech synthesizers.

The project expects the adaptation of a CMS (contents management system) and an e-learning system called "Campus Virtual Teledomedia". This application is already in a production stage, though it has some accessibility limitations. It is necessary to take a "design for all" philosophy in order to improve the accessibility of disabled or older people and obtain a system capable of an automatic adaptation to special needs or desabilities of the user. Besides this goal another objective of the project is to take a flexible and modular development strategy to make new functionalities possible, such collaborative environments, task scheduling support, local domotics systems management or cognitive rehabilitation process.

The main feature of the proposed system is the modular and multi-layer architecture to achieve the independence between information (stored in a neutral format based in XML) and the visual or sonorous specific format. The adoption of international or "de facto" standards like Web Accessibility Initiative (WAI) or Web Accesibility

Guidelines (WCAG) for the design of accessible web-bases services will guarantee the full compability with specialized presentation devices such as screen-readers or a tactil screen.

Besides this accessible feature new automatics transformation mechanisms will be designed to increase visual or sonorous aspects of the information showed to the user or simplify it to mere pictographic symbols (in situations of severe cognitive disabilities)

Main goals

- Facilitate a full access to the educational programs of the system, guaranteeing an individualized learning process and the remote tracking of the user progress
- Manage a home domotic network via an accessible web-based interface to achieve an increasing of the home security of the disabled or elderly user.
- Facilitate an immediate multimedia connection with an welfare remote center
- Provide support decision-making software to help the user to schedule or remind events or consult step-by-step guides of everyday activities.
- Provide a set of adaptable dynamic games useful for cognitive rehabilitation under the remote supervision of a qualified therapist.

Conclusions

The achievement of the presented objectives will suppose the transformation of an elearning application into an accessible information management platform open to future adaptations or devices, fully oriented to guarantee accessible and individualized learning or rehabilitation experience.

References

- Coughin, J.F.(1999) Technology Needs of Aging Boomers Rev. ISSUES in Science and Technology. Available in http://www.nap.edu/issues/16.1/coughlin.htm
- Fernandez, J.M.; Gaitán, R.; García-Camino, M. & Gil, S. (2000) Soluciones de Comunicación para personas mayores y con discapacidad. Guía de productos, servicios y aplicaciones de telefónica. Ed. Fundación Telefónica.
- Franco, M.; Orihuela, T; Bueno, & Cid, T. (2000) Programa Gradior: Programa de Evaluación y Rehabilitación cognitiva por ordenador. Ed.Edintras.
- Rodriguez Cifuentes, T. (2000) Accesibilidad a la web de las personas con discapacidad visual. En Actas I Congreso internacional de nuevas tecnologías y necesidades educativas especiales. Murcia.
- W3C (1999) Web Content Accessibility Guidelines 1.0 Ed. Trace R&D Center.

Modeling the Tutor-Learner Interaction in an E-Learning Environment: An Instructional Design Perspective

Ileana de la Teja
LICEF Research Center, Télé-université, Montreal
idelatej@licef.teluq.uquebec.ca

Aytac Simsek
Syracuse University, IDD&E, Syracuse
aytacsimsek@hotmail.com

Abstract
Importance of modeling the rapport between tutor and learners in an e-learning environment arises from a learner-centered design approach in which it is essential for the designer to plan the support for learners. This paper describes the implementation of a graphical knowledge modeling approach developed at LICEF Research Center to orchestrate the processes and resources of tutors and learners. Organized into strata, the model allows representing the various roles of the tutor in an e-learning environment. Advantages of this approach include a filtering mechanism to facilitate management of complex interactions between tutor and learners.

Context

From a learner-centered approach in an e-learning environment, the tutor is an actor that supports the learner by addressing his needs with a variety of instructional strategies and tools. Several studies have contributed to understand the roles of the tutor (Goodyear et al. 2000; Rigault et al.1998; Rowntree 1995) as well as the nature of the support that can be provided to the learner (Harley et al. 2001). One of the key roles of the tutor in an e-learning environment is that the facilitator provides ample opportunities for interaction (Vrasidas 2000). According to Moore (1989), the tutor delivers instruction, gives lectures, provides feedback and encourages the learner, whilst the learner asks questions, submits homework and discusses problems. In an e-learning environment, this interaction cannot be completed without considering that, according to the learner's needs, the tutor can be called to assist the learner in other types of interactions: learner-content, learner-learner and learner-interface (De la Teja 1997; Hillman et al. 1994).

Given the complexity of the T-L interaction, the development of specifications to ensure the quality of the support provided to the learner can become an intricate task for the instructional designer who needs to plan and describe the actions, resources and conditions of the interaction. How is this to be done? It has been suggested that the use of models can be helpful to reduce complexity by separating out a small number of important things to deal with at a time (Rumbaugh et al. 1991). Of particular interest are models using a graphical representation language because they facilitate the elaboration of complex systems (Yourdon 1989; Scheiber 1993; Paquette 2002.) This paper depicts the use of a graphical modeling approach to represent the interaction between the learners' needs and tutor support. Two particular areas of inquiry are addressed: Which are the elements to consider when planning the support in an e-learning environment? How can the support provided by tutors be represented in a graphical form?

This paper focuses on the use of models in instructional design and presents the main characteristics of MOT Plus, the software used to model the Tutor-learner interaction. Finally, issues on the implementation of the modeling approach are addressed.

Instructional design and models

Since the early 1980's considerable work has been done on the use of models in instructional design (Romiszowski 1981; Wilson, Jonassen & Cole, 1993; Paquette 1994; Wasson & Bourdeau 1998). More particularly, studies done at LICEF[1] Research Center of the Télé-université, have led to the development of an instructional design method based on knowledge modeling. This method, known as MISA[2] describes in detail the process to elaborate the learner's model (Paquette et al. 2002), but information on how to model the support provided by tutors is scarce. To address this gap, this study examines how the different roles played by the tutor can be graphically represented in regard to the learner's model.

In MISA, the modeling approach rests on four main categories of knowledge: procedures, concepts and principles (Anderson 1983; Romiszowski 1981).

- Procedures are used to describe actions (e.g. Elaborate a definition of freedom).
- Concepts are used to represent the resources required to execute the actions (e.g. Forum, Online teaching guide) as well as the resulting product (e.g. Definition of freedom).
- Principles characterize the relationships between concepts and procedures (e.g. criteria to decide when or why certain choices should be made while using a procedure or a concept).
- Facts are objects, events, names, etc. (e.g Forum of course BIO 3059, a specific Web site).

MOT Plus

Different software tools are available to the instructional designer to create graphical models (Kasowitz 1998), but few of them allow visualizing the relationship of the four rather abstract knowledge units described above. MOT (French acronym for Object Modeling Tool) is the product of research and development efforts to answer that need. Fig. 1 presents the forms and links used to construct models with MOT.

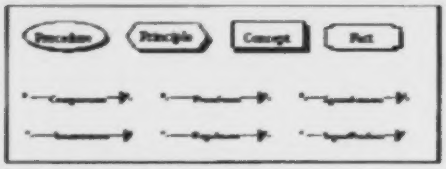


Figure 1. Graphical forms and links used in MOT and MOT Plus software.

Several researches in different domains (e.g. Paquette et al. 2001; Saliha-Hassane et al. 2000, De la Teja et al. 1997) suggest that these forms and links are enough to represent simple learner-tutor interactions. However, a more sophisticated tool was necessary to manage complex instructional scenarios in which, for example, the support provided by the tutor is varied and is expressed through different roles. A new version of MOT, i.e.MOT Plus, was developed to represent strata, a sort of organizing hierarchy. With strata it was possible to size the entire model in all its complexity but at the same time simplify the model description by separately representing specific points of view.

Modeling the T-L interaction

In exploring the advantages of MOT Plus in modeling the T-L interaction, the learner's model and the support provided by the tutor were represented in a large number of actions then divided up into specific tasks that would be handled by different roles. A filter mechanism was used to visualize only those graphical forms pertaining to a specific role. Furthermore, it was possible to keep the link between the different roles. Fig. 2 illustrates the main forms used in the elaboration of a model of the T-L interaction.

---

[1] French acronym for Laboratoire d'Ingénierie Cognitive et Environnements de Formation

[2] French acronym for Method for the Engineering of Learning Systems

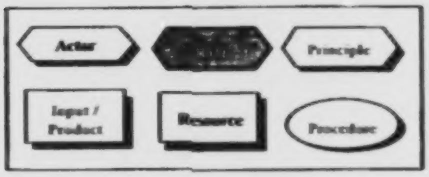

Actor
Principle
Input / Product
Resource
Procedure

Figure 2. Forms used in the construction of a model of the T-L interaction.

With these forms, the different elements of the T-L interactions were captured. As shown in Fig. 3, the elements in the upper dotted box correspond to the learner's model. Here, the learner's action (main oval) consists in defining the concept of Freedom as stated in the objective of a learning unit (white rectangle). To accomplish the action, the learner is provided with different resources (gray rectangles): a forum and a bibliography. The definition of Freedom is the result (white box) of a learning effort done according to the rule (white hexagon) requiring that the action is accomplished in collaboration.

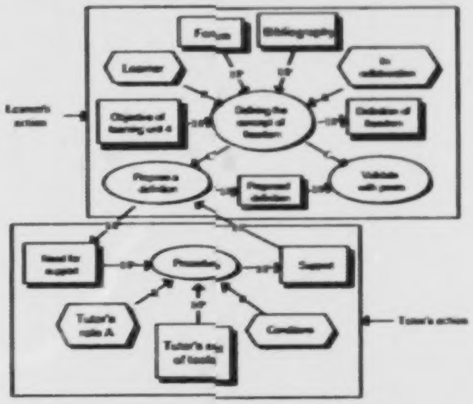

Forum
Bibliography
Learner
In collaboration
Learner's actions
Objective of learning unit 4
Defining the concept of freedom
Definition of freedom
Prepare a definition
Proposed definition
Validate with peers
Need for support
Procedure
Support
Tutor's role A
Tutor's kit of tools
Conditions
Tutor's action
I/P

Figure 3. Tutor-learner interactions.

In the lower dotted box, the tutor's model is illustrated. Relevant elements are identified and represented using the forms in Fig. 2. A link between the learner and the tutor's actions is indicated by the arrow "I/P", explaining that in the preparation of a definition, the learner needs support (white rectangle). In the example, the intervention of the tutor is part of a more complex model as shown in Fig. 4.

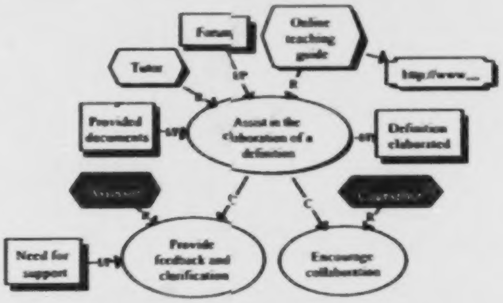

Forum
Online teaching guide
Tutor
http://www...
I/P
R
Provided documents
Assist in the elaboration of a definition
Definition elaborated
C
C
R
R
Need for support
Provide feedback and clarification
Encourage collaboration

Figure 4. Partial view of the tutor's model.

In this model, the tutor assists the learner in the elaboration of a definition. He executes this process (oval) through a forum (gray rectangle), following the guidelines for online teaching (hexagon) that can be found at a specific web site. The main process is decomposed in two actions (dotted ovals) executed by the tutor according to specific roles: assessor and counselor (Goodyear et al. 2000). Details on the model can be fully specified indicating the tools, conditions, inputs and outputs for each one of the actions.

Conclusions

Depending on the complexity of the learning scenario prepared by the instructional designer, the model of the T-L interaction may require to be handled with filters and strata. The description of these functionalities goes beyond the goal of this paper. For the purposes of this study, it is important to highlight that modeling the T-L interaction reveals to be a complex endeavor due to the many roles and tasks of the actors. The type of support provided by the tutor as well as the resources he/she requires depend on the nature of the learner's needs, which are "construed" and difficult to predict (Vrasidas 2000). The present study suggests that MOT Plus is a useful tool to create a generic model where more specific instantiations can be integrated without creating communication overhead. The graphical modeling approach has increased the degree of completeness and coherence within and across the models of the two actors.

There are many factors that influence the interaction between the learner' needs and the tutor supported plans by the instructional designer. Further studies might include intervention of peers, experts, groups of tutors as well as the type of need as expressed by the learner (implicitly or explicitly). Moreover, the impact of innovative multimedia resources should be explored to develop more effective learner and tutor support.

References

Anderson, J. (1983). *The Architecture of Cognition*, Harvard University Press, Massachusetts.

De la Teja I., Lundgren-Cayrol, L., et Paquin, C. (1997). *Mise à l'essai du campus virtuel version '97*. Compte rendu. Revue de l'éducation à distance, Canada. 12(1 / 2).

Goodyear, P., Salmon, G., Spector, M., Steeples, C. & Tickner, S. (2000). Competencies for Online Teaching: A Special Report. *ETR&D Journal*.

Harley, H., Seal, C., and Rosson, M.B. (na). *A Formative Evaluation of Scenario-Based Tools for Learning Object-Oriented Design*, ACM Crossroads. Students Magazine. Available at http://dev.acm.org/crossroads/xrds5-1/eval.html

Kasowitz, A. (1998). *Tools for Automating Instructional Design*, Eric Digest, New York.

Paquette, G. (2002). *Modélisation des connaissances et des competences*, Presses de l'Université du Québec, Montreal.

Paquette, G., Aubin, C. & Crevier, F. (1994). An intelligent support system for course design. *Educational Technology*, 34(9), 50-57.

Paquette, G., De la Teja, I., Lundgren, K. & Léonard, M. (2001). *La modélisation cognitive, un outl de conception des processus et des méthodes d'un campus virtuel*, AECT.

Ricciardi-Rigault, C., Paquette, G., De la Teja, I. & Paquin, C. (1998). Le Campus Virtuel : un réseau d'acteurs et de ressources. *Revue de l'éducation à distance*. 12 (1 / 2).

Romiszowski, A. J. (1981). *Designing instructional systems: Decision making in course planning and curriculum design*. London: Kogan Page.

Rowntree, D. (1995). *Tutoring Online*, British Journal of Educational Technology, 26(3).

Rumbaugh, J., Blaha, M., Premerlani, W., Eddy, F. & Lorensen, W. (1991). *Object-oriented Modeling and Design*. Prentice-Hall, Canada.

Saliah-Hassane, H., Saad, M. & De la Teja, I. (2000). *Virtually and remotely accessing and controlling laboratory real devices: A new trend in teaching and learning engineering*. ITHETE 2000, Turkey.

Vrasidas, C. (2000). Constructivism Versus Objectivism: Implications for Interaction, Course Design, and Evalution in Distance Education. *The International Journal of Educational Telecommunications*, 6(4).

Wasson, B. & Bourdeau, J. (1998). *Actor interdependence in collaborative telelearning*. Available at: http://www.ifi.uib.no/staff/barbara/presentations/edmedia98/

Wilson, B. G., Jonassen, D. H. & Cole, P. (1993). Cognitive approaches to instructional design. In G. M. Piskurich (Ed.), *The ASTD handbook of instructional technology*, 21.1-21.22. New York: McGraw-Hill. Also available at: http://www.cudenver.edu/~bwilson

E-Learn 2002
GWeb Enterprise Portal

ABSTRACT

The George Washington University has developed an enterprise portal solution to fulfill the varied needs of students, faculty, alumni, staff and friends. The ability to integrate email, online student registration, courseware software, enterprise data and other existing resources into a comprehensive single-sign-on portal allowed for greater application interoperability, extended usage, and enhanced University wide communication.

PAPER

In late 1998, The George Washington University (GW) started conceptualizing innovative ways to use web technologies to replicate its sense of community in the online world and to enable more agile communication within its constituencies. GW needed an all-in-one comprehensive and integrated enterprise portal; a solution that would allow all types of constituents – students, alumni, faculty, staff or some combination of these roles - the ability to use services and receive information tailored to their specific needs. Moreover, the system was to provide the ability to integrate applications such as email, online student registration, courseware development and management, and other existing resources into a comprehensive single-sign-on portal.

GW decided to build its own portal and named it GWeb. The Interactive Multimedia Applications Groups (IMAG), a team within the Administrative Applications department of GW's Information Systems and Services, spearheaded the development of GWeb. Initial features were based on student, staff, faculty, and alumni interests, focus groups, GW administrative guidance, including the Web Advisory Committee of GW's Information Technology Advisory Council and the Technology Committee of GW's Board of Trustees. GWeb went officially live in September 2001 after a "test drive" period that lasted eight months, as we collected and responded to user feedback to improve services and features.

Developing the University portal independently allowed GW to focus on its specific needs and opportunities distinctive to GW. While the challenge of building a portal may have been greater than using a generic product, the autonomy and independence generated allowed GW to provide solutions responsive to the community's needs and values. Furthermore, the ability to integrate existing resources into a comprehensive single-sign-on portal allowed for greater application interoperability, extended usage, and enhanced University-wide communication.

The GWeb portal is based upon a mix of academic, collaborative, informative and personal services to encourage use and promote community interaction. Services of personal nature, such as weather from around the globe, movie show time listings, comics, and classified ads provide resources that would otherwise require users to search elsewhere for these features. The aggregation of the GWeb services increased usage and the effectiveness of communication between the University and its constituencies.

Today, thanks to its proven infrastructure, more and more applications are being built on top of the GWeb architecture to facilitate the University's operations and academic learning.

Currently, GWeb includes the following features:

- Role-based configuration. Users are presented with applications and communication that are relevant to their affiliation within the University (i.e. student, staff, faculty, alumni, or guest).
-
- Role-based polling and surveys. Users are presented with polls and surveys that are relevant to their affiliation within the University.
- Content management and distribution. Organizations and departments within the University can post news and events on the portal and have the same content syndicated out to their own website on the University's main web server.
- Online directory: Users can search email and campus addresses for faculty and staff. Student and alumni email addresses may also be searched.
- Access to external applications. The portal provides single sign-on to Email, library catalogues, and the University's online courseware application.
- Secure distribution: Staff and faculty can obtain instant, secure access to their personal identification numbers (PINs) for accessing BANNER, the University's enterprise system, over the web.
- Employment listings and employment applications: This application allows users to browse and apply online for GW employment opportunities. The data feeds directly from the BANNER database.
- Training registration: Allows training providers to manage GW employee training.. The system feeds data back to the BANNER system to record, track and report on fulfilled employee-training requirements.
- Bookmarks and Web Notes. Users can bookmark web sites or save the contents of various web pages through GWeb. These bookmarks and notes can then be shared with other GWeb users and accessed from any computer.
- Instant Messaging: Users can send instant messages within the GW network and to other popular networks, including AOL, MSN, Yahoo and ICQ.
- Alumni Mentoring Program: Students may browse through alumni profiles to select a mentor.
- Student Elections: Students may vote online for their school board representatives.
- Entertainment: GWeb modules include news from washingtopost.com, weather from around the world, comics, horoscopes, movie show time listings, live broadcasts of GW's radio station, real-time robotic cameras from around campus, news feeds from and classified ads.

Developing the portal required three predominant types of activities occurring almost concurrently: business development, technical development, and design and usability. Each is outlined below:

Business Development

It was necessary to build relationships throughout the University and beyond to make GWeb happen. Two types of relationships were required. First, relationships needed to be established within the University to secure commitment to GWeb. Second, relationships with content providers were required to enable GW to provide services such as news and movie listings. GW established a partnership with the Washington Post that became a win-win solution. While integrating washingtonpost.com with the portal, the Post developed the standards for content distributions, which will later be used with other washingtonpost.com customers.

Technical Development

GW's in-house knowledge of the systems that were to be integrated was one of the reasons for the successful design of the portal solution. IMAG's ability to easily reach for knowledge and expertise within the Administrative Application division made the links between the portal, the administrative data and the systems relatively simple.

Scalability issues were addressed carefully to ensure GWeb's ability to handle a growing user base and an expanded service offering. Furthermore, the University's high standard of and commitment to security demanded particular attention to preserving the integrity of University data.

Design and Usability

Crucial to the success and adoption of GWeb was making it easy to use and understandable for the user. Early on, mock-ups were created and their practicability examined. Special efforts went into creating an environment that would be friendly, inviting, and intuitive. Focus groups were used to assess ease of use, intended audience and future development needs. The personalization aspect of GWeb allowed for each user to see a specific page made especially for them. Whether the feature being used is a particular discussion group, a favorite news section, or weather reports from a hometown region, each user can easily personalize GWeb to their needs and preferences. Additionally, applications like email, instant messaging, and the courseware application are made accessible without additional logins.

The evidence of the success of the GWeb portal comes from the usage that we are registering. Whether because of the email integration, the instant messaging, or the comics column, users are valuing the application and are using it every day. Because of its successful adoption, the University has used the portal as one of the major means of communication. Surveys are proposed to users over the portal. The ability to then correlate the survey data with enterprise data provides the University with a powerful tool for strategic planning initiatives.

The self-service aspect of the portal has reduced the cost associated with providing direct assistance. The portal has eliminated the need for publishing a hardcopy version of the GW phone directory and reduced the costs associated with maintaining directory entries.

The portal has assisted with identification of data quality issues in our enterprise database. A few staff and faculty members who tried accessing one of the portal applications, which required the submission of personal data, learned that their birthdate or social security number was recorded incorrectly in the enterprise database and then were able to take steps to correct their information. Staff and faculty members can easily view their online directory entry and update it with a few clicks.

The employment vacancies listing program allows for the display of job descriptions, which were previously not available through the web. Job applicants can submit their resume online, thereby improving the quality of staff by increasing the pool of resumes from which University managers can choose.

There are several elements which give GWeb sustainability throughout the University. Its capabilities have changed the way we develop and deploy applications. For example, by being able to access our enterprise database, users are now able to provide correct and updated information ranging from birth dates to office phone numbers with only a few clicks. With our online directory, finding a department contact number or email address is simple. With the new calendar, users are able to add events into one consolidated calendar, which can be sorted by various user groups such as student organizations, classes, departments.

GWeb Portal has been well received throughout the GW community and has received support from Vice Presidents and the Board of Trustees, as well as becoming a permanently bookmarked site for thousands of students, faculty, administrators, and staff that populate the GW community. All these elements further sustain the University by providing information in a single consolidated portal, accessible to anyone, customizable by any user, and further projects The George Washington University's online presence in the world wide web.

Although GWeb has been live since September 2001, it is a work in progress. We have already added new features such as a robotic camera that allows the user to control viewing of various parts of the GW community. With such innovative modules being developed every day, GWeb has become a powerful tool and resource that will further sustain access to services and communication among the many constituencies that make up the GW community.

The fact that thousands of University constituents have incorporated use of the portal into their daily use of on-line services speaks for itself. An integrated tool such as this is the direction of the future for access to services and information. The business process, technical and usability challenges already identified and solved during this project should prove beneficial to any other higher education institution wishing to take the next step into the future of web-based services, integrated information and targeted communications.

Issues in Rural Uptake of Online Learning: an Australian Perspective

Dr. Ann Deden
a.deden@ecu.edu.au
Learning and Development Services
Edith Cowan University
Perth, Western Australia

Abstract: Worldwide, many hopes for improved access to tertiary education have been pinned on Internet-based telecommunications. This presentation reports the extent and success of attempts to encourage rural and remote Australian secondary school students to use the Internet to participate in tertiary education, and identifies key features of successful programs.

The Discrepancy Between Metropolitan And Rural Rates Of Tertiary Participation

Based on 1996 census data, the Australian Department of Education, Training and Youth Affairs (DETYA)[1] calculated that 28.4 percent of metropolitan Australians between the ages of 19 and 21 were enrolled in higher education, as compared with 18.3 per cent of their peers from rural and isolated locations. Yet rural Australians constitute 46 percent of the total population. In rural and especially in remote areas, populations tend to be very sparse, spread over vast distances. Transportation and communication are often minimal and seasonally unreliable. And a significant proportion of rural and remote Australians are disadvantaged not only by location but by socioeconomic status as well. Taken together, these factors make the issue of rural and remote education equity a challenge of daunting proportions. Many state and national government leaders expect that online learning offers a panacea that will happily resolve this dilemma.

The presentation reports the results of an investigation into whether this expectation is likely to be realised with current approaches, and derives a criterion list of potential success factors that should be piloted.

Project description

The investigation took the form of a structured survey of existing programs, and an analysis of those programs in terms of factors identified in the research literature as affecting secondary students' tertiary education decisions. We assessed the extent and methods used to address both factors that encourage tertiary participation and those that discourage it.

Most programs that met the criteria for inclusion is this study are limited to vocationally oriented in-School offerings, known as VET in School programs. Typically, these programs focus primarily on encouraging students to complete school through Year 12 by providing local access to an expanded range of attractive vocational subjects. Many such programs offer TAFE Certificate I or II qualifications, along with high school completion awards.

Programs such as the Nhulunbuy High School, New South Wales Access Clusters, and the New England Institute of TAFE programs integrate significant participation by the local secondary school, relevant local industries, community telecentres[2] and TAFE institutions. By engaging active local business and community support, the programs help create a climate in which further education, as well as the use of distance learning technologies, can become normative, and reinforced by social interaction. Furthermore, they demonstrate the relevance of advanced learning to careers in local industries. This shows students that they will not necessarily have to abandon their communities if they pursue tertiary goals. Experiences with supportive distance learning facilities and staff can also help secondary students feel more comfortable with the idea of engaging in tertiary study via distributed learning approaches.

---

[1] Name changed in 2002 to: Department of Education, Science, and Training (DEST)

[2] Telecentres are community-managed facilities that offer Internet access and skills training. Many also support video-based lectures and student assessment for tertiary vocational programs.

It was extremely rare to find university-initiated rural tertiary participation programs using technology. A number of universities, particularly those with regional campuses, conduct at least some rural student recruitment programs. However, there is at present no university program that uses online learning as part of a program guiding rural and remote Australian students through either an enriched conventional or an alternative pathway to university.

Edith Cowan University's Harvey Aspirations program is in the early days of a three-year pilot trial, seeking to adapt the Upward Bound model from the U.S. to Western Australian requirements, and to incorporate online learning as part of the process. While Aspirations provides more of the elements that the research suggests are essential for the success of tertiary encouragement programs, it continues to rely on a substantial amount of face-to-face contact, and as yet makes little use of the Internet. ECU is able to provide that at Harvey due to the proximity of its Bunbury campus. Thus, we were unable to identify any working model of a rural/remote tertiary encouragement program in which a metropolitan university campus provides the university component and uses distributed learning technologies to support any significant portion of its interaction and contact with distant school students.

However, from the analysed programs and related research, it was possible to generate at least a starting set of recommended features that would contribute to the effectiveness of any tertiary encouragement programs that used distributed learning technologies to reach rural and remote secondary students.

Toward a Best Practice Model

To be successful, model programs will need to effectively address as many of the factors that currently discourage country students from pursuing further tertiary learning, as well as incorporate a number of strongly encouraging elements (James et al. *op. cit.* 1999). Based on analysis of the data gathered, the following features can contribute strongly to the potential success of tertiary encouragement programs for rural and remote Australian students:

- Early intervention, perhaps as early as Year 7 and certainly by year 9 or 10, to help ensure secondary completion to a level appropriate for each students' tertiary study goals, to broaden students' exposure to career and related study options, and to begin to address any academic deficits or enrichment needs

- Inclusion of self-management and independent learning and living skills, including the use of distributed learning technologies

- Effectively addressing students' and families' financial concerns regarding the costs of leaving home for tertiary study

- Engagement of family, school and community members, and of local telecommunications resources, so that students experience more social support and continuity between home and away tertiary locales

- Focus on tertiary study pathways to careers that require university as well as TAFE preparation

- Active, well-integrated partnerships across participating educational sectors

- Community and family involvement in selection of subjects and provision of relevant work experience and work-based learning

- Residential camp experiences conducted on university campuses

- Incorporation of regional clusters of schools interested in the same program, with shared contribution to program teaching

- Use of distance learning and telecommunications technologies to foster ongoing high levels of interaction among cluster schools and with linked universities

- Technical and curricular support from state education agencies

- Active involvement with a specific university and/or faculty that offers courses seen as relevant and beneficial to the economic life of the community—whether it is geographically close or not

- Exploration of careers requiring tertiary preparation

- Tertiary level learning skills and academic remediation, bridging, and enhancement as appropriate to each student's goals and skill levels

- Provision of additional social, counselling, and academic skills support once students embark upon tertiary study

It is likely that such programs will also need to encompass some professional development for both secondary and tertiary teaching, counselling and advising staff. Significant professional and organisational learning will be involved as staff from different institutions and sectors work together to develop well-articulated pathways for rural and remote students, to track student progress, and to provide appropriate and effective programs and advice, both face-to-face and via distributed learning modes.

Next Steps

The findings of this study can help to guide strategic planning for tertiary access in any country facing the challenges of distance, culture, and socioeconomic status in its attempts to upgrade the educational attainment of its rural and remote citizens. The full government-sponsored report (to be published this year) includes a number of recommendations that will be considered at the national level, including the funding of pilot project designed to develop varied working best practice models.

References and relevant links:

Australian Bureau of Statistics:
http://www.abs.gov.au/

Australian Department of Education, Science and Technology Home Page:
http://www.detya.gov.au/highered/index1.htm

Deden, A. (2002, in press) *Distributed Learning in Non-metropolitan Australia.* Department of Education, Science and Technology, Canberra, ACT, Australia.

James, R., Wyn, J., Baldwin, G., Hepworth, G., McInnis, C. and Stephanou, A. (1999). *Rural and Isolated School Students and their Higher Education Choices.* Commissioned Report No. 63, National Board of Employment, Education and Training Higher Education Council, Canberra.

University Strategies in the Online Learning Marketplace

Ann Deden
Learning and Development Services
Edith Cowan University
Perth, Australia
a.deden@ecu.edu.au

Jan Herrington
School of Communications and Multimedia
Edith Cowan University
Perth, Australia
j.herrington@ecu.edu.au

Abstract: Universities worldwide are faced with enormous challenges as they decide on how the rapid changes in technology and the widespread availability of the Internet will impact upon their modes of operation. This paper examines the strategic planning implications of cost, risk, quality, and potential outcomes driving universities' investments in online learning. It explores a continuum of valid strategic positions universities can adopt, based on their analysis of these factors.

Universities attracted to Web-based delivery need well-defined policies and strategies in place that will give the them the best chance of promoting effective learning, gaining market share, generating profits, and demonstrating leadership in the quality of the online learning experiences they offer. In order to achieve such ends, a university must partner strategically, build its capacity wisely, and manage its online business commercially.

What Options Does A University Have In Defining Its Online Profile?

Every university needs to make a choice among 'big picture' strategy alternatives. For example, five possible options are suggested below, ranging from simple Web-assisted learning (effectively opting out of the competition) to one requiring a significant university commitment to Web-based delivery. In Australia, the national government's Department of Education, Science and Training (DEST) definitions of mode levels A, B, and C indicate the degree of Web-dependence a course displays. They do not and should not be taken to indicate that, for instance, Mode C is necessarily best in all circumstances. Rather, the choice of mode should be seen as reflective of the university's strategic market focus and pedagogical philosophy.

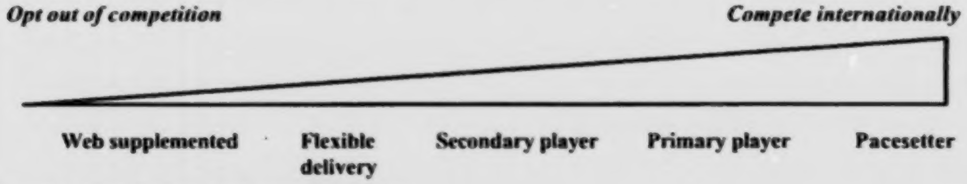


Figure 1: Continuum of online profile options

Option 1: Web-supplemented (DEST Mode A)

This option uses Web components to enrich the learning of a student cohort that is primarily campus and classroom based. Web use is recommended by the teacher, but is not strictly required in order for students to achieve unit outcomes. Universities may opt to offer this level of Web enhancement for some or all of its courses as a result of any of the following considerations:

- The course content is primarily hands-on laboratory or technical work.
- Students are unlikely to have good online access.
- The institution has decided to very gradually use the Web as one way to enrich the high-quality face to face learning experience that is already a distinguishing, marketable feature of the university.
- The particular course caters for only a small, local student population, and that population finds it relatively easy to attend regularly scheduled classes.

Online resources provided at this level can range from basic unit information to inclusion of other resources such as access to databases, and other topically relevant Websites, links to the university library and other student services. Given the traditional emphasis on on-campus teaching, it is likely that a university will find the largest number of its online learning resources and units will be at this level. Some institutions also start their online endeavours at this level. Though this is changing as student expectations rise, many courses marketed as 'online' have been primarily delivered via traditional print distance education.

Funding implications: Costs depend on features that are included and the condition of pre-existing course and unit resources. Average costs would range from a minimum of $500 to $5000 for the development of the materials.[1]

Option 2: Flexible Delivery using Web-dependent Units (DEST Mode B)

At this level, Web use is required, but other learning resources and/or experiences are also essential unit components. The Flexible Delivery option packages a mix of learning resources to support substantially online unit delivery. At this level, units and courses usually need at least moderate redesign to take advantage of Web affordances to create a more learner-centred environment. Hence, instructional designers, multimedia and Web-production personnel are typically involved. If this is the teacher's first foray at this level, then supportive professional development is also essential.

Universities may opt to offer this level of online engagement for some or all of its courses as a result ofany of the following considerations:

- It can enhance quality assurance for offshore programs.
- It aligns with the needs of an older local student population with work and home commitments that make traditional university attendance problematic.
- Students can be expected to have good online access.
- The university's IT infrastructure can provide reliable, reasonably high-speed access to remote learners, and to at least the library.
- The university has made a strategic commitment to using the Web to create more learner-centred teaching, and has aligned the necessary financial resources and support services.

Funding implications: Bates (2000) estimates costs for the development of a Web-based new unit to be around $28,300 Canadian dollars. Any such figure is simply an estimate. Bates gives four ways to estimate: 'wild guesses', 'marginal costs', 'careful estimates' and 'actual costs.' Multiplying such a figure by the number of units to estimate the cost of whole courses denies the possibility of economies of scale with template developments and other savings. The figure is also rubbery because the total cost will depend on the nature of the unit itself, and the tasks and resources that need to be produced.

Option 3: Secondary Player

---

[1] Unless otherwise stated, all dollar values are given in Australian dollars. With the exchange rate typical in mid-2002, the Australian dollar is worth a little more than half a US dollar.

A Secondary Player profile would involve offering Mode B or Mode C (fully online) units and courses. The critical feature here is the use of external providers (e.g., Open Learning Australia or OLA) for course management and marketing, in return for a percentage of enrolment income.

Universities may choose this approach for some or all of their online courses. For example, Curtin University of Technology offers most of its online courses through OLA, but also administers some directly. The decision to go to the market through a large broker or distributor can be influenced by factors such as:

- A determination that at least some programs can reach larger markets.
- The costs of reaching that wider audience are shared through a consortium approach.
- An opportunity to join with a larger provider that offers the IT infrastructure and support, and perhaps administrative support as well, that would be too costly for the individual university.
- A desire to enhance the university's name recognition through association with more widely known consortium members.

Funding implications: Funding implications will depend on the nature of the relationship, for example, whether the outside provider pays the university for unit development, or whether the university underwrites and contributes units. Administration, infrastructure and maintenance costs would need to be covered. However, the cost of joining a consortium can be significant.

Option 4: Primary Player

A primary player provides a fully e-commerce-enabled, e-learning Web Portal for all student-university interactions; may host secondary players' courses in non-competing areas; and markets through direct channels (e.g., Website, direct mail, advertising) as well as indirect channels (e.g., brokers, links to consortia and other accrediting universities).

Universities can reasonably consider this option when, for example:

- Their IT infrastructure and administrative systems are all integrated, online, robust on a 24x7 basis, and secure, allowing for all student transactions and services, as well as units, to be delivered entirely via the Web.
- They have identified programs with strong actual or potential online learning markets. These markets offer enough income to cover not only course development, delivery, and upgrading but also marketing and at least a portion of significant ongoing IT infrastructure and administrative system improvements.
- They have developed and debugged the online courses for these markets.
- They have strong name recognition in their selected market segments, and have experienced success in marketing their online courses.
- They have developed and implemented policies and practices that assure quality staffing, quick response times from teaching and support staff, and reasonable workload formulas for delivering online courses that will meet the quality standards of their face-to-face programs.
- They have made the financial commitment to continued updating and enhancement of all of the above.

Funding implications: Infrastructure and development costs for the portal would be needed, together with management and maintenance costs. It is important to remember that the rapid pace of IT evolution, coupled with increasingly intense competition for online learners means any primary players will need to commit very significant funding on a long-term basis.

Option 5: Pacesetter

Pacesetters may be traditional universities or commercial entities. *Pacesetters* contribute to the advancement of online learning, pushing the boundaries and defining the rules of the game. In addition to being a primary player, *Pacesetters* make major contributions such as:

- development of software for student-centred online teaching and learning

- development of new benchmark virtual university environments
- models for online interactive support of online students
- evaluation of virtual university outcomes
- business models for an online virtual university
- models and templates for effective online course development
- adaptation or development of effective administrative systems
- integration of on-campus and online flexible delivery
- models for the management of staffing and workload issues
- partnerships with other providers
- commercialisation of intellectual property

Funding implications: *Pacesetter* status results from a strategic commitment to deliberately pursue this position on the playing field. It requires significant prompt and ongoing realignment of resources, as well as resource enhancement through major grants, partnerships, and commercial arrangements.

Conclusion: Strategic Planning Recommendations

A university may target different levels of Web involvement for different markets or different curricular areas. A key criterion for targeting resources should be identification of the university's strong and strategic course offerings, as well as those of emerging strengths and strategic significance. However, the university as a whole must also choose appropriate targets to provide the underlying marketing, and technology and staffing arrangements required by the academic programs.

Online teaching and learning does not offer universities a 'sure bet' opportunity for increasing enrolments, reducing costs, or enhancing their reputations. The online learning market is highly competitive, yet the parameters of success in that market are not yet clearly defined. A prudent business-like approach to the possibilities, challenges, and risks e-learning presents would encompass market research including identification and analysis of potential partners and competition, analysis of expertise and resources within the university, strategic direction and priority-setting, an evaluation of the university's technical and staff readiness, plus careful cost-benefit and risk analysis.

Reference

Bates, A.W. (2000). *Managing technological change: Strategies for college and university leaders*. San Francisco: Jossey-Bass.

Designing E-Learning Success:
Curriculum Design that Encourages Student Success

Stephanie Delaney
Instructional Design
Highline Community College
United States
sdelaney@highline.edu

Abstract: It can be challenging for some students to succeed in an e-learning environment. One way that instructors can insure online success is to design success elements into the curriculum of the course. Success elements are, quite simply, components of a course that facilitate student success. This brief paper explores the idea of success elements as a tool for reviewing whether new or existing e-learning courses facilitate student success. The paper goes on to explore several types of success elements that instructors can integrate into their curricula that will improve student success without significantly adding to the instructor's workload. Success elements will also help the instructor to have a better idea of how the class as a whole is absorbing the course material.

Introduction

Faculty in higher education complain regularly about how the work of their students disappoints them. Students are unable to write well, unable to cite properly, unable evaluate the quality of research sources . . .the list goes on. Rather than complain about poor student work, this paper proposes identifying the elements which are most troublesome and giving the students the tools they need to do what is required and to do it right. These tools are identified here as success elements. Many will view this as handholding that should not be necessary with today's college students. However, for those who are willing to accept that students are not as prepared as they wish and are willing to do something about it, they will be rewarded with higher quality work, less time spent grading and much less teaching related frustration.

Evaluating Curriculum

The first step in creating success elements is to identify the problem areas in a course. This is most easily done while grading student work or after calculating final grades. Determine the areas where students tend to falter or fail to live up to your expectations.

Case Study – Inadequate Papers

One instructor notes frustration with students who fail to ask questions about an assignment before turning them in. Rather than ask for clarification on an assignment, students would e-mail the assignment with a note saying that they hoped the work was ok since they had run into some hurdle that they could not get over.

To address this problem, the instructor began providing web links to the type of information that students claimed they could not find. She gave them as starting points and discouraged the students from using the provided resources in the papers. However, once the students saw what type of site they were looking for, they were able to find additional resources and consequently turn in better work.

Most instructors can quickly and easily list the top five or ten problem areas for students. Go through your own class and start a list of the problems that crop up. You may want to keep a running list while you are grading student work. Note any comment that you make more than twice – that is probably a place where a student success element would be useful.

Keep in mind that student inadequacy often goes beyond academic concerns. Students may be unable to manage time well enough to turn in a paper in time, may not have a computer at home, or may have domestic issues which interfere with the ability to study and complete assignments. While few faculty wish to get involved in the personal lives of students, simple success elements can assist the student in managing personal shortcomings more effectively. Interestingly, the elements designed to help the struggling student often assist the high achieving students as well.

Determining Success Elements and Incorporating them into the curriculum

After you have determined where students are having problems, you can begin to identify solutions. Sometimes a solution is as easy as giving the students more information. Other times, an assignment may need to be restructured to assist students in surmounting common hurdles. Here are a few practical suggestions that you might find useful in your own class. Keep on mind that finding the appropriate success elements is often an ongoing experiment. Soliciting student feedback throughout the class can result in some great ideas.

Pre Class Assignment

Online classes often require certain basic technical skills – the ability to download a document, to send an attachment, to do basic web searching, and so on. Students may say they know how to do these things, but they sometimes overestimate their abilities until it is too late. To address this problem, a pre-class assignment may be a good tool.

In one case, the pre class assignment is given to students about 2 weeks before the class begins. Students are asked to complete a series of simple tasks before the first day of class or on the first day of class. Tasks include finding a basic piece of information on the Internet, downloading needed software, buying the textbook and creating a schedule with the proposed hours of study. Students are asked to e-mail the assignment to the instructor as an attachment, testing that skill as well. This assignment gives students the opportunity to test their abilities in a non-stressful situation, outside of class. The two-week time period gives students the time to acquire some of the more basic skills before the class begins. If the student realizes that they do not posses needed skills, they still have time to select a different class.

Week One Monitoring

The first week of class can be challenging to e-learning students. They may be confused about how to start the class or how to proceed once class begins. Students may not realize the importance of reading and following *all* of the directions and as a result miss important information. Also, students new to e-learning are often challenged by technical problems in the early days of a class. Detailed monitoring of students can make the process much easier for the student and, in the long run, for the teacher as well. The monitoring generally consists of tracking each student on a daily basis and following up immediately when the student fails to meet a deadline.

A simple first step in week one monitoring is to ask each student to contact the instructor by email on the first day to insure the instructor that the student has been able to access the course materials and is doing ok. Students who fail to contact the instructor get a follow-up e-mail the following day and a telephone call the day after that. This helps identify those students who did not think to check their e-mail for information about their online class or those who got stuck and figured the problem would somehow resolve itself. The personal contact from the instructor makes students feel less isolated in the online environment.

Another week one monitoring activity is to have something simple due early on. Examples include biographies, student home pages, textbook exercises and the like. Those who fail to submit work in a timely manner are contacted by e-mail and telephone.

Another, more time consuming, monitoring project is to reply to all email within an hour of getting the message, when possible. The downside for the instructor is that they are practically glued to their computer for the first week. The upside is that students get a sense that the instructor is there, cares for them and is attentive to their needs. This impression lasts throughout the term, even after response times return to normal. This connection with the instructor also results in higher retention rates.

It is generally advisable to notify the students when the intense monitoring period is over (though they may not have been aware it was going on) and to set out contact expectations in that message.

Syllabus Quiz

Students frequently disregard information in the syllabus, even when that information is read to them in class. In the early days of an online class, students suffer from information overload and are likely quickly scan the syllabus or to skip it altogether. A short syllabus quiz is an ideal way to insure that students are attentive (at least at the beginning of the course) to the important elements of the syllabus.

Most courseware enables faculty to set up objective, automatically graded quizzes so that, once the quiz is created, it is little work for the instructor to administer. For those without a course management tool, a quick short answer or objective quiz can achieve a similar result. Encourage retention of the important elements of the syllabus by including syllabus questions in every quiz or exam as a bonus point or easy question.

Hyperlinked Rubric or Criteria list

Many faculty members have lists of criteria or rubrics that they use to evaluate student work. One way to improve student work is to give students access to that criteria and hyperlink each of the elements to an example and additional information.

For example, proper formal essay structure may be required in an assignment. List that in a criteria list or rubric and hyperlink it to an example of a properly formed essay. Identify the portions of the essay that make it particularly noteworthy and explain why. Ideally, this example would be a student answer, letting students know that the level of expected work really is possible. In addition to the example, the instructor could link to campus and online resources where the student who has trouble with essays can go for help. This might include links to the campus writing center and reference librarians as well as online writing labs and tutorials on essay writing.

The instructor can benefit in two ways. First, the general quality of work improves. Second, when students do turn in problem work, rather than writing lengthy explanations about what was wrong with the essay, the instructor can refer the students to the existing helpful resources. Some instructors even ask the student to write a comparison of their own work to the model and to rewrite the problem area(s) based on that critique.

Peer Grading

There are many ways to incorporate peer grading into a curriculum. From the perspective of student success, peers can review the first draft work of classmates using a set of criteria set by the instructor. This enables the peers to catch common problems overlooked in the haste of assignment preparation – poor grammar and spelling, improper formatting, and other basic problems. Depending on the class and the students, more sophisticated problems can be corrected. Either way, the result is improved work from the student and less grading time by the professor.

Incorporating peer grading into the curriculum is generally as simple as adding an additional due date a few days before the final assignment is due. Sometimes additional days will be required so that the reviewer has time to read it and to make meaningful comments and that the reviewed student has time to rewrite the assignment.

Summary

The ideas presented here are, for the most part, not new ones. What may be new is the holistic and systematic approach to improving student performance by taking greater responsibility student success. The concept of incorporating success elements into the curriculum is a series of actions that a faculty member can take to improve the quality of student work while reducing time spent grading and banging ones head against the wall in frustration. The initial investments of time are often modest and the products can frequently be used in more than one class, term after term. The next time you identify a frustrating yet typical student behavior, take action and address it.

A DISTRIBUTED LEARNING MODEL FOR PROBLEM SOLVING AND PROGRAM DEVELOPMENT

Fadi P. Deek and Idania Espinosa

ABSTRACT

Technological advances are paving the way for improvements in many sectors of society. Traditional education has primarily been teacher driven, lectured-based in one location. Distributed learning is an emerging paradigm that can contribute significantly to the learning process. This paper explores the difficulties novice programmers' face when learning to program and proposes how distributed learning can be used in learning problem solving and program development.

INTRODUCTION

Novice programmers have difficulties in breaking down a given problem, designing a working solution, and debugging a program. Many programming environments, software applications, and learning tools have been developed to address these difficulties [2][3][4][5]. Several factors play a role in developing problem solving skills and program development in students. Achieving these skills is based on the internal cognition of the individual, the instructor abilities, environmental factors and the programming language. Why do novices have such difficult time learning to program? This question is answered from different angles: student, teacher, and programming language. Novice programmers normally find programming frustrating and difficult. They may not have the sufficient preparation to grasp concepts that are abstract and complex. Novices are not familiar with designing and testing logical structures for solving problems by computer. They lack an adequate mental model about the internals of a computer and how it operates. Some programming teaching methods are also a factor that hinders students' ability to learn, such as the over-emphasis in introductory computing courses on language construct and programming syntax [2][6] and not on problem solving skills.

LEARNING STYLES

Educational research shows that students have different styles of learning. These learning styles can be identified based on the type of information students prefer to receive: sensory or intuitive, visual or verbal, inductive or deductive, actively or reflectively, and sequentially or globally [1]. Instructors should mold their teaching styles to that of students' learning styles in order to effectively maximize learning in classroom.

Sensing learners tend to retain information like facts and observations. They process information more effectively through sights, sounds, and physical sensations. They are detailed oriented and prefer solving problems using well-defined steps. They are practical and complain when information is not related to the real world. Intuitive individuals, on the other hands, are more imaginative and thus prefer abstract concepts and information that is open to interpretation. They rely on memory, ideas, and their own insights. Sensing learners tend to get lower grades than intuitive learners do on lectured courses.

Visual learners retain information through images more so than verbally. They perceive information more effectively via diagrams. If a lecture does not incorporate some visual representation of a concept, visual learners have the tendency to forget the material. Research shows that most students in science classes are visual learners [1]. Lectures are mostly verbal with abstract concepts, formulas, and few diagrams. Verbal learners learn based on written and spoken words.

Inductive learners learn based on first specific scenarios and then more general principles. Students tend to use given facts and observations to infer principles. Deductive learners, on the other hand, prefer general principles first and then deduce consequences. Research shows that inductive learning promotes a deeper understanding and retention of information. Classrooms tend to use deductive approach [9].

Active learners prefer group discussions and exchanging ideas with others. Reflective learners tend to think things through and then experiment. They prefer individual work or in pairs. In a lectured course, both groups are actually neglected and enforce a passive approach to learning. Studies show that students in an active environment excel in comprehension, memory retention, and problem solving. [7]

Sequential learners gain an understanding of information in small, connected pieces. They solve problems efficiently, but may lack an understanding of the larger problem domain. Global learners' approach is all-or-nothing. Initially, they may appear to be slow students, but once they grasp the larger picture, they can make connections that sequential learners do not identify.

DISTRIBUTED LEARNING: AN ALTERNATIVE TO LEARNING PROBLEM SOLVING AN PROGRAMMING

A new model of learning has emerged which collectively brings together these models. This is distributed learning. This section describes this model of learning and also describes the solutions to existing problems in programming. According to Syllabus Magazine in 1995, distributed learning is not just a new term to replace distance learning. Rather, it comes from the concept of distributed resources. Distributed learning is an instructional model that allows instructors, students, and content to be located in different, non-centralized locations so that instruction and learning occur independent of time and place.

Programming using distributed learning model serves as microcosm of the future of learning whereby learning can take place both inside and outside of classrooms. The boundaries have been removed and interactions with people from different locations and different times are possible. The use of distributed learning in computer classrooms provides a new direction for teaching. It resolves the many difficulties that have been observed by novice programmers in learning software development. Below is a summary of difficulties encountered by students and the provisions needed along with a distributed learning environment to resolve these issues.

1. Lack a mental model to visualize abstract relationships
2. Instructors in traditional learning hold an important role in transferring knowledge. If instructor is lacking social skills necessary for interacting with students, technical ability, or effective speaking, an impediment for learning results
3. Students fall behind in classrooms and miss fundamental concepts.
4. Lack of motivation

5. Limited knowledge in a scientific area which may result in difficulty in interacting and following complex discussions
6. Students passivity in class
7. Small programming assignments which tend to lead to individualistic work habits
8. Deficiencies with traditional teaching methods, esp. lectured-based teaching
9. Emphasis on competition for grades rather than learning
10. Programming language paradigms do not associate with natural tendencies of problem solving.

The difficulty of mentally representing abstract concepts is overcome by the use of visual modeling tools. Sensory immersion devices assist in visualizing abstract concepts. These devices have been successful in areas of science and medicine. Once this is extended to the computer world, novices will be better able to model abstractions.

Distributed learning provides alternate means of learning than traditional teaching methods. By allowing students to engage in collaborative learning exercises and to use visual modeling tools, they can spread their depth of learning. The goal is to provide a more enriched curriculum that can guide students to achieve maximum learning potential. Interacting with students could enhance cognitive skills and complement individual cognition.

Distributed learning offers a solution to the third difficulty described whereby students fall behind in class. Virtual classrooms can provide additive means of learning, such as discussion forums, so in the event that a student falls behind, other sources of information are readily available to bring students up to speed on misunderstood materials. For students who prefer learning at their own pace, distance learning course can facilitate this.

CONCLUSIONS

Distributed learning has great potential to be the wave of the future in academic development in support of learning without boundaries to time and distance. It offers a wider spectrum of instructors, advisors, and collaborators than in any single educational institution. It provides a means of attaining skills from remote sources and collaborating with dispersed team members. Technology provides the essential tools for establishing interactions, but these tools, if misused, could lead to adverse effects. A balance is necessary between virtual and direct communication within group members in order to develop and sustain a sense of community. Interactions based on phone conversations alone lack the vibrancy of face-to-face. Also, while technology-mediated communication (i.e. teleconferencing, digital and video) will open the doors of virtual interactions over various information mediums, it will not completely replace personal contact. In order to optimize the use of the distributed learning model, provisions must be made and new inventions devised which provide the best of both worlds for learning. The future of distributed learning is via collaborative virtual workspaces and sensory immersion devices [8]. Further studies are necessary to measure the performance of dispersed team members using CVW. More research is also needed in the area of sensory immersion to study the impacts of these devices in the (virtual) classroom. High performance computing will gradually enable virtual communities to make possible face-to-face interactions and sensory immersion to be an integrated part of everyday life.

REFERENCES

1. W. B. Barbe and M. N. Milone, "What We Know About Modality Strengths," *Educational Leadership*, vol. 38, pp. 378-380, February 1981.

2. F. P. Deek, H. Kimmel, and J. McHugh, "Pedagogical Changes in the Delivery of the First Course in Computer Science: Problem Solving Then Programming," *Journal of Engineering Education*, vol. 87, no. 3, pp. 313-320, July 1998.

3. F. P. Deek and J. McHugh, "Problem Solving and the Development of Critical Thinking Skills," *Journal of Computer Science Education – ISTE SIGCS*, vol. 14, no. 1/2, pp. 6-12, April 2000.

4. F. P. Deek and J. McHugh, "Prototype Software Development Tools for Beginning Programming," *Journal of Computer Science Education – ISTE SIGCS*, vol. 14, no 3/4, pp. 14-20, April 2001.

5. F. P. Deek and J. McHugh, "A Survey and Critical Analysis of Tools for Learning Programming," *Journal of Computer Science Education*, vol. 8, no. 2, pp. 130-178, August 1998.

6. F. P. Deek, M. Turoff, and J. McHugh, "A Common Model for Problem Solving and Program Development," *Journal of the IEEE Transactions on Education*, vol. 42, no. 4, pp. 331-336, November 1999.

7. W. J. McKeachie, *Teaching Tips: A Guidebook for the Beginning College Teacher*, 8th Edition, Lexington, Massachusetts, 1996.

8. M. C. Salzman, C. Dede, and B. Loftin, "ScienceSpace: Virtual realities for learning complex and abstract scientific concepts," *Proceedings of IEEE Virtual Reality Annual International Symposium*, New York, pp. 246-253, 1996.

9. L. K. Silverman and R. M. Felder, "Learning and Teaching Styles in Engineering Education," *Engineering Education*, vol. 78, no. 7, pp. 674-681, April 1988.

Building and Accessing E-Learning Resources

Bich-Liên Doan and Yolaine Bourda
Supélec, Plateau de Moulon, 3 rue Joliot Curie, 92192 Gif/Yvette.
France
E-mail : (Bich-Lien.Doan , Yolaine.Bourda)@emse.fr

Abstract: This paper shows the importance of taking account of the structure in order to describe and retrieve educational resources. Each educational resource is associated to metadata and structure. We propose combining the structural and the textual analysis of the resources to improve the performance of the system. The user is able to manipulate information at several levels of abstraction, for example a set of resources, images, chapters dealing with one particular area.

Building Educational Resources

Nowadays, more and more educational resources are published and accessed through the World Wide Web (WWW). But educational resources on the WWW lack explicit semantics and structure. This can be improved by the use of metadata to describe the semantic content and by the use of typed links to represent the structure of the resources. Standardized metadata such as Dublin Core Education [1], LOM [2] bring better understanding of the educational resources content and aim, but there is a little description of the structure of these resources.

In order to underline the importance of taking into account of the structure, we classify various types of links that we can find to relate educational resources. Links of structure: they represent the logical structure of a resource, either the inclusion, the sequencing of parts of a resource (for example, the list of prerequisites).

Links of semantic association: these links reflect a semantic association between two pages, or two concepts and are very diverse because they concern the cognitive aspects of the author. Indeed according to the context, the term "winter" can suggest cold, season, country etc. Links of navigation: purely functional, they are used to physically cut out a text in a set of pages limited in volume (number of bytes). They are used for navigation between the pages, for example back link, return to the home page. Links of references: they are used to reference to pages in connection with the subject, for example the bibliographical references, or the references to similar sites and personal pages.

All of these links are often chosen by the author during the building of pages, but the types of links are not explicit with the Hypertextual Markup Language (HTML). To mitigate these problems, we consider that a educational resource is either an atomic unit of information such as an image, a passage, a title…, or a composition of other resources. A resource can be defined as a semantic unit of information, autonomous in the sense that it can be given as a response to a user request. From there, we can consider different levels of resources. A global resource can be structured in a hierarchy of several resources, it is composed of structured elements representing either section, paragraph, image, sound, graph called resources too. Each level in the hierarchy corresponds to a different level of granularity. We choose a tree structure of nodes for our example to be understandable, but in fact, we can have a Directed Acyclic Graph (DAG) structure. For example we can have a first organization level, composed of several domains, sub-domains and so on. Each hierarchical level represents a level of granularity, the lowest level of granularity is that of the components of the atomic resources (not decomposable). This concept of granularity is significant because it intervenes in all the stages of our new information retrieval system. Indeed, during the description of the resources, our formalism makes it possible to describe resources, to express the structural or semantic relations between the resources, to adapt this description to structured pages with the HTML format (META tags) or XML (the tags are defined by the author of the pages according to a particular DTD). Thus, it is possible to explicit the various types of relations between resources, between components of various natures (multi-media like its, image, video) or of various types like paragraphs, references, summaries...

The semantics and the structure of resources as we specified previously may be done by the author of the pages, manually, thanks to metadata. A classical hierarchical clustering algorithm can determine the hierarchy of resources and provide the summary of each cluster. The first solution enables a precise control and the labeling of each represent of clusters by the author, but it requires human help. The second solution is completely automatic but the drawback is that the labels

BEST COPY AVAILABLE

are a list of keywords extracted from the resources and maybe some concepts are omitted. For a quality reason and to enable the author to control the indexing phase, we build the structured resources with the help of the author of resources.

In the building phase of the educational resources, we propose to describe the resources using the IEEE LOM[2] semantics and to apply the RDF serialization[3] with the XML syntax[4].

In the following sections, we take the same example of an E-learning Web course delivered at Supelec's school. In this example, there is one "computer science course" resource which is composed of other resources. The educational resource material has been created by Yolaine Bourda. The domain of the resource is the database management systems (DBMS), including the SQL language. The courses are currently used by students both in Paris and in different geographical places of the Supelec's school: Metz and Rennes. Firstable, the audience is the Supelec's students but it can also be extended to any elearner who can access the http://wwwlsi.supelec.fr/www/yb/poly_bd/ site. This is an example of the LOM metadata describing three resources:

```
<?xml version="1.0" encoding="iso-8859-1" ?>
<educational_resources>
<General>
<title><langstring xml:lang="en">"Learning databases"</langstring></title>
<identifier><entry>"http://wwwlsi.supelec.fr/www/yb/poly_bd/"</entry></identifier>
<keyword>"course, computer science"</Keyword>
</General>
<LifeCycle>
      <contribute><entity> Yolaine Bourda </entity><date>"1997 september"</date>
      </contribute>
</LifeCycle>
<Educational>
<intenteduserrole>"2nd year Supelec's students"</intenteduserrole>
</Educational>
</educational_resources>


<educational_resources>
<General>
<title><langstring xml:lang="en">What is a DBMS?</langstring></titel>
<identifier><entry>"http://wwwlsi.supelec.fr/www/yb/poly_bd/tdm"</entry></identifier>
<keyword>"DBMS"</Keyword>
</General>
<Relation>
      <kind>"isPartOf"</kind>
      <resource><identifier>"http://wwwlsi.supelec.fr/www/yb/poly_bd/"</identifier></resource>
</Relation>
</General>
</educational_resources>

<educational resources>
<General>
<title><langstring xml:lang="en">"Learning SQL"</langstring></titel>
<identifier><entry>"http://wwwlsi.supelec.fr/www/yb/poly_bd/tdm_sql"</entry></identifier>
<keyword>"SQL"</Keyword>
</General>
<Relation>
      <kind>"isPartOf"</kind>
      <resource><identifier>"http://wwwlsi.supelec.fr/www/yb/poly_bd/"</identifier></resource>
</Relation>
</General>
</educational_resources>
```

BEST COPY AVAILABLE

The e-learning resources and their organization are partially illustrated in figure 1. Through this example, the same author is responsible for the publication of the three documents (described beyond and illustrated in figure 1 by *d, d1 and d2)*, and the date of the creation is the same for the whole documents too; nevertheless, this piece of information has been omitted when the resources composing the root document have been described. This omitted information may be deduced thanks to the dynamic propagation of the metadata along the structural links. The first resource *d* represents the Web site as a collection of E-learning resources. Each resource is described thanks to the LOM metadata. *d* is composed of the two resources *d1* and *d2*. The classification of links categorizes the "isPartOf" and "requires" attributes as structural ones. Each attribute can be static or dynamic. Static means that the attributes are local to the resource and that they can't be propagated along the hierarchy of the metadata. For example, the "kind" and "identifier" attributes are static. "Dynamic ascending" and "dynamic descending" respectively mean that the attributes can be propagated along the hierarchy towards the root or towards the leaves. For example, in figure 1, "author" is a dynamic descending attribute, therefore every resources composing *d* inherit from the value of author. "Keyword" is both an ascending and a escending attribute, so *d21* is indexed by keyword = syntaxe + query whereas *d211* and *d212* are indexed by keyword = course + computer science + SQL + query.

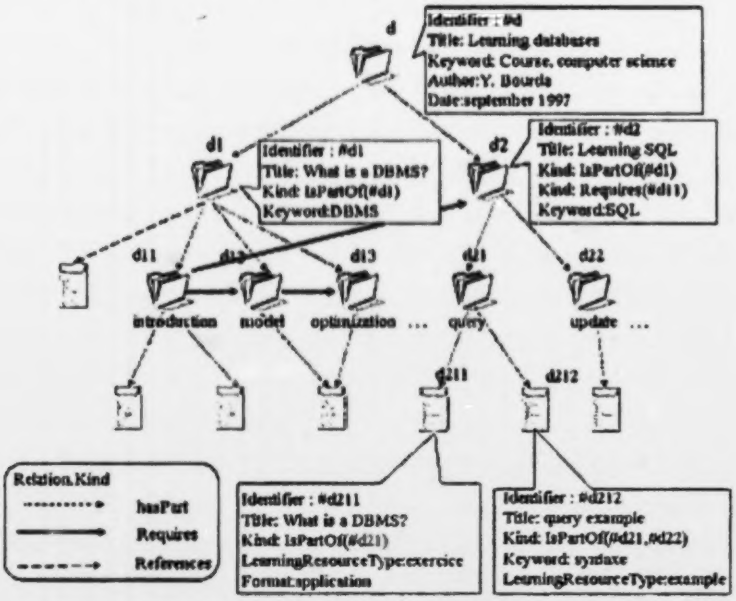

d
Identifier : #d
Title: Learning databases
Keyword: Course, computer science
Author:Y. Bourda
Date:september 1997
d1
Identifier : #d1
Title: What is a DBMS?
Kind: IsPartOf(#d1)
Keyword:DBMS
d2
Identifier : #d2
Title: Learning SQL
Kind: IsPartOf(#d1)
Kind: Requires(#d11)
Keyword:SQL
d11
d12
d13
d21
d22
introduction
model
optimization …
query
update …
d211
d212
Relation.Kind
hasPart
Requires
References
Identifier : #d211
Title: What is a DBMS?
Kind: IsPartOf(#d21)
LearningResourceType:exercice
Format:application
Identifier : #d212
Title: query example
Kind: IsPartOf(#d21,#d22)
Keyword: syntaxe
LearningResourceType:example

Figure 1: A partial organization of a hierarchy of educational resources

Accessing Educational Resources

Let's assume that DB is the corpus of the resources. In order to support the new functionalities we introduced in our paper, we defined a new query language that supports:

- dynamic granularity of the response, i.e. the granularity of the resource (a chapter, a section, an image) is not expressed in the query but determined by the information retrieval system with the evaluation function at the request time,
- querying on metadata attributes of each resource,
- combination of multi-typed requests allowing the system to manage requests against resources of various types.

The relevant documents in response to a query can be computed with the following evaluation function: where *R* is the relevance rate of the document and *pi* is the weight of each attribute of metadata. *di* is a distance associated to the level of propagation of the attribute.

$$R = \sum_{i=1}^{n} p_i \times \frac{1}{1+|d_i|}$$

$$p_i = \frac{1}{n}$$

We opt for an OQL-like syntax defined by the ODMG[5].

We give two examples showing the power of expressiveness of the query using both metadata and

BEST COPY AVAILABLE

structure.

Query 1: find documents dealing with both "query" and "update" whose author is "Yolaine Bourda"

`Select d from DB where d.lifeCycle.contribute.entity="Yolaine Bourda" and d.general.keyword="query"+ "update"`

Thanks to the ascending propagation of the "keyword" attribute (figure 2), the evaluation function returns *d2* as the most relevant answer with the score: 1/2.

Query 1: find SQL courses in computer science published after 1995

`Select d from DB where d.lifeCycle.contribute.date > "1995" and d.general.keyword="SQL"+ "course" + "computer science"`

Thanks to the descending propagation of the "keyword" attribute (figure 3), the evaluation function returns *d2* as the most relevant answer with the score: 1. *d21* and *d22* where candidates too, but their scores : 1/3 are less than *d*, (note that the level of granularity of *d* is bigger than the *d21* or *d22* one).

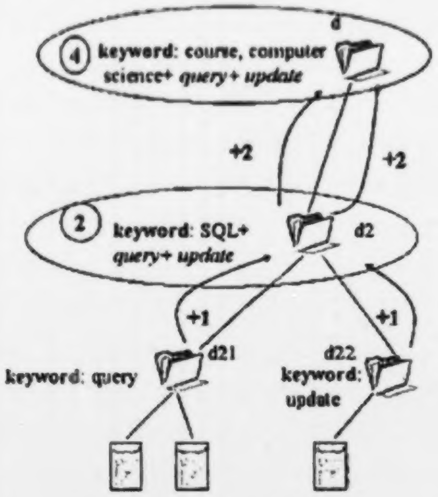

d
4
keyword: course, computer science+ query+ update
+2
+2
2
keyword: SQL+ query+ update
d2
+1
+1
d21
keyword: query
d22
keyword: update

Figure 2 : ascending attribute

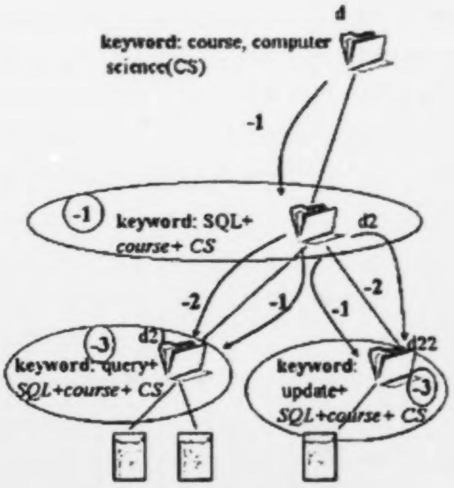

d
keyword: course, computer science(CS)
-1
-1
keyword: SQL+ course+ CS
d2
-2
-1
-1
-2
-3
d21
keyword: query+ SQL+course+ CS
d22
keyword: update+ SQL+course+ CS
-3

Figure 3 : descending attribute

Conclusion

Classical information retrieval systems provide static responses (fixed by the pre-defined granularity of resources), without taking into account neither the structure of a resource nor its semantics. Here we explain how to explicit the structure of educational resources, and we suggest a new information retrieval system that can index and search educational resources organized into multi-typed resources. This will enable end-users to request in a powerful semantic query language and to provide more suitable responses at several levels of granularity.

References

[1]http://www.dublincore.org/documents/education-namespace/
[2] http://ltsc.ieee.org/wg12/index.html
[3] http://www.w3c.org/XML
[4] Walid Kekhia and Yolaine Bourda. Implementing Learning Object Metadata using RDF. Ed-Media, Tampere, 2001
[5] http://www.odmg.org/

BEST COPY AVAILABLE

Connecting the Dots: Uniting Education Around the World

Laura Diggs, Ph.D. & John Wedman, Ph.D.
University of Missouri-Columbia

This paper describes a current and ongoing effort to increase global awareness by providing a unique use of Internet2 and video for English instruction with international teachers and students, exchanging cultural information, addressing needs of learners from diverse cultures, and understanding the importance of providing enabling technology experiences that learners cannot have otherwise. The University of Missouri-Columbia College of Education (MU CoE) has implemented a globalization initiative and there are currently 4 schools in Taipei, Taiwan that are connected with K-12 schools in Missouri as well as MU faculty and pre-service teachers. This year, the MU CoE sent three faculty and staff members to Taipei to develop and implement a literature-based English curriculum for students to share with their American counterparts. The goals of this globalization initiative are a critical 3-part model that is a unique experience that currently does not exist. This experience evolves around information and learning, enabling technology, and global connections. This 3-part model is based on: 1) connecting a K-12 school in Taipei, 2) with a K-12 school in Missouri, and 3) MU CoE Literacy faculty. The connection is provided through utilizing Internet2 and video conferencing equipment.

The process of this globalization initiative focuses on individual school needs, but all involve utilizing technology to allow students to have email as well as face-to-face conversations to practice online communication, establish friendships with students of other cultures, exchange cultural information, and develop and understanding and tolerance for other cultures. Students from both cultures benefit from the opportunity to improve their English language (written and verbal) skills as well as identifying the benefits and limitations of online communications.

Current projects where partners include schools in Taipei working with Missouri schools include two elementary schools, one K-9 school, and one senior high school. Projects include development of web sites for descriptions and pictures of participating teacher and students, the school and surrounding community, special events and holidays, as well as information on foods and day-to-day life for students their age. Schools have participated in paired reading of English children's literature books and had face-to-face video conversations around the books. Several schools are participating in science projects together where they collect samples of vegetation, water, and wild life to compare and contrast on the web site with their partner school. With the time difference between Taipei and Missouri being a complicating factor, partners are sharing information through threaded discussions and emails as well.

The impact of this globalization initiative has proven to be beneficial to the Taiwanese students having authentic conversations with native speaking English speaking students their own age and improving their English writing and oral skills. The Missouri students have discovered a new cultural appreciation as well as developing friendships. The MU CoE faculty and pre-service teachers have acted as cyber-tutors to help in the writing process as well as professional development for the Taiwanese teachers.

This summer, three of the Taiwan schools are planning trips to Missouri to visit their partners and learn more about living in the United States. One school will have the opportunity to participate in the ThinkQuest Internet2 conference in Seattle, Washington after spending time in St. Louis, Missouri, taking field trips to Boeing corporation, St. Louis Science Center, and other points of interest. Students will collect digital photographs, movies, and other media objects to share as part of the conference and globalization initiative.

E-Learning : The Design of Cognitive Crutches in the 21st Century

Koen DePryck, Ph.D.
Center for Adult Education, Antwerp (Belgium)
Institute of Knowledge Management, Brussels (Belgium)

Abstract

This paper deals with the implications of evolutionary epistemology for the design of Learning and Knowledge Tools. Evolutionary epistemology brings to the table a set of concepts that allow us to construct new cognitive tools that, embedded in or connected to our evolutionary past, may contribute to our cognitive future.
Human cognition is neither static nor deterministic but has evolved, under evolutionary pressure, into a set of tools capable of interacting with those aspects of reality bound to enhance our potential for survival as individual beings or as a group.
Any meaningful design of IT-based Knowledge Tools will need to take that double evolutionary context into consideration. It must address

1. **the issue of providing input to a wide range of cognitive modules, many of which serve multiple cognitive function.**
2. **the issue of compatibility with a wide range of cognitive styles.**

We try to point at the relevant characteristics of our mental system and explore the systemic conditions the evolutionary context imposes on knowledge tools and knowledge management systems.

Paper

The history of human tool-making is also a history of crutch-design. A hammer is a fist. Power (most often electric power) has added a new dimension to tools but did not really change their nature—it just made them even more powerful. We have not only developed tools to decrease our physical limitation, we also developed tool to decrease our cognitive restrictions: magnifying glasses and telescopes, clocks, books, …[1]

Every tool is somehow connected to our cognitive wiring if not but for the simple reason that we use them. If that connection goes wrong because it is too complex or because it is poorly designed, the tool quickly looses its attraction and usefulness. The study of cognitive tools is therefore also a study in ergonomics and a study of interfaces.[2]

The study of our tools is a study of ourselves. In a sense, tools are a magnifying glass trough which we can look at our own design. Looking at the cognitive tools that we use can help us to peek inside our minds and to take a look behind the curtains of evolutionary pressure. But an understanding of how our mind functions should allow us to come up with new and exciting cognitive tools without having to rely too much on trial and error.

---

[1] Slide: list of physical and cognitive tools
[2] Slides: examples of how tools connect to our neural circuitry

When we look at educational software, for example, we find an incredible amount of utterly useless products. They simply don't resonate with our cognitive processes. They are like a beautifully sculptured hammer made out of glass: nice to look at, perhaps, but utterly impractical.

A VCR is a wonderful tool. Let us take a look at the buttons. Record (memory storage), play (retrieval), ff, fb, pauze, index (use of markers to facilitate retrieval), … It is not clear if each successful and often used function of the machine corresponds to a primitive 'human' cognitive function, although it is safe to assume that unsuccessful gadgets probably fail to connect to such a human function, except perhaps for a small and marginal group of people.[3]

Human cognition is neither static nor deterministic but has evolved, under evolutionary pressure, into a set of tools capable of interacting with those aspects of reality bound to enhance our potential for survival as individual beings or as a group (and thus indirectly as individuals). New technologies and e-learning will only be successful if they connect to our evolutionary history. At the same time, successful new tools are likely to profoundly change our thinking, our behaviour, our values, …

At the level of the species (or, if one prefers, at the level of individual selection) evolution has constructed, over millions of years, a set of cognitive modules and clusters of such modules. Individual modules define operations over inputs. The input can be either external, as in the case of sensory inputs, or internal, generated by the module itself or generated by some other mental subsystem. Furthermore, it is reasonable to assume that severalmodules originated as either backup or add-on to older modules, resulting in a by all means complex system.

Cognitive modules and clusters of such modules interact with proper as well as actual input domains. In the case of a module (perhaps constituted by more fundamental modules) for syntactic pattern recognition, actual sentence patterns make up the proper input domain, whereas a rather large set of auditory constructs (from babies' 'talking' to songs of birds and sometimes even mechanical noise produced by machinery) would belong to the actual domain without belonging to the proper domain.

As human beings, we generate huge amounts of actual but improper inputs. The use of IT in general and in education more specifically allows us to explore the boundaries of our mental modules and their interaction. Furthermore, it is not unreasonable to assume that the increasingly large amounts of improper input have an effect on the microcircuits of our cognition. Since a reduction of visual experience causes a reduction of the number and size of synapses in the visual areas of the cortex, a culturally increased amount of specific visual experience (such as we would find in specific types of interaction with computers) could lead to an increase in the amount and size of synapses required to handle that input to cognitive modules. The cortex of wild animals may be up to one-third thicker in wild animals than in domesticated ones, something Darwin already noted.

---

[3] Slide: picture of VCR as a cognitive tool, relating buttons to cognitive functions.

For obvious reasons, the production of improper input to our mental system is greatly restricted by the characteristics of that system and its larger environment, although some degree of randomness, noise, and perhaps coincidence may not be avoided.

In this paper, we try to point at the relevant characteristics of our mental system and explore the systemic conditions or the constraints that the evolutionary context imposes on knowledge tools and knowledge management systems.

Our cognitive system can be described by number of aspects:[4]

- Input
  - Visual, auditory, tactile, kinaesthetic, olfactory
  - Verbal, non-verbal
  - Proper, improper
  - Focus
- Content
  - Paradigms
  - Need-based, interest-based, …
- Processes and operations
  - Differentiation, categorization, seriation, logical deduction or induction, analogy, counting, mapping, …
- Learning
  - Implicit, explicit
  - Speed, …
- Level of abstraction
  - Distance from information present in sensory input
- Level of complexity
  - Number of units of information, degree of novelty, ..
- Storage
  - Memory
  - Retrieval
- Output
  - Cfr. Input
  - Communication

The specifics of each of these aspects have been shaped under evolutionary pressure in a relatively stable context. IT and E-Learning dramatically change that context. In order to maximize the usefulness of cognitive tools, we must identify their strengths as well as their weaknesses and compare those with our 'innate' tools. It is only on the basis of such an inventory (perhaps also including characteristics of successful 'older tools, such as books) that we will be able to integrate existing E-learning tools successfully and to design new tools that are even more powerful than the ones we have available today.

Mathematics is bound to play an essential role in the development of meaningful new tools. Pattern recognition, typically something humans are fairly good at, can be enhanced by teaching computers how to deal with pattern. Understanding how we handle patterns will allow us build tools that are even better at doing that than we ourselves are.

---

[4] Slides: overview of the aspects of a human cognitive system

Nevertheless, the relationship between innate and the set of new tools is typically ambiguous. Computers make it easier to count. Databases enhance our memory. On the one hand, new tools obviously outshine a number of our innate functions, perhaps contributing to their decline. On the other hand, they make it possible to train our innate functions or to compensate for deficiencies. Children playing games on their computers develop superior eye-hand coordination. Foreign languages are more easily learned using speech technology and sound analysis, vocabulary is more easily memorized with the help of appropriate software. Even common word processors can help people with language problems (dyslexics, ...) by incorporating tools such as speech recognition, spelling correction and functions to find homonyms.

E-Learning exists at the somewhat paradoxical crossroad of making us less dependent on the restrictions of some of our innate functions and the enhancement of others. E-Learning must therefore be approached as part of a larger epistemic system that includes our innate as well as the totality of the cognitive tools that we have developed throughout our history.

That is especially important if we take the distribution of cognitive functions in a population into consideration. At the level human social interacting, (or, if one prefers, at the level of group selection) evolution has come up with a range of cognitive styles, ranging from the predominantly verbal to the predominantly non-verbal, from the predominantly inductive to the predominantly deductive, from the predominantly synthetic to the predominantly analytic, and so on.

Any meaningful design of IT-based Knowledge Tools will need to take that double evolutionary context into consideration.

1. At the level of the individual, it must address the issue of providing input to a wide range of cognitive modules, many of which serve multiple cognitive functions.
2. It must also address the issue of compatibility with a wide range of cognitive styles, avoiding a simplistic reduction of human cognition to a single evolutionary thread or, worse, a single static set of cognitive functions.

In conclusion, I argue that E-Learning tools must be sufficiently 'traditional' in order to change our traditional ways. In the design of educational software, all too often too much energy is spent trying to make something 'unique', something 'different'. While that may appeal at first, in the long run it tends to decrease the chances to make a truly lasting contribution to a genuine learning society.

Providing Higher Education Degrees Through Telecommunications and Collaborations

Rita L. Dobbs, Ph.D., Department of Technology, The University of Texas at Tyler, USA, rdobbs@mail.uttyl.edu
W. Clayton Allen, Ed.D., Department of Technology, The University of Texas at Tyler, USA, callen@mail.uttyl.edu

Abstract: **This paper will provide critical information to interested higher education personnel for designing/implementing undergraduate/graduate degree programs utilizing telecommunications, collaborations, and technical support services. Collaborations among the Mexia State School, a MHMR facility, The University of Texas at Tyler (UTT), and the UT TeleCampus, a virtual university designed as a central support system for the 15 component campuses and research facilities that comprise the U T System, allow students to obtain degrees that would have previously remained unattainable. The Department of Technology at UTT provides custom designed degree plans through a combination of interactive television courses, web-based courses, and academic credit for work experience to grant degrees in appropriate fields. Technological support, tutorial programs, and digital libraries are among the essential support services provided to participating students.**

As The University of Texas at Tyler (UTT) steps into the new millennium, a new era will be much more complex and demanding than the last one. It will be characterized by rapid changes in demographics, growth of an information-age economy, and revolutionary technological advances. The 21st Century will also place new pressures and demands on universities to be more accountable and more affordable, to serve an increasingly diverse society, and to deliver education using alternative models. The University must be positioned to meet these realities in order to prepare students to meet the challenges of a fast-paced and shrinking world. The University of Texas at Tyler welcomes the challenge, and in doing so will become the distinctive choice for those seeking academic excellence, opportunity for personal and professional growth, and a dynamic environment for learning in the new millennium.

UTT was established by the Texas Legislature in 1971 as Tyler State College and was renamed Texas Eastern University four years later; it became a component of The University of Texas System in 1979. UTT became a four-year university by action of the legislature in 1997; it had been created as an upper-level university.

Challenges for Students

University students will need to *take more responsibility for their learning*, for exploring and understanding complex concepts, and for accurate analysis and creative synthesis. They must become fully engaged, active partners in the educational process, learning to navigate through the rich information environment that exists outside of the classroom and challenging themselves to become intellectually vigorous in order to acquire, evaluate and use the information available to them. In short, students must not only learn, they must also acquire the skills to learn effectively on their own.

Challenges for The University of Texas at Tyler

The University of Texas at Tyler is transforming itself into a four-year, comprehensive, regional university with a full range of undergraduate and graduate degree programs. Only a comprehensive university that emphasizes the integration of

BEST COPY AVAILABLE

liberal arts and professional education can provide the depth and breadth of knowledge, skills, and attitudes that students will need for success in the new millennium.
The University will respond by creating the "U. T. Tyler Tradition"-a solid foundation for successful learning that is based in the humanities, arts, and sciences and that fosters rigorous intellectual growth and academic development in all disciplines. The "U. T. Tyler Tradition" will provide the "cornerstone" for preparing students to accept and even anticipate the multiple transitions they will make during their lives. This distinctive curriculum will provide the necessary base of knowledge and engage students in self-discovery where they develop the art of reflection and embrace intellectual challenges.

The Department

The Department of Technology is a student-centered department committed to conducting multi-option programs targeted at preparing technical professionals, instructors, and educators who exceed standards. In accordance with this statement, the Department of Technology continually strives to improve the array of managerial and technical knowledge and skills of individuals by offering programs and courses based on industry's need for applications oriented, technically competent, flexible and internationally competitive employees. In order to ensure that the program offerings are technically up-to-date, the Department employs laboratory instruction based on tabletop technology and computer-based simulation.

The Department of Technology has adopted the NAIT definition of Industrial Technology. It is viewed as a field of study designed to prepare technical and/or technical management oriented professionals for employment in business and industry. The programs in the Department include:

1. The application of theories, concepts, and principles found in the humanities and the social and behavioral sciences, including a thorough grounding in communication skills.

2. The understanding of the theories and the ability to apply the principles and concepts of mathematics and science and the application of computer fundamentals.

3. The application of concepts derived from, and current skills developed in, a variety of technical and related disciplines which may include, but is not limited to, materials and production processes, industrial management and human relations, marketing, communications, electronics, and graphics.

These concepts have served as the basis of an ongoing program and curriculum improvement process throughout the history of the Department. As a result of this commitment, the Department of Technology entered into an agreement with the personnel of the Mexia State School to offer undergraduate and graduate programs via interactive television classes (ITV) and through web-based courses offered through the UT TeleCampus component.

Mexia State School

Mexia is located approximately 100 miles southwest of Tyler. Personnel at the Mexia State School previously had to travel to Waco to take courses from Baylor University, a private institution where tuition rates were proving to be prohibitive for the personnel wishing to continue their education.

Today the school employs almost 1,500 individuals. The school operated exclusively from wooden barracks until June 1951, when the first permanent brick buildings were completed with beds for 312 boys. In September 1953, a second group of buildings was completed with 425 beds. Money for this early construction came from a one cent a pack cigarette tax levied by the Texas Legislature. Construction of new buildings continued through the 1950's with the completion of additional dormitories. A 50-bed infirmary was opened in 1958. In 1963 the peak period of construction ended with the dedication of 14 new buildings on the state school campus.

During the past years, the school's population has changed as other services became available in the community. From its origin has a home for young men and women with various levels of mental retardation, the school has become a place where individuals with profound and severe retardation in addition to behavior and medical problems live. The average age of the school's residents is now 45 years old. Mexia State School is a regional operation of the Texas Department of Mental Health and Mental Retardation. (Mexia State School)

Providing Degrees for Mexia Students

In order to meet the needs of the Mexia students, a special undergraduate degree was made available to the students, the Bachelor of Applied Arts and Sciences (BAAS). This degree program has been identified with the "inverted curriculum." It gives primary consideration to areas of emphasis meeting the educational and career goals of community and junior colleges. Only students who have specialized at the junior college or community college level in technical or vocational studies and desire to continue in their pursuit of a degree may follow a program leading to the Bachelor of Applied Arts and Sciences degree.

The courses, which lead to the degree, may differ from student to student, making it possible to customize the degree program to fit a student's needs. The purpose of this program is to provide opportunities for those individuals planning to enter the technical or vocational occupations, or for those who have already entered the technical or vocational occupations but have decided that additional educational preparation will strengthen their previous training and improve career advancement opportunities. A student may also prepare a professional dossier of past work experience for consideration of academic credit up to 18 semester hours. This allows the personnel at the Mexia State School to complete their undergraduate degree. The courses for the BAAS are offered to the Mexia State School through ITV courses that originate at UTT and are transmitted to Mexia through a T1 line via compressed video. Mexia students are able to conduct counseling sessions and student conferences through the ITV system. Professors from the Department of Technology travel to Mexia at least one time during the semester to make a personnel contact with students and to help assimilate them into campus life.

UTT library provides digital resources for the remote students. Complete instructions for accessing the electronic databases as well as instructions for requesting interlibrary materials are in place on the library homepage found at http://library.uttyler.edu/distance.htm

Students in Mexia who are pursuing the Masters of Science in Technology/Human Resource Development (HRD) option have two options available to them. They may take courses through the ITV system or they may take courses through the UT TeleCampus. The HRD degree option can be customized to meet the particular student's area of interest and can accommodate the interests and special skills of each student. Professors in the department meet with each degree-seeking student individually to construct a degree plan that is perfect for that student's career goals. The success of the program has been tremendous with the growth of the program exceeding double digit increases each year.

Human Resource Development is a professional field of practice that focuses on education and training of adults in diverse settings. It is organized learning activities arranged within an organization in order to prepare young people to manage the dual roles of family member and wage earner, to enable them to gain entry-level employment in a high-skill, high-wage job and/or to continue their education.

The online Master of Science degree/HRD option utilizes the resources of UTT, The University of Texas at Galveston (UTG), The University of Texas at Permian Basin (UTPB), The University of Texas at Arlington (UTA), and the UT TeleCampus. The Department of Technology assumed responsibility for developing nine (9) courses in the

MS degree option and utilizes 6 courses from the component institutions. This truly makes the MS degree in Technology/HRD option a unique opportunity, not only for the personnel of the Mexia State School, but also for the citizens of Texas and beyond.

The UT TeleCampus (UTTC) is the support center for online learning within the University of Texas System's fifteen component campuses. Online courses and degree programs can be completed entirely at a distance and meet the same high-quality academic standards as their onsite equivalents. The UT TeleCampus provides everything a student needs to participate, including admission applications, registration and financial aid information, classrooms and academic resources. The goal of the TeleCampus in placing programs online was the creation of collaborative degrees, utilizing the best resources in faculty expertise from all campuses. This was the model followed in developing the Master of Science Degree in Technology/HRD option.

"An excellent example of the expanding e-learning programs offered by state university systems, the UT TeleCampus was launched in 1998 by the University of Texas System. Students may earn an MBA, Masters in Computer Science, and various other online degrees from a school within the UT system. Students who wish to earn a degree must first apply and be admitted to one of the universities in the UT system. That campus will then serve as the student's "home" campus, and ultimately award the degree," Dr. Darcy Hardy, Asst. Vice Chancellor for Academic Affairs and UT TeleCampus Director.

Conclusions

In order to participate in a UT TeleCampus online course, certain computer requirements and browser configurations and plug-ins are needed to enable a successful experience. Online students must also have a confident level of computer literacy.

An important part of an online course will involve Web conferencing and other interactivity such as synchronous chat. These tools provide a means for communicating with the instructor and classmates much like a student would in a face-to-face environment.

By using the "Getting Started" CD-ROM, published by the UT TeleCampus, a student can start the semester with the advantage of being able to receive all multimedia aspects of any given course. Necessary software requirements are consolidated on one easy-to-use CD provided by the UT TeleCampus and mailed to each student enrolled in the online program. (UT TeleCampus)

Extensive support services are provided by TeleCampus staff in the way of instructional design and course development, as well as faculty training in bringing courses from the lecture-based classroom to the Web-based classroom. Technological support, policy, marketing research and external communications are among the other essential support services provided to the campus from the UT TeleCampus (UT TeleCampus).

The Department of Technology at The University of Texas at Tyler is striving to provide quality educational programs to students who wish to pursue their educational career goals. By collaborating with specific institutions, UT components, and the UT TeleCampus, the Department of Technology is bringing higher education degrees to the citizens of Texas and the world.

Resources

Mexia State School, (2000-2002) [Online],
Available: http://www.mhmr.state.tx.us/Schools/MexiaSS/MexiaSS.html

The University of Texas at Tyler, (2000-2001) Undergraduate /Graduate Catalog
[Online]. Available: http:// www.uttyler.edu

UT Telecampus, The University of Texas System [Online], Available:
http://www.telecampus.uttsystem.edu

Technology, Education and Knowledge: Digital Divide or Knowledge Leverage ?
-Some Thought Following a Pilot Project of the European Commission-

Patrick-Yves Badillo and Dominique Bourgeois
Research Center on Media, Information and Knowledge
University of Aix-Marseille II (Université de la Méditerranée)
France
badillo@ejcm.univ-mrs.fr

Abstract: Knowledge is a key factor in the new information society and technology induces a considerable demand to the education systems. The virtues of a "socratic school", resting on four pillars: to learn how to know, to learn how to make, to learn how to live together, to learn how to be, must be accessible thanks to the use of the information and communication technologies. Form-Ami is a pilot project of the European Commission with a view to promoting new university training courses in the specialized skills required by the information industries. Form-Ami can be considered as a reference for the diffusion of a new pedagogical paradigm. We will show how the new pedagogical and knowledge mediation is a key for the future. But, to break the digital divide will be more and more costly at the beginning. Only later the fruits of these efforts will be available...

> *"The illiterate of the future will not be the person who cannot read.*
> *It will be the person who does not know how to learn."*
> *A. TOFFLER quoted by I. PRIGOGINE, letter, 1999*

Need for Radical Teaching Innovations... to Surmount the Knowledge Gap

The harmonious development of the information society depends *on the coherence of the "triptyque": technology - education - social diffusion. The technological push* made possible to develop networks which store, treat and convey an increasingly significant quantity of information. A new training paradigm appears with the rise of the Information and Communication Technologies (ICT); the usual teaching actors have to make a difficult and long adjustment: training and knowledge are accessible with new methods thanks to new technologies. Remote teaching becomes a distributed teaching in which the learner plays an increasingly active role in interaction with the teacher. *Beyond the technological development much more significant breaks become visible concerning "Knowledge" and its diffusion.* In the context of the information society the Universe of Knowledge is recombining. In a rather traditional way one can distinguish "data", which are simply data recorded in a system (discrete, objective data, which record facts on the world and are easily structured, organized and transferred) and information which makes possible to transmit a message; thus Picasso passes a message through Guernica, and influences minds. According to T. H. Davenport and L. Prusak (1997), knowledge constitutes "a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of knowers. In organizations, it often becomes embedded not only in documents or repositories, but also in organizational routines, processes, practices, and norms" (p. xii).
In short, knowledge is a key factor of the firm competitiveness in the new economy based on information. Consequently, work and knowledge which were two relatively distinct values in the taylorist universe are mixing. Then training and the control of knowledge become a new stake. Acquired knowledge is becoming obsolete almost instantaneously and any individual must learn throughout his life. Taking into account the economic importance of the stakes, it is not astonishing to observe that, beyond the traditional places of knowledge, the Schools and the Universities, new training places are set up: companies develop training structures, such as for example Motorola University, Hewlett Packard or Sun University; one also sees, for example, Microsoft diffuse its own certification labels, equivalent to professional diplomas.

Form-Ami: a Pilot Project of the European Commission to Apply the "Socratic" Teaching Method

Technological progress thus modifies radically the relation between man and information and induces a considerable demand with respect to the education systems (See J. Richarson, 1996). *Virtues of a "socratic school"* resting on four pillars (on this topic see the publication of the European Commission, 1998): to learn how to know, to learn how to make, to learn how to live together, to learn how to be, must be accessible thanks to the use of ICT. Indeed, ICT must help the teachers to set up a teaching approach supporting not only training but also an hypothetico-deductive reasoning mode which will permit the learners to acquire an autonomy vis-a-vis the life events (see the document of the European Commission, 1998, p. 11). It is on this condition that the Knowledge Gap will be surmounted.

The Socratic Approach: a Process or "The Art to Be Confined"

> *"[...] research and knowledge are on the whole only reminiscence"*
> *PLATO, Menon, translation from Les Belles Lettres, tome III, 2, 1923*

Form Ami[1] is a pilot project of the European Commission with a view to promoting new university training courses in the specialized skills required by the information industries, through the socratic method and on the basis of an important consortium which includes academic institutions and information firms. *The socratic approach refers to the philosophy of education and to the teaching method presented by Plato. One will retain in particular the idea of the socratic "maïeutique", which is an art of obstetrician, and the conditions of the knowledge learning: the role of the teacher is that of a guide and the learner is responsible for his learning, which cannot be an accumulation of knowledge, but rather a search of knowledge by reminiscence.*

Within the framework of the Form-Ami project the socratic approach is implemented gradually, so that the students adapt to work as a group, by using more and more the multimedia tools and while trying more and more to solve by themselves the problems which they encounter. Thus two stages can be distinguished each one corresponding to a part of the teaching and to the realization of multimedia products: in the first stage all the students attend the same courses which give them the bases in art and mechanics of information; in the second stage the students follow specialized courses in the option which they have chosen: Security, Geographical Information Systems or multimedia Pedagogy. So they are very few in each option (between 5 and 12) and the follow-up work by the teachers is very effective. Obviously it is during the second stage that the socratic approach is the most applied, but the first stage is essential for a transition between a traditional teaching and a teaching based on the socratic approach with the intensive use of ICT.

Implementation of the Socratic Method for the Realization of Multimedia Products

For the academic year 2000-2001 among 500 European candidates finally 28 students obtained their diploma. The students were of 11 different nationalities; they represented largely the European Union and there were also non European students. Five multimedia products linked to the courses were realized on the following subjects: Theory of Information, Information market, Security, Geographical Information Systems, Pedagogy. The socratic method is in the heart of the teaching and of the realization of the multimedia products. From a pedagogical point of view the thread rests on a flexible process during which the students learn how to learn by working in group and with the multimedia tools. Of course, the students benefit from the help of the teachers, in particular from the content of research and work carried out for many years by the teachers-researchers-experts.

The principles of the implementation of the socratic method are best described by the process of realization of the multimedia product "pedagogy". For this multimedia product, realized during the second stage of the Form-Ami project, the socratic approach is reinforced, because the students are accustomed to work together, have better ability to use multimedia tools and also because of the number of students (only 12 students). So the teachers ask the students 12 questions to define progressively the outline of the multimedia product with the students. Questions are the guideline for the construction of the multimedia on line product and socratic exercises. The students define themselves 4 groups of 3 students and then work together; each group works on 4 questions, of course with the permanent help of different teachers (from the University of Aix-Marseille II -

---

[1] The Form-Ami backgrounds were defined by D. Deberghes, Administrateur Principal, European Commission, Information Society DG.

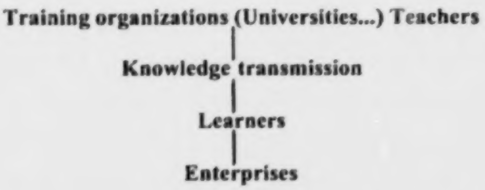
Université de la Méditerranée/EJCM -, the University of Tampere, the University of Koblenz-Landau and the CJD Maximiliansau). There is a high level of interactivity between the students and the teachers.

The Pedagogical and Knowledge Paradigm[2]

The Old Pedagogical Paradigm Confronted with the New Knowledge Diffusion Model

The old pedagogical paradigm can be defined as a knowledge push. In this framework, which is dominant since the beginning of the Gutenberg's Galaxy, teachers are the holders and have the monopoly of knowledge; they produce and diffuse knowledge with a specific place in the society.

Old pedagogical paradigm:
Knowledge push: teachers produce and diffuse knowledge

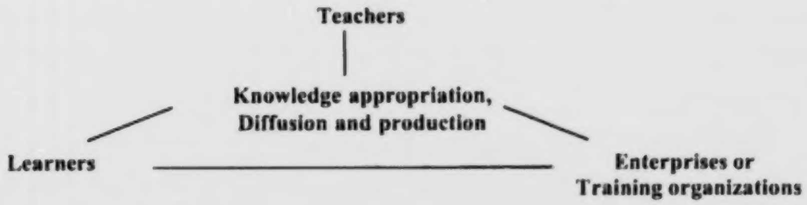


But today this old paradigm is questioned by changes which affect the universities. The whole university world will switch over tomorrow; according to P. Lévy (2000), "the universities will depend more and more exclusively on their customers (...) the students can now learn elsewhere (...) by shopping around in cyberspace where the on-line training offers are daily becoming more varied, more precise, better organized" (p. 95).

A Key for the Future: the New Pedagogical and Knowledge Mediation Paradigm

The Socratic approach is a new pedagogical model with the realization of multimedia on-line products: Form-Ami can be considered as a reference because it is perfectly adapted to the new information and knowledge society. *We define Form-Ami as a new interactive knowledge mediation paradigm: in the context of the new pedagogical paradigm teachers share knowledge and produce knowledge in collaboration with students and enterprises or training organizations.*

Interactive Knowledge
Teachers, learners and enterprises share, produce and diffuse knowledge



In this new interactive knowledge mediation paradigm the learning process becomes more and more a common construction and collaboration: "*Young people will be guiding their teachers to new kind of learning models*", predicts Mr. Juha Lipianen from Nokia (ED-MEDIA 2001, Hypermedia Laboratory, University of Tampere, June 2001). "*Knowledge is not delivered; it grows in unpredictable ways because learners move through this space according to their own needs, intentionally connected to others. Participation in this space makes it grow for you, over time and through your use and interaction.*"(P. Clifford and S. Friesen, 2001).

---

[2] source: P.-Y. Badillo, communications to different conferences and Final Form-Ami Report, July 2001.

Form-Ami is a useful reference because its pedagogical principle, defined about five years ago, anticipated the more up-to-date present research. According to D. Jonassen (2001) learning process is efficient if it is organized as a "solving problem" system; students are confronted to a problem and they have to solve it; the only professional legitimated goal of everybody is "problem solving" (decision making, modeling...). Form-Ami has been a rich pedagogical experiment because the students, of course with the help of the teachers, have had to solve problems: how to apply in practice the courses, how to produce a multimedia product, how to organize their practical training. Teachers have also to adapt their pedagogical approach and the educational organization to help the students to solve the problems. This new pedagogical paradigm is also described, for example, by B. Collis (2001): "What is our first aim? Learning from experiences, from one's own and from those in one organization, and building upon these experiences....".

Conclusion: From Digital Divide to Knowledge Leverage ?

The Socratic approach based on ICT permits the following results:

- *The Internet is a vast set of knowledge resources for the students: students often learn more effectively by discovery (constructivism) and by interaction (collaboration) than by lecture (direct traditional training).*
- *The students learn to work together, to be together and to collaborate in the context of different nationalities, different scientific backgrounds, but with a common objective and a common work: they learn to realize multimedia on-line products.*

But the new pedagogical model needs high investment in software, material and an intensive involvement of all the actors: very high intensive work of the learners (in Form-Ami: evening until 9.00 p.m. and some Saturdays, intense exchanges par e-mail), high investment of the teachers anywhere, anytime..., a lot of help by tutors. We have also to highlight the fact there is a danger: students can be hypnotized by new technologies; it is imperative to ask them to work on the content and to produce content through exercises.

In conclusion, with its Socratic organization Form-Ami has introduced a new pedagogical model. Form-Ami must be considered as a reference; this project was several years in advance and is fully adapted to the new pedagogical paradigm based on problem solving pedagogy and learners experience. However it is obvious, for cost reasons, that the generalization of the socratic method to standard courses is impossible. We will recommend to adopt this method for specializations for which today the needs are essential. *New technologies multiply the knowledge, learning and diffusion possibilities but also the cost; new technologies in pedagogy are submitted to the well known network effect: to launch a network is very expensive, then it is cheaper and cheaper. So, to break the digital divide thanks to new technology and new pedagogical method like the socratic approach will cost more and more at the beginning. Only later the fruits of these efforts will be available...*

References

Clifford P. and Friesen S. (2001). Bringing learning to learners: the Galileo Educational Network. *ED-MEDIA 2001*, Hypermedia Laboratory, University of Tampere, June 2001.

Collis B. (2001). Linking Organizational Knowledge and Learning *ED-MEDIA 2001*, Hypermedia Laboratory, University of Tampere, June 2001.

Davenport, T. H. and Prusak, L. (1997). *Working Knowledge: How Organizations Manage What They Know.* Cambridge, MA: Harvard University Press.

European Commission (1998). *Teaching, Learning, Information: towards an open Socratic school.* Luxembourg: Official Office of the publications of the European Community.

Jonassen D. (2001). E-Learning to solve problems. *ED-MEDIA 2001*, Hypermedia Laboratory, University of Tampere, June 2001.

Lévy P. (2000). *World Philosophie, Le marché,le cyberespace, la conscience.* Paris: Editions Odile Jacob.

Richarson J. (1996). *Information technology: a new path to creativity in education.* Paris: Editions Eska.

CARA
A Constructivist Approach to E/C Resource Management and Administration

Michael Draper and Yves Perrin, – CERN, Geneva
(11 July 2002)

Abstract

Very often extremely valuable Education & Communication (E/C) material gets forgotten about and is buried in a drawer or computer file system once the event for which it was originally developed is over. CARA aims at making these resources, developed in various corners of CERN, wider known and available to as many people as possible. Our target audiences are the community of High Energy Particle (HEP) physicists but also high school teachers and the media. Such an approach saves both developer time by providing a source of inspiration and of documents and will help in gradually improving resource quality by building on what has been done before. CARA will be based on the CERN Document Server (CDS) which already hosts a large database relating to HEP containing more than 500,000 records. CDS also offers many related utilities including a document format converter and an automated information submission system. It uses the MARC based CDS metadata set extended for E/C material.

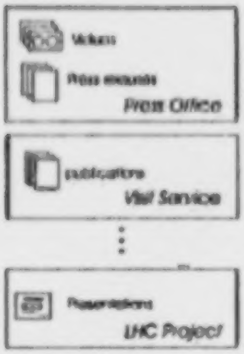
Why?

- re-usability of E/C material such as presentation slides, articles, brochures, leaflets, pieces of text, diagrams, photos, screen shots, web pages, video clips, animations, simulations, games, etc
- availability to other user communities (high school teachers, media, etc)
- automatic review of resource validity and characteristics.
- Reduce effort spent on duplication

Related benefits

- enlarge source of information and inspiration
- complement and/or improve quality of E/C material on a given topic by building on top of what already exists rather then re-inventing the wheel.

How?



Step #1

- identify potential sources of E/C material and types of available resources
- make inventory of existing resources

Step #2

Resource's metadata
Resources

- specify appropriate set of metadata to describe resources as fully as possible (identify the characteristics that potential users of the resource are likely to use when searching for resources and the characteristics that are useful to control the relevance of the resources over time)
- test relevance of this metadata with representatives of the targeted user communities on a few typical resources
- review specification of the metadata set accordingly

title:	CERN in 2 minutes, Du Big au Bang, Technology at CERN
location:	Press Office, Photo service, CMS
media type:	poster, film, leaflet, picture, presentation, etc
topic:	General information about CERN, Assembly of CMS detector
size (as seen by user):	23 pages, 800x600, 2m x 1.5m, 23mn
archive size:	47 KB, 3 video tapes
available formats:	Word, Illustrator, Power Point, JPEG
original event/context:	Open Day, Dalai-Lama visit, webcast
author(s) identification:	John Smith / CERN-EP
ownership:	CERN, Scientific American
creation date:	July 1975
last modification date:	May 1999
language:	English, Italian
interactivity level:	none, medium, high

correctness confidence : unknown, Press Office validated, DG validated

sub-topics / keywords : WWW, Tim Berners Lee

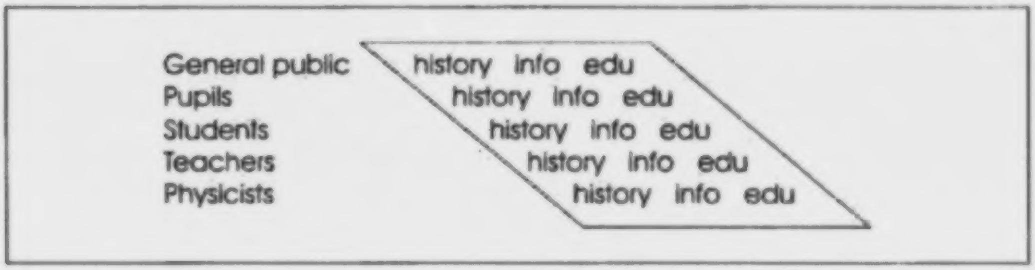
identified components : not analyzed, resource_id1, resource_id2

intended audience (level, age, etc): general public, physics students, pupils

estimated interest in year: edu/2001, info/1999, history/2000, etc

resource id : unique identifier of the resource within the system

next review year: 2003, 2005



Example of how the interest of an E/C resource might drift and survive over time for the community it was developed for and for other communities

Step #3 .

review all existing resources and for each of them:

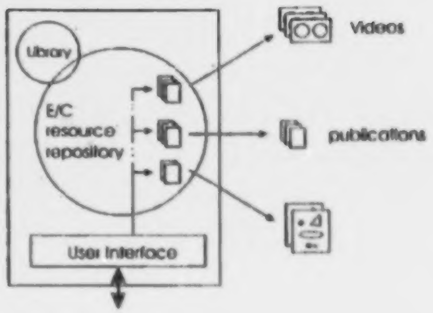
- decide on the validity, redundancy, and usefulness
- if useful, record the metadata values corresponding to the resource

Hosting platform

- The CERN Document Server (CDS) is one of the major information sources for High Energy Physics. It containing link s to more than 500,000 resources (mostly scientific papers within the field of HEP, but also photos, videos and posters).
- The E/C resources will be catalogued in a separate "sub-base" inside CDS. Authors and/or system managers will use on-line submission procedures to add new material or modify existing resources.
- A customized, and easy-to-use (c.f. Google), user interface to ease E/C resource search, retrieval, submission as well as document format conversion.

BEST COPY AVAILABLE

CERN Document Server


Library
E/C resource repository
User Interface
Videos
publications

Criteria to measure system operation and maintenance quality

- how populated does the system get ?
- how accurate/up-to-date are hosted documents' metadata?
- how frequently is the system used?
- how much its use crosses CERN organization and targeted user communities boundaries?

Related issues

- responsibility of content (individual, group, project, lab) on expressed opinion, information sensitivity, data correctness, etc)
- copyright issues
- automatic signaling that metadata needs reviewing

Effects of Social Interaction on Learning in a Hybrid Model of an Online Course, Child Abuse Detection and Reporting

Brenda Dressler, Ph.D
Instructional Technology & Teacher Education
New York Institute of Technology
United States
brendres@aol.com

Abstract: The paper is a report on the findings of the effect of social interaction on learning in this online course, Child Abuse Detection and Reporting. The course is delivered in the hybrid format, a mixture of asynchronous and synchronous models. A one-way analysis of variance was used to examine the scores on the questionnaires of 101participants for evidence of the effect of the chat on learning outcomes. Findings indicate no significant between the scores of Group I, the participants who completed the questionnaire before attending the chat and the scores of Group II, the participants who completed the questionnaire after attending the chat. Participants' evaluations of the course's interactivity reveal that the chat is viewed positively both by Groups I and II. Educators need to develop distance-learning models that encourage social interactivity.

Introduction

Given the tremendous growth of online courses educators and psychologists are investigating whether learning takes place in this format. Learning is defined as a "change in human disposition or capability that persists over a period of time and is not simply ascribable to processes of growth." (Gagne, 1985, p.2). A permanent change in knowledge, skill, attitude or interest or value develops from the learning experience. A fundamental aspect of learning is social interaction. Learning is accomplished when students are actively engaged (Leider & Jarvenpaa, 1993). Furthermore, educators who teach distance-learning courses concur that for these courses to be successful the student learner must be actively involved (Catchpole, 1993; Webster & Hackley, Dec. 1997). When a learner is actively involved learning is facilitated.

Adults learn through life experiences and then reflect on the knowledge gained and skills acquired. These are important factors in adult learning (Webster & Hackley, Dec.1997). Some educators of adult learners view successful learning as including "collaboration, interactivity, application, democracy, constructivist, and a sense of community" (Eastmond &Summer, 1998, p.34). In the Child Abuse online course, participants collaborate when they analyze their experience with witnessing or reporting suspected abuse/neglect and with the case studies imbedded in the course readings.

New York State Department of Education mandates a two-hour workshop on Child Abuse Detection and Reporting Course for teachers and other school personnel. The United Federation of Teachers (UFT), a state approved provider offers this class in two formats. One format is the traditional face-to-face classroom setting. The second format is an online course and is the focus of this research proposal. Two models of this online course, hybrid and asynchronous, has been ongoing for over five years. The hybrid course is the subject of this research paper.

The hybrid online course was offered each month from October 1996 through June 1998, excluding July and August to pre-service and in-service teachers, assistant principals, school secretaries and paraprofessionals. Participants are given two weeks to complete the assignments and access to AOL is required. The course consists of six parts: an introduction, four reading assignments that include six (6) questions, a myth and fact questionnaire consisting of 19 questions and a series of open-ended evaluation question and a synchronous one-hour chat. For purposes of this study, asynchronous learning is defined as learning that can take place in any location and at any time using a computer with Internet access. Synchronous learning is defined as learning that takes place at a distance but at the same time.

America Online's message boards are the electronic analog of the old familiar corkboard and pushpins. Participants post their answers and read messages at any time. Folders are posted on boards (the messages are inside the folder). The folders are organizational tools placed on the board to help you locate topics. The instructor asks additional questions, encourages class members to read and react to each other's responses. The instructor also posts questions based on participants' responses that appear on the electronic message board. Participants are required to write one or two sentences explaining their answers to the myth and fact questionnaire and e-mail their answers to the instructor. After the answers are received, the instructor then e-mails the correct answers to the individual participant. All required reading and responses are in the asynchronous format. Participants can complete their work when it is convenient for them. At the end of the two-week period participants are required to meet in a chat room for one-hour to discuss case studies in the reading assignments and in the newspapers and to respond to additional questions raised by the instructor. During the chat, participants collaborate and determine whether reasonable cause to suspect child abuse/neglect is present in these cases studies.

The Study

This research examines the following hypotheses regarding the distance learning hybrid model:
Hypothesis 1: Participants (Group II) who complete the myth and fact questionnaire after their participation in the interactive chat has significantly higher scores that those participants (Group I) who completed the myth and fact questionnaire before they participated in the interactive chat.
Hypothesis 2: Participants (Group II) who complete the myth and fact questionnaire after their participation in the interactive chat express greater levels of satisfaction than those participants (Group I) who complete the myth and fact questionnaire before they participated in the interactive chat.

Participants consist of new teachers who need to meet New York State Department of Education's requirement for certification and experienced teachers who need to take the course to be certified as an assistant principal and /or principal. These participants teach in the New York City public schools. Other school personnel such as paraprofessionals and school secretaries also take this course.

This study uses quantitative and qualitative data obtained during a one and one half-year period from 101 participants who have completed this hybrid online course. The quantitative information derives from the scores on the myth and fact questionnaire used to measure learning outcomes. Learning outcomes are operationalized by performance on the myth and fact questionnaire. The scores of the participants in Group I (n=71) who complete the myth and fact questionnaire before participating in the chat and the scores of the participants in Group II (n= 30) who complete the myth and fact questionnaire after participating in the chat are compared. A one-way analysis of variance was conducted to determine whether the mean scores of Group I and Group II were significantly different from each other.

In the Learning Hall (chat) The instructor asks questions such as, " how can the barriers to reporting suspected child abuse/neglect be removed?" and " do you know the name of the designated reporter and the members of the School Child Abuse Team?" and " do you agree or disagree that this case should be reported and explain why or why not?"

The qualitative data presented is taken from three courses, consists of open-ended evaluation questions. Participants are asked to evaluate the course. They are also asked whether the course was interactive and if they have any suggestions to improve the course. In addition, qualitative information from participants' interactive discussions with online classmates and with the instructor during the chat and at the electronic message board has been collected.

Findings

A one-way analysis of variance conducted to determine whether the mean scores of Group I and Group II were significantly different from each other indicated there was no significant difference between the two groups. Participants' responses to assigned questions posted on to the message board were brief, no more that a sentence or two. Answers were not well developed nor were they reflective. There was little response to the instructor's additional questions posted on the message board. Similarly, very few participants responded to each other's comments that were posted on the message board.

The following are comments made by Group I and Group II participants in three (3) classes in the evaluation section.

Group I: "Miss personal reactions and look forward to the chat; very efficient; reading others responses made it interactive; more convenient if my computer skills were better; looking forward to the interactive conference; look forward to chat room segment in which we will be able to "talk"at a more convers ation-like atmosphere; driving me crazy is the message board people are responding to me and then some one responding to them or me; suggest that it would be more interactive-maybe meet twice to discuss the topics at hand other than at the end of the class; incorporate the video into the course; turned out to be a course on learning to do more on the computer as well as the child abuse course; I couldn't have asked for more convenience; sometimes online learning is a much more social experience than traditional forms of distance learning, such as correspondence study; Info and materials were every bit as effective as taking the course in a classroom; In their hearts, I believe most teachers would report child abuse. With this information, they now have it in their heads as well; I am looking forward to "chatting" with other participants. Even though I cannot see or hear other participants, I still feel I have classmates. At this point I don't find this course to be interactive. However the day of the conference will be interactive."

Group II: "I enjoyed the online chat the most. It was interesting to see how we each interpret the information we had regarding child abuse. I believe there should be required refresher courses available. The course was great. I would love to take another course on the Internet; I did not find it to be very interactive for me since none of my questions were ever addressed on the conference chat. It was interactive enough because each person could post responses to other students' posts and because of the meeting in the Learning Hall. It was informative and fun using on-line technology to talk with colleagues."

Conclusions

There was no significant difference in the scores measuring learning outcomes of Group I and Group II. It may be that studies on distance learning should consider other aspects of student learning such as what did they learn, did they learn to analyze and did they learn to be critical about the subject matter, is there student participation and collaboration and was interactivity encourage by the instructor. A model that encourages social interactivity needs to be developed for the online course. Also, the extent to which students' technological abilities impact learning and social interactivity in an online class needs to be investigated.

Generally, participants did not click on to the message board to communicate with other classmates. Their answers to the six questions were brief. This was probably due to limited experience with technology as indicated in their evaluations.

In the evaluations, the chat is viewed positively both by Groups I and II. Evaluations indicate that Group II felt connected to each other. Group I looked forward to the chat. Success in the chat room however, depended on good typing skills to keep up with the discussion. Furthermore, if the class had too many students then discussions in the chat room were difficult. The ideal size consisted of 10 students. The chat did give the students the opportunity to collaborate on various cases and situations in the schools.

References

Catchpole, M.J. (1993). Interactive media: The bridge between distance and classroom education. In T. Nunan (Ed.), *Distance Education Futures* 37-56. Adelaide: University of South Australia Press.

Eastmond, D. (Summer 1998). Adult learners and internet-based distance education. *New Directions for Adult and Continuing Education*, 33-41.

Gagne, R. (1985). *The Conditions of Learning and Theory of Instruction*. FLA: Holt, Rinehart and Winston.

Leider, D.E. & Jarvenpaa, S.I. (1993). The information age confronts education: Case studies on electronic classrooms. *Information Systems Research;* 4, 24-54.

Webster, J. & Hackley, P, (Dec 1997). Teaching effectiveness in technology-mediated distance learning. *Academy of Management Journal* 40:6 1282-1309.

Estimating Development Time for E-Learning Programs

Mark Eaton
Cerner Virtual University
Cerner Corporation
E-mail: meaton@cerner.com

Abstract: Project managers and instructional designers face two challenges with every new e-learning project engagement - accurately scoping the project and then controlling it. The former often involves undisciplined practices. The latter is made more difficult because of it. Accurately estimating projects requires detailed analysis that is rarely available prior to signing agreements and contracts. The success or failure of a project is often determined by the quality of estimations since they tend to set client expectations. This paper recommends using estimators that are designed for specific types of e-learning solutions to improve quality and accuracy of scoping. Estimators provide a foundation for terms of reference, project scope, and help set client expectations. There are four steps in developing an estimator – define a learning event, define levels of interaction, identify development activities, and create the estimating matrix.

Methods for Scoping Projects

Project managers face two challenges - accurately scoping the project and then staying within scope. Since scoping sets client expectations, the success or failure of a project is often determined right from the beginning by the quality of these estimations.

There are three basics approaches in estimating projects for fixed fee services. The first is a simple gross estimate with a percentage of time added on for risks. It is quick, but not accurate and doesn't help when there are misunderstandings about the requirements.

The second method is to use a ratio of development time to learning time. Example: it takes 600 hours to develop 1 hour of learning; therefore, a two-hour e-learning program will take 1200 hours to develop.

I use ratios to analyze internal changes to development tools and processes for a specific type of e-learning program. With the exception of the changes, all factors remain the same and it is helpful to measure what effect, if any, these internal changes have on the development timeline. Ratios work when assessing these changes if they are internal to one program or activity.

It is very risky, however, to use ratios in a proposal that involves new technology or for comparing different solutions. Consider two proposed solutions where one is a simple slide presentation and the other has interactive practice exercises. The ratio for one will be significantly less than the other and the reason for the differences is not always as obvious as it is in this example. Ravet & Layte (1997) recognize this and suggest splitting ratios into components like knowledge acquisition, practice, and testing.

The third method is to use a tailored estimator for the specific type of e-learning solution that is proposed. More and more e-Learning content developers are using various types of estimators.

In this paper, we look at the steps to develop an estimator – define a learning event, define levels of interaction, identify development activities, and create the estimating matrix. The estimator is the best method to scope projects because it becomes the terms of reference and clearly communicates types of learning events and levels of interaction.

Process in Developing an Estimator

Step One: Define a Learning Event

It is usually necessary to begin by evaluating the type of analyses the designer will use in the instructional design approach. For example, Task Analysis is a process to identify target and enabling objectives (Gagne, Briggs, & Wager 1992). The analysis can be used to identify an event profile and course map. From this, designers can identify the lowest level of granularity.

This lowest level in the course hierarchy is a recognizable learning event that can be added, removed, or modified somewhat independently within the course. It is consider portable if it meets this criteria and it needs to be defined to help set client expectations. For example,

> A learning event is considered the lowest portable learning object and is an independent set of tasks that collectively form a complete piece of instruction. It is a short piece of instruction that takes only a few minutes to complete and no more than 10 minutes.

The next step is to classify learning events into various levels of interaction. Ten minutes of instruction that is almost entirely text-based is much different than ten minutes of instruction that includes games, even though both may take the same amount of time to complete.

Step Two: Define Levels of Interaction

There are many classification systems that are available to classify levels of interaction. Schwier (1992) proposes taxonomy of interactions in terms of the user's cognitive engagement. He evaluates interaction on three levels – reactive, proactive, and mutual interaction.

More recent classifications include defining the interaction between the actors – students, instructors, and the system or program (Wagner, E. D. 1998, Sook K. S. & Bonk, Curt J. 1998). Others describe interaction from the developer's perspective and the media components – graphics, text, animations, simolations, user inter-face controls, etc. (Bixler, B. & Spotts, J. 1998, Sims, R. 1997).

I use the classification scale in Table 1. It has six levels to describe types of learning events and how users react to them.

Level	Type	Description
1	Single Document	Characterized as a single document like on-line reference manuals. Controls are limited to scrolling or clicking objects for sequential or non-sequential hypertext navigation within the document.
2	Web Document	Multiple documents. Involves additional branching for specific instructional support (Schaefermeyer, 1990).
3	Multimedia	Includes text, graphics, animation, and audio. User can play, pause, rewind, and advance through the animations.
4	One-True-Path (OTP) Simulations	Simulates basic features of the system or environment. OTPs are usually linear. The prominent feature is that triggers are embedded within the simulation so that navigation occurs by interacting with the simulation.
5	Multiple-True-Path (MTP) Simulations	Limited exploration. MTPs have more effective hands-on realistic experiences than level-4 OTP programs. Multiple parallel pathways exist, but are limited or controlled.
6	Scenario Simulations	The best example of this is an aircraft flight simulator. The learning program not only has the look and feel of the actual system, but also uses underlying algorithms that fully describe the real world system. Great for what-if scenarios.

Table 1: Classification by Levels of Interaction

Step Three: Identify the Design and Development Activities in the Construction of a Learning Event

Designers identify activities that are involved in designing, developing, and producing learning events. These activities are fairly common across e-learning solutions. Table 2 gives a sample of activities.

Activity	Description
Design	Creating the training scenario - writing assignment text or directions, writing any learning support messages that may be required, identifying and describing the scenes or pages, and identifying the conditions that will let the student progress between tasks and events. Output is a detail design document or storyboard.
Database Development	Entering data into the data structure. May include data entry into an actual database or creating other data sources that the event will utilize.
Authoring	Developing learning events using tools or authoring systems that do not require programming.
Programming	Actual programming using high-level languages or scripting languages.
Integration	Integrating tasks together into learning events and integrating events into lessons. Setting triggers for navigation and integrating all the learning support tools the end-user will need.
Testing	Testing - following the development of each learning event or after all learning events have been integrated. Estimations take into account the number of iterations that will be required between development and testing.

Table 2: Development Activities

Step Four: Create the Estimation Matrix

It is here that you document approximate times required for the various activities in developing a learning event. Table 3 shows a sample matrix. Notice that it takes approximately 7 hours to build a level-1 learning event and 110 hours to build a level-6 learning event. Thus the matrix accounts for variations in each activity among the various types (interaction levels) of learning events.

Levels Activities	1: Document	2: Web Document	3: Multimedia	4: OTP Simulation	5: MTP Simulation	6: Scenario Simulation
Design	2	3.5	5	6	12	20
Database	.2	.2	1	4	8	20
Authoring	3	5	7	7	8	15
Programming	0	0	2	4	6	30
Integration	1	1	3	3	6	10
Testing	1	1	3	3	6	15
Total Time	**7.2**	**10.7**	**21**	**27**	**46**	**110**

Table 3: Estimation Matrix

Using the Estimator

Table 4 shows the output of the estimator to scope a proposal. In this example, a learning program will be designed to develop skills on using a word processor. The first column documents the proposed learning events. The second column identifies the level of interaction that is required for each event. The last column is the estimated time to manage the activity based on the estimating matrix in Table 3.

Proposed Learning Events	Level	Development Time
Home Page	1	7.2

Course Overview & Getting Started	2	10.7
Opening the Word Processor	3	21
Creating a New Document	4	27
Enter Text in the Document	5	46
Running Spell Check	5	46
Saving Changes to the Document	5	46
Open and Modify an Existing Document	5	46
Copy and Paste	5	46
Adding Tables and Graphics	5	46
Closing a Document and Exit	5	46
Summary/Review	2	10.7
Total Development		**398.6**

Table 4: Sample Course Plan with Learning Events, Levels, and Estimates

There are several advantages to using this approach. First, it provides scope of the project. At a consulting rate of $120 per hour and approximately 400 hours to develop, the fee is over $47,000. If the client needs the project closer to $40,000, the number of learning events or the interactions can be adjusted to bring the project into range.

Secondly, it sets client expectations right from the start. Any changes (interactions or number of learning events) can be managed as out-of-scope as opposed to absorbing the changes within the fee and timeline of the arrangement.

Finally, estimations are *distributed* across the learning events. It is much simpler to add, remove, or classify learning events instead of re-scoping the entire project each time there is a change.

References

Bixler, B., & Spotts, J. (1998). *Screen design and levels of interactivity in web-based training.* Paper presented at the International Visual Literacy Association 1998 Conference, Athens, GA. Retrieved April 2, 2002, from Pennsylvania State University, Royer Center for Learning and Academic Technologies Web site: http://www.clat.psu.edu/homes/jds100/john/research/ivla1998/ivla98.htm#toc3

Gagne, R. M., Briggs, L. J., & Wager, W. W. (1992). *Principles of instructional design (4th ed.).* New York: Harcourt Brace Jovanovich College Publishers.

Ravet, S., & Layte, M. (1997). *Technology-Based Training: A comprehensive guide to choosing, implementing, managing, and developing new technologies in training.* Houston : Gulf Publishing Company.

Schaefermeyer, S. (1990). Standards for instructional computing software design and development. *Educational technology*, June, 9-15.

Schwier, R. A. (1992). *A taxonomy of interaction for instructional multimedia.* (Eric Document Reproduction Service No. ED352044)

Sims, R. (1997). *Interactivity: A forgotten art?* Retrieved April 2, 2002, from Georgia State University, Instructional Technology Online Web site: http://www.gsu.edu/~wwwitr/docs/interact/

Sook K. S., & Bonk, Curt J. (1998). *Interaction: What does it mean in online distance education?* (Eric Document Reproduction Service No. ED428724)

Wagner, E. D. (1998). *Interaction strategies for online training designs.* (Eric Document Reproduction Service No. ED422881)

SPIDER TUTORING SYSTEM For TEACHING COMPUTER PROGRAMMING LANGUAGES

Mahmoud M. El-Khouly
Mathematics Department, Faculty of Science, Helwan University, Egypt.
melkhouly@yahoo.com

Abstract: This paper presents a spider tutoring system (STS) for teaching computer programming languages through WWW. In this version, spider technique have been used to update the databases used by the blackboard hosted at the tutoring agent (TA) server, with blackboard module a student can exchange his expertise with other students. Due to overwhelming size and growth rate of Internet, spider's discovery had been restricted to direct discovery technique only.

Introduction

Learning one of the computer languages today, is essential for students in both undergraduate and graduate levels. However, when I asked around 300 faculty students about their knowledge about the computer, I found that they almost use it as a tool for typewriting or games. There are many reasons for not learning computer programming languages (e.g. economical reasons, the lack of good instructors, geographical distance, etc…). Egyptian government offered a free internet from beginning of the year 2002, therefore accessing the internet costs only 0.2 $/hour (previous cost was 2$/hour) which gives us a good support to provide some web-based tutoring system for teaching computer programming languages.

The movement toward client-server applications began in the late 1980s and so in many organizations there are already many server applications with well-structured APIs for RPC or IPC access by a client. However, in many cases the backend server is a relatively standard database monitor, which provides no logic or protocol specific to the current application. The emergence of network computing, where the client side of the application logic is provided by JAVA applets that are downloaded at runtime to a Web browser, offers a new opportunity for constructing the agent-equivalent of a Web browser (Alper, 1997). With the WWW as an educational platform, it will be feasible for the students to access the multimedia courseware with general-purpose browsers. No special tools are required to start learning. For the courseware provider, it is not necessary to worry about the distribution and maintenance of the copies of the courseware but they just take care of the original on their server (Kiyoshi et al., 1997).

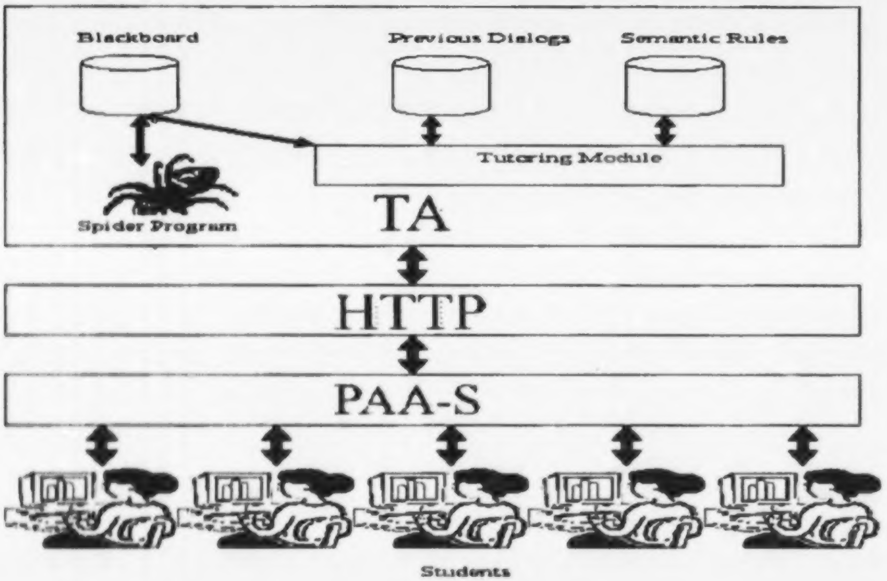


Figure (1): STS system

Lewis Johnson (Lewis Johnson, et al., 1997) support interaction with teachers and students through their project ADE, using off-the-shelf whiteboard and teleconferencing tools. But this required both teachers and students to be on-line.

M.M. El-Khouly, et.al. (2000), presented an expert tutoring system (E-TCL) for teaching computer programming languages through WWW. In this paper, I extend the features of that system to include spider technique. The most common application for spiders is creating and updating the databases used by search engines.

The proposed system consists of two agents representing a server-clients relationship, tutoring agent (TA) as a "server", and personal assistant agent for students (PAA-S) as a "clients". The PAA-S can communicate with TA through WWW to retrieve the tutoring dialog of the command(s) that a student wants to practice, and to access the experiences of other students in blackboard module (as shown in (fig. 1)).

Pedagogical Design

When the structural computer language course content was analyzed, it was clear that the subject matter was topical in nature, and could be organized into a small number of reasonably self-contained modules.

The following form the central core of any procedural computer language curriculum.

- Input/Output statement
- Conditional statement
- Loop
- Array
- Function
- Structure
- Input/Output files

The following was adopted as a model for each module:

1. Introduction: here the basic ideas and concepts were presented. The major goal was the motivation of the central idea of each module.
2. Syntax section: basic understanding of the syntax of the command, and ay examples about different forms. After all, a series of multiple choice questions are presented. The student must answer these before progressing to the next activity.
3. Procedural section: algorithmic understanding to reinforce connecting statements together to build more lines of programs pieces.
4. Strategic section: problem solving: after the student is familiar with the basic concepts in the module, more complicated multi-step questions are presented. This reinforces problem solving strategy.
5. practice exercises: at the end of the activities in each module, a series of exercises is presented to the student. Each problem is graded and the student is told whether he/she is correct or not.
6. Graded quiz: after the practice exercises, a series of questions is given to the student. They focus on the procedural and strategic components of the module.

Tutoring Agent

TA contains tutoring module, previous dialogs database, semantic rules base, spider program, and blackboard database.

Spider Program

A spider program creates a database by scanning the Internet and updates by continually scanning the WWW. To index a site, a spider must crawl it, meaning it must find all the pages the site's home page links to. Spiders add the pages they crawl to the search engine's database – a task that can be performed in several ways. Some spiders add every word of a web page to the database index. While others include only words listed in special <Meta> tags embedded in a page. Some spiders are being developed to execute multimedia-oriented searches or the automatic assignment of categories based on content.

Two basic techniques of discovering exist: blind discovery and directed discovery.

- blind discovery entails simply trying to access every IP address is existence
- direct discovery -which is significantly faster than blind discovery-entails scanning a list of known domains to see which ones are still on line and responsive. A list can be constructed or acquired in a number of different ways, but the most extensive approach is to start with the list of top-level domains (TLDs). *Directed discovery isn't necessarily limited to the original list of sites: as the* spiders crawls each page, it's bound to discover new links. By adding new links to the database of site, more and more pages get introduced to the system (David Pallmann 1999).

Personal Assistant Agent for Students

The personal assistant agent for students (PAA-S) consists of three components, student model, tutoring module and user interface module.

Conclusion

In this paper, STS system had been presented for teaching computer languages. STS consists of two agents, tutoring agent, and personal assistant agent for students. They communicate with each other as client-server through WWW. This allows the system to communicate with other agents to exchange semantic rules and tutoring text for different languages. The spider technique had been used in PAA-S. Such that the blackboard modules hosted at TA, can be updated continually to see whether the student is on-line or off-line and therefore checking whether he/she will contribute to the current inquiry or not? This will safe time for waiting students who are off-line.

References

ALPER C and Colin H (1997) *Agent Source book: A Complete Guide to Desktop, Internet, and Intranet Agents*. John Wiley & Sons, USA.

David Pallmann (1999). Programming Bots, Spiders, and Intelligent Agents in Microsoft Visual C++, Microsoft press.

Kiyoshi Nakabayashi, Mina Maruyama, Yoshimasa Koike, Yasuhisa Kato, Hirofumi Touhei, & Yoshimi Fukuhara. (1997). Architecture of an Intelligent Tutoring System on the WWW. In Proc. 8th World Conference of the AIED Society, Kobe, Japan.

Lewis Johnson & Erin Shaw (1997). Using Agents to Overcome Deficiencies in Web-Based Courseware. AI-ED'97 workshop on intelligent educational systems on the world wide web.

M.M. El-Khouly, B.H. Far, & Z. Koono. (2000).Expert Tutoring System for teaching computer languages . Expert Systems with Applications, 18, 27-32.

Semi-online Workshop for Planning and Developing Online Courseware.

Authors:			
	Larisa Enriquez	Interactive Products Department	larisa@piaget.dgsca.unam.mx
	Dámaris García	Interactive Products D epartment	damaris@piaget.dgsca.unam.mx
	Erika Nuevo	Interactive Products Department	erika@piaget.dgsca.unam.mx
	Elga de la Cruz	Interactive Products Department	elga@piaget.dgsca.unam.mx
	Sonia López	Interactive Products Department	sonia@piaget.dgsca.unam.mx
	Mariana Vázquez	Interactive Products Department	
	Gabriela Aranda	Interactive Products Department	gaby@piaget.dgsca.unam.mx

Institution: National Autonomous University of México

Abstract

During this presentation, it will be demonstrated how the Academic Computer Center (at the National University of México) is helping their face-to-face teachers to develop online content for online courses.

Introduction

The Academic Computer Center is nationally recognized as a leader in computers and telecommunications technology. Among other things, it is responsible for bringing computers and telecommunications training to the Mexican population. The Academic Computer Center has over 200 different courses and 300 face-to-face teachers but by the end of the year 2001, only three online courses formed part of the course catalogue. How can we expand our online courses offering? How can we help teachers modify and make their notes more accesible for an online course? How can they experience an online lesson?

In order to answer these questions is that a semi-online workshop for planning and developing online courseware has been designed.

The workshop consists of two modules, the first of them (over three weeks) is to be given through the Internet and the second one (over six weeks) is to be given in a classroom in two-hour sessions per week.

Content

The Semi-online workshop for planning and developing online courseware was designed for those teachers interested in developing online courses. Because we think teachers are the content experts and that they do not necessarily need to know about programming, designing or administering a server, the only pre-requisites that we required the teachers to have prior to the workshop were:

1. Managing the Windows interface
2. Internet connection
3. Being able to use a word processor
4. Have email access
5. Have already selected the coursware's content

The workshop consists of two modules. The first one is theoretical and when finished, the student will be able to understand the significance of the instructional design. The student will be introduced to the distance education concept and the technologies for delivering it.

The first module is based totally on the Internet; forum discussions, handing-in assignments, evaluating online products and suggested readings are some of the activities proposed for this module. The student (in this case, the teacher) faces the situation that his or her own students will also be facing; loneliness, motivation, feedback and evaluation are four basic concepts that are easily explained with words but are difficult to achieve with this media. In order to help them face this issues we worked on each of them, as follows:

Loneliness We regularly send emails to the students; either to tell them we received their homeworks, o to ask them about their feelings being in the course.
Motivation. During the discussions on the forum, we tried to collect some of the students' comments or works, telling the rest of the group about an interesting view or work.

Feedback. Because students are expecting to know if they are doing well in the course, it is important to tell them about their performance as well asto make them feel that the tutor is following the discussions, by asking questions and directing the discussion.

Evaluation. Evaluating a person that is at a distance is difficult, first of all, because we are never sure who is behind the computer. The way we have dealt with this question is by assigning several activities along the course in which students have to work constantly. This system has helped us to, not enhance a proactive interaction among students, but also brings the opportunity to construct related and more complex activitites as the course advances.

During the case of the second module, students are basically developing their courseware content. Face-to-face sessions are used for supervising, consulting and sharing ideas and experiences within the group. A special content delivery system was developed for students in order to help them construct and see their course; they are also able to view the other on going projects.

In México, most teachers do not have any distance education experience; neither as students nor asfacilitators. It is difficult for them to adapt and interact freely at their first online course, and because we know they have good ideas, questions and proposals for teaching we decided that, for the second module, face-to-face sessions would be better than online assistance.

Development

An interdisciplinary group developed the workshop. A graphic designer, two instructional designers, a media integrator, a system developer and an interface designer were integrated into the team.

Planning: We consider that there are two basic problems to solve when someone decides to transfer a faco-to-face course to an online one: the content's development and the role the teacher must assume because of the technology. We decided to concentrate on the first problem and help teachers identifying differences, advantages and disadvantages of the Internet for the delivery of information. The workshop's coordinator and the two instructional designers worked on this stage.

Content Selection: Because an online facilitator teaches at a distance, it is important to be aware of this significance. That is why the first two subjects to be overviewed in the workshop are Distance Education and Distance Education Delivery Technologies. The next subject is Internet and online education, concentrating on online courses. The following subjects deal with independent study, instructional design, and web content design usability concepts. All these subjects are taught through the Internet and students have plenty of activities to do. At the end, students are asked to develop their course content and face-to-face sessions are used to show each person's progress and to discuss ideas and doubts. Teachers are asked to put their materials on a server, using a system and an interface designed specially for them. People participating in this stage are the workshop's coordinator, the instructional designers and the interface designer.

Development: Once the program was decided and the content selected, it was time to develop the workshop's site (web pages for the online module and the course delivery system to be used during the second module). The whole team participates at this stage.

Evaluation: When both web sites were finished (the online course and the course delivering system for the teachers), functionality, usability and learning evaluations were applied. We invited teachers to participate on the 6-week workshop. Twelve teachers attended the workshop but only nine finished it. We handed out a questionnaire to those persons who abandoned the course for feedback, as well as those who did finished it.

The main comments we received about the online module were:

- the agenda wasn't very clear to people; they didn't understand how the course content and activities were distributed along the six weeks
- people needed a printable version of the documents
- people thought it would be important to have an a students' space so they could post personal information and thus to get better acquainted with each other
- some notes should be improved by adding specific references

For the course delivery system, they told us:

- they had the possibility of sending 'pdf' documents
- they could see other people's courses
- they wanted to use our delivery course system in the future for their courses

For the didactic aspects, they all agreed:

- time was top limited in order to reach the course's objective
- there were too many activities
- face-to-face assessments could be improved by discussing and analyzing more fully everyone's progress
- they wanted assessments after the workshop was completed

Results

- Four online computer courses were developed as a result of the workshop and three of them are now part of the online course catalogue.
- The workshop site was redesigned and the teacher's notes were improved.
- The workshop now lasts 9 weeks (three to be attended by Internet and 6 face-to-face sessions).
- The workshop was included on the online course catalogue and promoted through the university's web page and newspaper.
- 24 students enrolled in the following workshop.

Bibliography

Ángelez Gutiérrez, Ofelia. (1998). Selección y recopilación del material de apoyo del Seminario-Taller: Evaluación y diseño curricular. ANUIES. México,

Tony Bates (1995) Technology, open learning and distance education, Routledge studies in Distance Education. ISBN 0-415-12799-8

David W. Brooks (1997) Web-teaching, a guide to designing interactive teaching for the worldwide web. New York, plenum publishing. ISBN 0-306-45552-8

Desmond Keegan (1999) Foundations of Distance Education. Great Britain, Routledge publishing. ISBN 0-415-13909-0.

Desmond Keegan, (1994).Otto Peters on Distance Education. The Industrialization of Teaching and Learning. Routledge. London and New York.

Hannafin, Michael J. (1988).The Design, Development, and Evaluation of Instructional Software. Macmillan Publishing Company. New York.

Jakob Nielsen (1999) Designing web usability: The practice of simplicity. New Riders Publishing

Colin McCormack, David Jones (1997). Building a Web-based Education System, John Wiley & Sons. ISBN 0471191620

Gloria Pérez Serrano,. (1994).El profesor-tutor. Perspectiva humana de la educación a distancia. Revista Iberoamericana de la educación superior a distancia. Madrid. UNED, AIESAD, vol. VI, núm 2.

William K. Horton (2000) Designing web-based training: How to teach anyone anything anywhere anytime John Wiley & Sons

iQUIZ: A Tool Making Internet Quizzes easy to Develop and Use

Hanna Farah, and Abdulmotaleb El Saddik
School of Information Technology and Engineering (*SITE*)
University of Ottawa
161 Louis Pasteur, P.O. Box 450, Stn A, Ottawa, Ontario, Canada, K1N 6N5
Tel: (613) 562-5800 x 6277, Fax: (613) 562-5175
hfarah@farahtech.net, elsaddik@site.uottawa.ca

Abstract

This paper presents a tool called iQUIZ that tries to facilitate composing, distributing and correcting online quizzes for different groups of students in a given course. iQUIZ is a client-server TCP/IP-based application; the server can be used by educators and/or organizations to compose and host online quizzes. The client application will be used by students or any other party (e.g., customers) solving the quiz. iQUIZ is characterized by its ease to use graphical user interface and its high degree security features.

1. Introduction

University teachers spend a lot of time differentiating and correcting exercises and quizzes and posting student marks on the web. They may do it using a web-based learning system like WebCT or just by typing the information using a standard word /and or HTML editor. On the other hand, and based on our own observations, students don't express much interest in assisting to labs or discussion groups. This work tries to facilitate composing, distributing and correcting online quizzes for different groups of students in a given course. We want to give the students a good reason to assist to labs or discussion groups.

2. Architecture

iQUIZ is a client-server application developed in Visual C++ using MFC. The client sends its ClientID and Password to the server for validation, if it is the first time the server will create an account for that verified client (there is an authorization from the server administrator to create an account for that new user by having registered the student number for example so that not all students can create accounts).

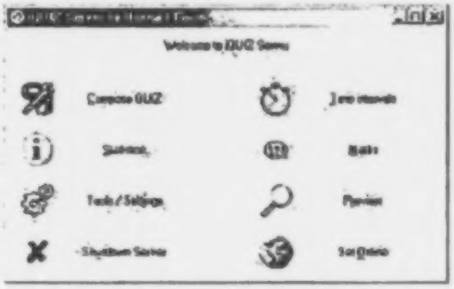


Figure 1. User interface of the iQuiz server

The server hosts the quizzes and sends the quiz version corresponding to the client ID. The communications take place in real time, each time the client answers a question, the answer is automatically sent to the server and stored locally. The communication socket is destroyed when the quiz is over.

2.1 Security issues

- Digital signature:
    - Both the server and the client are digitally signed to prevent malicious users from modifying the code or resources of our application. Unlike Java applets that can be decompiled and modified.
- Encryption:
    - All communications between the server and its clients are encrypted.
    - Local quizzes are stored on disk but using a very strong encryption algorithm(Blowfish 128 bit encryption for example)
    - Data stored on the client's side for high availability purposes are also encrypted using the same algorithm (Blowfish 128 bit).
- Semaphores:

BEST COPY AVAILABLE

- To allow only 1 client application to be ran on a single computer by a single user, we create semaphore objects in memory.

2.2 Upload

iQUIZ can communicate with an FTP server using the File Transfer Protocol to upload files to that server. A feature of iQUIZ is automatic marks upload at a given time interval, which will be discussed in the next Section.

3. Implementation / Easy to use UI

Figure 1 represents the user interface of the server. It consists of 8 items which can be described as follow:

3.1 A friendly, easy to use interface to compose the quiz

As can be seen in Figure 2, the educator can compose a question with a maximum of 5 multiple answers. She/He can also specify the difficulty level of this question, and has the option to give a maximum amount of time the student is allowed to have in order to answer the question. In the Scenario field the educator can specify several consecutive questions on a subject which the student can read in a popup window. The total questions field shows the number of already composed questions with their difficulty level respectively.

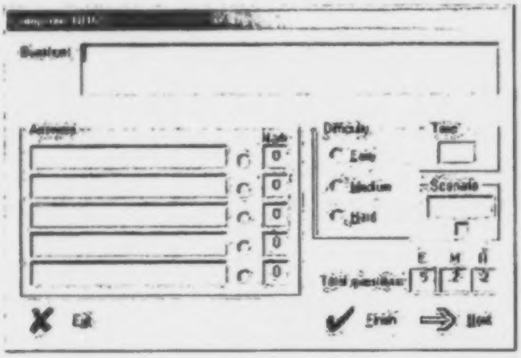

Question
Answers
Mark
0
0
0
0
0
Difficulty
Easy
Medium
Hard
Time
Scenario
E M H
Total questions 5 2 2
Exit
Finish
Next

Figure 2. User interface for composing a quiz

3.2 Option to have the quiz available at defined times only

This feature allows only students from a specified group or groups to do the quiz in a specific time interval. It has also a no time restriction option (see Figure 3).

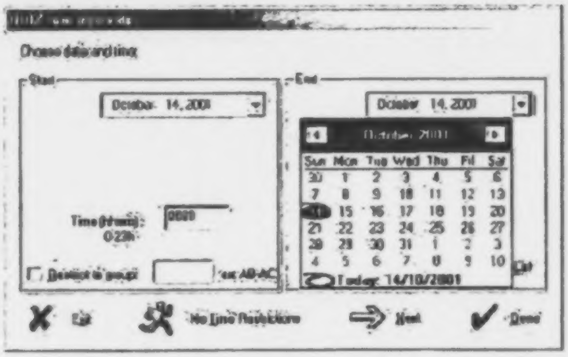

Choose date and time
Start
October 14, 2001
Time (hh:mm):
0200
End
October 14, 2001
Sun Mon Tue Wed Thu Fri Sat
30 1 2 3 4 5 6
7 8 9 10 11 12 13
14 15 16 17 18 19 20
21 22 23 24 25 26 27
28 29 30 31 1 2 3
4 5 6 7 8 9 10
Today: 14/10/2001
Restrict to group
ex: AB-AC
Exit
No Time Restrictions
Next
Done

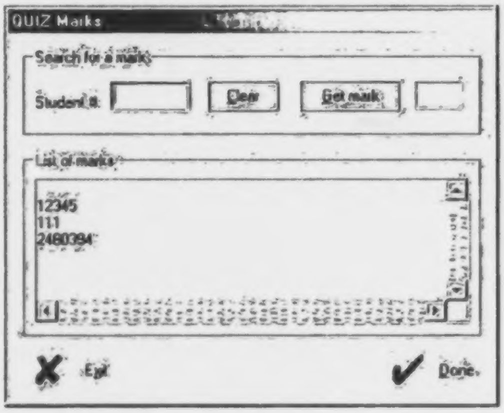
Figure 3. User interface of the quiz time interval

3.3 The statistics tool

This tool allows the educator to view the statistics of using the iQuiz tool. She/he can find the number of submitted quizzes, the average mark, the lowest mark, etc...

3.4 Lookup a mark instantly

This option allows the educator to search for a mark for a specific student in her/his database.

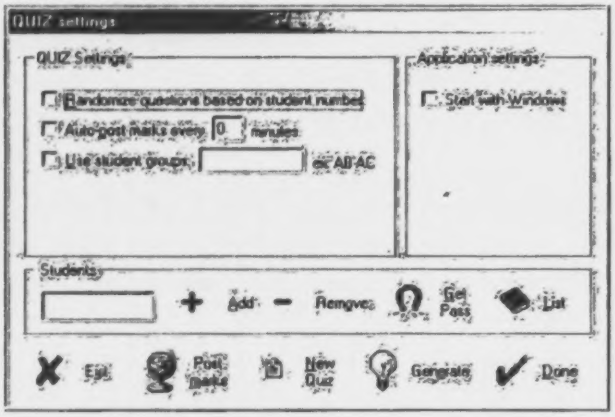

QUIZ Marks
Search for a mark
Student #:
Clear
Get mark
List of marks
Exit
Done

12345
111
2480394

Figure 4. Searching for a specific student marks

3.5 Tools/ settings

Figure 5 displays the various features of the iQUIZ tool: the ability to load with Windows on startup. The quiz can differ from one student to another when Randomize is checked so even in the same group; the order of the questions in the quiz will be based on the student's number. The educator does not need any more to worry about posting marks; iQUIZ will automatically do it for her/him and on regular basis if she/he wishes. Marks are posted via FTP with a single click. The educator can also arrange students in groups and manage them with ease. The iQUIZ server auto-corrects the quiz, put the marks on the educator's desktop and uploads them to the desired FTP site.


QUIZ settings
QUIZ Settings
Application settings
Students
Add
Remove
Get Pass
List
Exit
Post marks
New Quiz
Generate
Done

☐ Randomize questions based on student number
☐ Auto-post marks every 0 minutes
☐ Use student groups: ex: AB AC
☐ Start with Windows

Figure 5. Quiz settings

The educator can also specify how many question of each type (easy, medium, hard or difficult) the quiz should contain and how many different versions of the quiz should be generated (therefore we will have different quizzes for different students in the same group). She/he can also have 1 different version generated for each group.

BEST COPY AVAILABLE

3.6 Preview

The educator can preview what each generated quiz contains before hosting the quiz and setting the server online. This is to ensure that everything will be done as planned by the educator and give her/him the comfort and more control over the quiz. This feature is based on the well known concept of what you see is what you get (WYSIWYG).

3.7 Set online

This button sets the server online and makes it ready to accept client connections. Note that the educator can set predefined time intervals and iQUIZ will go online and offline automatically. With the ability to startup with Windows, the educator doesn't have to remember to execute the iQUIZ tool each time she/he turns on her/his computer. After the server is set online, this buttons turns into a Set offline button to tell the server to break all connections and stop accepting new connections.

3.8 Shut down server

This button shuts down all communications and terminates the application.

4. Evaluation

The system has been tested by two educators, who generated a number of quizzes for their students. They were very satisfied with the easy to use user interface and the lack of complexity. At the same time we did a network communication in order to study the number of users (students) the system can simultaneously support. Our simulation showed that we could support about 300 users without decreasing the response time from the server. This is due to the fact that we are using TCP/IP communication protocol and therefore we could support virtually thousands of users (every user will be given a special port). Practically and based on our prior experience [elsaddik2001] the server last will increase linearly with the increasing number of users.

5. Conclusion and future work

After the success of our test simulation we are planning to use it in fall 2002 (Course ELG5121 Multimedia communications) at University of Ottawa. We are also planning to add some other features, among others:

- Load several quizzes at once and have a specialized tool to compose the quizzes separating the communication part from the composition part.
- Remote control the server from another computer.
- Email support: we want to be able to send congratulation emails to the students with the highest achievements!

We also plan to use XML-based specification and develop a Java version of this project to ease deployment and allow usage on different operating systems.

6. References

[Belnap(976] Belnap, N. D., The Logic of Questions and Answers. New Haven: Yale University Press.

[elsaddik2001] El Saddik A., Interactive Multimedia Learning', ISBN: 3-540-41930-6, Springer-Verlag (2001), 200 pp.

[Lee et al. 1995] Lee, W. W., Mamone, R. A., & Roadman, K. H The Computer Based Training Handbook: Assessment, Design, Development, Evaluation. Englewood Cliffs. N.J: Englewood

[Tinoco2002] Tinoco, L. C. QUIZIT Tutorial. Blacksburg, VA: Virginia Tech Computer Science Dept. http://pixel.cs.vt.edu/~ltinoco/quizitdocs/

A DISTRIBUTED WEB-BASED K-12 MANAGEMENT SYSTEM

JOÃO FERREIRA, ALBERTO SILVA, RUI AZEVEDO, GONÇALO BORRÊGA

ISEL / DEI-IST-UTL / INESC-ID LISBOA

(jferreira@deec.isel.ipl.pt, alberto.silva@acm.org)

Abstract: The project "Rent@School - Bringing the Future to the Education" is a research effort to study and prototype information system architectures to support, standardize, and facilitate the management of K12 schools at a national scale. It looks for the sharing and dissemination of relevant information among different stakeholders, based on the ASP model and also on a novel architecture, which we called "distributed and multi-instance web architecture". This architecture means that beyond the existence of a unique central/national Rent@School instance, multiple Rent@School instances can be installed at local/regional scale, in a way that autonomy, performance and flexibility of all the system can be improved. This issue is introduced and discussed in this paper from two complementary perspectives: from the organizational and management information systems perspective; and from the integration and large-scale interoperability.

1 Introduction

Education is considered by modern societies to be one of the most important and strategic factors that contributes for the development, wealth creation and solidarity of any Nation [1,5]. In this context, Rent@School (RS) is a research project where we will propose and discuss organizational and information system architectures to support, standardize, and facilitate the management of K-12 (from kinder garden till 12th year) schools at a national scale, as well as, the sharing and dissemination of relevant information among the different stakeholders, such as students, teachers, schools' administrators, parents, and Ministry of Education' support and technical employees. This project is particularly oriented by the Portuguese educational public system (the educational private subsystem has some facets and requirements that we deliberately did not consider).

The RS project is being developed in the context of the ISG (Information System Group of INESC-ID) where we are interested on two main research topics. First, to study organizational systems, architectures and patterns, in particular those with complex, dynamic and distributed features which can be found in different areas of the economy and society, such as public administration, education, transports, logistics, or tourism. Second, to study the best information systems architectures and patterns to support the referred systems, following a technological perspective.

RS is based on the ASP (application service provider) model, however, adopting a novel architecture, which we called "distributed and multi-instance web architecture". This architecture means that beyond the existence of a unique central/national RS instance, multiple RS instances can be installed at local/regional scale, in a way that autonomy, performance and flexibility of all the system can be improved. This issue is particularly interesting and novel and it is introduced and discussed in this paper from two complementary perspectives. First, following the organizational and management information systems perspective. Second, following a more technical perspective, in particular regarding issues of application integration and large-scale interoperability based on the web services concepts.

The main novel contributes of this paper can be summarize in three points. First, we propose and discuss the interest of an information system that can support, standardize, and facilitate the management of K-12 schools at a national scale. Second, the proposed architecture is not restricted by itself to the classic and central ASP model because it allows the installation and configuration of multiple instances promoting, in that way, the autonomy, flexibility and performance of the overall system. Third, we propose and discuss the importance to develop this kind of system with public and open interfaces, promoting integration and large-scale interoperability among different systems.

This paper is organized in 6 sections; including this one (Section 1) that describes the context, the motivation and its main contributes. Section 2 describes briefly the Portuguese educational system, and in particular the subsystem of public K-12 schools. Section 3 identifies the most relevant (functional and non-functional) requirements that the RS design and prototype should take into account. Section 4 presents and discusses issues related to the information system architectures that support the RS, as well as, related to the application integration and large-scale interoperability. Finally, Section 6 refers some considerations related the future work and the research aims.

2 Portuguese Educational System

The educational system in Portugal, like in most of the developed countries, is organized in classical training and/or professional levels. The following educational levels exist in Portugal: pre-primary; primary - 1st cycle (1st to 4th years); 2nd cycle (5th to 9th years); secondary-high school (different areas, like classical, artistic and professional are available); and higher education (divided in University and Polytechnic). The Portuguese educational system is available, at all different levels, either Public or Private. Quoting the official source INE regarding year 2000/2001, the education K-12 has a total population of 1.261.603 students (approximately 12% of the Portuguese population) distributed by 16.984 educational facilities or schools.

The RS formulates his proposal for all K-12 schools and other performers acting in the Public educational sub-system. In Portugal this sub-system in organized as shown in figure 1.

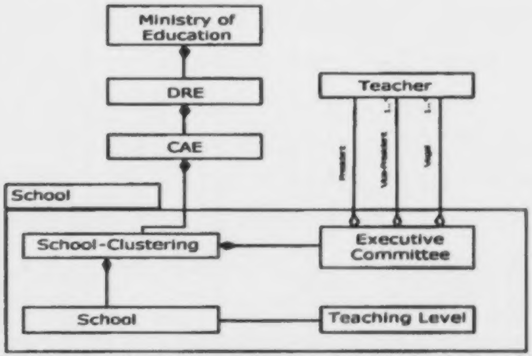


Figure 1: Organization of Portuguese educational system for the first degrees levels.

Schools are the elementary unit of educational activities. For financial reasons, regarding the level of performance on administrative tasks, the schools are organized in groups, called "school-clustering" or just "clusters". Each school can provide and manage more than one educational level. The main objective of the cluster structure is the possibility of different schools sharing a package of resources (e.g., human, technical and others) obtaining a better global costs system performance. The Ministry of Education is responsible for the planning, promotion, follow up and evaluate the available resources for the public education sub-system. This sub-system is divided in various responsibility levels namely the Educational Regional Delegations (DRE) as 1st hierarchical level. As the 2nd level there is Educational Supporting Centers (CAE). Each school is associated to a certain CAE (and therefore to a certain DRE), besides the cluster they belong to.

3 General Requirements of Rent@School

In this section we summarize the main requirements that should be supported by the RS system. Namely, we identify two major groups of requirements: functional requirements, that match the use cases; and non-functional requirements, that match the common needs that the system should satisfy independently of specific functionalities.

3.1 Functional Requirements

RS provides a personalized service for different types of stakeholders. It can be seen as a "multifaceted portal for the Portuguese K-12 teaching system", becoming the personalized portal for schools, students, parents, teachers and administratives. We identify the main functionalities of the RS based on these stakeholders: **Administrator, MinistryOfEducation-User, School-SuperUser, School-Executive, School-Administrative, School-ClassDirector, Student, Teacher and Parent.**

Like other ASP applications, the responsibilities of each user are based on the chained delegation approach and profile management. The "Administrator" actor is the user with more power on the RS, in particular she can manage schools, and for each school she can manage the School-SuperUser accounts. The "School-SuperUser" actor is responsible for the configuration of school data and for the management of other school users, such as "School-Executive" or "School-Administrative" that performs very important roles in school administration and management.

"Student", "Teacher" and "Parent" are not school-level users; they are global-level users. This means that students and teachers should have a global identification, independently of the current school association. The same should be verified for parents: independently of the number of students associated, and the different school registrations, the parent should not have to manage various system user-accounts to access the data of their dependent students.

This issue of global identification of students, teachers and parents (independently of the school and the academic year) is novel and we expect that it can bring a real impact in the quality level regarding the management of the education system. Namely, it can bring the following contributes (1) a better and simple way to record history and curriculum of the different actors; (2) a more integrated and personalized service can make possible a simpler, direct and easier interaction; and (3) a significant simplification in the administrative processes such as school registrations, student transfers and evaluation.

3.2 Non-Functional Requirements

Non-functional requirements have to do with general aspects of the system like performance, robustness, liability, distribution, security, integration with the Internet and opening to standards. We identify in this project the following non-functional requirements: **Usability, Performance and scalability, Local and access type independency, Privacy and confidentiality, Openness and integration with other systems, Messages and alerts delivered through multiple channels.**.

4 Rent@School Architecture

In this section we discuss important topics related the RS architecture, a well as its mechanisms to support open-interface and interoperate with other systems.

4.1 Distributed Single Instance Architecture

In order to satisfy the general requirements identified in Section 3, in particular the non-functional requirement of "local and access type independency", RS should have necessarily to be developed based on a web information systems architecture.

RS follows the typical ASP model, in a way that it provides several functionalities to a selected range of actors that have previously subscribed to the system. Additionally, those functionalities are supported by a complex information system, kept and managed by a credentialed entity and responsible by supporting a number of quality of service parameters, such as performance, security, privacy and confidentiality of data, and liability. This entity – the RS manager – can be a telecommunications operator and/or an institute related to the Ministry of Education.

The main advantages present in this model resides in the fact that the participant actors never have to be worry about technological issues, such as: installation, licensing and configuration of applications; data quality; backups; availability of computing systems; or even issues concerning the updating of new versions. On the other hand, this model requires that the support computing architecture provides extremely large performance and scalability levels (thinking on the huge number of potential users), and doesn't allow for an eventual decentralization and autonomy of the information systems at the regions level (e.g, at DRE and CAE level) or even at the school level.

4.2 Distributed Multiple Instance Architecture

In order to solve the problems referred on the previous paragraph, we propose (to be developed in the second phase of the project) a novel architecture based on multiple instances of RS.

This architecture consists in multiple instances of RS, which can be installed at different management levels of the public education system hierarchy. For example (without considered the central/national level): at regional level (e.g., at all DRE); at school-clustering level; or even in a mixed way, such as at the central level and at the school-clustering level for the ones that may have technical conditions to operate one RS instance.

Although there are some variants in the way the deployment and configuration of the several instances are performed, we assume in this article for the sake of simplicity, that the various instances would be installed at the school-clustering and therefore, every school belonging to its school-clustering share the same RS infrastructure.

The main aspects that this architecture intends to improve, relatively to the single-instance architecture, are:

- *Performance and scalability of the global system* : The fact that there would exist multiple instances has as direct consequence in the multiplication of access points, as well as in the distribution of the total charge of the system along those different points, and so the overall system would provide a better performance and a better scalability.
- *Decentralization and autonomy.* This is one of the main advantages of this architecture, which would allow that RS's instance configuration and management would be as close as possible to the communities that most use it: the schools. Among other factors, we may work in a more productive way and answer more quickly and in a more agile way to the identified requirements. In case the central/national instance would be temporarily deactivated, the regional/local instances could be working adequately in the schools. It is important to notice that although a very significant number of functional requirements (e.g., most use-cases that are performed by teachers, students, class directors and school administrative) the accesses are performed directly on the regional/local RS's instances; other functional requirements (e.g., the parents authentication, the teacher record and historic search) will still require access to the central/national RS's instance.

On the other hand, in spite the several advantages, this architecture requires significant issues that should be adequately analysed and supported in a concrete implementation of the system. Namely (1) every instance should be installed on machines that have a permanent connection to the internet; (2) the existence of adequate technical support, preferably provided by an entity that is external to the schools; and (3) the existence of adequate management support (typically developed by the school's executive committee).

4.3 Interoperation Mechanisms

One important and complex aspect for the success of the distributed architecture is the existence of interoperation mechanisms between the central/national and the regional/local instances, in the support of the adequate distribution and information management and of some general use cases.

On the other hand, in order to support normal complementarities between RS and other information systems in the education domain, and in order to satisfy the non-functional requirement "openness and integration with other systems" (§3.2), it is relevant the public specification and exposal of a basic set of interfaces and services according to the common Internet technologies, actually designated as "web services" [6, 7].

There are some ways to describe the concept of "web service". Maybe the simplest one is the following: "a set of operations that are available at the global scale through an electronic address of the type URL". One other one, more generic, defines a web service as "an interface that describes a collection of operations that are accessible from the network through a mechanism of XML standard messages". The web services underlying technology is strongly based on the Internet, its technology and standards, such as TCP/IP, URL, XML, HTTP or SMTP. The TCP/IP, HTTP and SMTP protocols take the general role of guaranteeing the transport of messages between the web services; other protocols may also be used, such as FTP, MQ or IIOP. However, due to its ubiquity, HTTP takes the role of the *de facto* standard as a transport protocol of the exchanged messages between web services. On the other hand, to some levels, XML plays a basic role in web services, such as a mechanism of description of the data independently of the programming languages, operating systems, and computer architectures.

5 Rent@School Current state

As previously referred, RS is a project in development, being on its first iteration, in which a first prototype is being developed based on the distributed single instance architecture, but already with support for the generality of the actors and representative use-cases. For the second iteration we aim to explore the multi-instance architecture and mechanisms related to openness and interoperation.

According our plan, the first iteration takes place until September of 2002 (started in September of 2001), and the second iteration would be developed between May of 2002 and December of 2003. It is still left open the possibility of transferring the RS technology to an institutional or enterprise context that would promote and adequately support it. For more details regarding the utilization or evaluation of the RS's state the reader can consult [2, 3, 4].

6 Conclusion and Future Work

In this paper we propose and discuss the main ideas of an ambitious project that can contribute to a better future for the management of the Portuguese education system.

The RS presentation in this paper was deliberately positioned at a high level, particularly by drafting its main requirements, possible information system architectures, and integration technologies. Other documents describe the current state of the project at a detailed level, namely: the "requirements and business analysis" document [3] or the "end-users point of view" document [4].

We plan the development of this project, in research and prototype terms, along the next sixteen months and based on two iterations. The first iteration has already started and is expected to finish on September of 2002. Its main objective will be the development of a prototype application, based on the distributed and single-instance architecture, to demonstrate the original concept.

The second iteration should start next months and it is expected to finish on December of 2003. Its main interest would be the design and implementation of the RS's open and public API, as well as, the research and discussion related to organizational and information system architectures.

References

[1] Roberto Carneiro (2001). *O Futuro da Educação em Portugal: Tendências e Oportunidades, Um estudo de reflexão prospectiva*, Departamento de Avaliação Prospectiva e Planeamento do Ministério da Educação.

[2] Rent@School Web Site. http://berlin.inesc-id.pt/rentaschool/

[3] Alberto Silva, Rui Azevedo, Gonçalo Borrêga. *Rent@School: Relatório Técnico - Descrição dos Requisitos*, February 2002.

[4] Alberto Silva, Rui Azevedo, Gonçalo Borrêga (March 2002). *Rent@School: Guião de Utilização*.

[5] E. Hobsbawn (2000). *On the Edge of the New Century*. The New Press.

[6] W3C, *Web Services Activity*, 2002, http://www.w3.org/2002/ws/

[7] WebServices.Org, *The Web Services Community Portal*, 2002, http://www.webservices.org

The Challenges of Implementing a University Copyright Policy in the Digital World

by

Donna L. Ferullo

Copyright laws are complex and can be confusing especially when trying to ascertain their applicability to digital works. Many universities have developed copyright policies to define the rights and responsibilities of their faculty, staff and students but there is a great challenge in implementing such policies. Many questions arise such as how does one reach all of the stakeholders in a university; what are the important issues for particular stakeholders such as libraries and distance learning programs; how does one educate the students about their copyright responsibilities; and how does a university navigate the legal potholes of the copyright law?

This brief paper highlights my experiences in establishing a copyright office at a major university. The University Copyright Office (UCO) at Purdue University has been in existence for two years. It was established as a result of a new copyright policy that took effect in July 2000. The policy provides some guidance about the copyright law and the expectations for faculty and staff. Students are included by referencing their honor code. The major focus of the policy is to inform the university community that they have both a legal and moral obligation to comply with the copyright law. The UCO is charged with advising faculty and staff on the use of copyrighted works for research and teaching but does not address questions of ownership of works created at the university. Educating the university community about the copyright law is also a primary responsibility of the Office.

One of the first hurdles was to develop a game plan on the best way to inform the university community that the Office existed. I met with faculty and staff from all levels and all disciplines to determine what were the questions and issues on campus and what did they think would be the best way to convey my message. It became quite apparent during the early stages that many were confused as to how copyright worked in the digital world. There was also a misconception that all educational use is fair use under the copyright law. I also discovered that many people did not even have a basic understanding of the copyright law. Even though the majority of the copyright concerns revolved around digital issues, the university community needed to have a clear, concise understanding of what the copyright law was about before they could move forward and apply the concepts to digital materials.

As I heard the concerns, I began to formulate a strategy for communicating with a diverse group of people who had very different levels of understanding. I embarked on an awareness campaign that was comprised of a combination of print, web, and targeted outreach programs.

A brochure entitled "A Guide to Copyright" was developed that condensed the fundamentals of the copyright law as it pertained to higher education. The brochure was distributed to all faculty, administrative/professional staff, and clerical staff at all of the campuses. The information in the brochure put the university community on notice that they were obligated to comply with the copyright law. As part of the educational component of the UCO, the brochure will be sent to all faculty and staff on an annual basis.

It was important for the UCO to establish a web presence on campus. The information that was included in the brochure was expanded on for the web site. Differences in the copyright law between classroom teaching and distance learning were highlighted with examples. Other components such as a Q & A section as well as a copyright news section were added. This is the second iteration of the web site and the structure and content will be changed according to the needs of the university.

The third approach was to promote the services of the Office through meetings with faculty and presentations to different groups on campus. I've worked with many of the distance learning faculty in assisting them in trying to achieve a win-win situation by using the materials they need to teach the course while still abiding by the spirit and letter of the copyright law.

Libraries also face many challenges in providing e-services and maintaining copyright compliance. There are library exemptions in the copyright law but the digital aspect for a service such as e-reserves is a bit hazy. Many times the only exemption that is applicable is fair use. Licensing access to materials is becoming more the norm for libraries than owning materials. It is therefore more important than ever for librarians to negotiate with all their vendors for the broadest possible use of materials.

The copyright issues around distance learning are certainly many and varied. The majority of concerns about copyright and distant learning revolve around what is allowed and what is not allowed for various formats of materials. Unfortunately, there is no easy answer. Many times it comes down to applying the fair use doctrine when no other copyright exemptions are appropriate.

One of the first myths that needed to be debunked is that distance learning does not necessarily mean that the professors or the students have to be in a far away place. The distance could be from one building to another on campus. Distance learning for the most part means that the professor and students are not in the same place and more often than not the learning is asynchronous.

The second myth is that everything on the Internet is free and clear to use. Many believe that no one owns the material that is posted. It is sometime difficult for many to understand that a work on the Internet enjoys the same copyright protection as a book or a journal article.

The third myth, as mentioned above, is that all educational use is fair use. Granted, fair use is probably the most utilized exemption in higher education for anything that occurs outside face-to-face teaching or classroom teaching but that does not automatically mean that every use falls within that exemption. It is critical that the university community understands the four-factor fair use test and can articulate the applicability of it to their situation. If they have made a good faith determination that their use is fair, a court can reduce the money damages if the university and/or employee are found guilty of copyright infringement.

The student honor code encompasses the rights and responsibilities for students during their tenure at the university. This certainly includes the expectation that they will comply with the copyright law. It has been my observation that students are unaware of exactly what the copyright law is and how it applies to them. Current and future students learn differently than many of their older professors. Their learning style is much more e-based than print based. To many students everything they need is on the Internet and many lack the ability to differentiate and critically evaluate the information and the source of the information such as what is provided for them through the library like full text journal databases and a web page posted by a group or an individual. If they can freely access it then it must be free. In their minds free access is equal to free use. So it is even more critical than ever for students to understand the copyright law. But how does a university make that happen? I maintain that the professors play a crucial role in educating the students not only in their discipline but also in the more fundamental requirements of the academy such as compliance with the copyright law. Educate the professor to educate the student.

In this litigious society universities must take precautions to protect themselves from both frivolous and valid law suits for copyright infringement. One of the best defenses to any such suit is to have developed and implemented a copyright policy. It is also very important that the university community be constantly aware of their responsibilities under the copyright law. A comprehensive and systematic program of copyright education and awareness will go a long way in minimizing the number of lawsuits and protecting the university.

The University Copyright Office at Purdue is still in its infancy stage but certainly great strides have been made. The number of questions that were generated by the brochure, web page and speaking engagements has risen over 500% from the first year to the second year and I fully expect that increase to continue as the Office becomes firmly entrenched in the infrastructure. I have concluded that one of the measures of success is that many people are now able to identify a potential copyright issue. They might not have the answer but they have recognized that there is an issue. The combination of that recognition and the resources of the UCO result in a win-win position for the university.

Interactive Video Content Supporting CSCL Environments

Matthias Finke
Department of Mobile Information Visualization
Computer Graphics Center
Germany
E-mail Matthias.Finke@gris.informatik.tu-darmstadt.de

Abstract: Creating knowledge within a community on the Internet is performed with great success. Thereby, *computer supported collaborative learning* (CSCL) environments use different media formats to convey information content and to establish communication channels between participants. With this paper, we announce a design approach integrating *interactive video* content as the basic media format into a CSCL environment in order to meet the requirements for group discussion concerning knowledge creation. A system prototype has been designed with an emphasis on a navigation model for supporting the community members.

Introduction

The Internet is a global network that relies on user interactivity. The world largest hypermedia system, the World Wide Web (WWW), which is based on the Internet, was introduced in the early 90's. Due to bandwidth limitation text based information was mainly transmitted within the WWW at that time. The development of the Internet enables today's user to transmit and retrieve multimedia content like sound, images, graphics, etc. The use of the medium *video* has become quite popular on the Internet and the amount of available content is growing rapidly. Higher bit rates, which means a faster transmission of data, new compression techniques and new transfer technologies, like the streaming technology, make it possible to transmit video content on the Internet today. A rather new video format that can be found on the Internet is called *hyper video*, also denoted as *interactive video* (IAV). The general target of interactive video is to integrate the user within the presentation and to provide him with an active role that encourages him to exert influence on the way the content is presented.

We denoted interactive video as a composition of video and additional information. Additional information supports the video and can consist of different media formats, like audio, images, graphics, animation, etc. Interactive video content enables us to combine additional information with objects within a video sequence. A number of projects have focused on this subject since the beginning of the 90's as described in (Sawhney 1996 and Stotts 2002). So far, interactive video content over the WWW is determined for presentation purposes, allowing a user to view the video content and to interact with video objects in order to request additional information. This interactive presentation form has been used in e-learning environments to support the process of knowledge creation as described in (Guimarães 1999).

Creating knowledge is a process often performed by a single person, for instance, by utilizing the WWW. A different approach to creating knowledge is *collaborative learning* (CL) within communities. Within these communities, users may discuss topics or problems. Communities can have a number of different objective targets, for instance, to share experiences or to work.together on complex problems, which might be very difficult to solve by a single individual. A discussion on the WWW can be of synchronous character, like *chat-rooms* or asynchronous character, like *new groups*. CSCL can be understood as a form of knowledge creation based on group discussion that relies on both the information exchange and retrieval between distributed community members in a network.

The WWW is a basis for many communities exchanging and retrieving information content consisting of different multimedia formats to perform group discussion. So far, little has been done to provide communities with multimedia tool sets allowing them to use video content as a basis for their distributed discussion. With this paper, we announce a concept that provides a system architecture for *video based discussion forums*. The problem which will be dealt with in this paper is: *How do we support video based collaborative learning within distributed environments*?

General System Approach

The popularity and advantages of digital video content on the WWW can be associated with the *dual coding theory* as described in (Paivio 1986), which is especially true for virtual learning environments. This theory attempts to give equal weight to verbal and non-verbal processing. Furthermore, it is assumed that there are two cognitive

BEST COPY AVAILABLE

independent subsystems: one is specialized for non-verbal information and one is for verbal information. Recall or recognition is enhanced by presenting information in both non-verbal and verbal form. *This is an important aspect* for our design approach, since video content is a carrier for both verbal and non-verbal information content. Learning, on the other hand, is an active process and a high degree of interactivity is important for the success of knowledge creation. Based on the consideration of video as an audiovisual information carrier and the importance of interactivity in relation to learning processes, we chose interactive video content as a hypermedia information structure for our CSCL environment.

A video based discussion forum is based on two main components: the *presentation* and the *authoring* component. The authoring component is responsible for enabling a user to contribute to the community forum. The presentation component is responsible for presenting the information content. Information content in our design approach contains the subsets *video content*, *additional information* and *navigation data*.

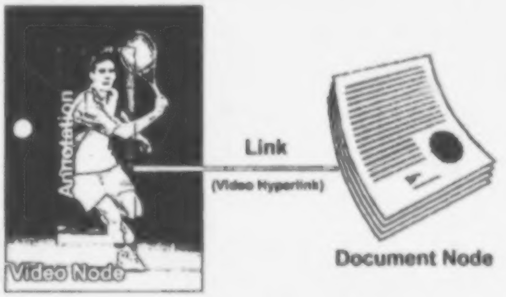


Figure 1: Video Object Linked to Document

The interactive video structure used in this system approach is based on the *Dexter Hypertext Reference Model* (Halasz & Schwartz 1994), including the notation of *links* and *nodes* that is the essence of hypertext. A *video node* can be associated with a video object like a *tennis player* in a tennis match. In contrast to a node in a hypertext document, a video node in an IAV has a spatial and temporal characteristic, since it can move within a video sequence. A video hyperlink consists of two endpoints: a video node that is associated with an object in a video sequence and a document node providing additional information about the video object. The result of the combination of video and additional information with nodes and links spans an information space, which we denote as a *video based hypermedia information structure* (VHIS). The activation of a video node leads via the video hyperlink to the presentation of the associated document node. In addition, the visualization or annotation of the video node within the video sequence supports the user with the navigation. Figure 1 shows the relation between video node, video hyperlink and document node.

An authoring component is needed when a user provides his contribution by extending the interactive video content. The authoring component can be divided into *video node authoring* and *video hyperlink authoring*. Since a video node is associated with a video object, *location data* is needed to determine the position of the video node. The generation of location data is a demanding task, see (Finke 2000). The authoring process concerning the generation of video hyperlinks is rather straightforward. The user selects a video node and defines a new video hyperlink and the document node, which is presented after activating the video node.

The video based hypermedia information structure described here can become very complex and unmanageable for the community participants. This could reduce the effect of knowledge creation within the group. Therefore, we introduce a concept to support the navigation capability of a user in such a CSCL environment. This concept visualizes the hypermedia structure, showing the user the availability of hyperlinks in a video sequence. In addition, when a member provides information for the community discussion, he has to provide additional *meta data* that specifies his contribution. The meta data set includes *user name*, *time*, *media format*, *user comment* and a *contribution category* and will also be visualized in order to support user navigation. Furthermore, this concept will support the communication within the community discussion.

System Design

A first prototype presents the *video content*, the *additional information* and provides an *authoring tool set* to extend the interactive video content with user contribution by combining video nodes with document nodes via video

BEST COPY AVAILABLE

hyperlinks. In addition, a discussion board is implemented in the system design, visualizing in a first approach the video hyperlink structure combined with the meta data, which describes every contribution. The discussion board helps the community members to get an overview of the ongoing discussion. Furthermore, it helps them to navigate within the interactive video structure. These functionalities are important aspects for our CSCL system design.

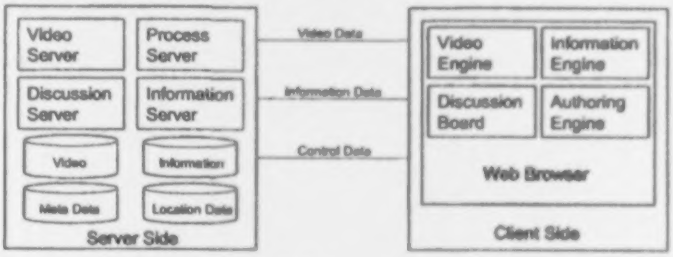

Video Server
Process Server
Discussion Server
Information Server
Video
Information
Meta Data
Location Data
Server Side
Video Data
Information Data
Control Data
Video Engine
Information Engine
Discussion Board
Authoring Engine
Web Browser
Client Side

Figure 2: Reference Model

The system is designed as a server-client architecture enabling asynchronous group discussion for community members. Using the Internet, the system is implemented in a WWW environment using a Web browser on the client side to visualize the interactive video content and the discussion board, including a tool for providing user contribution. Figure 2 shows the main system components. On the server side, a video server streams the video content towards the client side. The information server receives the request regarding an activated video hyperlink. In addition, this server receives the meta data and the contribution of the users. The discussion server generates information for client navigation purpose based on the meta data and the dynamic interactive video structure. On the client side, there are four main components. The video engine presents the video content and is the user interface for every interaction regarding the video hyperlinks and the video controlling. The information engine represents the discussion contribution of the community members. The discussion board presents the video based hypermedia information structure in combination with the meta data. Based on the authoring engine, contributions can be provided by the community. Figure 3 shows a screen shot of the Web application. The client application front end is divided into four areas. If a user clicks with the mouse pointer on a video object, which is combined with a video hyperlink, the associated document is presented in the information window. In addition, the content of the discussion board is synchronized with the video *play-time* and will always be updated when an interaction with a video object occurs.

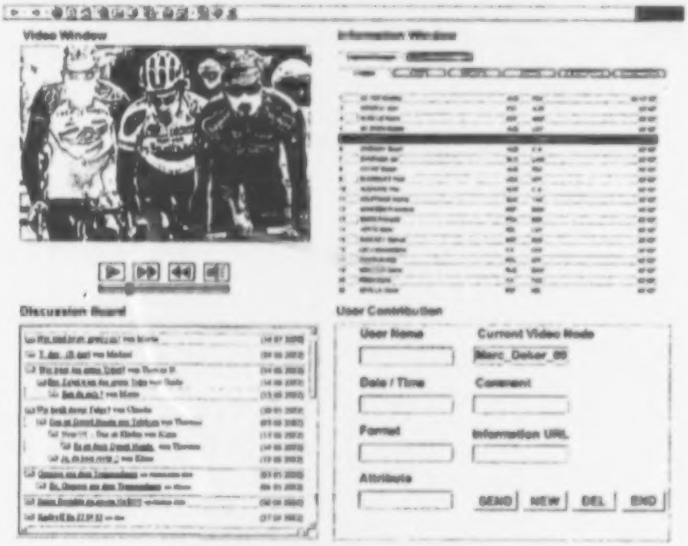

Video Window
Information Window
Discussion Board
User Contribution
User Name
Current Video Node
Marc_Deker_08
Date / Time
Comment
Format
Information URL
Attribute
SEND
NEW
DEL
END

Figure 3: Web User Interface

BEST COPY AVAILABLE

User Scenario

Figure 3 shows the Web application on the client side. Upon user request, the video nodes are annotated within the video stream, visualizing the video hyperlinks and thus the existence of additional information. When a user wants to activate a video hyperlink, he clicks on a video object in the *video window*. The *information window* then presents the additional information (user contribution) and the *discussion board* is updated. In the *discussion board window*, the meta data *user name*, *user comment* and *time* associated with the contribution is shown and graphically highlighted. If the user clicks on this highlighted data set entry, then the complete meta data set is presented within the *user contribution window*. This is one way to navigate through a video based discussion forum.

Another way to navigate in the video based discussion forum is by scrolling the *discussion board* entries. If a user finds an interesting entry, he clicks on it in the *discussion board window*. The *video window* then jumps to the video sequence in which the video object can be found that is associated with the entry in the *discussion board*. Furthermore, the *information window* presents the user contribution associated with that entry and the full meta data set is presented in the *user contribution window*.

As mentioned above, these two navigation options lead to the presentation of the meta data set in the *user contribution window*. In addition, the *current video node* name is also presented there. If a user wants to provide a contribution to the current video node, she chooses the NEW option and fills out the form in the *user contribution window*. The contribution along with the meta data is then sent to the server with the SEND option. A user can always delete his contribution with the DEL option. At this stage of the development, the additional information denoted as the user contribution is given in form of URL addresses.

Conclusion

We have described a video based discussion forum that takes advantage of interactive video content. Community members can exert influence over the way the interactive video based information is presented. In addition, users can insert additional information in to the interactive video structure by defining new video nodes and links into the interactive video structure. With this approach, users can exchange and share their experiences and views by inserting additional information into the presentation platform and thus into a dynamic *video based hypermedia information structure*. The integration of an advanced discussion board supports the navigation within the information structure for the community members. Since the complexity of such a hypermedia information structure can easily become quite large, a mechanism for navigation purposes is mandatory. This concept along with the integration of meta data sets is the basis for an enhanced navigation model, which provides a better understanding of the information content within a community discussion and supports the success of knowledge creation.

References

Guimarães, N. (1999). Towards Hypervideo on the Web", Proceedings of IMSA99, Third IASTED International Conference on Internet and Multimedia Systems and Applications, Grand Bahamas.

Finke M. (2000). An Architecture of a Personalized Dynamic Interactive Video System, Digital Content Creation Conference, Bradford, UK.

Halasz, F., & Schwartz, M. (1994). The Dexter Hypertext Reference Model: Hypermedia, Communications of the ACM, Vol. 37, No. 2, pp. 30-39.

Paivio, A. (1986). Mental Representation, A Dual Coding Approach, Oxford, u.a.: Oxford University Press, Inc., , pp. 53-83.

Sawhney, N. (1996). HyperCafe: Narrative and Aesthetic Properties of Hypervideo, Proceedings of the Seventh ACM Conference on Hypertext. New York: Association for Computing Machinery.

Stotts, D.(2002). Hypervideo Support for Distributed Extreme Programming, Technical Report, Department of Computer Science, University of North Carolina, March.

DISTANCE LEARNING AT SECONDARY LEVELS: CONTEXTS AND NORMS FOR THE LEARNING OF MATHEMATICS

Josep M Fortuny ,Universitat Autònoma de Barcelon, Joaquin Giménez, Universitat de Barcelona, Spain. Philippe Richard, University of Montreal , Canada

Distance Learning for Secondary Education

Since 1998 the Departaments de Didàctica de la Matemàtica i les Ciències Experimentals of both Universitat Autònoma de Barcelona & Universitat de Barcelona, develop a research project concerning the use of the Internet to attend those students who are not able to go to school regularly, specially those at the hospital or at home (Gimenez & Fortuny, 2000), and high performance athletes (Figueiras, 2000). In other papers we have discussed some aspects relating the communication model used by tutor and students under the influence of technology - web pages, e-mail, electronic forums, - and the impact that a virtual tutor has on the students participating in the experience (Figueiras, 2000; Fortuny et al. 1999). Specially in mathematics, the syntax of its language shape some of the learners' actions to make the others know about their progress.

We also detect a great influence of tutor's and students' context arising from the case studies carried out on statistics, algebra and geometry. It is an influence on both the way they manage the experience of learning at a distance, and the way they access to the contents,. This and its contribution to the norms they agree for developing the experience are the discussion points of this paper.

A great amount of the work carried out on distance training and self-learning attend university or professional levels, for it aims to be used by those adults who engage a working society highly influenced by the actual self-learning paradigm. Within this frame, it is supposed that many of the knowledge that people have when access to a job has been acquired using self-learning programs and, moreover, that it is an up to date learning (Duart, 2000; Guigou, 1999). However, this paradigm is quite different when adapting and justifying the use of new technologies for communication in secondary levels of education, for aspects such as affect, curricular constraints, and the influence of technology on the motivation and willingness to learn, become more valued (Brieba, 2000): Personal contact among peers and teachers has a high relevance at this level of education and responses to questions concerning why should we introduce distance learning experiences has not an immediate answer. Standards for secondary education emphasise objectives to be carried out in a classroom setting, such as peer-discussion in a community; handling of objects in the space; learning how to speak and moderate a debate; and we are far away from consolidated proposals joining the use of distance learning to the objectives of the actual curricula. Rejecting simplistic approximations concluding if the conversion from a non-technology-oriented course structure to a technology-oriented one led to a quantifiable difference of any sort, our commitment in this specific project is a social and politic one: distance education at a secondary level to attend those people for whom it seems to be the best opportunity, specially the use of the Internet.

Dynamic contract, sociomathematical norms and context influences

Different situations led us to adapt learning units for learning at a distance to the different contexts in which the learners develop their activity. Evidence in the cases studied suggests focus in the way it modifies the design of the learning environments and curricula adaptation for each setting.

The influence of the family is an important factor to take into account with hospitalised students (Muria et al. 2000). When students work at home, and even when they communicate with their tutors, usually do it in the company of their relatives, who work with them. If the correspondent activities do not take into account this factor, there is no possibility for the tutor to follow the student by observing only their communication via e-mail, and there is a need to engage the family in the experience and make explicit their role together with the ones of tutors and students. This is the main point to create a new setting for learning and not to force the students to reproduce at a distance the norms and constraints which they have learnt that prevail in the classroom.

This must be also applied to the case of high performance athletes, who due to sport training must be absent from school for long periods of time. However, the role of the family has almost no influence when planning or designing the environment to be used during the tutorial, but the hard training sessions and press of the competition arise as the main factors that mould the learning experience of the student:

> *I am a bit lost with these of determinants. I did not know how to do anything for you and I hope that you will help me tomorrow. The videoconference doesn't work, it may be the change of the modem, I don't know. Let's meet tomorrow at 12h o'clock to communicate by telephone or chat. Maybe that the championships are coming closer and I cannot concentrate.* (Figueiras, 1999)

This kind of assertions are a key to adapt the contents to the special situation of the student, and shows not only the influence of the natural context in the student's activity, but the implicit agreements arising during the experience. It is important for the tutor to recognise it as a new agreement in the relationship that he/she construct with the student. In the example above, the student assumes that the high grade of flexible learning permits him to look for spaces of collaboration in order to cover the program. This occurs not at the beginning of the tutorial but later, while he maintains a personal relationship with his tutor.

Therefore, we face different norms or rules, what we here roughly label as *contract*, some of them implicitly assumed by the learners as a result of their interaction, and some of them stated from the very beginning of the experience (fig. 1). Moreover, these rules are continuously re-negotiated, and new ones appear leading us to a dynamic view of this contract. It is not possible to conduct the experience under the rules of a planned contract unless it deal with this dynamic process. Keys for the construction of these rules need to be recognised by the learners and, in the contexts of distance education we are dealing with, they must look for them in their written conversations via e-mail. For this reason is important to describe and familiarise with the kind of actions that permit us to communicate and collaborate at a distance. If the participants learn how to participate (by writing) on a electronic conversation and how to express ideas related to the specific contents, they mould their actions to make the other know about their own interests, implicitly or explicitly. Distance learning and people who engage on-line courses require a new interpretation of *context* and its dimensions (Badia et al. 2000).

Two main aspects are directly related with the context of the experiences we are discussing: the design of the activities concerning didactical and pedagogical issues of the course proposed, and an important and not yet sufficiently investigated question: the student's rejoining the school setting after the conducted tutorial.

Adapted Design for a dynamic process

For each one of the cases proposed to be attended, a web based environment is prepared for the student to cover the same curriculum which is considered at the corespondent school. Thus, there is a decision to give priority to the program followed by the current teacher. To this extent, the main point in the exploratory studies has been to investigate the way in which this new learning settings permit the student to follow his or her learning activities, more than to innovate or to experiment a new *mosaic* knowledge, as a hypertext system like the Internet suggest.

Interactive points have been used, discussed and analysed to know and let the learners know about socialisation roles of tutor and students, and its influence in the relationship among them and the materials. Internet is the most significant contact with the mathematical activity for these students, and giving references, using reactions, or emotional activation resources, are considered beyond a classical *talk-with-the-tutor* way of interaction. Figure 2 enlighten this points attending a personal experience of a sick student studying at home.

Design of the tutorial units and adapted curriculum

We have analysed some crucial aspects of a unified model of conducted-at a distance tutorial concerning several experiences with secondary students. It is important to emphasise the differences between this kind of precise support for some students, and general courses designed totally to be carried out at a distance, specially what concerns to design, evaluation and implement *(Muria et al 2000). In the sections above, starting from some researches on the* cases conducted in the project we offered the main points to be taken into account in the planning phase: contact with the family when appropriate; sharing from the beginning the initial rules and objectives to take into account; and flexible -collaborative, personal- design of the virtual learning environment.

But attending the end of the experience, it is more important to ensure the students' rejoining the school setting and the adaptation to the way of assessment of his or her current teacher at the school than evaluate the goals or benefits of the distance environment alone. We have detected that new habits of reading and writing, offering of open responses due to the asynchronicity of the distance conversations; and creativity arising from the contact with a virtual environment contribute to shape the learners' experience after the tutorials. Concerning the cases we are discussing here, this led us in the future to evaluate which of the interactive issues arising in the experience of learning at a distance are used by the students once they came back to their classroom setting.

This project is supported by the DGICYT, reference PB96-1201 and a grant from the Comissionat per a Universitats i Recerca de la Generalitat de Catalunya.

References

Badia, T, Barberà; E, Giménez, J & Rosich, N. (2000) *Les dimensions del context en l'educació virtual.* (Projecte IN3). Barcelona, Universitat Oberta de Catalunya.

Brieba, C. (2000) *Papel de los aspectos emotivos y afectivos en la tutorización personalizada on-line.* Unpublished manuscript, Universitat Autònoma de Barcelona.

Duart, M. (2000) *Aprendizaje sin distancias*[electronic paper. http://campus.uoc.es/web/cat/articles/josep_maria_duart.html] Universitat Oberta de Catalunya.

Figueiras, L. (1999) [E-mail correspondence from an on-line teaching experience on linear algebra] Unpublished corpus of data.

Figueiras, L. (2000) *Written discourse in virtual environments*. Universitat Autònoma de Barcelona. Manuscript submitted for publication.

Fortuny, J. M., Murillo, J., Martín, J.F., Trevijano, D. (1999). Aprendizaje sin limites. Un modelo de diseño interactivo como soporte y ampliación instruccional en la enseñanza de la geometría en la ESO. *Contextos Educativos: Revista de Educación, 2,* 27-52.

Giménez, J & Fortuny, JM (2000) Télétutorisation en mathématiques et traitement de l'heterogéneité. In: A. Ahmed et al. (eds) *Proceedings of the CIEAEM 1999*, Chichester, Elis Horword eds.

Guigou, J. (1999, December) *L' autonomisation des apprentissages dans la société capitalisée.* Plenary conference presented at the 5è. Col.loqui Europeu sobre l'Autoformació, Barcelona.

Muria, S; Latorre, R; Rosich, N & Giménez, J. (2000) *An exploratory study about the use of a statistics tutorial unit in a rich on line environment: The case Ivan.* Unpublished manuscript, Universitat de Barcelona. [Catalan version available by the authors]

DISTANCE EDUCATION AT SECONDARY LEVELS: CONTEXTS AND NORMS FOR THE LEARNING OF MATHEMATICS

Josep M. Fortuny, Departament de Didàctica de la Matemàtica i de les Ciències Experimentals, Universitat Autònoma de Barcelona, Spain, JosepMaria.Fortuny@uab.es

Joaquin Giménez, Departament de Didàctica de les Ciències Experimentals i la Matemàtica, Universitat de Barcelona, Spain, jgimenez@uoc.edu

Philippe R. Richard, Département de didactique, Université de Montréal , Canada, philippe.r.richard@umontreal.ca

Abstract:

We analysed some crucial aspects of a unified model for conducting distance tutorial concerning several experiences with secondary students. It is important to emphasize the differences between this kind of precise support for some students, and general courses designed totally to be carried out at distance, specially in relation to design, evaluation and implementation. At attending the end of the experience, it is more important to ensure the students' insertion in the school setting and the adaptation to the way of assessment of his or her current teacher at the school than evaluate the goals or benefits of the distance environment alone. We have detected habits for reading and writing, offered open responses due to the asynchronicity of distance conversations; and creativity arising from the contact with a virtual environment contribute to shape learners' experience after the tutorials.

DISTANCE LEARNING FOR SECONDARY EDUCATION

Since 1998 the *Departaments de Didàctica de la Matemàtica i les Ciències Experimentals* of both *Universitat Autònoma de Barcelona* and *Universitat de Barcelona*, develop a research project concerning use of the Internet for students who are not able to go to school regularly, specially those at hospital or at home (Gimenez & Fortuny, 2000), and high performance athletes (Figueiras, 2000). In other papers we have discussed some aspects relating the communication model used by tutor and students under the influence of technology -- web pages, e-mail, electronic forums, -- and the impact of a virtual tutor has on students participating in the experience (Figueiras, 2000; Fortuny et al. 1999). Especially in mathematics, the syntax of its language shape some of the learners' actions to make the others know about their progress.

We also detected a great influence of tutor's and students' context arising from the case studies carried out in statistics, algebra and geometry. It influenced both the way they managed the experience of learning at a distance, and the way they accessed the contents. This and its contribution to the norms they agreed for developing the experience were the discussion points of this paper.

A great amount of research on distance training and self-learning has been conducted at university or professional levels, for it aims to be used by those adults who engage a working society highly influenced by the actual self-learning paradigm. Within this frame, it is supposed that most of the knowledge that people have while accessing to a job has been acquired using self-learning programs and, moreover, that it is an up-to-dated learning (Duart, 2000; Guigou, 1999). However, this paradigm is quite different when adapting and justifying the use of new technologies for communication at secondary levels of education, for aspects such as affect, curricular constraints, and influence of technology on the motivation and willingness to learn, become more valued (Brieba, 2000). Personal contacts among peers and teachers has a high relevance at this level of education and responses to questions concerning why should we introduce distance learning experiences has not an immediate answer.

DYNAMIC CONTRACT, SOCIOMATHEMATICAL NORMS AND CONTEXT INFLUENCES

Different situations led us to adapt learning units for teaching at a distance to the different contexts in which the learners develop their activity. Evidence in the cases studied suggested focus in the way it modifies the design of the learning environments and curricula adaptation for each setting.

The influence of the family is an important factor to take into account with hospitalized students (Muria et al. 2000). When students work at home, and even when they communicate with their tutors, usually they do so in the company of their relatives, who work with them. If the correspondent activities do not take into account this factor, there is no possibility for the tutor to follow the student by observing only their communication via e-mail, and there is a need to engage the family in the experience and make explicit their role together with the ones of tutors and students. This is the main point to create a new setting for learning and not to force the students to reproduce at distance the norms and constraints which they learnt that prevail in the classroom.

This must be also applied to the case of high performance athletes, who due to sport training must be absent from school for long periods of time. However, the role of the family has almost no influence when planning or designing the environment to be used during the tutorial, but the hard training sessions and pressure of the competition arise as the main factors that mould the learning experience of the student:

> I am a bit lost with these of determinants. I did not know how to do anything for you and I hope that you will help me tomorrow. The videoconference doesn't work, it may be the change of the modem, I don't know. Let's meet tomorrow at 12h o'clock to communicate by telephone or chat. Maybe that the championships are coming closer and I cannot concentrate. (Figueiras, 1999)

This kind of assertions is a key to adapt the contents to the special situation of the student, and shows not only the influence of the natural context in the student's activity, but the implicit agreements arising during the experience. It is important for the tutor to recognise it as a new agreement in the relationship that he-she is constructing with the student. In the example above, the student assumes that the high grade of flexible learning permits him to look for spaces of collaboration in order to go through the whole program. This occurs not at the beginning of the tutorial but later, while he maintains a personal relationship with his tutor.

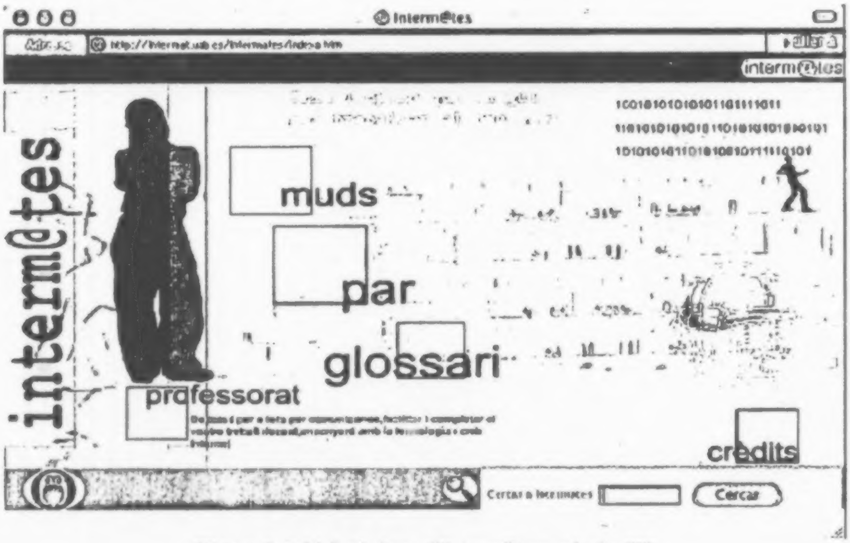


Figure 1: Initial window of Interm@tes web-site [1]

---

[1] English translations of the figures are available: http://www.mapageweb.umontreal.ca/richarp/intermates/aace/index.html

Therefore, we face different norms or rules, what we here roughly label as *contract*, some of them implicitly assumed by the learners as a result of their interaction, and some of them stated from the very beginning of the experience (fig. 1). Moreover, these rules are continuously re-negotiated, and new ones appear leading us to a dynamic view of this contract. It is not possible to conduct the experience under the rules of a planned contract unless it deals with this dynamic process. Keys for the construction of these rules need to be recognized by the learners and, in the contexts of distance education we are dealing with, they must look for them in their written

BEST COPY AVAILABLE

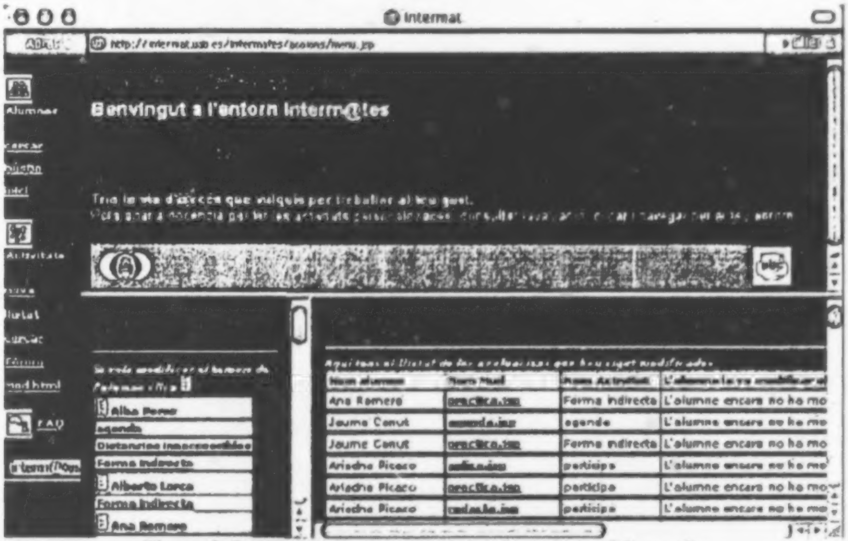
conversations via e-mail. For this reason it is important to describe and familiarize with the kind of actions that permit us to communicate and collaborate at a distance. If the participants learn how to participate (by writing) on an electronic conversation and how to express ideas related to a specific contents, they mould their actions to make the other know about their own interests, implicitly or explicitly. Distance learning and people who engage on-line courses require new interpretation of *context* and its dimensions (Badia et al. 2000).

Two main aspects are directly related with the context of the experiences we are discussing: the design of the activities concerning didactical and pedagogical issues of the course proposed, and an important and not yet sufficiently investigated question: the student's return to the school setting after the conducted tutorial.

ADAPTED DESIGN FOR A DYNAMIC PROCESS

For each one of the cases proposed to be attended, a web-based environment was prepared for the student to cover the same curriculum, which is considered at the correspondent school. Thus, there is a decision to give priority to the program followed by the current teacher. To this extent, the main point in the exploratory studies was to investigate the way in which this new learning setting permits the student to follow his or her learning activities, more than to innovate or to experiment a new *mosaic* knowledge, as a hypertext system like the Internet suggests.

Interactive points have been used, discussed and analysed to know and let the learners know about socialisation roles of tutor and students, and its influence in the relationship among them and the materials. Internet is the most significant contact with the mathematical activity for these students, and giving references, using reactions, or emotional activation resources, are considered beyond a classical *talk-with-the-tutor* way of interaction. Figure 2 enlightens this point attending a personal experience of a sick student studying at home.



Benvingut a l'entorn Interm@tes

[illegible]	[illegible]	[illegible]	[illegible]
Ana Romero	[illegible]	Forma indirecta	L'alumne encara no ha mo
Jaume Canut	[illegible]	agenda	L'alumne encara no ha mo
Jaume Canut	[illegible]	Forma indirecta	L'alumne encara no ha mo
Ariadna Picaso	[illegible]	participa	L'alumne encara no ha mo
Ariadna Picaso	[illegible]	participa	L'alumne encara no ha mo
Ariadna Picaso	[illegible]	participa	L'alumne encara no ha mo

Figure 2: Personalized gate to recognize the actions of the pupils

DESIGN OF THE TUTORIAL UNITS AND ADAPTED CURRICULUM

Mainly, the web-based environment was built in a hypertextual form starting from the disciplinary contents and technological aspects. The disciplinary contents were structured according to a catalogue of key questions which cover of compulsory secondary education, age 12 to 16, adapting at the beginning the modular base and the pedagogical principles of *Bon dia Mates* project – curricular material which was financed, diffused and published in paper version by the *Departament d'Ensenyament* of *Generalitat de Catalunya*, of which a static web version by the *Programa d'Informàtica Educativa*. However, the access to the contents, which vary with the needs of the users, is possible not only starting from a glossary, blocks of matters, a set of questions-answers game and an internal search engine, but also starting from mini didactic units (fig. 3). The latter were organized

BEST COPY AVAILABLE

to launch a progressive study of the key questions with various points of interactivity, including elements of orientation, regulation and synthesis for the pupil and the teacher, in addition to the possibility of communication with the peers or the tutor. In the case of complex key questions, as on figure 3, we developed the organization of the tutorial units thanks to behavioural research (Richard, 2002).

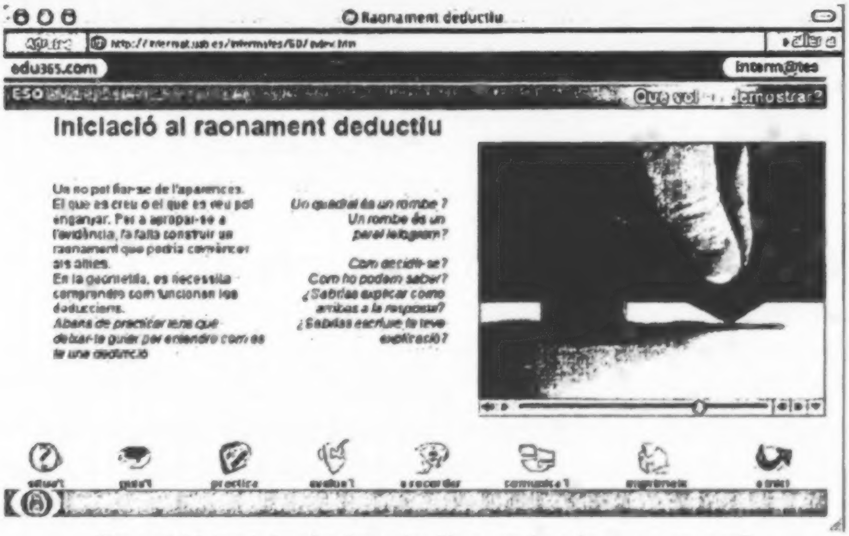


Figure 3 Main window for the study of key question *what means to proof?*

REFERENCES

Badia, T., Barberá, E., Giménez, J. & Rosich, N. (2000). *Les dimensions del context en l'educació virtual* (Projecte IN3). Barcelona: Universitat Oberta de Catalunya.

Brieba, C. (2000). *Papel de los aspectos emotivos y afectivos en la tutorización personalizada on-line*. Unpublished manuscript, Universitat Autònoma de Barcelona.

Duart, M. (2000). *Aprendizaje sin distancias*. Retrieved August 18, 2002, from Universitat Oberta de Catalunya Web site: http://campus.uoc.es/web/cat/articles/josep_maria_duart.html.

Figueiras, L. (1999). [E-mail correspondence from an on-line teaching experience on linear algebra]. Unpublished raw data.

Figueiras, L. (2000). *Written discourse in virtual environments*. Universitat Autònoma de Barcelona. Manuscript submitted for publication.

Fortuny, J. M., Murillo, J., Martín, J.F. & Trevijano, D. (1999). Aprendizaje sin límites. Un modelo de diseño interactivo como soporte y ampliación instruccional en la enseñanza de la geometría en la ESO. *Contextos Educativos: Revista de Educación, 2,* 27-52.

Giménez, J. & Fortuny, J.M. (2000). Télétutorisation en mathématiques et traitement de l'hétérogénéité. In A. Ahmed et al. (Eds.), *Proceedings of the CIEAEM 51*. Chichester: Elis Horword.

Guigou, J. (1999, December). *L'autonomisation des apprentissages dans la société capitalisée.* Plenary conference presented at the 5è Col.loqui Europeu sobre l'Autoformació, Barcelona.

Muria, S., Latorre, R., Rosich, N. & Giménez, J. (2000). *An exploratory study about the use of a statistics tutorial unit in a rich on line environment: The case Ivan.* Unpublished manuscript, Universitat de Barcelona. [Catalan version available by the authors].

Richard, P. R. (in press). *Modélisation du comportement en situation de validation*. Bern: Peter Lang.

ACKNOWLEDGEMENTS

The authors wish to express their gratitude to *Comissionat per a Universitats i Recerca de la Generalitat de Catalunya* and *Proyecto Sur de Ediciones S.L* for their support. This research has been supported by DGIGYT (Spain) under Grant PB96-1201.

BEST COPY AVAILABLE

Privacy and Anonymity in an Online Course: Perceptions and Expectations of Distance Education Students

Dannie B. Francis, Department of Adult Learning and Instructional Technology, University of Wyoming, United States, DannieFrancis@email.msn.com

Guy M. Westhoff, Department of Adult Learning and Instructional Technology, University of Wyoming, United States, westhoff@uwyo.edu

Abstract With the emergence of the Internet and the increased use of online courses, email, and chat rooms, the issues of privacy, anonymity and the security of personal information have evolved to a new level of importance. These issues have been discussed extensively as related to open access of online services, but have only lightly been addressed with regard to students in online courses. Online distance education courses bring into play a new set of classroom variables and factors, particularly the attitudes and expectations of distance education students who are making use of the Internet to further their education. This study sought to answer the question: What are the perceptions and expectations of students in an online course with regard to privacy and anonymity? Results indicated that the respondents shared a noncommittal attitude toward privacy and anonymity issues expressed a lack of concern for the issues.

Introduction

"The fundamental concept of distance education is simple enough: teachers and students are separated by distance and sometimes by time" (Moore & Kearsley, 1996, p. 1). Correspondence and independent study courses were the first generation of distance education classes. "The earliest documented home study course offered in the United States was shorthand" (Moore & Kearsley, 1996, p. 20). The State University of Iowa began radio broadcast courses for credit in February of 1925 and followed up in 1934 with courses in oral hygiene and identifying constellations through television broadcasts (Moore & Kearsley, 1996, p. 27). This ushered in the broadcasting and teleconferencing era of distance education. The Open University was introduced as a key player in distance education in the 1960's and 1970's. In 1991 the World Wide Web introduced us to the third generation of distance education classes. "By June 15, 1995 seventy three percent of the countries of the world were Internet connected to some degree" (Khan, 1997, p. 20) and online classes were ready to be launched into homes all across America.

The relatively recent phenomenon of online education has opened the door to many research opportunities. Among the research options have been several studies conducted concerning privacy and anonymity of persons who use the Internet (Bodi, 1998; Descy, 1997; Metivier-Carreiro & LaFollette, 1997; Singleton, 1998). While privacy issues are not unique to the Internet, Holt (1998) reminds us that "risks may be magnified by the power and reach of electronic systems," and to date studies have not addressed students of online classes. This study will specifically address such students and ask the question, "What are the perceptions and expectations of online students with regard to privacy and anonymity?"

Privacy is defined as all information available in an online class, which can be used to identify the student taking the class. Examples of privacy information for students include name, address, phone number, age, gender and social security number. Anonymity is defined as the ability to take a class without other individuals being aware of your identity or personality. An example of this would be allowing students to use an alias for class instead of their real name.

The face-to-face interaction of the traditional classroom usually results in students revealing some components of their personality. Race, gender and age are examples of traits that are immediately open to the scrutiny of other students while grooming habits, shyness or a tendency to be outspoken are traits that might reveal themselves over a period of time. Distance education, and more specifically, online courses bring into play a new set of classroom variables and factors (Holt, Kleiber, Swenson, Reess & Milton, 1998). Students who are typically reserved in a traditional classroom might "blossom" in an online class and with greater participation by a larger number of students, the usually dominant personality might become just another voice in the class.

Because there are environmental differences between traditional classrooms and online courses this study will explore what expectations and perceptions exist with regard to privacy and anonymity in online courses. Other studies have shown that individuals who utilize Web-based commerce such as email and chat rooms do expect some level of security with regard to their privacy, and educators should be aware of this concern for their online students (Holt, 1998).

In a study conducted at the University of Wyoming (Novick & Francis, 2001) a class of twenty-nine students were surveyed for their opinions on privacy and anonymity within their online courses. Of the twenty-nine students surveyed slightly over forty-one percent responded. Of the students who responded, those who had taken two or more online courses showed less concern over privacy and anonymity issues than those who were new to online education. The strongest reactions were to the question, "Should a student be able to use a pseudonym for chats and threaded discussions?" A little over eighty-three percent of the respondents disagreed or disagreed strongly with this concept. Mild concern was expressed over the sharing of home phone numbers and addresses while video streaming for chats and biographies were basically neutral showing no concern against or enthusiasm for the concepts. A copy of this study is available in the 2001 National Meeting proceedings from AECT.

Methods

Students in outreach programs offered by the University of Wyoming were offered the opportunity to complete an online survey regarding attitudes towards issues of privacy, anonymity and personal information sharing in an online educational environment. The survey was offered in April and May of 2002. The survey instrument was built in Macromedia's Dreamweaver 4 software using radio buttons and text boxes as the response method. The URL for accessing the survey was sent to students by email with the assistance of the University of Wyoming Outreach School. Students who chose to participate were asked to select the provided URL and complete a questionnaire consisting of a demographics section and twenty attitude questions. The attitudes questions were rated on a Likert scale with five categories ranging from strongly agree to strongly disagree.

The responses were submitted via the Internet directly to the researcher when the respondent chose a submit button at the end of the survey. Likert responses were weighted one through five. The responses were tallied with a strong concern for privacy or anonymity resulting in a high score (5) while a strong preference for openness or minimal privacy and anonymity resulted in a low score (1). Of the twenty questions ten were related to issues of privacy and ten were related to anonymity. Statistics were performed using SPSS.

Findings and Conclusions

This study showed that online distance education students had similar attitudes towards issues of privacy and anonymity within the online course. These attitudes were noncommittal and expressed a lack of concern or previous thought about the issues of privacy and anonymity. Moss (2000) identified that users of chat rooms and e-commerce expect a certain level of security. However, from the results of this study it appears that students in an online distance education course do not. This result could be attributed to the fact that these online students are interacting within an environment where access is controlled via password protection.

The increase in web-based distance education courses and entire degree programs offered online, it is important to determine student attitudes toward the issues of privacy, anonymity, and sharing personal information and the degree these attitudes impact the success of the course and students in online courses. Future studies need to be conducted to ascertain specific attitudes related to the issues of privacy, anonymity, and the sharing of personal information by the students in an online distance education course.

References

Bodi, S., (1998). Ethics and information technology: Some principles to guide students. *Journal of Academic Librarianship*, 24 (6), 459-63.

Descy, D, (1997). The Internet and Education: Some lessons on privacy and pitfalls. *Educational Technology*, 37 (2), 48-52.

Holt, M. E., (1998). Ethical Considerations in Internet-based adult education. In B. Cahoon (Ed.), *New Directions for Adult and Continuing Education*. Jossey-Bass, San Francisco, CA.

Holt, M. E., Kleiber, P. B., Swenson, J. D., Rees, E. F., and Milton, J., (1998). Facilitating group learning on the Internet. In B. Cahoon (Ed.), *New Directions for Adult and Continuing Education*. Jossey-Bass, San Francisco, CA.

Kahn, B. H., (1997). *Web-Based Instruction*. Englewood Cliffs, New Jersey: Educational Technology Publications.

Metivier-Carreiro, K. and LaFollette, M. C., (1997). Balancing cyberspace promise, privacy and protection: Tracking the debate. *Science Communication*, 19 (1), 3-20.

Moore, M. G. and Kearsley, G., (1996). *Distance Education: A Systems View*. Belmont, California: Wadsworth Publishing Company.

Moss, M., (2000, March 28). SEC's plan to snoop for crime on Web sparks a debate over privacy. *The Wall Street Journal*, p. B1, B4.

Novick, S. L. and Francis, D. B., (2001). Privacy and anonymity: Issues for online students or not? Unpublished manuscript, University of Wyoming.

Singleton, S., (1998). Privacy or freedom on the Internet: What are the conflicts between proposed new privacy laws and freedom on information. *Update on Law Related Education*, 22 (2), 16-19.

Blended Learning: What is it? How does it impact student retention and performance?

Patricia C. Franks

Many institutions have developed educational programs that provide a continuum of totally on-campus courses, supplementary Web-enhanced courses, and completely online courses (Pittinsky, 2001).

Since the early days of universities, a traditional oral lecture has been a keystone of higher education (Brusilovsky, 2000). Even distance learning is not new. Major universities including The University of Michigan and Ball State University in Indiana literally created distance learning 15 years ago as a revenue producer. Rio Salado College, one of ten colleges in the Maricopa County Community College District of Phoenix, Arizona, has provided distance learning for more than twenty years (Walczak, 1999).

Educators who have tried both approaches realize that neither the traditional lecture format nor the distance education approach is appropriate for every student, every teacher, and every course. This leads us to a third option, blended learning.

Blended Learning

A blended approach to learning is accomplished by leveraging technology to make education more accessible. "Simply put, blended learning is learning that employs multiple strategies, methods, and delivery systems ("The Node Learning", 2001)." Blended learning is sometimes referred to as "integrated learning," "hybrid learning," or "multi-method learning." The primary focus of this article is on the integration of classroom- and Internet-based resources in ways that improve conditions for teaching and learning.

To create a successful blended learning approach to teaching and learning, two tools are essential: 1) learning technology and 2) blended learning strategy (McArthur, 2001).

Learning technology enables the instructor to create course materials in different formats including printed textbooks, online textbooks, online lecture notes, QuickTime movies, CDRoms, PowerPoint Presentations, streaming media, and videotapes of lectures and demonstrations. Dr. David Rose, co-director of the Center for Applied Special Technology (CAST), believes in providing students with "multiple representations of information" and a menu of different ways to get the information they need (O'Neill, 2001).

A blended learning strategy must be developed to identify the best "blend" of strategies, methods, and medias to help students meet the course objectives.

Blended Learning as a Process

It's important to understand that instructors don't create successful blended courses in one fell swoop ("The Node Learning", 2001). The best approach is to use your course goals plus identified teaching and learning objectives as a basis for your blended course. Remember, teaching and learning come first, technology follows. Stephen Ehrmann ("The Node Learning", 2001) puts it another way: "If you're headed in the wrong direction, technology won't help you get to the right place."

Once you clarify your goals and objectives, you're ready to determine the best method to achieve them. Technology can help in one of two ways: 1) by providing administrative or logistical support for the instructor and students and 2) by enhancing teaching and learning.

If you want to develop your blended course in stages, it may progress something like this:

1. First, provide administrative and logistical support for your students and yourself by posting your current syllabus, office hours, and a list of course references on line.

2. Then add a discussion forum or chat room for students to ask questions or discuss assignments outside of class.
3. Next, post course materials such as lectures, course notes, and presentation slides online.
4. Finally, revise the entire course to take advantage of some ways in which the web can help create a more active learning environment. For example, for a class that meets for 1 hour and 15 minutes twice a week, deliver live lectures and demonstrations in a large lecture hall one day. Instead of meeting in person the second day, facilitate online group work.

Embrace blended learning if you believe it will enhance teaching and learning in your courses. But don't be disappointed if things don't work out the way you planned the first time you try this approach. Remember, blended learning is a process, and evaluation is an important part of the process. You may need to rethink the ways in which you evaluate student performance. For example, if you assign online discussion questions, you will need to determine criterion on which to base a grade for discussion responses.

Blended Learning at BCC

Until the Fall of 2001, instructors at BCC had only two options: 1) to teach in a traditional fashion without an online component for their students or 2) to teach an entire course online. There was no middle ground. Only students enrolled in distance learning courses through the SUNY Learning Network had the opportunity to interact with others in a flexible but challenging asynchronous environment. All of that changed when WebCT, an online course development and management system, was implemented. It was used to provide an online component for six courses in the Fall of 2001. By the Spring of 2002, the number of WebCT supplemented courses grew to 23.

As stated earlier, the primary focus of this article is to discuss the integration of classroom- and Internet-based resources in ways that improve conditions for teaching and learning. Instructors interested in using WebCT first considered the goals and objectives identified for their own courses and their students. Then they decided how an online supplement using WebCT could help them achieve those goals and objectives. Some decided to post course materials and engage in discussions with students. Others posted lectures and PowerPoint Presentations. Still others created online tests and quizzes.

Traditional classroom instructors weren't the only ones to recognize the benefits of using WebCT to enhance their courses. Three instructors teaching either in our synchronous distance learning room (Luminet) or teaching video-based courses decided to use a WebCT supplement to engage students in discussions, and the instructors of four SLN courses opted to supplement those courses with WebCT in order to utilize the testing component.

Comparison of Student Success Rates Determined By Completion of an Introductory HTML Course and Average Class Grades Earned

The introduction of WebCT at BCC provided many instructors with the option to incorporate web-based technology into their on campus courses. In some cases, sections of those courses had already been taught completely online through the SUNY Learning Network. For the first time, statistics could be compiled to compare the retention rate of students in blended courses with sections of the same course taught in the traditional mode and completely online. One such course is BIT 173 – Basics of Web Page Creation.

Data was gathered from two online sections of BIT 173 taught completely over the SUNY Learning System, two sections of BIT 173 taught completely on campus without the benefit of an online supplement created in WebCT, and two sections taught on campus with an online supplement. Since students taking online courses are not required to take placement tests, it is not possible to compare entry-level skills or knowledge of the students enrolled in any of the sections. Therefore, only retention rates and final grades were used in this comparison. Consistency was provided across all sections and semesters by providing students with the same syllabus; assigning the same readings, activities, and discussions; and requiring students to take the same examinations and complete the same midterm and final projects. The same

BEST COPY AVAILABLE

instructor taught each of the sections included in the study. The main difference was in the delivery method used. The figures are summarized in the table below.

Comparison of Success Rates of Students Enrolled in Different Sections of Basics of Web Page Creation Based on Delivery Method

Retention Rates and Average Grades

Delivery Method	Semester	Number of Students Completing Course	Retention Rate	Average Grade
Traditional – on campus with no web-based material	Spring 2001	49	83% (96% after students who earned a GPA of 0 were excluded)	2.67
Blended - on campus supplemented with WebCT	Fall 2001	50	79% (90.9% after students who earned a GPA of 0 were excluded)	2.896
Completely online through the SUNY Learning Network	Spring 2001 and Fall 2001	30	75% (85.6% after students who earned a GPA of 0 were excluded)	3.346

Limitations

The figures above do take into account some variables, such as the removal of one student who audited the course since no numeric grade was available. Students who earned a GPA of "0" were excluded from the computations since they completely dropped out of school. Their failure to complete may have had more to do with personal problems or second thoughts about school in general than completion of this one course. Of course, a separate study looking at retention within the college system would want to include those students.

Entrance exam scores were not available for online students and students not enrolled in a degree program, and no pre-test was given to students. Therefore, it is not possible to know if the students entered with comparable skills and knowledge.

More detailed information related to the statistics reported above will be available at the conference.

Findings

The table above highlights two outcomes in which this research was interested, retention rate within the course and average class GPA based on the method of course delivery. The traditional courses included in the study were 3 sections of BIT 173 – Basics of Web Page Creation – 2 day sections and 1 evening section. The blended courses were taught in the Fall of 2001 and included 4 sections of the same course – 3 day sections and 1 evening section. Although the retention rate and success rate as evidenced by average GPA was better for the blended course than the traditional, it is not possible to know if the fact that class sizes were slightly smaller had any impact. The completely online courses experienced the lowest retention rate but the highest GPA. One section taught in the Spring of 2001 and one taught in the Fall of 2001 were used in this study. No other sections of these courses were taught on campus in the Fall or Spring 2001 semesters.

BEST COPY AVAILABLE

In the case of the Internet-only courses, the instructor had been familiar with the software and hardware, having taught at least one online course each semester for the previous four years. In the case of the courses supplemented by WebCT, the technology was new and the semester used in this study being used on campus for the first time. It was as new to the instructor as to the students. It would be useful to compare the retention rates and average GPA by method of delivery in a second semester to this first semester to see if the instructor's familiarity with the technology has any bearing on student retention and achievement. The same instructor is again teaching 3 blended courses and 1 completely online course this semester, which ends the middle of May. The report will be updated to reflect these figures and presented at the conference.

Closing Thoughts

In the very near future, greater bandwidth, faster processing speeds, and better software will enable students to download larger files more quickly. Instructors will be able to create even more interactive and entertaining web courses. Multimedia may actually be viewed as just another teaching tool. And wireless devices will facilitate access to courses anytime and from anywhere.

In the past few years, much emphasis has been placed on the technology. Professors employing the new technology to post course materials are becoming more efficient. Now it's time to concentrate on pedagogical issues related to the use of technology to see if we can help instructors become more effective.

Those individuals who thought distance education would replace traditional classes were wrong. But so were the individuals who predicted that distance education was a passing fad. Both are here to stay – and blended learning is an exciting alternative to both.

References

Brusilovsky, P. (January 2000). Web Lectures: Electronic Presentations in web-based instruction. Syllabus, 13(5), pp. 18-23.

McArthur, J. (September 19, 2001). Blended learning: a multiple training strategy. Video Webcast. [On-line]. Available: http://www.connectlive.com/events/opm/.

O'Neill, L. (April 2001). Universal design for learning: making education accessible to all learners. Syllabus, 14(9), pp. 31-32.

Pittinsky, M. (July 2001). A convergence opportunity. Converge, 4(7), 54-56.

The Node's Guide to Blended Learning. (2001). [On-line]. Available: http://node.on.ca/guides/blended/.

Walczak, R. (April 1999). Nature abhors a vacuum. Converge, 2(4), pp. 56-61.

The Effect of Interactive Applets in Mathematics Teaching

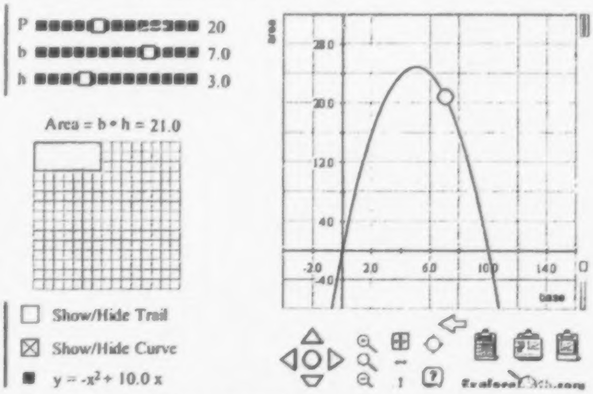
George Gadanidis
Faculty of Education
University of Western Ontario
Canada
ggadanid@uwo.ca

Abstract: Interactive applets, which are typically web-based, are the most recent manifestation of technological tools used in mathematics education. This paper briefly reports on recent case studies of three grades 5-6 and one grade 10 teacher where the use of web-based applets may have acted as pedagogical models for teachers' classroom practice, shifting the teaching focus from the learning of isolated concepts to algebraic relationships among concepts. The paper also describes an upcoming study of the affect of the availability of interactive applets on the pedagogical thinking of teachers.

Interactive applets, which are typically web-based, are the most recent manifestation of technological tools used in mathematics education. They are unique in their focus on small interactive units, due in large part to the current nature of web-access where large programs are unwieldy and quickly exhaust download capabilities and user patience. Well designed interactive applets enable students to engage in investigations of mathematical relationships without having to spend a lot of time learning how to use the tool that creates the various representations of these relationships. For example, the Maximize Area applet (ExploreLearning, 2000a), shown in Figure 1, enables students to investigate multiple representations of area and perimeter relationships. The focused and user-friendly nature of well-designed interactive applets may make them appropriate as models of mathematical concepts and of new pedagogical directions, as is the case at the Illuminations.nctm.org web site of NCTM (2001).

Some research indicates that "our thinking is deeply molded by material devices and socio-technical collectives" (Levy, 1993, p. 10). Perhaps well designed and easily accessible interactive applets that allow students and teachers to use and explore mathematical relationships may affect what Levy refers to as the "cognitive ecology" of learning environments (Levy, 1993). It may be possible that "new forms of representation change the mathematics being taught" (Confrey, 1993, p. 335). New media not only enable us to express our ideas in new ways – they also affect the ideas we have. "We don't always have ideas and then express them in the medium. We have ideas *with* the medium. Making progress is an episode of materially mediated thinking – reasoning or coming up with a new idea – happens jointly in the mind and in the medium at every stage" (DiSessa, 2000, p. 116). And perhaps more importantly, some research indicates that there may be a spillover effect, where learning to think with material devices affects our thinking even when the devices are not present (Borba & Villarreal, 1998). However, some research also indicates that attempts to change teachers' mathematics conceptions and teaching practice "are minimally effective, in part because teachers filter what they learn through their existing beliefs" (Stipek et al 2001, 214) and teachers assimilate new ideas without substantially altering existing beliefs that drive their practice (Cohen & Ball 1990).

This paper briefly reports on recent case studies of three grades 56 and one grade 10 teacher using web-based interactive applets in their teaching of mathematics. The paper also describes an upcoming study of the affect of the availability of interactive applets on the pedagogical thinking of teachers. In the cases described below, teachers were first introduced to a variety of web-based interactive applets. The teachers selected which applets to use in their teaching based on the mathematics topics in their next unit of study. The three grades 5-6 teachers chose an applet dealing with measurement (Figure 1) while the grade 10 teacher chose an applet dealing with the vertex form of a quadratic function. (Figure 2) (ExploreLearning 2000a; 2000b).



Area = b • h = 21.0

☐ Show/Hide Trail

☒ Show/Hide Curve

■ $y = -x^2 + 10.0x$

Figure 1. Maximize Area applet.

BEST COPY AVAILABLE

Brief summary of the use and effect of interactive applets

The Maximize Area applet (Figure 1) may have acted as a pedagogical model for grades 5-6 teachers' classroom practice as the approach to teaching about area and perimeter described above varies from the norm. In previous years, teachers in the study did not focus on the relationships between area and perimeter. Their typical approach to area and perimeter is more reliant on the development and use of formulas, with minimal emphasis on the relationship between area and perimeter. The grade 5 teacher said, "I think I do more the traditional way, separating the two." One of the grade 6 teachers said, "I do perimeter first." The grade 5 teacher reflected on the effect of this difference on students: "When I introduced area and perimeter [in previous years] they didn't see a relationship between the two, but when you fix one at a given constant, and you can manipulate the other, they really found that pretty neat."

The grades 5-6 teachers used the Maximize Area applet in the context of teaching a unit on measurement. They met and decided on the general direction for the classroom and online activities. The grade 5 teacher then used their ideas to develop a detailed lesson that was shared with the grade 6 teachers. The lesson plan started with the following problem: "We're going to build a pen for your dog. Your parents are going to go out and buy 24 metres of fence. You're going to build it with four sides. How are you going to get the biggest area for your dog to play?" In the grade 5 classroom, the teacher drew one possible pen configuration on the board and then asked the students to find and draw all possible configurations on grid paper. Then students developed a table of values, recording the dimensions of the pens they had drawn, and they plotted area versus length on a graph. Students had previous experiences plotting straight line graphs and were surprised that the area graph was curved. "And they said oh that's kind of a neat shape because they're used to […] getting a straight line […] and the reason I wanted to do that [in class] was because once they go to the computer that is what they are going to see. […] I didn't want them to go to the computer right away because […] I think they would see the graphs and say that's neat but not relate it to any meaning […] I think that was a big key for their understanding." The next day, the grade 5 students went to the computer lab and were asked to solve the problem where the perimeter is 20 metres. The teacher was impressed with how well students understood and solved the problem of finding the pen with maximum area. "They liked seeing this, they liked seeing the area changing." The teacher was also surprised "because I have some grade fives that are not top grade fives but all of them got it." Some students asked, "is the biggest area always a square? […] Wouldn't a circle be bigger? […] They were really thinking."

In contrast, the grade 6 teachers decided to do the computer lab component of the lesson before they did the classroom component. They did this because of minimal access to the computer lab and because of the tight timelines of other classroom activities. In the computer lab, the grade 6 teachers noticed that some students were not focusing on the problem at hand when they were using the Maximize Area activity. "Some of them thought it was a toy […] changing sliders all over the place." The grade 6 teachers stated that they felt students going to the computer lab were expecting something different, "it seems they were expecting a game or a fun activity." They noted that the activity worked better with the grade 5 students because "your kids knew what to expect when they went to the lab because they had done those kind of activities (in the classroom), and they knew what the problem was all about." The grade 6 teachers said that next time they would reverse the order of the lesson activities, to match the sequence used by the grade 5 teacher.

In the case of the grade 10 teacher, the effect of using the Quadratics: Vertex Form applet (Figure 2) appears to have shifted the pedagogical focus from studying the individual and isolated effects of coefficients of quadratic equations to a holistic and dynamic exploration of relationships between quadratic equations and graphs. The teacher used the applet in a lab setting where each student worked on their own computer. Students however collaborated in some cases to discuss

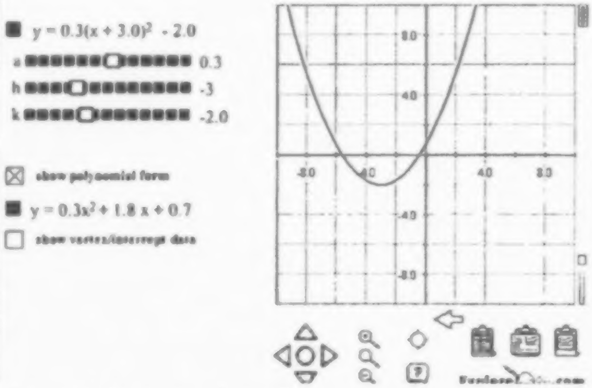
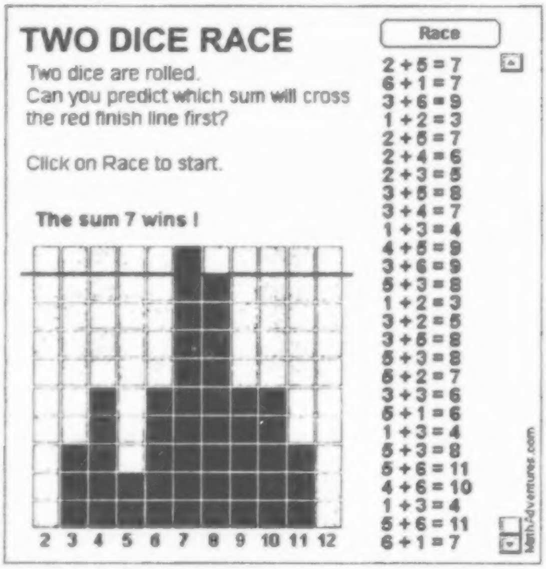


Figure 2. Quadratics: Vertex Form applet.

what they discovered and to check their answers and understanding. Students were provided with a set of worksheets prepared by the teacher. The worksheets included: (1) An explanation of how to log in to the school network and how to access the applet online; (2) a set of guided investigations, questions and instructions; and (3) a self-test section where students manually graphed quadratic functions in vertex form and used the applet to check their answers. As students worked through the worksheets, the teacher was surprised at how focused the students were and how well they seemed to understand. However, he indicated that he would withhold judgement until he saw how well students would do on an upcoming unit test. The teacher used the same unit test that he had used in a previous semester with a different class and compared the results of the two classes. The test scores on the topic of the vertex form of a quadratic of his current students were significantly higher than the test results of students in the previous semester who used graphing calculators (approximately a 30% difference in test scores on average). Although student ability can vary from class to class, the teacher felt that the two classes were generally of similar ability and that the test score difference was significant.

In previous semesters, the teacher taught the vertex form of a parabola using graphing calculators where over a sequence of three different classroom periods, students explored the effect of coefficients a, h and k, respectively, using the graphing calculator and then moving to paper and pencil graphs. A fourth classroom period was used to consider the effect of all coefficients simultaneously. When using the Quadratics: Vertex Form applet, the teacher spent only two classroom periods on the topic: one in the lab (as described above) and one in the classroom to reinforce concepts using paper and pencil activities and graphs. The teacher noted that his approach changed when using the Quadratics: Vertex Form applet in that he started with the big picture first (exploration of relationships between all there coefficients and the graph) rather than considering each coefficient in isolation. He also noted that he spent much less time teaching this topic (about half the time). The teacher felt that in contrast to the Quadratics: Vertex Form applet, his previous use of graphing calculators did not allow students to see the dynamic nature of relationships between coefficients and graphs and that the graphing calculator user interface is relatively primitive.

Both studies involved the use of a single web-based applet on a limited basis. The studies offer some support for existing research that shows that material resources affect the mathematics taught (Levy, 1993; Confrey, 1996; diSessa, 2000) by shifting to some degree the mathematics teaching focus from isolated concepts to relationships among concepts. However, the specific effects in each of the classrooms, including the level of pedagogical success experienced by the teachers, varied. More research is needed to explore the potential use of interactive applets as models of mathematics relationships and teaching practice.



TWO DICE RACE

Two dice are rolled.
Can you predict which sum will cross the red finish line first?

Click on Race to start.

The sum 7 wins !

```
2 + 5 = 7
6 + 1 = 7
3 + 6 = 9
1 + 2 = 3
2 + 5 = 7
2 + 4 = 6
2 + 3 = 5
3 + 5 = 8
3 + 4 = 7
1 + 3 = 4
4 + 5 = 9
3 + 6 = 9
5 + 3 = 8
1 + 2 = 3
3 + 2 = 5
3 + 5 = 8
5 + 3 = 8
5 + 2 = 7
3 + 3 = 6
5 + 1 = 6
1 + 3 = 4
5 + 3 = 8
5 + 6 = 11
4 + 6 = 10
1 + 3 = 4
5 + 6 = 11
6 + 1 = 7
```

Figure 3. Probability applet.

Upcoming research

In 2002-2003 a follow-up study will be conducted to investigate the nature of the pedagogical thinking, and more specifically the lesson planning, of mathematics teachers when designing lessons on given topics, with and without access to interactive applets similar to those shown in Figure 2 and Figure 3 (MathAdventures.com 2002). Does the availability of interactive applets whose focus is on exploring mathematical relationships affect the lessons designed by teachers? The study will involve 16 teachers and will have four stages. Structured, task-based interviews (Goldin 2000) will be used in the first stage of the study. Each of the teachers will be interviewed for 1 hour each, 30 minutes for each of the two tasks. A laptop will be available to demonstrate the interactive applets. Each of the 30 minute sections of the interviews will be structured as follows:

- The lesson planning task will be presented.
- Teachers may ask clarification questions.

BEST COPY AVAILABLE

- Teachers will be asked the following sequence of questions:
  - What do you know about the topic?
  - What are your expectations for students?
  - What introductory activity would you use to set the stage for the lesson?
  - What sequence of activities would you plan?
  - How will you know whether students have met your expectations?

In the second stage of the study, lesson plans described by teachers will be analyzed in terms of the level of student mathematical thinking and performance that they facilitate, based on the four-level scheme described in Table 1 (Gadanidis 2002). In the third stage of the study, each teacher will be interviewed for an additional 30 minutes. The analysis of their lesson planning will be shared and questions will be asked to determine: (1) The extent to which the analysis seems appropriate to the teachers; and (2) other insights or explanations they may have that would enrich the analysis. In the last stage of the study, a model will be developed to describe the effect of the availability of interactive applets on the lesson planning of mathematics teachers.

Level	Emphasis
1	Recalling mathematical facts and simple skills.
2	Applying mathematical procedures to solve routine problems.
3	Understanding and explaining mathematical relationships.
4	Extending understanding to new contexts or more general cases.

Table 1. Levels of student thinking

References

Borba, M. & Villarreal, M. (1998). Graphing calculators and the reorganization of thinking: The transition from functions to derivative. In *Proceedings of the 22nd Psychology of Mathematics Education Conference* (Volume 2, pp. 136-143), Stellenbosch, South Africa.

Cohen, D.K., & Ball, D.L. (1990). Relations between policy and practice: A commentary. *Educational Evaluation and Policy Analysis, 12*(3), 331-338.

Confrey, J. (1993). The role of technology in reconcepṛualizing functions and algebra. In Becker, J.R. & Pence, B.J. (Eds.) *Proceedings of the XV Psychology of Mathematics Education – NA* (Vol. I, pp. 47-74). San Jose, USA: Centre for Mathematics and Computer Science Education at San Jose State University.

Di Sessa, A. (2000). *Changing minds: Computers, learning and literacy*. London, England: The MIT Press.

ExploreLearning.com (2000a). Maximize area. *http://www.ExploreMath.com*. Charlottesville, VA: ExploreLearning.com.

ExploreLearning.com (2000b). Quadratics: Vertex form. *http://www.ExploreMath.com*. Charlottesville, VA: ExploreLearning.com.

Gadanidis, G. (2001), Web-based multimedia activities as pedagogical models. *Asian Technology Conference in Mathematics* (223-232). Melbourne, Australia: RMIT University.

Gadanidis, G. (200 . Tests as performance assessments and marking schemes as rubrics. Available at *http://publish.edu.uwo.ca/george.gadanidis/publications.htm*.

Gadanidis, G., Graham, L., McDougall, D., Roulet, J. (2002 – in press). *Mathematics online: Visions and opportunities, issues and challenges, and recommendations (A White Paper)*. The Fields Institute for Research in Mathematical Sciences, Toronto.

Goldin, G.A. (2000). A scientific perspective on structured, task-based interviews in mathematics education research. In A.E. Kelly & R.A. Lesh (eds) *Handbook of research design in mathematics and science education* (pp. 517-545). Mahwah, NJ: Lawrence Erlbaum.

Levy, P. (1993). As technologias da inteligencia. O futuro do pensamento na era da nformatica, trad. C.I. da Costa. Sao Paulo, Editoria 34. (Traducao de Les Technologies de l'Intelligence.) Quoted in M. Villarreal (2000). Mathematical thinking and intellectual technologies: The visual and the algebraic. *For the Learning of Mathematics*, 20(2), 2-7.

MathAdventures.com (2002). Two dice race. *http://www.mathadventures.com*. London, Canada: MathAdventures.com.

National Council of Teachers of Mathematics (2001). Illuminations web site. *http://www.illuminations.nctm.org*. Reston, VA: National Council of Teachers of Mathematics.

Stipek, J.S. et al (2001). Teachers' beliefs and practices related to mathematics instruction. *Teaching and Teacher Education, 17*, 213-226.

Interaction, Distributed Cognition and Web-based Learning

Penny Ann Garcia, Ph.D.
Department of Human Services and Educational Leadership
College of Education and Human Services
University of Wisconsin Oshkosh
Oshkosh, Wisconsin USA
garcia@uwosh.edu

Abstract: The purpose of this paper is to set the stage for future discussions on an expanded definition of the term *interaction* as applied to web-based instruction. The classic definition may be constraining and reductive in that it does not consider the multiplicity of interactions possible within a web course virtual environment. The field of distributed cognition can illuminate the number of interactions that may be considered. A brief overview of distributed cognition is given. Cole and Engestrom's modified mediated triangle is presented prior to suggesting modification of that triangle to reflect the distribution of cognition over the tools and interactions found in web-based courses.

Introduction

Much attention has been focused on the role of *interaction* in virtual classrooms. Interaction has traditionally been defined by examining two categories – individual and social. Individual interaction has been that which occurs between the student and course information in books, computer programs and lab experiments. Social interaction has come to signify that which occurs between a student and teacher or other students. Most discussion concerning interaction in any distance education class has centered on social interaction. However, due to the increased usage of digital tools by faculty to facilitate the students' grasp of understanding and to the very nature of the web interface which houses the web-based course, a dialogue towards a more robust view of interaction in web-based courses should lead to increased awareness of how the interactions between student or students with the tools routinely used within that course impact the learning experience.

Rationale

Just as the sciences have found richness and interdependency in the study of complex systems, education can expand its view of cognition from the microcosm of the individual to the complexities of distributed cognition. This leads to a renewed interest in the writings of Munsterberg, Luria, Dewey and Vygotsky all of whom recognized the role of interaction in constructing meaning – interaction not only between humans but with tools as well.

Munsterberg (1914) gives one of the first reasoned considerations about distributed cognition. He writes, "A letter, a newspaper…exists outside of the individuals themselves, and yet it intermediates between two or between millions of people in the social group…The book remembers for the social group, and the experiences of the group, objectively recorded in it, shape the social action and the social thought. The letter can connect any distant social neurons; the paper may distribute the excitement from one point of a social group to millions of others. Every objectified expression becomes a social short cut."

Alexandria Luria (1928) asserted that the use of tools and the refinement of these tools was fundamentally unique to humans and stated that these tools "not only radically change his conditions of existence, they even react on him in that they effect a change in him and his psychic condition." These tools included not only basic and advanced technologies but also uniquely human functions such as language. All tools mediate between the person and the task at hand and fundamentally affect human activity.

BEST COPY AVAILABLE

John Dewey echoed this view of the social nature of human development as well. Dewey's (1938) wrote, "Experience does not go on simply inside a person…we live from birth to death in a world of persons and things which in large measure is what it is because of what has been done and transmitted from previous human activities."

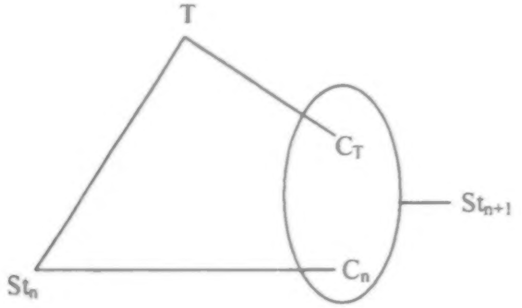
The notion of distributed cognition arises from such consideration of people in action. Certainly activity is enabled by intelligence but the individual does not solely contribute this intelligence. Rather the intellectual resources that shape and enable activity are distributed across people, environments and situations. As Roy Pea (1993) so simply states "…intelligence is accomplished rather than possessed."

In reality, adult students in their daily work interact with a variety of artifacts that significantly enhance their cognitive ability. This cognitive ability, this intelligence, is distributed among other people and tools – cultural artifacts – and, in turn, enables the individual to obtain feedback, gather information, and test hypotheses that extend their mind's potential. As this cognition is distributed, the result obtained is greater than the single whole of the content on which interaction is focused. Instead, each of these distributions across artifacts adds increased dimensions to that content knowledge.

Implications for Web-Based Courses

The traditional classroom and, by extrapolation, the traditional web-based course is founded on the notion of solitary intelligence. Too often, the social, physical, and artifactual surroundings in which cognition takes place have been largely disregarded. Increasingly this view of intelligence has been questioned both by the practitioners of education and the consumers of the education products (or students), business and industry. The observation of what Lave (1988) refers to as Just Plain Folks and experts alike by a wide variety of researchers confirmed that in real-world settings (as opposed to school settings) that the mind rarely works alone. In order to cope with complex activities in an efficient way, human cognition in the real world distributes intelligence among individuals, environments, cultures, symbol systems, tools, and artifacts. In the past much of this distribution was accomplished at a leisurely pace through discussion, shared physical activities, and apprenticeship. Today's society moves at a pace that disables these traditional opportunities for distributed intelligence. Instead, computers and other digital information technologies, while threatening to isolate us even further, also carry the power to create more opportunities for interaction both with the tool and with other humans.

The technologies that deliver web-based courses cannot be viewed as passive neutral delivery systems. These technologies include both the hardware and the software whether it be the web-course building software (e.g. Blackboard or WebCT) or software the students use to construct meaning from the course content. Any technology is a tool that mediates between the subject (learner) and the object (curriculum), creating the classic cultural-historical Vygotsky (1978) mediational triangle. In mediating that transaction, the nature of the object, the subject and the outcome is changed by the technology. In order to truly represent the dynamic nature of this interaction, Cole and Engestrom (1993) added a fourth element, time. In the course of time the two worlds, a student interacting with curriculum delivered through instructor and a student-mediated-by-tool interacting with curriculum, are constantly integrated. This results in the modified mediational triangle shown in figure 1.



BEST COPY AVAILABLE

Figure 1: Instructional mediational triangle symbolizing that new states of the student arise from the integration of information obtained both from the mediated (tool) and direct (instructor) connections between the student and the curriculum. [T, mediating tool; St_n, student's state of knowledge at time *n*; C_T, curriculum as represented via the tool; C_n, curriculum at time *n*; St_{n+1}, emergent new state of student's knowledge at time $n+1$.]

This triangle deals only with the interactions of a single student with a single tool and the curriculum. Within a web-based course, a myriad of tools can be considered which may impact a student's state of knowledge: the student develops a disposition to learning through the ease (or dis-ease) of interaction with the web courseware, the student interacts with various courseware tools, the student interacts with other students via the courseware tools, the student interacts with content via courseware tools and other tools as required by the instructor for the task at hand.

For instance, consider a web-based course delivered in a traditional web-course environment such as WebCT. First students must interact with the primary tool – their local computer – to access the course. Upon entering the virtual course environment, they are asked to make use of the discussion forum tool, the bulletin-board tool, the e-mail tool, the chat tool and the electronic drop box. They need to download and upload materials, convert documents to various formats, and move to a variety of locations specified on the web. Additionally, they may be required to construct a web-page using web publishing software, storyboard their ideas with a thought-processor software, use presentation software to create a synopsis of research, or create an interactive portfolio using a multimedia software. Each of these tools carries with it a means for interacting with the content from different perspectives. Then consider that students may or may not be acting with these software programs solely as individuals; rather, they may take their Inspiration document, email it to colleagues who create their comments in the notes section, and return it to the individual for consideration. Another consideration would be any of the variety of ways that web-based courses may be structured to include a face-to-face component during the semester. All of these actions, these tools, are neither passive nor neutral. Rather, the experience forms a whole that alters students' perceptions of web-based courses, their own ability, that of their instructor, their relationship with other students, and, most importantly, the sum knowledge of the content interacted with during the course duration.

Recognizing that several interactions occur within a virtual classroom leads to a consideration of how the triangle in figure 1 might be modified to reflect the affect of those interactions as it relates to the student's emergent new state of knowledge. Given that there are now multiple tools mediating the curriculum, will that result in a different emergent knowledge state? If those interactions are successful will that knowledge state be enhanced over that of a traditional classroom? If those interactions are perceived as negative by the student, could the knowledge state be actually be less than what would have been achieved by the classic mediated triangle? Figure 2 is presented as a first step towards modeling this state.

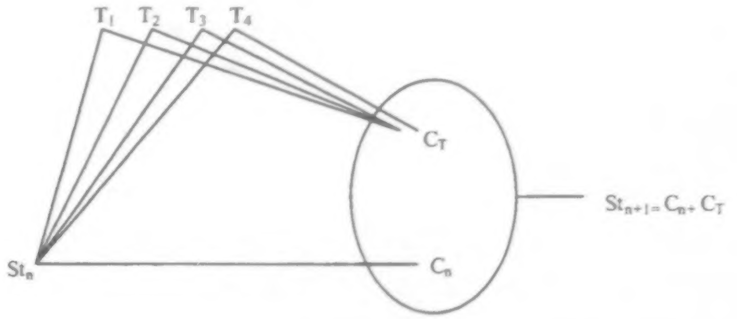


Figure 2: Instructional mediational triangle symbolizing that new states of the student arise from the integration of information obtained from the mediated (tool) and direct (instructor) connections between the student and the curriculum.[T_1,T_2,T_3,T_4 mediating tools; St_n, student's state of knowledge at time *n*; C_T sum curriculum as represented via the mediating tools; C_n, curriculum at time *n*; St_{n+1}, emergent new state of student's knowledge at time $n+1$.]

Conclusion

A dialogue towards enlarging the traditional view of interaction in web-based courses should encompass the recognition of the impact of distributed intelligence in the web environment as well as a careful consideration of the means used to deliver a course on the web. This dialogue can serve to inform the creation of better tools for delivery of web-based courses while providing a basis for reflection on student reactions to the both the web course environment and the instructor. It would allow the examination of the role of the instructor in the virtual environment and how that role may differ significantly from that of the face-to-face classroom. Most importantly, it can lead to recognition of learners as inventors of, and users of, distributed-intelligence-as-tool, rather than as passive receivers of intelligence-as-entity.

References

Cole, M. & Y. Engestrom (1993). A cultural-historical approach to distributed cognition. Distributed cognitions: Psychological and educational considerations. G. Salomon. Cambridge, Cambridge University Press.

Dewey, J. (1963 (Originally published 1938)). Experience and Education. New York, Macmillan.

Lave, J. (1988). Cognition in Practice. Boston, MA, Cambridge University Press.

Luria, A. R. (1928). "The problem of the cultural development of the child." Journal of Genetic Psychology 35: 495.

Munsterberg, H. (1914). Psychology: General and applied. New York, Appleton.

Pea, R. D. (1993). Distributed intelligence and designs for education. Distribute cognitions: Psychological and educational considerations. G. Salomon. Cambridge, Cambridge University Press.

Vygotsky, L.S. (1978). Mind in Society: The development of higher psychological processes. Cambridge, Massachusetts: Harvard University Press.

Binding Virtual Molecules Sounds Good! : Exploring a Novel Way to Convey Molecular Bonding to Students

Miguel Garcia-Ruiz
School of Cognitive and Computing Sciences
University of Sussex
United Kingdom
miguelga@cogs.susx.ac.uk

Abstract: This paper describes a doctoral research that explores a novel way to convey molecular bonding to students by using a multimodal virtual environment system. Twenty-four chemistry students participated in an exploratory experiment to see if non-speech sounds (musical sounds and natural sound effects that represent information) played as feedback and informative aide in a virtual environment, along with 3D visualization of molecular structure, are useful to support molecular bonding understanding. The experiment consisted of four counterbalanced conditions where participants bound virtual molecules in a desktop virtual environment by using a 3D mouse and listening to sounds and visualizing molecular structures in stereo, as well as using a plastic model set. Results indicated positive outcomes from usability and performance analyses, where non-speech sounds were useful to support molecular bonding understanding

Introduction

This research concerns the application of auditory display, which is the use of sound properties in computer interfaces to convey information (Kramer, 1994), along with visualization techniques, as a way to support understanding of abstract information, such as molecular bonding. Past research (Salzman et al, 1996) shows that a good medium to present both sound properties and visualization techniques is using a virtual environment (a computer-generated 3D graphical environment where the user interacts with it and its contents). Virtual environments offer a unique way to present information in more than one sensory modality with the possibility to complementing or supplementing each, as well as keeping its users from being passive observers, where they interact with the virtual environment, and therefore learn by doing.

Molecular bonding is an abstract topic where students have difficulty to understand how two atoms or molecules bind, as well as the bond characteristics, such as its energy and length, and how both characteristics interact. Literature abounds on showing students' misconceptions and misperceptions about molecular bonding and structure (Hapkiewicz, 1991; Peterson et al, 1989, to name some).

This research suggests that non-speech sounds played in a virtual environment can effectively support students' performance of molecular bonding, and therefore enhance its understanding. To convey bonding information, we used in this research two types of non-speech sounds: *earcons* and *auditory icons*. Earcons are musical tones that convey a message (Blattner et al, 1989), and auditory icons are natural sound effects that have a meaning (Gaver, 1986).

Method

To test the idea of using a multimodal virtual environment to convey bonding, we developed three virtual environments that worked as molecular modelers, and conducted an experiment to test them. It consisted of a within-subjects design, and had four counterbalanced conditions. The conditions can be seen in (Tab. 1).

Condition:	*Activity:*
A (Traditional tool used for teaching molecular structure)	Participants bound two molecules using a plastic model set, bond energy and length values appeared on a label attached to the bond.
B (Visual condition)	Participants bound two virtual molecules in the virtual environment, color variations from yellow to red represented bond energy, and participants watched bond length and atom charges.
C (Visual + earcons)	Participants bound two virtual molecules in the virtual environment; earcons represented bond energy (pitch variations of a pure sine tone), and trumpet and piano notes represented atom charges. In addition, participants watched the molecular structure.
D (Visual + auditory icons)	Participants bound two virtual molecules in the virtual environment; auditory icons (changes in pitch of an electric discharge sound) represented bond energy, and sounds of hitting metal and crystal represented atom charges. Furthermore, participants watched the molecular structure.

Table 1: Conditions Used in the Experiment

The molecular structures were different in each condition, and they do not exist in nature. We did this to avoid participants' previous knowledge recalls. The charges used for the bindings were arbitrary.

Participants were twenty-four chemistry undergraduates from first and second-years (twelve women and twelve men with ages ranging 23 years) from Sussex University in England (the entire experiment was conducted there), and were paid for their participation. Participants' answers to verbal questions asked prior to the experiment indicated that all of them had enough knowledge about molecular structure to perform the experiment.

We used pre-questionnaires to get participants' characteristics, and questionnaires with Likert scales and open questions to obtain the system usability at the end of each condition and at the end of each experimental session. In addition, we measured participants' performance by timing each condition and getting participants' errors they made during the binding through computer logs and by videotaping the virtual environment for further analysis.

The experiment ran on a desktop virtual environment system consisting of a SGI O2 workstation. We developed the virtual environment using DIVE (Distributed Interactive Virtual Environment), a virtual environments browser and programming interface. Participants watched the virtual environment in stereo by wearing a pair of NuVision shutter (polarizing) glasses, and listened to the non-speech sounds by wearing a pair of high-fidelity headphones Sennheiser model HD 570. Further, participants manipulated the environment's point of view and the virtual molecules using a six-degrees-of freedom mouse (Spaceball 3003). The complete virtual environment system can be seen in (Fig. 1), and a screenshot of one of the virtual environments is shown in (Fig. 2).

Figure 1: Virtual Environment System

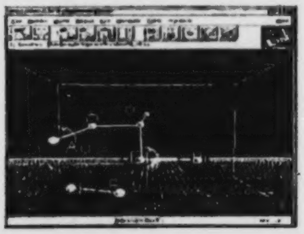


Figure 2: Screenshot of the Virtual Molecules

Participants also used a model set (Fig. 3) to see possible differences between the use of a traditional tool for learning molecular structure and the developed virtual environments.

Figure 3: Plastic Model Set used in the First Condition

Results

Emergent findings obtained from usability questionnaires shown that manipulation of the molecular structures using the plastic model set was easier than using the virtual environments. However, most participants preferred the virtual environment with musical sounds to perform the bonding, and they stated that the virtual environments with sounds provided better feedback (Fig. 4).

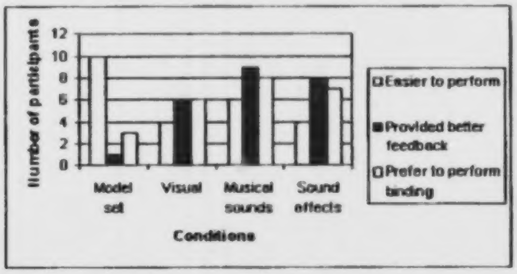


Figure 4: Some Results Obtained From Usability Questionnaires

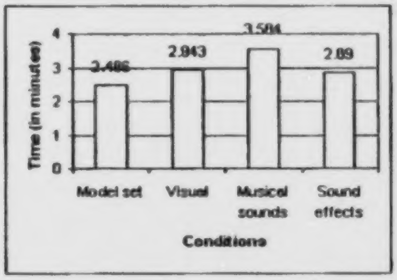


Figure 5: Average of Completion Time in Each Condition

We can see in (Fig. 5) that participants took less time when using the model set. In the conditions with virtual environments, they spent less time when used the virtual environment with sound effects.

Conclusions

The purpose of this paper was to describe preliminary findings of a research on the application of a multimodal virtual environment to support students' performance and understanding of molecular bonding. We carried out an experiment with chemistry students to assess the usability of auditory and visual modalities that represented molecular bonding in a desktop virtual environment. Results showed that although a considerable number of students found the model set easier to manipulate, they preferred the virtual environment with musical sounds to do the bonding. Furthermore, in the conditions that used a virtual environment, participants performed bonding faster in the virtual environment with sound effects.

Acknowledgements

This doctoral research is supported by the Telematics School of the University of Colima and PROMEP grant scheme of the Ministry of Education in Mexico.

BEST COPY AVAILABLE

References

Blattner, M.M., Sumikawa, D.A., Greenberg, D. (1989). Earcons and Icons: Their Structure and Common Design Principles. *Human Computer Interaction*, 4(1), 11-44.

Gaver, W.W. (1986). Auditory icons -- using sound in computer interfaces. *Human-Computer Interaction*, 2(2), 167-177.

Hapkiewicz, A. (1991). Clarifying chemical bonding. *The Science Teacher*, 58(3), 24-27.

Kramer, G. (1994). An introduction to auditory display. In G. Kramer (Ed.), *Auditory display, sonification, audification and auditory interfaces. Proceedings of the First International Conference on Auditory Display.* Reading, MA: Addison-Wesley, 1-77.

Peterson, R., Treagust, D.F., & Garnett, P. (1989). Development and application of a diagnostic instrument to evaluate grade-11 and 12 students' concepts of covalent bonding and structure following a course of instruction. *Journal of Research in Science Teaching*, 26(4), 301-314.

Salzman, M. C., Dede, C., & Loftin, B. (1996). ScienceSpace: Virtual realities for learning complex and abstract scientific concepts. *In Proceedings of IEEE Virtual Reality Annual International Symposium*, New York: IEEE Press, 246-253.

Accessibility Implications for Multimedia

Multimedia techniques are engaging instructional tools.

> "Everyone benefits from dynamic visual displays and dialog. Well, not everyone. Viewers who are deaf miss all audio content that is not also presented in a visual form. Those who are blind can access only the visual content that is also presented in spoken form. It is not difficult to make video and multimedia products accessible to viewers with sensory impairments, but special considerations should be made at the design phase to assure full access to everyone."
>
> (Burgstahler, 2001)

Electronic accommodations can assist those who are deaf by providing text captioning or links to texts. Millions of Americans have enough hearing loss to affect their ability to hear at a typical volume level. Some people are born deaf or are hard-of-hearing, others experience a hearing loss from accident or illness, and some gradually lose their ability to hear. The elderly are the fastest growing group of individuals who are deaf or hard-of-hearing. Text links allow these people to fully access educational materials with fellow students.

Although captions were developed to make home television accessible to viewers who are deaf and hard-of-hearing, they are important to Internet based video. There are several types of captioning. "Off-line captioning" is developed once the video has been created. The captioner types the captions, which are the recorded on the video image. Captions typically appear on the screen as a group and erase as a group since they do not scroll. Captions are either "open" or "closed." Open captioning appears on the screen wherever the video is presented. It is recommended that products be specifically designed for people with disabilities, for training and education. Closed captions appear only when special equipment, called decoders, are purchased by individuals. "Since 1993 all television sets thirteen inches or larger sold for use in the United States must have built-in decoders." (Burgstahler, 2001)

"Real-time captions" are simultaneously created during a video production. They are most frequently used for live programs such as videoconferences. Similar to a courtroom reporter, a trained stenotypist enters spoken content by typing phonetic codes on a special keyboard that facilitates high-speed transcription. Computer software translates the phonetic codes into text that typically scroll across the bottom of the video production in a continuous motion.

Captioning is usually considered when the video production is complete. Special precautions need to be considered to avoid covering critical visual content with captioning. Burgstahler provides several suggestions for making attractive and functional captions, these include:

- Use one or two lines of text.
- Use a sans serif font, such as Helvetica, and proportional spacing.
- Caption the exact wording of speakers, including slang and grammatical errors. Occasionally a few words may be edited to facilitate reading speed.
- Caption sound effects that contribute to the understanding of the content.
- Use italics to indicate the narrator, off-screen voices, sound effects, and other vital information.
- Synchronize captions with the aural content.
- Avoid changing the location of captions on the screen.

(Burgstahler, 2001)

People who are blind cannot access the visual content of a video production unless there is an audio link available. Once a video product is complete, audio content must be added to the production. When pauses occur in the original production, the audio description voice reads the titles and speakers' names, describes the scenery, objects, and other visual information. Because additional audio description is not of value to other audiences it can be distracting. Audio descriptions are usually not included with a standard video but can be provided as an optional format. Providing this option is particularly important for Internet based videos used in educational programs at all levels. The audio link may be used by those who need this service therefore, it is not distracting to other viewers.

The National Center for Accessible Media (NCAM) is a research and development facility that works to make media accessible to disabled persons, minority-language users and people with low literacy skills. This site also maintains separate types of disabilities. NCAM promotes the use of a Web Access symbol and provides model examples of accessible pages. Creators of web and CD-based multimedia projects need an authoring tool to make their materials accessible to persons with disabilities. NCAM meets this need by providing MAGpie, the ideal authoring environment for multimedia providers who want to add captions, subtitles and audio descriptions to their work. The Trace Research and Development Center provide funding for MAGpie. (http://www.wqbh.org/wqbh/pages/ncam)

MEASUREMENT OF LEARNER ATTITUDES TOWARD INTERNET

Instrument Development: Constructing a valid and reliable instrument was essential for this study (found in Appendix C). Validity is expressed by three different approaches: content validity, criterion-related validity and construct validity, however, each is pertinent to the other. The reliability of an instrument expresses the degree an instrument measures whatever it was set out to measure. The more reliable an instrument, the more confidence the instrument scores obtained would be reproduced when administered again to the same participants (test-re-test).

The instrument used a two position forced choice response to the statements. This instrument forces respondents to choose between the two options provided, Agree or Disagree. This format enhances consistency of responses, makes it easier to tabulate and code the data into a database and is easier and quicker for subjects to respond. However the disadvantages of this format may include constraining or limiting the respondents' choice. Some respondents are uncomfortable in completing a scale with no neutral position. The instrument was also jury validated for content. The instrument was then administered to forty-seven (n=47) undergraduate allied health students. The sample distribution was 70% female and 30% male, 40% White Non-Hispanic, 47% Hispanic, 4% Asian-Pacific Islander, 6% Black-Non Hispanic and 2% American Indian or Alaskan Native. The instrument was reviewed and found to be a homogenous instrument with good internal validity and reliability. The Analysis of Variance (ANOVA) was used to test for differences ($p<.05$) between the group of subjects and the years of computer experience. The subjects grouped based on the following scale: less than 1 year, 1-2 years, 2-5 years and more than 5 years. At this time it was suggested to broaden the years of experience to the following: less than 1 year, 2-5 years, 5-10 years and more than 10 years.

There were no differences in attitudes towards multi media between ethnic backgrounds or gender for the undergraduate allied health students. Ninety-five percent of the respondents reported feeling comfortable using computers, 100% of the females and 86% of the males were comfortable with computers. Sixty-eight percent of the subjects had more than 5 years of experience with computers.

The principle components factor analysis with a varamax rotation identified three factors in addition to measurement of attitudes to assist with the overall assessment of individual reactions to multimedia. The three factors are identified were: 1) Factor one: Learner score for overall Internet delivered multi media as an *effective* learning tool. This factor identified principle components for assessing not only beliefs about multimedia, but also the type of delivery system. 2) Factor two: Learner score of *preference* for courses using Internet delivered multi media. This factor measures learners' preference for learning. The subjects in the study indicated a preference for teacher based delivery over the Internet delivered multi media. 3) Factor three: Learner score for how Internet delivered multi media *enhances* learning. This factor measures attitudes of preference. This is a key underlying assumption that those individuals who perceive that Internet delivered multi media enhances learning are more likely to gain the most advantage from this type of delivery system.

The instrument was rewritten as a final twenty-one-statement instrument with five background and demographic statements A four-point Likert scale was used with a forced choice response: Strongly Agree (SA), Agree (A), Disagree (D), Strongly Disagree (SD). This forced-choice scale omitted the option of neutral or not applicable, which may be troubling to some of the respondents. Four open-ended statements for the respondents to write in their opinion of the strengths, weakness and importance of Internet delivered multi media. This final instrument was used for the remainder of the study.

Subjects: The final target population for this study is undergraduate and graduate students enrolled in Southwest Texas State University statistic courses (n=70). There were three classes of students: Class 1: 22 male and female undergraduate students from various ethnic backgrounds. Class 2: 30 female undergraduate students from various ethnic backgrounds. Class 3: 18 male and female graduate students from various ethnic backgrounds. The total subject demographic information was 74.6% female and 25.4% male, between 19 to 48 years of age although majority of the students were between 19 and 26 years of age, from various ethnic backgrounds. These demographics closely resemble the SWTSU demographic profile.

Study Limitations: This study was affected by the following limitations, sample size, technology, terminology and scoring scale. The sample size (n=70) is a small group. A technological glitch was a factor that may have affected the outcome of the post-test is the technology. The class 1 study may have been tainted by the intervention, an Internet delivered multi media presentation. The technology, Internet access, and RealPlayer plug-ins were not functioning on the day of the pilot study. Class 1 completed the intervention and post-test one day later with out any technological problems. This may have impacted the results of the post-test. The third limitation was the content the Internet delivered multi media segment described, streaming media. This content may have been too abstract for the respondents. The recommendation for future studies would be to use content that is applicable to the audience.

The term "Internet delivered multi media", although defined on the instrument is not a common term and the respondents may not have truly understood the concept when answering the questionnaire. Learners' may be apprehensive about trying new teaching methods especially on-line methods without proper orientation or instruction.

The instrument scoring scale utilized 1 = Strongly Agree to 4=Strongly Disagree. This created some confusion with data interpretation. The scoring scale for the future should be reversed to reflect 4=Strongly Agree to 1=Strongly disagree. This reflects the "normal" thought of a large number being a positive or good result and a low number being a negative or poor result.

Quantitative Results: Numerous surveys have been constructed to measure learners' attitudes towards computers. However, few instruments have been published that measure learners' attitudes towards learning by Internet delivered multi media. This descriptive study constructed an instrument to measure learner's perceptions about Internet delivered multi media.

Of the total sample population for the final instrument administration (n=70), 63 pre and 64 post tests were available for analysis using SPSS software using a factor analysis with a varamax rotation, analysis of variance, chi square and numerous *t*-test. The principle components factor analysis with a varamax rotation identified four factors for the final instrument in addition to measuring attitudes to assist with the overall assessment of individual reactions to multimedia. The four pure constructs are identified :1) Factor one: Learner score for Internet delivered multi media as an

BEST COPY AVAILABLE

effective learning tool. The factor measured the overall reaction to this media as an effective tool for learning. This factor identified principal components for assessing not only beliefs about multimedia, but the type of delivery system. Internet delivered multi media places the responsibility of learning on the learner. 2) Factor two: Learners score of Internet delivered multi media as an *interactive* learning tool. This factor identified the importance of activity versus passivity. This factor plays an important roll in the transfer of learning by this medium. The subjects in the study indicated interaction with a person via Internet delivered multi media is important.3) Factor three: Learner score of their *preference* for courses using Internet delivered multi media. This factor measures learners' preference for learning medium. The subjects in the study indicated a preference for teacher based delivery over the Internet delivered multi media. 4) Factor four: Learner score of how *user friendly* the Internet delivered multi media is. This factor identified and measured the learners' attitudes and perceptions towards the convenience and level of difficulty of this media. Many learners are intimidated by media or find it confusing and these can lead to learning barriers.

The analysis of variance (ANOVA) was used to test for differences ($p < 0.05$) in total attitudes toward multimedia between the two groups for comfort using computers. The data is illustrated in Table 3 below.

Table 3. Differences in Attitude Towards Multimedia

		Sum of Squares	df	Mean Square	F	Sig
Pre Total	Between Groups	309.778	1	309.778	5.402	0.024*
	Within Groups	3211.343	56	57.345		
	Total	3521.121	57			
Post Total	Between Groups	170.477	1	170.477	2.446	0.124
	Within Groups	3553.353	51	69.693		
	Total	3724.830	52			

*Significant difference

There is a significant difference in attitudes towards multimedia between the two comfort groups on the pre-test. However a significant difference does not exist on the post-test. It is assumed the intervention is responsible for changing the subjects' attitudes towards Internet delivered multi media. Such that after viewing the short multi media segment, those uncomfortable with computers now have a higher attitude score for multi media. Cross tabulations were calculated for gender verses computer experience groups. There was no significant association found between gender and experience.

The *t* test for independent samples (a =.05) revealed no significant differences between each of the four groups based upon age, race, and gender for the pre and post totals in the attitude instrument.

Qualitative Results: Qualitative results were obtained from the attitudinal survey. Two trends were apparent from the attitudinal survey data. First, overall student response to the effectiveness of Internet delivered media as a learning tool is favorable. Second, attitudes for preference of courses using Internet delivered multi media are not favorable.

Qualitative research results did not support one of the research questions; do learners find Internet delivered multi media learning more effective than traditional classroom learning? Only 31% believe Internet delivered multi media is as effective as traditional lecture instruction. However, 79% believe Internet delivered multi media is an effective tool for learning before the intervention and 87% after the intervention due to the uncomfortable group changing opinions. Seventy-eight percent believe this media enhances the learning process. 53% enjoy learning through streaming media and 61% will tell others about courses using Internet delivered media.

However, majority of the respondents (90%) preferred an instructor to present the course material, 70% valued Internet interaction with the professor or person teaching the material and 98% valued person-to-person contact. Ninety-one percent believe active student participation is important for learning. However, 49% are excited about learning using this medium and only 39% prefer courses that use Internet delivered multi media. The majority (97%)of the respondents like to learn at times convenient to them.

After the intervention, 76% are not fearful of learning through this medium, nor do they find it confusing (70%) or difficult (70%). A large percentage of the respondents believe this medium is not helpful with retaining (75%) or grasping (59%) difficult concepts.

Only 3% of the respondents reported having less than one year of computer experience. Where as, 70% of the respondents have five or more years of experience. Those with more years of computer experience are more comfortable using computers. This may be responsible for the statistical difference in attitudes towards multimedia between the two comfort groups.

Learners Response To Statements: Students were also given an opportunity on the survey to comment on the strengths, weaknesses, and importance of Internet delivered multi media. Three points stand out from their subjective remarks.

First, the greatest weakness of Internet delivered multi media is the lack of teacher-student interaction and direction. Students may waste precious time searching for answers. In the event technological problems arise, precious time may be wasted searching for the contact person. These issues create discouragement and frustration leading to learning barriers.

The strengths and importance of Internet delivered multi media go hand in hand. Internet delivered multi media is important because it allows institutions to reach people in distant places who may not otherwise have access to the information or content. One of the greatest strengths of this media is repetition. Internet delivered multi media allows students to view the information at times convenient to them and as often as needed. This media also meets the needs of the various learning styles.

Overall the qualitative data provides support that learners' attitudes will change after experiencing an Internet delivered multi media segment. Even after the intervention more students believed this media enhances learning and is an effective learning tool, it did not change their preference for traditional instructor lead courses.

REFERENCES

Billig, S., Gibson, D., Sherry, L., and Tavalin, F. (2001). New Insights on Technology Adoption in Communities of Learners. Retrieved May 4, 2002 from http://www.rmcdenver.com/webproject/SITEproc.html

Boettcher, J.V. (1998, August). How Many Students are "Just Right" in a Web Course? Syllabus Magazine. 12 (1). Retrieved May 4, 2002, from www.syllabus.com/syllabusmagazine/aug98_magcol.html .

Bonk, C.J., and Reynolds, T.H. (1997). Learner-Centered Web Instruction for Higher-Order Thinking, Teamwork, and Apprenticeship. In Khan, B.H. (Ed), *Web-Based Instruction* (167-178). Englewood Cliffs, NJ: Educational Technology Publications.

Burgstahler, S. (2001). Creating Video and Multimedia Products that are Accessible to People with Sensory Impairments. Retrived from the Internet, May 4, 2002, http://www.washington.edu/doit/Brochures/Technology/vid_sensory.html

Cox, C., and Pratt, S. (2002). The Case of the Missing Students, and How We Reached Them with Streaming Media. Computers in Libraries. 22(3), 40.

Cruver, P. (2001). Broadband and the Future of Learning. Multimedia. 8(4), 28-29, 31.

Dooley, K. (2001). Towards a Holistic Model for the Diffusion of Educational Technologies: An Integrative Review of Educational Innovation Studies. Educational Technology & Society. Vol 2(4), 1999. ISSN 1436-4552. Retrieved May 4, 2002 from http://ifets.ieee.org/periodical/vol_4_99/kim_dooley.html .

Durrington, V., Repman, J., and Valente, T.(2000). Using Social Network Analysis to Examine the Time of Adoption of Computer-Related Services Among University Faculty. Journal of Research on Computing in Education. 33(1), 16-17.

Ellis, T. (2001). Multimedia Enhanced Educational Products as a Tool to Promote Critical Thinking in Adult Students. Journal of Educational Multimedia and Hypermedia, 10((2), 107-123.

Fichter, D. (2000). And..Action! Multimedia on the Intranet. Online. 24(5), 84, 4.

Freeman, M. and Capper, J. (1999). Educational Innovation: Hype, Heresies and Hopes. Asynchronous Learning Network Magazine. 3(2). Retrieved from May 27, 2002 from http://www.aln.org/alnweb/magazine/Vol3_issue2/ALNMag3_2_ma.htm

Gatlin-Watts, R., Arn, J., Kordsmeier, W. (1999). Multimedia as an Instructional Tool:Perceptions of College Department Chairs. Education, 120(1), 190-196.

Garcia, J.C . (2001). An Instrument to Help Teachers Assess Learners' Attitudes Towards multimedia Instruction. Education. 122(1), 94-102.

Gay, L., and Airasian, P. (2000). *Educational Research Competencies for Analysis and Application.* Upper Saddle River, New Jersey.

Gloster, A., and Saltzberg, S. (1995). Multimedia and Asynchronous Learning: Changing the Role of Academic Computing. Proceedings of the 1995 CAUSE Annual Conference. Retrieved May 27, 2002 from http://www.educause.edu/asp/doclib/abstract.asp?ID=CNC9540.

Guan, Y., Wang, J., Gable, R., and Young, M. (1998). Student Attitudes Toward Multimedia Classrooms. Paper presented at the Eastern Educational Research Association Conference. Tampa, Fl, February 26, 1998. ED427774.

Hagner, P. (2000). Faculty Engagement and Support in the New Learning Environment. EDUCAUSE. Sept/Oct, 27-37.

Hayes,B., and Robinson III, E. (2000). Assessing counselor education students' attitudes toward computers and multimedia instruction. Journal of Humanistic Counseling, Education & Development. 38(3), 132-140.

Howles, L.(2002). Streaming Media Tutorial. Wisconsin University, Do It web site. Retrieved May 4, 2002 from http://pocahontus.doit.wisc.edu.

Jaffee, D. (1998). Institutionalized Resistance to Asynchronous Learning. Journal of Asynchronous Learning Network. 2(2), 40-43.

Kolb, D. A. (1985). Learning Style Inventory. Boston, MA: McBer and Company.

Knee, R., Musgrove, A., Musgrove, J. (2000). Learning and Leading with Technology Lights, Camera Action! Streaming Video on Your Web Site. Learning and Leading with Technology. 28(1), 50-53.

Landis, M. (2001). A Comparison of Interaction in AV-based and Internet -based Distance Courses. Eductational Technology and Society. 4 (2), ISSN 1436-4522. Retrieved May 4, 2002 from http://ifets.ieee.org/periodical/vol_2_2001/landis.html

Massy, W and Zemsky, R. (1995) Using Information Technology to Enhance Academic Productivity. Retrieved January 5, 2002, from http://www.educause.edu/nlii/keydocs/massy.html.

McLuhan, M., (2001). The Medium is the Message. Retrieved November 12, 2001, from http://www.nwlink.com/~donclark/hrd/media.html

Montag, M., Simson. M.R. & Maurer. M. (1984). Manual for the Standardized Test of Computer Literacy and the Computer Anxiety Index, Iowa State University Research foundation, Inc., Ames.

Nowaczyk, R., Santos, L., and Patron, C. (1998). Student Perception of Multimedia in the Undergraduate Classroom. International Journal of Instructional Media. Vol 25 (4), 367 - 379.

Perry, T., Perry, L. (1998). University Student's Attitudes Towards Multimedia Presentations. British Journal of Educational Technology. 29(4), 375-377.

Rogers, E. (1995). *Diffusion of Innovations*. New York, New York.

Smith, S., Woody, P. (2000). Computers in Teaching. Teaching of Psychology. Vol 27 (3), 220-223.

Strom, J. (2001). Streaming Video: A Look Behind the Scenes. Cultivate Interactive. Retrieved May 27, 2002 from http://www.cultivate-int.org/issue4/scenes/

Surry, D.W. (1997). Diffusion Theory and Instructional Technology. Retrieved November 12, 2001, from http://intro.base.org/docs/diffusion/.

Takacs, J., Reed, W., Wells, J., Dombrowski, L. (1999). Journal of Research on Computing in Education. 31(4), 341-350.

Tooth, T. (2000). The Use of Multi Media in Distance Education. Retrieved May 4, 2002, from http://www.col.org/Knowledge/ks_multimedia.htm .

U.S. Congress, Office of Technology Assessment, *Teachers and Technology: Makin the Connection*, OTA-HER-616 (Washington, DC: U.S. Government Printing Office, April 1995).

Van Horn, R. (2001). Streaming Video and Rich Media. Phi Delta Kappan, 82 (7), 561-2.

Vrtacnik, M., Sajovec, M., Dolnicar, D., Pucko-Razdevsek, C., Glazar, Al, Brouwer, N. (2000). An Interactive Multimedia Tutorial Teaching Unit and its Effects on Student Perception and Understanding of Chemical Concepts. Westminister Studies in Education. 23(1), 91-100.

Webopedia. Retrieved May 4, 2002, from www.webopedia.com.

Electronic Portfolios: Effective Assessment Tools in Teacher Education Programs

The School of Education at Northern State University has implemented the electronic portfolio as an assessment tool and as a means of integrating technology throughout teacher education. The electronic portfolio offers a unique opportunity to build preservice teachers' proficiency with technology as well as showcase their expertise in teaching.

The portfolio concept is very popular in education today – and for good reason. First, today's educators have embraced constructivism – the belief that teaching is an active and learner-centered process. This philosophy recognizes that students build their own understanding of the world by using what they already know to interpret new ideas and experiences. Constructivists emphasize not only what students know, but what they do.

Secondly, the growing interest among colleges of education in performance assessment makes a transcript of grades and a score on the National Teachers' Exam (NTE) seem inadequate indicators of competence. A wise person once said: "There is a lot of difference between naming the tools and building the house."

And thirdly, there is still competition for teaching jobs in most areas of the country. It is imperative that prospective teachers be able to demonstrate their teaching competence in concrete ways – to university faculty, to prospective employers, to policy makers at the state and national levels, to parents, the media and the general public.

Why electronic portfolios rather than the paper versions? Electronic portfolios emphasize process as well as product and are multi-sensory in nature, including images, sound, video, text, and multimedia products. It's more fun to see a great bulletin board than to read about it, and it's more effective to hear a university supervisor talking about a preservice teacher's strengths than to read a letter of recommendation. In addition, electronic portfolios facilitate the integration of technology throughout the teacher education program; they provide students with exposure to a wide variety of technology experiences – all in the context of teaching and learning.

The critical phases of portfolio development are collecting, selecting, and reflecting – but the process actually has many phases. Burke, Fogarty, and Belgrad (1994) proposed ten: projecting, collecting, selecting, interjecting, reflecting, inspecting, perfecting, connecting, injecting (and ejecting), and respecting.

As students think about what entries they will collect, how to select those that best convey their abilities, and how to present what they have learned, they are constantly reflecting. Reflective thinking (as defined by Dewey, 1933) is the ability to give serious and persistent consideration to a subject in order to act deliberately and intentionally rather than routinely and impulsively. If teacher educators want preservice teachers to move beyond non-reflective reliance on impulse, tradition, and authority, opportunities for reflection must be provided throughout the teacher education program.

After piloting the use of electronic portfolios with twelve teacher education students during the 1998-1999 academic year, the School of Education at Northern State University began implementing electronic portfolio components into teacher education methods courses. The model used for electronic portfolio implementation solicited proposals from faculty members interested in integrating electronic portfolio components into their methods classes. Faculty received monetary compensation for the creation and integration of electronic portfolio components into their courses.

Each student-created electronic portfolio is original; portfolio components are designed to address one or more of the ISTE National Educational Technology Standards (NETS) and performance indicators for teachers. In addition, students must address each of the five categories of the knowledge base for teacher education at Northern State University: Knowledge of Self as an Individual, Knowledge of Content, Knowledge of the Learner, Knowledge of Pedagogy, and Knowledge of Self as a Teacher and Member of a Learning Community.

Electronic portfolios have been a part of the teacher education programs at Northern State University for four years; current efforts have focused on assessment of the electronic portfolio process and product. Teacher education graduates are asked to complete a self-assessment survey of their technology expertise and their comfort level with technology integration. During their professional semester, preservice teachers showcase their electronic portfolios and receive feedback from university faculty members. Electronic portfolio components are then assessed to determine whether appropriate opportunities have been provided for students to meet the ISTE National Technology Standards (NETS) and performance indicators for teachers as well as the required program outcomes for teacher education graduates of Northern State University.

This presentation will focus on the data collected from the self-assessment surveys as well as the results of the electronic portfolio assessment. Specific components of original student-created electronic portfolios addressing one or more of the ISTE standards and meeting one or more program outcomes will be shared along with accompanying assessment tools, including a newly-developed holistic rubric.

Burke, K., Fogarty, R., & Belgrad, S. (1994). The mindful school: The portfolio connection. Arlington Heights, IL: IRI/Skylight.

Dewey, J. (1904). The relation of theory to practice in education. The Third National Society of Education Yearbook (Part I). Chicago: University of Chicago Press.

Dewey, J. (1933). How we think: A restatement of the relation of reflective thinking to the educative process. Boston: Heath.

Dr. Constance Geier is an Associate Professor of Education at Northern State University in Aberdeen, South Dakota. She has been at NSU since 1991 and has taught courses in Educational Psychology, Educational Assessment, and Educational Research. She currently serves as NSU's LOFTI Coordinator. LOFTI is a $10 million federal technology challenge grant administered by the United States Department of Education. LOFTI stands for Learning Organizations for Technology Integration, and NSU is one of numerous partners in the five-year grant.

The Changing Role for Universities as Life Long Learner Centres

Ralph Genang, Delft University of Technology, the Netherlands, r.r.m.genang@io.tudelft.nl

Sicco Santema, Delft University of Technology, the Netherlands, s.c.santema@io.tudelft.nl

Abstract:
Universities can become Life Long Learner centres if they adapt quickly to the needs of future knowledge workers. Technology enables universities and research institutions to prepare their organizations to serve and develop future life long learners.
By motivating learners with similar interest to collaborate and innovate, universities will develop stronger ties to the corporate world and their knowledge workers, who will need continuous education in order to effectively compete in the ever changing business world.
This working paper will present you some relevant points and questions. Interested persons can contact the authors for more information about this research program.

Introduction

Today 30% of the total work forces are skill-based workers, workers that need a continuous learning environment in order to do their job efficiently. The US Department of Labour in 2000 forecast that by 2015, 85% of our workforce will be a knowledge-or skill-based worker. How can companies feed all the right skills to the right people acknowledging that most of these future skills don't even exist today?

A primary requirement for any company operating in the knowledge-based economy is to structure individual and organizational learning to create a learning environment amongst its employees, partners and clients. Being able to learn at the speed of change and continuously create and share specific knowledge will be a required skill in order to maintain a competitive advantage over both the near and long term.

Businesses are increasingly operating on a global scale, often in a multi-lingual and multi-cultural environment in different time zones. Due to this growing internationalization, learning at the speed of change and providing employees access to the right knowledge at the right time faces an even more challenging task

Access to Knowledge is one of the Keys

A lot of research and knowledge is available in universities and research centres throughout the world. Many companies, especially SME's do not have the resources to create their own knowledge centers and are in no position to maintain their knowledge centers and create new knowledge.
Employees who have access to a knowledge base where they can share their expertise are stimulated to innovate individually and as a team, yielding increased performance of both individuals and teams, resulting in better performance of the company.
Can Universities and their Research Centers Offer the Necessary Life Long Learning Environments and feed individuals with the necessary knowledge?
In order to contribute to a society that learns at the speed of change, universities will have to learn in close contact with the industry what the purpose of learning is in today's world.

What is the purpose of learning?
1. Learn how to solve problems what is a problem?
2. Learn how to communicate and collaborate in a multi-cultural and global society
3. Learn how to address the impacts of external forces and change

4. Learn how to become a transferor of skills
5. Learn how to stimulate a desire to learn

Learners have to develop three sets of skills that will carry them to a life long learning process

1. Has an ability to learn (Intellectual Capital). The ability to learn has to be coupled to the individual learning style of the student.
2. Knows how to define and solve problems (Creative Capital). They have to be able to apply knowledge to innovate and create solutions to problems
3. Knows how to work with people (Emotional Capital). He has to develop the interpersonal skills to work with a diverse group of people

Today's sixth form students are learning problem solving skills beyond the knowledge based A-levels. They live in a different world than their parents. They know how to use the Internet and other information and communication tools to solve problems quicker and differently and are learning to collaborate and exposed to different learning systems, they grow up in a multi-cultural, global environment, they are capable in multi tasking, they are learning teamwork and leadership skills.
What is the relevance of these skills to a university education as it is currently offered? How important are these skills to a university education and beyond?

Qualifications

Our society is obsessed with the term qualification. So what is a qualification?
Is it the ability to memorize and demonstrate any specific knowledge a qualification for anything? Is it a set of skills required for a job? What job are we qualifying these people for? Will today's jobs still exist tomorrow and visa versa? Is it is an arbitrary designation by the Government, school or university? Is it to measure progress of the learner or of the teacher?

What is the value of today's qualification in an ever-changing world? Since today's economy requires continuous learning being able to effectively compete, the university's role must continue beyond issuing degrees. They'll do that by establishing outreach programs where they will offer short courses and seminars on relevant subjects to the community at large. At the same time universities must encourage in-reach programs by utilizing industry experts, establishing research projects with industry and forming cooperative curriculums with other universities on a global basis.

Tools and technology

Tools have to be created that take advantage of technology and contribute to the ongoing learning process. These tools should give learners easy access to knowledge. They must be able to create their own learning material in constant collaboration with their peers and motivate each other to update their knowledge in a manner so others can benefit from it. The offered continuous learning environment should be based on different learning styles. Some learners prefer to learn by hearing, others by watching or by reading and others by doing.
How will we provide learners with these tools?

In order to be effective, learning must be collaborative, particularly between the learners. The best way to accomplish that via electronic media is through simulations using interactive game theories. Rather than a lecturer, the learning is delivered via a facilitator, which can be an independent third person of one or more of the learners.

Before simulations can take place, universities or research institutions will have to focus on accumulating relevant content based on knowledge available within the institution or within its network. Publications are current carriers of knowledge. But the society does need another carrier that will enable users to access data instantly and remotely.

The carrier does need to shift capture and application of knowledge towards the presence and if possible the future.
Knowledge can only exist in the present. In the past knowledge becomes commodity data and in the future, knowledge becomes intelligence. In the future past knowledge can only be useful if it can be communicated by "insiders" to outsiders through a story reflecting the context of the situation in which the knowledge grew. For future users this knowledge will become commodity data. Capturing this data is relevant for future innovation and the process can only be successful if it is captured in the present.

We believe you cannot learn unless you are emotionally involved! So in order for new knowledge and innovation to grow out of commodity data, the learner, must have a special relationship to the situation, he or she must be emotionally involved and peers must approve his or her experience. This will stimulate the learner to take the effort to capture and share the knowledge and allow it to become commodity data for future purposes.

Delivering learning through a technology media such as the Internet requires a completely different approach than that used in the classroom. The vast majority of Internet based canned courses are created by trying to duplicate a lecturer's role by offering either printed text or in some cases audio or video overlays on a screen. Without an intimate classroom environment and synchronous feedback from the lecturer, this method via the Internet is ineffective, at best.

Both the universities and corporations are introducing technology into their learning centres to lower the costs of training, make the material more relevant and to allow employees, partners and clients to access necessary courses at any time from any place. Up to today it is not clear if these learning centres have the right learning effect.

Building effective courses and creating content to be delivered via the electronic media that can be used by people from different backgrounds and with different interests is a very expensive process initially. However, the results that it will yield will give a rapid return on investment

Example: Business to Business marketing at Delft University of Technology

At Delft University of Technology a first prototype of a new carrier was created over the last five years. There are three different levels of knowledge in this knowledge environment: commodity data, commodity knowledge and new knowledge. (Santema, Genang, 1999) Actually all the bodies of knowledge are just bodies filled with interesting data, or as we call it "commodity" data. As Karl Marx (1957) quoted, a commodity is a mysterious thing, a hieroglyphic – a picture thing, a "beautiful" system now taken to be difficult or impossible to decode. Succeeded in motivating the learners to react on this "commodity" data in order to "learn" it, to deepen it and make their own knowledge of it. But this is not enough. The learner should be able to share his or her knowledge with other learners following the course. Can learners be motivated to state what data they found (and where) and what they did to process it in order to make it knowledge for them. And what happens when they discuss it with other learners. Will they motivate their progress, will they change it, will they convince others and therefore deepen the knowledge they derived from the data? Can they add new knowledge? In order to achieve these learners were rewarded on information and knowledge sharing. Groups of learners were deliberately instructed to look at a subject from different angles and using "knowledge" out of our learning environment or any available medium to substantiate their opinions. The focus of education shifts more to the self-expression and judgment of the learner. (Sakamoto, 1999). There are no instructor-based lectures but student-based lectures. The lectures of the instructor are recorded and his commodity knowledge is now accessible through ICT. Learners can access this data (their perspective) and use it to solve problems. They learn how to find, access and apply relevant knowledge to solve a specific knowledge in collaboration with other users. The time saved by not giving lectures anymore is now for learners. They can discuss face-to-face their learning moments, ideas with other learners or experts. (Representatives of the industry are invited to challenge the learners with future problems, which they do have to solve based on available knowledge, creativity, resulting in future intelligence. Learners prepare their own subjects, they have to use their own hunger to learn to motivate their fellow learners, and they become their own instructors. This is one example how learners are motivated to cooperatively use "content" to create "new knowledge" among the participants. The setup is summarized in (figure 1) The process is baptized Learner-Led-Learning. We are currently studying how we can improve knowledge creation by introducing simulations that will connect learners with different or similar backgrounds and interests to increase innovation. There is a huge interest from the industry to access the current knowledge base and use it as a resource for development and innovation. Some students still access the environment after graduating.

	Classic lectures	**Workshops**
Commodity knowledge **(Teachers perspective)** = **Commodity data** **(Students perspective)**	Learning environment, (Bodies of knowledge)	Learner groups
Teacher **New knowledge** Student	Via - Learners - Www - Instructors	Discussion learners Amongst themselves, and With instructor(s) or Guest speaker(s)
	ONLY ICT	**FACE to FACE**

Figure 1: possibilities for ICT based classrooms, Santema Genang, Delft, 2000

Technology has been a tool during this process enabling learners and instructors to speed up the process of solving a problem by having instant access to relevant knowledge and peers.

Summary: Break the Rules

In order for universities to serve a roll as life learning centers they must address intellectual capital, creative capital and emotional capital in the educational process. Universities have to understand that life long learning not a choice but a requirement in today's economy. Their role is to develop life long learners and provide life long learners with the right tools.

Before that will happen, education has to shift from the past towards the future, towards innovation and creativity. Universities and government must question the value of today's qualifications in an ever-changing world and shift the focus towards evaluating problem solving skills, learning skills and people skills. They will have to prepare their content and structure their organization to allow the establishment of outreach programs where they will offer short courses and seminars on relevant subjects to the community at large. Universities must encourage in-reach programs by utilizing industry experts. They must establish research projects with the industry and form cooperative curriculums with other universities on a global basis.

If universities and research centres succeed in creating, attracting and delivering life long learners and succeed in cooperating with other institutions; universities will play an important role in the future as "centres of knowledge and innovation".

Paulo Freire (Freire 1999) had a message to learners: "I'd like to say to us as educators: poor are those among us who lose their capacity to dream, to create their courage to denounce and announce. Poor are those who, instead of occasionally visiting tomorrow, the future, through a profound engagement with today, with the here and now, poor are those who, instead of making this constant trip to tomorrow, attach themselves to a past of exploration and routine."

References:

Freire, P. (1999). Education and Community Involvement. In Donalde Macedo, Critical Education in the new Information Age.

Genang, Santema (1999). Delft University of Technology, Rethinking Education, Ed-Media paper.

Marx, K. (1957). Capital. Translated by Samuel Moore and Edward Aveling, London: Allen and Unwin

Sakamoto, T. (1999). Educational Reform by Information and Communication Technology, National Institute of Multimedia Education, Japan

"Living in the Information Age"

Writing Emphasis Goes Online

David C. Gibbs
Department of Mathematics and Computing
University of Wisconsin-Stevens Point
Stevens Point, WI 54481
dgibbs@uwsp.edu

Abstract

This paper describes a unique course residing at the intersection of two movements: an online offering containing a writing emphasis. The course is entitled "Living in the Information Age" and is offered in a department of Computer Information Systems. The learning activities of the online course are described along with their associated writing activities. Several successful strategies are described in some detail.

1 Introduction

The University of Wisconsin Stevens Point has been a leader in technology since the earliest days of networked computing. Technology leaders saw the direction of campus computing, and in 1985, having sought out and established corporate partnerships, succeeded in putting a local area network in place. By the early 1990s, all constituents of the university were regularly using the Internet – well ahead of its time for an institution of its size. Online courses followed as early as 1996, when faculty in the school of education recognized an opportunity to take their coursework to practicing teachers.

Almost a decade earlier, in response to a perceived decline in writing skills, the university began to develop "writing emphasis" courses. A writing emphasis course is typically a discipline-specific course in which students are required to research, compose, and revise text to an extent exceeding a normal offering of the course. The university established a writing emphasis graduation requirement for all freshmen entering in the 1981-82 academic year.

This paper describes a unique course residing at the intersection of the two movements: an online offering containing a writing emphasis. The course is offered by the Computer Information Systems department and is entitled "Living in the Information Age[1]". Several successful strategies are described in some detail.

2 The Learning Environment

The semester long course is taught entirely online (via the Internet) using the courseware *Blackboard* [1]. Blackboard provides instructors with a complete set of online course tools, including discussion forums, folders for course information and assignments, an online gradebook, a virtual classroom, and the ability to manage group interactions. The course described here utilizes each of these features.

3 The Course and its Activities

Students are exposed to course material in three separate ways: by reading and writing, by reading and responding to their classmate's writings in the peer editing process, and by reading and replying to their classmates postings in the online (asynchronous) discussion forums.

---

[1] Course Description: Outline of technological developments occurring in information access and storage, and effects the information revolution is having on everyday life, professions, privacy, security, automation, law, government and employment.

The course is comprised of four principal activities: (1) reading (books and websites) and responding to the readings (by writing or electronic discussions), (2) *e-News* posts (and responses to posts), (3) "*Because-You-Can*" posts (and responses to posts), and (4) *Web-Exercises*. Each activity includes reading and writing.

Readings

The formal readings for the course are intended to prod and provoke the reader. Listed in the order they are examined in the course, they are:

1) ***Technopoly***, by Neil Postman;
2) ***What Will Be***, by Michael Dertouzos;
3) ***Brave New World***, by Aldous Huxley.

Web readings taken from selected URLs are also utilized throughout the course.

A response to a formal reading comes in several forms, varying from a post in a discussion forum to a complete paper. The responses are described in section 4 below.

e-News Posting

An *e-News* post is a current news item of interest that is related to the *Information Age*. The news item may emerge from an online news service, such as Edupage [3], the New York Times Technology page [5], or from another web source. Posting means briefly summarizing the news item, placing the reference (usually a web address) in the appropriate discussion forum along with some provocative questions. Here is an example of an e-news posting (from September 12, 2001) in the discussion forum:

> Use of 911 in cell phones has been talked about for a number of years. Wireless carriers were supposed to have the first phase of the system in place by 1998, and phase 2 was to be established by Oct. 1 of this year.
>
> http://news.cnet.com/news/0-1004-200-7139433.html?tag=mn_hd
>
> But there is an ugly flip side to e911 - the simple fact that identifying the location of the cell phone usually means identifying your location - any time day or night - when calling or not.
>
> Should wireless phones be required to have 911 built-in? Why or why not? Does it represent yet another loss of individual privacy?

Each student must respond (asynchronously) to the questions. Often they are required to return a day or two later and respond to any previous student post.

"*Because-You-Can*" Posting

While similar to an *e-News* posting, a "*Because-You-Can*" (BYC) posting is may be somewhat whimsical. Students are asked to find an example of technology for which the only possible answer to the question "Why would they create that?" is "*Because You Can*".

> Want your hair stimulated and massaged as you brush it? You need the massaging hair brush. It will encourage hair growth by magnetically stimulating your scalp, increasing blood circulation.
>
> I think they should make it with adjustable, programmable settings, though, because my wife and daughter probably have their eye on it and their massaging and detangling needs are way different than mine.
>
> PLEASE tell me what the "blessing" is in this device? And what is the "curse"?

Posting a "BYC" means summarizing the technology and providing the reference (again, usually a URL). Because it is difficult to ask thought-provoking questions in this case, it is sufficient to attempt to establish something *beneficial* (and something *less than beneficial*) about the technology. And then challenge the class to do the same. The point of the exercise, besides having some fun, is to expose the extent to which technology can sometimes presents solutions in search of a problem.

Web-Exercise and Assignment

A web exercise and its assignment will usually involve some exploring of the web leading to a deeper understanding of "Life in the Information Age." Each exercise is organized around a theme [8], such as "Online Education." Sets of questions, accompanied by a series of links, guide the exploration. The written answers to questions are submitted either by e-mail or to a discussion forum established for the exercise.

4 The Writing Assignments

Writing assignments are submitted or exchanged through a variety of techniques, including e-mail (as body text or an attachment), a discussion forum, or the instructor's or the group's drop box.

The types of writing assignments vary from somewhat informal to highly formal. The informal writing assignments include *e-News* and *Because-You-Can* posts and responses. Submitted in a discussion forum created for that purpose, all students are given the opportunity to post, to read, and to respond to the questions raised and their classmates' replies.

Another informal type of writing is found in completing the Web Exercises. Consisting of one or two paragraphs, this writing can be posted in a discussion forum or submitted to the entire class (using a distribution list) or directly to the instructor using e-mail.

Somewhat more formal are responses to readings. These may take the form of answering questions posed by the instructor or posting a "reaction paper." In both cases, students are encouraged to compose text in a word processor making use of spell- and grammar-checking capabilities before copying and pasting into a discussion forum.

The most formal type of writing is the most familiar to college teachers and students, but with some online wrinkles. Given a topic rooted in the readings and discussions, students are asked to address the main points in three or more pages. Peer editing is key. In groups of three, students submit their writing in the digital drop box[2] for their group. Each student will edit two other papers, supplying feedback to their peers using standard word processing strategies. They may insert suggestions directly into the text, add comments using the software's "Insert Comments" ability, or simply use highlighting or font/color changing to draw attention to certain passages or paragraphs. The editor then re-submits the document (using a variation on the filename) to the group's drop box. The author picks up the paper, makes the changes deemed appropriate, and submits it to the instructor's digital drop box. When submitting their final drafts, each student is required to include the peer-edited versions of their papers. The instructor uses the same editing techniques to return marked-up papers to the students.

5 Successful Strategies

The most successful strategies for writing emphasis emerging in this online course are the informal *e-News* and *BYC* posts, the reaction papers, and the longer, more formal papers.

The *e-News* and *Because-You-Can* posts and responses are effective in generating lively electronic discussion, if not quality writing. Students today are well versed in "chatting" and the riposte style that emerges when questioning someone's assumptions. These "discussions" generally remain of high quality due to the implicit moderation provided by the instructor's virtual presence.

Forums for the purpose of discussing reaction papers are restricted to approximately ten students. Each student is required to respond to nine other reactions. Because of the seriousness of issues examined (e.g. personal privacy, ethics of genetic engineering), the dialog taking place here is at an even higher level than the e-News and BYC posts.

According to student evaluations, though they found peer editing of the formal papers a bit of a nuisance, almost all students found it valuable. As writers, they found it valuable in receiving feedback, and as editors, they found it valuable in learning from a classmate's views of the same subject.

6 Summary

Writing emphasis courses were added to the curriculum and graduation requirements in order to improve students' writing skill by increasing the quantity and quality of writing being done. This course presents a variety of writing tasks, from informal to formal, and it does so requiring the interaction of peers. Increasing both time on task and the amount of writing and rewriting with feedback can only assist the goal of improving writing skills.

References

[1] Blackboard Corporation, www.blackboard.com

[2] Dertouzos, Michael. (1998). *What Will Be.* New York: Harper-Collins.

[3] Edupage e-mail list subscription:

---

[2] Blackboard's "digital drop box" is essentially a managed file exchange service for only those members in the group (and the instructor).

www.educause.edu/pub/edupage/edupage.html

[4] Huxley, Aldous. (1932). *Brave New World*. New York: Harper and Row.

[5] New York Times Technology page subscription:
email.nytimes.com/email/email.jsp

[6] Postman, Neil. (1991). *Technopoly: The Surrender of Culture to Technology*. New York: Vintage Books.

[7] University of Wisconsin Stevens Point internal document: "Guidelines for Writing Emphasis Courses." (1981).

[8] Web Exercises in CIS 300 at UW Stevens Point:
www.uwsp.edu/cis/dgibbs/CIS300/WebXINDEX.htm

Building Responsive Dissemination Systems for Education with the Semantic Web: Using the New Open-Source "Liber" Application

Dr. David Gibson
National Institute for Community Innovations
Montpelier, Vermont
dgibson@vismt.org

Dr. Michael B. Knapp
Green River Data Analysis
Guilford, Vermont
mknapp@greenriver.org

Brandt Kurowski
Somerville, MA
E-Learn@BrandtKurowski.com

Abstract. There are numerous web-based survey instruments for educators that determine needs related to professional development, student results, and school performance. However, people receiving survey results also need simultaneous access to proven solutions to the concerns identified in such surveys. This paper explains a portal tool application of the Semantic Web which pre-configures channels of digital library content based on survey analyses and user profiles. The National Institute for Community Innovations (NICI) has developed the open-source code "Liber," that assists in the use of XML/RDF descriptions of digital resources to customize the presentation of digital library content to the needs of individuals and groups involved in K-12 education. The research and development of Liber has been supported with USDOE, and NSF subgrants and contracts from both NICI and the Vermont Institute for Science, Mathematics and Technology.

Introduction. The World Wide Web (WWW) has enjoyed unparalleled success as a tool for the publishing of digital content, but it remains difficult to find appropriate high quality resources online, even though many exist. Two reasons for this are that (1) the staggering quantity of information on the WWW defies any centralized, human cataloging efforts; and, (2) most WWW information is posted with little attention to information structure, making the cataloging of these resources by computers or humans more difficult. Computer scientists, researchers, and librarians have attempted to address this problem in varying ways, and strategies such as the html "meta" tag and the Dublin Core have been most successful. An effort to improve upon these technologies has led to the creation of the Semantic Web, a multidisciplinary initiative with a structure that allows machines to process information for accessibility of web content.

The core of the Semantic Web is the Resource Description Format (RDF), a standard for machine understandable metadata. Because RDF works in such a way as to allow applications to share data, even if they were built independently of one another, the Semantic Web allows catalogs of resources to be built using a decentralized model. Just as anyone can link to any page on the WWW, anyone can describe any resource on the Semantic Web. This allows for the development of intelligent routing of resources to users, based on RDF queries that express a user's interests.

A New Semantic Web Tool: Liber. The Vermont Institute for Science, Mathematics and Technology (VISMT) and the National Institute for Community Innovations (NICI) began piloting the application of the Semantic Web to the field of online education in the fall of 2000. After discussions with leadership from the Dublin Core Metadata Initiative and the W3C Semantic Web activity, we began development of the Liber engine (http://liber.sourceforge.net), now an open-source software application. Liber allows resources to be cataloged using an extensible metadata framework, and presents those resources through an integrated front-end tool.

Liber is a prototype of the application of Semantic Web concepts and technologies to the needs of the educational community. It is a catalog of community-contributed resources that have undergone review by experts and been cataloged by a librarian. At present, Liber uses RDF schemas from Dublin Core and IMS, merging them with custom RDF schemas representing GEM Element Set and NICI's Educational Reform metadata, to form a comprehensive vocabulary for expressing information about resources of interest to educators. Such an approach exhibits some of the principles of metadata as expressed by Duval, Hodgins, Sutton, and Weibel (2002). For example, the *modularity* of the schemas allows different educational groups to use a small set of core elements to tag resources for a wide variety of specialized educational uses. Second, the *namespace* we propose "*edreform:*" adds a new dimension to the existing core data elements available in existing metadata schemas. Third, the *extensibility* of the metadata system produced by Liber allows for an evolution in the vocabularies. Finally, we are proposing a number of *refinements* to concepts that were originally proposed for broader application. For example, we are proposing a scale of "novice to expert" that is commonly used in educational assessment, as a refinement of the dc-ed: audience.

The Liber prototype has powerful ways of searching resources – users can perform simple searches of the metadata, construct complex RDF queries with a simple web interface, or get a list of resources similar to an already discovered resource. With these tools, users can easily traverse the catalog without being confined by disciplinary boundary, intended audience, or other similarly limiting categorizations.

Liber Applications. The first Liber application was developed by NICI under funding from the US Department of Education, and is used to present online resources that are helpful to grantees in addressing the digital divide - disparities in access to online technologies by race, gender, ethnicity, and income. This work resulted in the application currently running at www.digital-equity.org. The PT3 (Preparing Tomorrow's Teachers to Use Technology, www.pt3.org) grant program that funded the work followed our recommendation to establish a metadata working group, and has promulgated an RDF standard at http://www.pt3.org/2002/elements/1.0/elements Following this initial project, in the spring of 2001, under funding from the US Department of Education's technology innovation challenge grant program, NICI began work on a metadata vocabulary to describe educational reform. The prototype educational reform metadata can be viewed at www.edreform.net/metadata.

EdReform Metadata. As we worked to develop the NICI educational reform metadata, we encountered difficulty due to the fact that metadata standards for education are devised from the perspective of practicing education, not researching and improving education. Existing educational metadata standards, such as IEEE LOM and IMS, are useful for cataloging courseware, but criteria of importance to educational improvement, such as urban teacher preparation, equity, and school leadership, are not addressed. Our prototype work demonstrates that existing metadata standards can be integrated, and that additional metadata specific to the needs of educators in the field will have to be added. For example, we have proposed the addition of control vocabulary under a new qualifier we termed systemic values (see http://www.edreform.net/wiki?EducationalReformMetadata/SystemicValues) to describe the beneficiary and mediator of an educational resource. Our intention is to develop an application framework for educational practitioners to propose cataloging terms, and to integrate those terms into both the existing frameworks of cataloging entities and the initiatives of a number of national educational organizations.

Our initial work indicates that this is possible, and we are now preparing to refine and promulgate the educational reform vocabulary, and develop a methodology to allow for the enhancement of the vocabulary based on an analysis of the proposals from the educators using the applications. We believe that this will significantly enhance the ability of field-based educators to use terms and phrases they naturally employ to describe important concepts in order to search for and access information on validated reform strategies and resources. Our goal is to improve the ease and efficiency with which field-based educators locate material on best practices relevant to their priority concerns.

Responsive Dissemination Portals. The second prototype implementation of Liber is under development at www.edreform.net. "Channels" of information are constructed from specific paths in the metadata, which respond to the key phrases and big ideas of expert panels on educational reform. We have thereby extended existing metadata vocabularies (e.g. Dublin Core, LOM) with an EdReform vocabulary, and included a new process of *aggregation* to define topics relevant to K-12 educational reform. These topics, regarded as critical to state and local K12 educators, include ideas such as urban teacher preparation, equity, and technology infusion. We have found that it is at this level of vocabulary that teachers, administrators, educational leaders and other organizational leaders can effectively interact with digital resources. Our proposed mechanism for *aggregation* is a unique addition to the conceptual framework of metadata principles, perhaps as new form of *refinement.* (Duval, et. al., 2002)

The NSF Protocol. Based on the success of these first two prototype implementations of Liber, NICI began collaboration with VISMT to develop a Liber portal for the NSF Funded National Systemic Improvement Initiative Protocol project. VISMT, in collaboration with seven other statewide systemic initiatives (together called the National Systemic Improvement Initiatives consortium), has developed a web-based survey (the "protocol", http://www.nsii.org/survey.cfm). Its purpose is to enable states and local education agencies (LEAs) to self-assess the extent to which systemic reform is established in their organization. Research by Fuhrman, Clune and others (2001) have shown a relationship between the depth and breadth of systemic change and improved student achievement. That portal is currently running at http://catalog.nsii.org and school systems that complete the assessment instrument are offered a responsively configured channel of resources based on the results of the NSSI survey.

NEA Keys. NICI has also developed an online survey instrument in support of educational reform for the National Education Association (NEA) that can be viewed online at www.keysonline.org/DEMO. Over 5000 users in three states have accessed this survey since it went online in the Fall of 2001. Our intention is to apply the architecture underlying the linkages between the interactive catalog and the NSII application to the NEA's application, as well numerous others. We have recently proposed, for NSF digital library funding, to strengthen the prototype, and to extend it to additional applications.

When a NICI survey is taken, factor analyses are performed on groups of survey questions, which calculate mean scores, priority levels, and standard deviations. Based on these calculations, an index is determined within each metadata category (such as school leadership). An application of the metadata to the factor analysis results matches indices with Liber cataloged resources. Furthermore, because respondents' own personal metadata profiles use the same vocabulary as the other digital resources, it can be used to match people and organizations with one another. Thus, we can expand the definition of cataloged resources to extend to individuals, work groups (such as the classroom), school systems, regional and national educational organizations and other learning organizations.

Conclusion. Liber begins to demonstrate the value and scalability of a responsive dissemination system that (a) queries K-12 educators, students, professional developers, teacher education faculty, and educational leadership via a set of web-based surveys. (b) scores surveys using factor analysis, and generates metadata profiles based on the results. (c) catalogues resources by elements, qualifiers, and controlled vocabularies based on factors assessed in the survey , and (d) presents resources to each user or organization in a channel that is pre-configured according to survey results. When accessed as we are describing, the dissemination of digital resources that are coming online now using XML and RDF standards will be "responsive" to learners, teachers, schools and other kinds of groups and organizations.

References

Fuhrman, S. (2001). From the capitol to the classroom: standards-based reform in the states National Society for the Study of Education. Chicago: University of Chicago Press.

Duval, E., Hodgins, W., Sutton, S., Weibel, S.L., 2002, Metadata Principles and Practicalities. D-Lib Magazine, Vol. 8. No. 4 http://www.dlib.org/dlib/april02/weibel/04weibel.html

Functions of an Online Mentoring and Professional Learning Portal

David Gibson
National Institute for Community Innovations
Montpelier, Vermont
Dgibson@vismt.org

Abstract

How does online collaboration work when a learner is in complete control of the dialog with advisors? How can remote advisors provide high quality feedback on work samples and artifacts? This paper discusses the online Professional Learning Portal project underway at the National Institute for Community Innovations, and presents some of the details of the theory and thinking that is guiding the development. The web-based software is part of work by the National Institute for Community Innovations (NICI at http://nici-mc2.org) to develop tools for enhancing preservice education and supporting increased use of technology, especially in Professional Development Schools.

Introduction

The online Personal Learning Planner is a human and machine web-based assistant site that is based on a theory of dialog recently articulated by myself and Anne Friedrichs (Friedrichs, 2000; Friedrchs and Gibson, 2001). The theory of collaborative interaction for learning is consistent with several writers concerned with authenticity, use of technology to create problem-centered learning teams, representation of complex dynamics in educational settings, and online learning. (Carroll, 2000; Gibson, 1999; Gibson & Clarke, 2000; Newmann & Wehlage, 1995; Stiggins, 1997; Wiggins, 1989, NSDC, 2001).

Friedrichs (2000) discusses four distinct dialogue stages that manifest themselves in the Personal Learning Planning process:

1. Sharing Experience: Listening to own and others' inner speech and natural attitude about a skill or concept.
2. Expressing and Examining Diverse Concepts: Recognizing conflicts; analyzing old and new concepts, models and beliefs; working in one's zone of proximal development.
3. Articulatiing Applications and Understandings: Practicing new skills; combining old and new concepts; using others' ideas, using scaffolds to renegotiate understandings.
4. Communicating New Powers and Creations: Celebrating effects of critical analysis

The online Personal Learning Planner (PLP) provides a structure within an online working space with private and public access controlled by the learner to enable the above framework to work among a learner and any group of people serving as critical friends and advisors to the learner. With funding from the U.S. Department of Education under the "Preparing Tomorrow's Teachers to Use Technology" program (http://www.ed.gov/teachtech/). NICI has developed the first version of the PLP as a "critical friends" online space for future teachers who are assembling portfolios of evidence that they meet the standards required for a teaching license. The PLP is designed to assist learners through the processes of:

- Self-assessment of strengths, interests and aspirations

- Planning preservice education learning goals and projects
- Linking goals and projects to valued outcome standards
- Creating original work and sharing the work with others
- Receiving high quality feedback for the improvement of their work
- Documenting and validating the achievement of learning goals
- Assisting in the selection and preparation of exhibits of learning

Future plans for the PLP include many other learner groups such as K12 students and teachers, trainer-of-trainers programs, leadership programs, and groups as learners, for example, school-based action research teams using the site to develop collaborative products and seeking advice from remote experts to shape and validate the group's work.

Rationale

The rationale for building a web-based tool focused on the improvement of preservice teacher work has two parts. First, there is a need for feedback to come from a diverse audience, yet preservice and induction programs sometimes have limited resources and structures that produce scant feedback to aspiring teachers. As a result, an aspiring teacher's work evolves in isolation, perpetuating the general conditions of teaching present in most schools today. A web-based professional network can help overcome isolation, but even more important, it can provide the future teacher with high quality information that might not otherwise be available. The advantages of "anytime, anyplace" access to experts is an obvious benefit of a web-tool.

The second rationale is that there is a need for effective documentation of learning beyond paper and pencil formats. Ideally, documentation should be a record of the decisions as well as the validation of the work produced. In small personalized programs, preservice teachers benefit from many interviews and observation/feedback sessions related to their work, but in many programs, that experience is limited to the last few months of preparation. An online personal learning planner can help create a longitudinal multimedia record of growth and change in an aspiring teacher's skills and capabilities

The sources of inspiration and rationale led us to ask "What does preservice teacher work look like?" "What would happen if we could build a site for the improvement of a future teacher's work?" "Could the principles of personalization and helpful feedback in a professional network assist teacher education programs?" The online Personal Learning Plan is a way to pose answers to these kinds of questions.

Critical Components in the Online Personal Learning Plan

One of the first questions often raised is whether online learning of any kind can truly be personal. Isn't person-to-person the most *personal* way to learn? In fact, isn't online work one of the most *impersonal* kinds of interaction there is between humans? I don't wish to argue these points here. Online learning is here to stay. It brings remote resources to the desktop anytime, anyplace. Yes, it is in its infancy. Yes, it lacks many important features needed for rich human communication, but so does writing, film, video, and even talking. Using new communication tools in learning is a matter of integration and balance and its effectiveness depends mightily on the attributes of both the learner and teacher. In spite of these challenges, online learning is growing and evolving at a rapid pace.

The Online PLP promotes a uniquely learner-centered approach to the challenge of integration and balance of technology in learning. The following basic assumptions guide the thinking behind the NICI - PLP.

Three bases of planning and action for learning

The purposes of learning can be categorized by three domains:

- Institutional priorities – our shared community goals
- Professional priorities – our scholarly traditions and expectations
- Personal priorities – our source of deep meaning

The Learning Cycle

The Online PLP can be a powerful extension and helpmate in the "action research" process of planning, doing, reflecting and consolidating knowledge.

Focus on the learner's work

The learner's productivity and self-efficacy is the ultimate goal of the Online PLP. Work samples are the critical source for evidence of learning, the documentation of progress, and the verification that high standards have been achieved.

Self-Direction and Making Meaning

Learners produce better and are more highly motivated the more they have decision-making power over their learning. Learners gain from posing questions to advisors, and from knowing about, developing and using a variety of learning assets - their strengths, interests, aspirations, community and personal resources. All learning is a matter of making personal meaning out of the alternatives presented in experience.

Flexible Thinking Tools

Learners gain from scaffolding and assistance in stages and types of thinking, for example, divergent thinking, using multiple frameworks and perspectives, and so forth.

Structure and Roles

The online Personal Learning Planner allows all media formats and a multiplicity of linkages among learning goals, projects, and the evidence of attainment of standards of performance. Distinct from electronic portfolios that concentrate on the presentation and storage of completed work, the PLP concentrates on the improvement of work and the documentation of change of work over time.

Three user levels and a server administrator level are provided. Users levels include the Learner, Advisors, and a Program Administrator. The learner is in charge of their PLP. They create or choose goals, link them to standards or other external sources, create work that stands in relationship to the goals, make decisions on when both goals and work will be shared with advisors, and decide when work and goals are to be archived into permanent storage. Learners can make digital collections from their body of completed work. Each collection is presented as a self-contained website in which each work can independently attach reflections, summative evaluation, and new context-setting narrative and graphics.

Advisors are associated with one or more learners. When a learner's goal or work is being shared for critique and feedback, the Advisor can discuss, offer direct edits or validate the goal or work as adequate for its purpose. For example, a goal might be validated as appropriate to completion of a secondary teaching license in science; a piece of work might be validated as evidence of achieving a standard of performance linked to one or more goals. The validation process can be formalized with rubrics or left as narrative, and any rubric can be associated with any piece of work's link as evidence. When a group of advisors scores a work using a common rubric, a summative rubric can be built upon completion of the work.

The Program Administrator can review all Learners and Advisor records, add and delete Learners and Advisors, set defaults on the number of advisors that need to agree in order for validation to be complete, create rubrics, create and edit standards, and make other selections associated with program management. The Server Administrator controls the hardware and communication decisions needed for site maintenance and archiving.

PLP as a Team Tool

The use of the PLP as a team tool assumes that agency for a group operates much like it does for an individual, once internal communication and trust within the group has been developed. Outside reviewers can be invited to become project advisors. The PLP allows anonymous or "tagged" contributions by group members to facilitate both group and individual accountability. As a collaborative tool, the PLP facilitates building a group's history as well as a collection of validated work products.

References

Bentley, T. (1999, December 8). Students empowered in Montpelier [Our Generation Page]. Times Argus Newspaper.

Carroll, T. (2000). If we didn't have the schools we have today–would we create the schools we have today? Keynote speech at the AACE/SITE conference, San Diego, CA.

Csikszentmihalyi, M. (1996). Creativity: Flow and the psychology of discovery and invention. New York: HarperPerennial, a division of Harper Collins

Fiebelkorn, D. (1997). An ethnography of change: A year in the life of capital city high school. Unpublished draft of doctoral dissertation, University of Vermont, Burlington.

Friedrichs, A. (2000). Continuous learning dialogues: An ethnography of personal learning plans' impact on four river high school learners. Unpublished doctoral dissertation. University of Vermont.

Friedrichs, A. and Gibson, D. (2001) Personalization and secondary school renewal. (Forthcoming from Brown University Regional Laboratory.)

Gibson, D. (1999). Mapping the dynamics of change: A complexity theory analysis of innovation in five Vermont high schools. . Unpublished doctoral dissertation. University of Vermont.

Gibson, D. (2000). Complexity theory as a leadership framework. Montpelier, VT: VISMT. Available: http://www.vismt.org/pub/ComplexityandLeadership.pdf

Gibson, D. & Clarke, J. (1999). Growing towards systemic change. Providence, RI: The Regional Laboratory.

Moffett, J. (1998). The universal schoolhouse: Spiritual awakening through education. Portland, ME: Calendar Island Publishers.

Newmann, F. M. & G.G. Wehlage (1995). Successful school restructuring: A report to the public and educators. Center on Organization and Restructuring: University of Wisconsin.

NSDC (2001). National standards for online learning. Forthcoming. National Staff Development Council.

Stiggins, R. J. (1997). Student-centered classroom assessment. Upper Saddle River, NJ: Merrill, Prentice Hall.

Wiggins, G. (1989). Teaching to the (authentic) test. Educational Leadership, 46: 41-46.

Large-Scale Interaction Strategies for Web-Based Professional Development

Paul J. Giguere, M.S.
Health & Human Development Programs
Education Development Center, Inc. (EDC)
Newton, MA – United States
pgiguere@edc.org

Scott W. Formica, B.A.
Social Science Research & Evaluation, Inc. (SSRE)
Burlington, MA – United States
ssre@gis.net

Wayne M. Harding, Ed.M., Ph.D.
Social Science Research & Evaluation, Inc. (SSRE)
Burlington, MA – United States
wayneh@gis.net

Abstract: The primary purpose of this paper is to briefly discuss five interaction strategies that can be used in large-scale (more than 30 participants) Web-based trainings. Evaluation data are presented from seven Web-based continuing education workshops conducted with United States Department of Education (USED) Middle School Drug Prevention and School Safety Coordinators (MSCs) that utilized two of these large-scale strategies. Results of the evaluation show that, contrary to the current literature, MSCs who participated in large-scale Web-based trainings were highly satisfied with many aspects of the workshops, including the on-line facilitation. The results point to a need to replicate these findings and to further study additional large-scale interaction strategies in Web-based training and professional development.

Introduction

As organizations begin to explore the use of the Web for conducting training and professional development, the issue of workshop or class size inevitably becomes a topic of discussion and debate. Organizations feel pressure to increase the number of participants enrolled in a Web-based training because the costs of creating such trainings (or converting a face-to-face training to the Web) are high and Web-based training can be structured to handle lots of participants (Boettcher, 1999). Increasing the number of participants in Web-based trainings can be an effective way to more quickly recoup development costs by using similar resources for a training of 100 participants that would normally be used for 30 participants. This approach does, however, run contrary to Ko and Rossen's (2001) findings that it is not possible to have a high level of interaction when more than 40 people participate in a Web-based training. Similarly, Palloff and Pratt (1999) indicate that given the large amount of time needed for facilitators and students to engage in substantive interaction, limiting training size seems to be a logical and necessary strategy to maximize the quality of the training. At issue then is the nature of the interaction strategy utilized and how it is impacted when the number of participants exceeds the original design or violates what the literature tells us is good practice. This paper presents five large-scale interaction strategies that, if used properly, should help minimize the potentially detrimental effects of increasing the number of participants in a Web-based training beyond the suggested maximum threshold.

Large-Scale Interaction Strategies

Large-scale interaction strategies allow a large group of learners (in numbers greater than thirty) to engage in some form of asynchronous discussion with a facilitator or instructor in an online environment. The premise behind the use of such strategies is that the objectives of the training have less to do with personal interaction (such as building a community of learners) and more to do with providing a means of reinforcing various elements from the content of

BEST COPY AVAILABLE

the training. For the purposes of this discussion, the five strategies described below are based on the presence of 100 people participating in a Web-based training that utilizes an asynchronous bulletin board-style Web-based discussion area. In each scenario, all participants have unrestricted access to the content of the training (materials, activities, etc.).

1. *Multi-Group Interaction* – This strategy divides the participants into four groups of twenty-five. Each group has its own discussion area and a single facilitator. Groups are not able to view other groups' discussions during the training, however, all groups engage in the same activities and address similar issues in the discussion areas with regard to the content of the training.

2. *Forum Interaction* – Based on topical interests (or through random assignment), participants are divided into four groups of twenty-five. Each group has its own discussion area and a single facilitator but, unlike the Multi-Group strategy, all groups are able to view other group's discussions during the training. This strategy can help achieve a large number of training objectives by having smaller groups of participants exclusively address certain objectives and by making the results available to all groups.

3. *Sub-Group Interaction* – More analogous to an active/auditor model, this strategy selects twenty-five participants who are provided a discussion area with a facilitator (the active group). The remaining 75 participants have "read-only" access to the active group's discussion area, i.e. they can read all of the discussions but cannot make postings. The selection of the active group can be accomplished through a registration process (some participants may prefer to be an auditor since this requires no interaction on their part) or selection can be done randomly.

4. *Large-Group Interaction* – This strategy provides a single discussion area, with one facilitator, for all 100 participants. As the training progresses and amount of participation in the discussion area increases, additional facilitators join in the discussion as needed to accommodate the increasing number of questions or comments.

5. *Meta-Interaction* – This strategy uses a synthesis approach whereby participants are able to submit questions or comments to a facilitator (which may also involve a small team of assistants) through e-mail or a Web-based form. The questions or comments are synthesized and posted by the facilitator (usually with his/her comments or reactions) to a "read-only" discussion area. Participants can then read the synthesis and continue asking questions or making comments.

The five strategies mentioned in this section just barely scratch the surface of what is possible using various interaction strategies in combination with computer-mediated communication tools. Each strategy also has various benefits and problems (the scope of which is beyond this paper).

The Study

Seven continuing education Web-based trainings were held with between 36 and 95 United States Department of Education (USED) Middle School Drug Prevention and School Safety Coordinators (MSCs). These events were meant to supplement a five-day face-to-face training that MSCs were required to attend at the beginning of their grant. The events lasted for five days, and each provided a more in-depth presentation of topics that were just briefly introduced at the face-to-face training. The first three training events utilized the *Sub-Group Interaction Strategy* (#3), and the remaining four events used the *Large Group Interaction Strategy* (#4). Post-event assessment forms were used to assess various aspects of each of the trainings including overall satisfaction, whether or not participants would recommend the event to other MSCs, satisfaction with the role of the facilitator, and usefulness of the information presented. As shown in Table 1, participants gave consistently high ratings to each of these aspects across each of the events.

Table 1. Participant Ratings Web Events 1-7

	Overall Satisfaction (Mean 1-5)[a]	*Recommend this event to others (Mean 1-5)*[b]	*Satisfaction with facilitator (Mean 1-5)*[a]	*Usefulness of information (Mean 1-4)*[c]
1: Using Existing Data to Inform Prevention Program Selection (N=37)[d]	Mean = 4.11	Mean = 4.39	Mean = 4.19	Mean = 3.32
2: Identifying Priorities and Strategies for Your Prevention Initiative (N=82)[d]	Mean = 4.05	Mean = 4.33	Mean = 3.91	Mean = 3.54
3: Promoting Prevention Through School-Community Partnerships (N=56)[d]	Mean = 4.30	Mean = 4.35	Mean = 4.11	Mean = 3.37
4: Selecting Research-Based Programs for Your School (N=93)[e]	Mean = 4.51	Mean = 4.53	Mean = 4.17	Mean = 3.59
5: Implementing Research-Based Prevention Programs in Schools (N=58)[e]	Mean = 4.45	Mean = 4.40	Mean = 4.36	Mean = 3.47
6: Sustaining Your Prevention Initiative (N=72)[e]	Mean = 4.59	Mean = 4.52	Mean = 4.17	Mean = 3.65
7: Linking Violence & Substance Abuse Prevention to Academic Success (N=96)[e]	Mean = 4.58	Mean = 4.57	Mean = 4.46	Mean = 3.65
OVERALL	**Mean = 4.40**	**Mean = 4.46**	**Mean = 4.20**	**Mean = 3.55**

[a] Based on a scale from Very Dissatisfied (1) to Very Satisfied (5)
[b] Based on a scale from Strongly Recommend They NOT Participate (1) to Strongly Recommend They Participate (5)
[c] Based on a scale from Not at All Useful (1) to Very Useful (4)
[d] Utilized the Sub-Group interaction strategy. Results indicated no significant difference between auditors and active participants
[e] Utilized the Large Group interaction strategy.

Conclusions

Results from independent evaluations of seven Web-based continuing education events utilizing the *Sub-Group Interaction Strategy*, and the *Large Group Interaction Strategy* suggest that, contrary to the current literature, the use of large-scale Web-based trainings does not negatively influence participants overall satisfaction with the event, their willingness to recommend the event to other participants, their satisfaction with the role of the facilitator, or their rating of the usefulness of the information provided in the event. Further research is needed determine whether the additional three large-scale interaction strategies would produce similar results and whether similar results would be obtained for Web-based trainings that are designed to be more dependent on close participant-to-facilitator or participant-to-participant interaction. Also, future research should examine the extent to which the positive results here depended on participants' prior participation in an intensive face-to-face training by comparing participants with and without such an experience.

References

Boettcher, J.V. (1999). Cyber course size: Pedagogy and politics. *T.H.E. Journal. 12*(8).

Harding, W.M. & Formica, S.W. (2001a). Evaluation findings for MSC continuing education web event #1: Using existing data in your needs assessment. [Report] Prepared for Education Development Center, Inc., Newton, MA and the United States Department of Education (USED).

Harding, W.M. & Formica, S.W. (2001b) Evaluation findings for MSC continuing education web event #2: Identifying priorities and strategies for your prevention initiative. [Report] Prepared for Education Development Center, Inc., Newton, MA and the United States Department of Education (USED).

Harding, W.M. & Formica, S.W. (2001c) Evaluation findings for MSC continuing education web event #3: Promoting prevention through school-community partnerships. [Report] Prepared for Education Development Center, Inc., Newton, MA and the United States Department of Education (USED).

Harding, W.M. & Formica, S.W. (2002a) Evaluation findings for MSC continuing education web event #4: Selecting research-based programs for your schools. [Report] Prepared for Education Development Center, Inc., Newton, MA and the United States Department of Education (USED).

Harding, W.M. and Formica, S.W. (2002b) Evaluation findings for MSC continuing education web event #5: Implementing research-based prevention programs in schools. [Report] Prepared for Education Development Center, Inc., Newton, MA and the United States Department of Education (USED).

Harding, W.M. and Formica, S.W. (2002c) Evaluation findings for MSC continuing education web event #6: Sustaining your prevention initiatives. [Report] Prepared for Education Development Center, Inc., Newton, MA and the United States Department of Education (USED).

Harding, W.M. and Formica, S.W. (2002d) Evaluation findings for MSC continuing education web event #7: Substance abuse prevention to academic success. [Report] Prepared for Education Development Center, Inc., Newton, MA and the United States Department of Education (USED).

Ko, S. & Rossen, S. (2001). *Teaching online: A practical guide.* New York, NY: Houghton Mifflin Co.

Palloff, R.M. & Pratt, K. (1999). *Building learning communities in cyberspace: Effective strategies for the online classroom.* San Francisco, CA: Jossey-Bass Publishers.

BUILDING A KNOWLEDGE COMMUNITY AMONG HIGHER EDUCATION INSTITUTIONS

Marycarmen Aguilar and Catherine Gihlstorf
Center for Innovation in Learning
Kenan-Flagler Business School
University of North Carolina – Chapel Hill
USA
CIL@bschool.unc.edu

Abstract: A professor's head holds a wealth of knowledge and experience both tacit and explicit; relating both to their chosen field of study and to their classroom teaching. Our Knowledge Community provides a repository and collaborative environment in which to capture, store and share this knowledge with others. It is a complete on-line, searchable archive featuring teaching resources, teaching best practices, faculty publications and working papers, and multimedia showcases of faculty research. The knowledge community also provides a place for collaborating partner schools to share research, exchange best practices and to leverage the intellectual assets of the collaborating schools. This project is in progress and scheduled for completion in September 2002. The current community contains 5 partner schools with plans to expand the number of schools over the next 4 years.

Project background

Kenan-Flagler Business School of the University of North Carolina (UNC) at Chapel Hill is one of the top worldwide research business institutions worldwide that is always looking to innovate and increase international collaboration among top business schools. Kenan-Flagler Business School promotes, enhances and facilitates collaboration and knowledge sharing internally in the business school as well as with its global partners. The Knowledge Community (KC) project emerged looking to enrich the internal and external knowledge sharing and collaborative goals of the Business School, as well as to improve the business school's efficiency by having in one location a website interface and a dynamic data base easy to integrate with other internal systems in the school, the university system, and with the systems of its global partners. Also, the Knowledge Community facilitates access to the faculty by external sources, and creates a global virtual community for the exchange of research publications and teaching best practices.

The Knowledge Community is designed to include Kenan-Flagler Business School and all its international partners such as the members of the OneMBA consortium and Centers for International Business Education and Research, CIBER schools. OneMBA is a global consortium allying 5 top business schools from around the world: South America, North America, Asia, and Europe. The OneMBA consortium is offering a premier global executive MBA program starting in September 2002. This program involves students from these 5 universities working on virtual global projects, as well as the faculty teams collaborating to design and teach courses for all of the students. One of the main funding sources that makes the OneMBA program possible is the CIBER grant that Kenan-Flagler was awarded this year. As part of the faculty development section in the CIBER OneMBA grant, the Knowledge Community project is designed to support the faculty development efforts of the OneMBA program and bolster recognition of faculty research at the associated partner schools.

The Knowledge Community project will assist the teaching and learning efforts within the consortium by documenting and sharing faculty teaching best practices and learning activities. It also strives to increase the visibility, and reputation of the faculty of partnering schools both within the consortium and externally by publicizing their research activities and areas of expertise. The project will be divided into three sections: a teaching and learning community, a listing of faculty publications and research activities, and a multimedia showcase section.

The Kenan-Flagler Knowledge Community will be a dynamic repository and collaborative environment in which to capture, store and share research and teaching materials about business topics. Through this virtual collaborative environment the faculty members will share and update all their actual research, all working papers and publications, in addition to sharing their teaching best practices, experiences, activities and teaching materials. The KC will be an instrument that will provide all the publications, research and information about the faculty experts and their specific areas of expertise.

Project Description

The Kenan-Flagler Knowledge Community (KC) has been a team effort involving different areas of the school, including: the Office of the Dean, Business School Faculty and students, information technology staff, program directors, marketing and communication areas, instructional designers, international areas, knowledge management experts, potential users and more. The project is led by the Business School's Center for Innovation in Learning, and supported by internal funds and a grant obtained from CIBER. The project's design and planning covers all research and teaching knowledge-sharing needs of the Kenan-Flagler Business School. This also includes the OneMBA consortium goals, and general trends in the field toward learning communities, knowledge management and information technologies. The fist stage in the project plan is for the pilot version to include the research publications and teaching materials from Kenan-Flagler. The next version will be offered to the OneMBA consortium, and the following versions will be shared with CIBER schools and other international partners of the Kenan-Flagler Business School.

The features in this first Kenan-Flagler version will have 6 main sections, divided into 3 functional areas: research, teaching, and multimedia information showcases. This version will have a stand-alone interface and will also provide various services to the Business School external website and other Kenan-Flagler program websites.

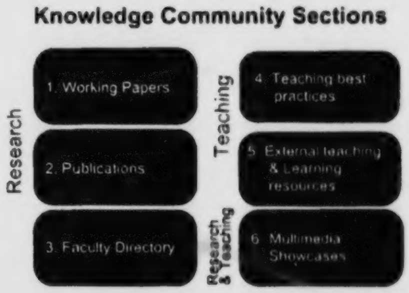


Figure 1: Knowledge Community Sections will cover the functional areas of research publications, teaching best practices and materials and the research multimedia showcases.

Research Sections

The first three functions involve capturing existing publication information on faculty research that currently exists in several non-searchable and searchable venues. This information will be collected on the web in a central, searchable location. A dynamic document-based system will allow information entry, retrieval, and reporting from one central interface. External users will access the information via a web browser. No software beyond this will be required.

Working Papers

Centralized repository of pre-published working papers and abstracts. Searchable via the web and linked from the Kenan-Flagler external web site. Faculty members or designates can maintain their individual

BEST COPY AVAILABLE

entries in this collection. After publication, papers will remain in the archive with the permission of the copyright holder. Currently, these materials reside on individual faculty member web sites, on departmental web sites or on external sites (i.e. SSRN)

Publications

Centralized repository of publications or links to them. Searchable via the web and linked from the Kenan-Flagler external web site. Faculty members or designates can maintain their individual entries in this collection. Currently, these materials reside on individual faculty member web sites, as list entries on the individual faculty member's page, in the faculty directory, in a listing in the annual research report for the Senior Associate Dean, and in a listing in the quarterly Research Newsletter.

Faculty Experts Guide (Faculty Directory)

Central repository for all faculty information with links to resources/papers, personal websites, areas of interest/expertise, contact information, background and recent research.

Searchable via the web and linked from the Kenan-Flagler external web site. Faculty members or designates can maintain their individual entries to this collection. Members of the media, prospective students and other researchers will be the primary users of this section

Teaching Sections

The Teaching sections involve capturing existing best teaching practices from Kenan-Flagler content experts, along with external teaching best practices, and sharing these practices with Kenan Flagler Business School partners and the faculty community. In addition, this section archives existing internal and external teaching resources and tools as a resource to aid faculty in teaching and technology development.

Teaching Best Practices

Centralized repository of Kenan-Flagler Business School faculty and staff teaching best practices. External faculty, specifically from the OneMBA consortium schools and other partner schools may add material to the Kenan-Flagler Business School system once registered in the database. This will allow Kenan-Flagler Business School to expand on an international scale and share the system with its global partners to create a virtual community. This will be searchable via the web and linked from the Kenan-Flagler external web site. Faculty members or Ph.D. students would be the users of this section.

Teaching Resources

The teaching resources section will be a centralized repository of external resources for teaching, including relevant research and best practices. It will include information on Kenan-Flagler Business School's teaching best practices and teaching materials that currently do not exist in any formal or searchable format. At present, some of this information is available at the Program offices or resides with Department Chairs. This information will be available via the web in a central, searchable location.

Multimedia Showcase

This portion of the project highlights the expertise of faculty from various schools. On a rotating basis, select faculty members from each of the schools will be showcased by the Kenan-Flagler Business School and OneMBA consortium. All multimedia showcases will be linked in the marketing website. Faculty will either speak on a current issue or an area of research, or be interviewed. The feature will be delivered via video/audio, audio only, or stills and audio. Each school will have the option of placing this feature on their individual school's pages as well. If feasible, an on-line chat may take place with the speaker during a short designated time or a threaded discussion may be opened to facilitate a dialogue. Faculty members and their schools will receive positive exposure and the program site will gain visitors and attract interest. The first version of the KC will have Kenan-Flagler Business School faculty, Kenan-Flagler guest speakers and faculty of selected global partners.

Data-Base Structure and Technology Tools

The knowledge community project data-base structure is a relation data-base where the two main tables are the Faculty information and the Resources that are written for each faculty member in the community. A best practices table is the third main table in this initial framework. The relationships between tables provide the associations with all the different elements trying to answer all potential questions about the research and teaching materials from the KC. This first structure will be modified and adapted for the following version to include all the feedback from Kenan-Flagler users and international partners.

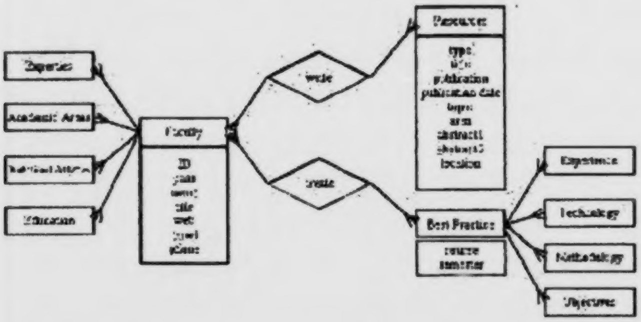


Figure 2: Knowledge Community Relational Data Base Structure

The technology tools that have been used by the team to develop and implement the knowledge community project were selected according to the corporate standards for global information knowledge management systems along with the UNC- Chapel Hill standards. The team will be work with the global partners to assure easy and successful system transfer according to their internal systems. The knowledge community project uses Oracle 8i as a database server and Tomcat 3.2.4/JRun 3.1 as an application server. On the application server, Oracle XDK, Oracle JDBC drivers and JDK would be installed. Additionally, Oracle Client should be installed on the application server to make a connection to the oracle server.

The team is currently working with UNC-Chapel Hill main campus Oracle policies and with the Kenan-Flagler Information Technology administrator to coordinate efficient communication between the different servers, tables and tools used.

Future Challenges

The first version of the KC is on schedule to be up and running at the end of 2002. The challenges confronted during the pilot version have taught us much which can be used for following versions, particularly to include all the lessons learned to increase the success of the future global versions of OneMBA and CIBER. Some of the challenges that the team visualizes for the future versions include: Obtain up to date information from faculty members researchers; Getting and entering the research publications and teaching materials into the system from faculty on a regular basis; Getting faculty to share their teaching best practices, Assuring information quality over quantity .

Knowledge management, global collaboration and knowledge sharing have been some of the university's chief initiatives and challenges in the last decades. For many schools, to open the doors to their latest research initiatives and share their experiences and intellectual production has been a cultural challenge and a difficult goal to achieve. The ones that have accomplished that now enjoy all the benefits and advantages of sharing all their research publications, research initiatives and best practices. This has had a positive impact not only on the organizations' internal cultures, but has also contributed to increasing the visibility of the organizations externally, especially to the various audiences interested in the subjects of business research and business teaching.

The Kenan-Flagler Business School KC project is an example of global collaboration and knowledge sharing. Creating and offering a knowledge community like this will allow all business Faculty from partner institutions to benefit from a virtual community and share their knowledge and experiences through this system in the future.

BEST COPY AVAILABLE

GEOGRAPHICALLY DISTRIBUTED INTERNATIONAL STUDENT TEAM COLLABORATION

Catherine Gihlstorf and Marycarmen Aguilar
Center for Innovation in Learning
Kenan-Flagler Business School
University of North Carolina – Chapel Hill
United States
CIL@unc.edu

Abstract A partnership of five top-ranked business schools on four continents, this 21-month MBA program develop global leaders and benefits executives through a curriculum that spans business cultures and best practices in Asia, Europe, North and South America. Student teams comprised of one student from each partner school collaborate on projects and coursework in a virtual environment, meeting face-to-face only once every six months. The program's toolbox consists of Blackboard's LMS for asynchronous discussion forums and course material distribution; CentraOne for synchronous collaboration, session recordings and virtual student presentations; and email for asynchronous collaboration and notification. Each student will be geographically distributed. A selection of both web-based synchronous and asynchronous tools was necessary to facilitate the student collaboration. While the program begins in September 2002, the collection of tools has been pilot tested for seven months in another MBA program.

Program Overview

A partnership of 5 top-ranked, international Masters of Business Administration (MBA) programs designed the OneMBA, an Executive MBA degree unlike any existing MBA program. The five partnering schools based in; *North America*; University of North Carolina in Chapel Hill, USA and Monterrey Tech (ITESM) in Monterrey, Mexico; *South America*;, Fundaco Getulio Vargas in Sao Paulo, Brazil; *Asia;* The Chinese University of Hong Kong and *Europe*; Erasmus University-Rotterdam School of Management in Rotterdam, The Netherlands, collaborated to design the program over a year and a half period. The program opened with the inaugural class of approximately 100 students in September 2002.

Each partnering school recruits and contributes students to the program. These students are identified as "local students" or students belonging to a specific partner school. The uniqueness of the program originates with the design of the instruction. Each partnering school designs the basic instruction for their "local" students and a committee of faculty designs a series of globally coordinated courses containing all students from every school. The format for the local instruction remains independent of the other schools. Currently, each school operates on a different schedule and delivery format. The globally coordinated courses however, involve all students and provide identical instruction. Globally coordinated courses begin once every six months with an experiential learning module. All students travel to a designated partner school for the 3 day experiential module. A new business theme organizes each of the 6 month global courses, and the theme, new global student teams and cultural material are introduced during these experiential learning modules. During any 6 month module, a student participates in a series of locally delivered courses as well one team-based, globally coordinated course. This paper focuses on the team-based, globally coordinated courses.

Student Profile/Team Composition

The target student for this program is an accomplished executive with 7-10 years of management experience and responsibility for global activities within his/her respective company. Extensive travel schedules and executive responsibilities functionally eliminate the possibility a traditional two-year full-time MBA program for this audience. The OneMBA program is designed to accommodate part-time executive students with a need for global management and cultural proficiency. Many students possess advanced degrees in areas of study other than business.

All students meet each other "virtually", prior to the debut of the program, by posting short biography pages on a Blackboard course site dedicated to student communication. This site hosts these biographies and all global team discussion forums for the duration of the 21-month program. The first face-to-face meeting between students occurs during a week long "opening week" hosted by the Americans in Washington, D.C. Students participate in cultural exchange activities, group skill-building exercises and engage in learning activities around the first learning module theme: organizational behavior. Global student teams are meticulously selected by a faculty/staff committee to provide representation from each school as well as representation from a variety of professions, industries and quantitative skill levels. Each team contains 5-6 students who participate in a different student team for each module in order to maximize the learning opportunities between colleagues.

Tool Selection

The program's selection of tools resulted from an analysis of our target audience, global coordination challenges and consideration of what each school currently provides. The OneMBA students travel frequently as part of their work responsibilities and accommodate course activities during and after work hours, often in brief time increments such as between meetings or flights. This student group expects superior customer service and support. Partnering schools decided that tool selection would be based primarily on meeting students' needs rather than operating with the lowest common technology denominator among the schools. Each student is required to have a laptop computer with a predefined configuration available for their use.

Team assignments in the globally coordinated courses typically focus on the discussion and analysis of a case study, participation in a simulation or group project preparation and presentation. Geographically dispersed team members represent a time zone span of 12 hours necessitating the availability of an asynchronous communication and collaboration tool. The pilot test of the proposed tools revealed that student of a similar profile to the OneMBA student appreciated the benefits of asynchronous time zone accommodation but realistically had limited time in which to complete assignments and therefore the immediacy of synchronous tools was highly valued. All schools agreed to provide three tools for student collaboration and communication; both asynchronous and synchronous. Student teams were free to use the communication and collaboration method or technology of their choice, but three market leader tools would be provided.

CentraOne

The Centra company located in Massachusetts, USA produces three levels of Internet-based synchronous communication products; E-meeting, Conference and Symposium; increasing in functionality and price with each level. Centra provides ASP services as well as licensing their products as package of a server license and concurrent user licenses. Centra Symposium offers the following features which met the anticipated needs of the program's students: full duplex audio over IP accommodating several hundred participants concurrently, session recording and playback, breakout rooms with the ability to import breakout groups' work back into the main session, application sharing and markup, text chat, whiteboard functionality, web page display and mark-up and one-way video.

As our students travel frequently, the program needed a web-based tool able to perform on a variety of Internet connections, whether from a hotel in Lagos or a corporate network in Las Vegas. The minimum entry requirements for any level of Centra license are a 133 MHz Pentium processor, a microphone and sound card and a 28.8 modem connection to the Internet. This low level of entry satisfied the need of students for flexibility in connecting and participating from a variety work assignments. The recording and playback feature allows students to record their meeting for team members unable to attend or for faculty feedback. Students can also present projects to a team of faculty for evaluation virtually. One way video allows for one group to view the other during the presentation such as the student presenter viewing the faculty member evaluation them.

Virtual office hours become more efficient on-line when faculty can "meet" with more than one student at a time and record the session for those students unable to attend. The application sharing and whiteboard features allow both the instructor and student to share, view and work on a spreadsheet, document or formula at the same time.

The University of North Carolina-Chapel Hill's Kenan-Flagler Business School purchased the Conference product and 10 seats at an educational discount of 50% in December 2001. After a seven month pilot test with a Weekend MBA Human Resources Management class and an online Working Spanish course, the school recommended the product to the OneMBA program with the caveat that the license is upgraded to the Symposium level and 20 additional seats licensed.

The following issues contributed to the recommendation to upgrade. The Conference level license provided excellent duplex voice over IP functionality but limited the number of speaking participants to 5 at any one time. The addition of a sixth student or faculty observer to the meeting necessitated "passing" one of the virtual "microphones" to the extra person and returning it to the originator when the he/she needed to speak again. This "passing the mic" impeded to the smooth flow of conversation. Symposium's inclusion of a whiteboard and integration with Blackboard made it a more appealing choice. The per seat license costs prohibited the purchase of more that 30 total concurrent licenses (seats) but the expectation is that no more than a third of the global student teams will be utilizing Centra Symposium concurrently.

The tool is intended to facilitate student collaboration on their virtual team assignments for the globally coordinated courses. It may also be utilized by any student for their local course collaboration as well. It has also been used as a communication tool for administrative meetings between the partnering schools.

Blackboard

The Blackboard course delivery product incorporates both synchronous and asynchronous tools as well as providing a shell in which to deliver course material. Three of the partnering schools had various levels of Blackboard implementations in use prior to the OneMBA program inception. The remaining partner schools utilized similar delivery products. After considering a number of open market products for course material delivery, the program technology committee selected Blackboard. Since each of the existing Blackboard schools operate a different level of Blackboard license, the OneMBA program itself purchased a level one license from Blackboard, and hosted it in Monterrey, Mexico. As each school maintains their own registration systems, Blackboard's level two or three licenses with registration integration were not needed. The OneMBA program pays the salary of a full-time host master for this server.

A uniform course delivery platform across schools provides students with a consistency and cohesion important when student teams experience the majority of their course interface locally and only 25% of it across the schools. During one module, a student will need to visit only one Blackboard login page for all his/her local and global courses; finding material located consistently within that framework.

Integrated discussion forums with file attachment capabilities provide the base for student team asynchronous collaboration and discussion. Blackboard also allows for the integration and scheduling of Centra Symposium events, therefore students need to enter only one Blackboard site to find all the tools or links to all the tools the program provides. This meets our target audience need for efficiency, consistency and superior support.

Faculty members favor Blackboard for the ability to upload material without knowledge of any scripting or coding language and to do so from any location with an Internet connection.

Email

Email, from either a program provided address or work-related account provides asynchronous communication and collaboration features for virtual teams. Email provides a means for communicating to schedule a virtual meeting or as a backup for other tools or as a means to communicate with faculty members. Each partnering school provides an email account to their "local" students. A roster of all students and clickable email addresses reside in the Student Communication Blackboard course.

Challenges

Support for the globally coordinated courses remains a challenge. Each partner school maintains technology and content support for their local instruction, but the global virtual teams in the coordinated courses fall under no specific school's oversight. The program is experimenting with a global time zone approach to support. The technology support staff at each school troubleshoots technology problems for global course teams during a specific assigned time span. One support email address (support@onemba.org) forwards a help request to the mailboxes of the technology coordinators for each school. The school responsible for that assigned time span (GMT time) answers the request.

Conclusion

Students assigned to global teams for a globally coordinated course meet face to face only once every 6 months. During the interim months, communication and project collaboration relies on a set of synchronous and asynchronous tools provided by the program. Unlike traditional programs, OneMBA students participate both in local courses at their home university as well as in global teams of 5-6 students, with at least one student from each partnering school. Cultural nuances, customs and work and communication styles will need to be negotiated via distance. Part-time executive students accommodate their learning and team collaboration into small time spans and prefer synchronous collaboration.

Areas for further study include the type of tool used for what type of communication/ collaboration, how do the groups dynamics and communication style change if the composition of the team contains more than one student per school, and what alternative technologies and methods, if any, do students use for communication and collaboration beyond what is provided by the program.

European Project:

DELOS (Developing a European eLearning Observation System)

Crsitina Girona
Universitat Oberta de Catalunya
Area of Educational Methodology and Innovation
cgirona@uoc.edu

The Universitat Oberta de Catalunya is participating in the **Delos project** from the beginning of the year 2002 until January 2004.

The project aims at the development, validation and establishment of a sustainable Observation System of experiences and institutions in the **elearning field** to contribute to the decision making process by different stakeholders (European policy makers and market actors). DELOS is a comprehensive and inclusive action that builds convergence and coherence among existing observation & analysis systems and approaches, provided by international organisations, by the various Services and Agencies of the European Union and by other targeted observation projects in European Commission Programmes, such as those in SOCRATES, LEONARDO DA VINCI and IST.

In its first development phase, aspecific analysis of the needs and priorities of the two main groups, the one of the "Information Users" and the other of the "Information Collectors", in Education and Training around the world, is being conducted trough a series of interviews, considering the different specialisations and characteristics of the institutions involved and aiming at the definition of the formulation of a comprehensive map of the different competencies and strengths available in Europe.
The mapping activity will consist in the following tasks:

1) Identifying all different E&T observatory systems, bodies (i.e. actors)
2) Recording the aims, structures and practices of the main E&T observatory systems (i.e. Profiling)
3) Identifying the main stakeholders (users) of the observatory systems
4) Recording the information needs and interests of the main stakeholders

This will allow a definition of the state-of-the-art and will contribute to set up proposals for improvement and define the new observatory.

The institution leading the project is MENON (Belgium). The rest of the project partnership is formed by SCIENTER (Italy), FIM (Germany), CEDEFOP (Greece), LRF (Greece), Swedish Agency for Distance Education (Sweden), EENet (Germany) i EDEN (Hungary).

First project results are expected by September 2002.

The European Commission is supporting the project and sees it as one of the best initiatives for decision makers and policy makers in the field of the use of technology in education.

Developing ICT-facilitators Competencies through a Blended Learning Approach

Lisa Gjedde
Research Program for Media and ICT in a Learning Perspective
Department for Curriculum Research
Danish University of Education
lg@dpu.dk

Abstract: A blended learning approach to a diploma course for in -service teachers, studying to become Pedagogical ICT facilitators, may have implications for their learning process in relation to a multimedia production. Drawing on cases from this diploma course in which a blended learning approach is providing experiential resources for teachers, the development of didactic tools will be related to the teacher's experiential problem oriented learning process.

Introduction

The development of Information and Communication Technology (ICT) has been instrumental in setting the arena for a new learning paradigm, calling for new roles for learner and teacher. It has also pointed to the need for a new set of competencies for the teacher, in order to be able not only to deliver instructions in a subject matter, but also to facilitate the learners' independent learning processes in a number of ways. This paper will explore some of the implications for an blended learning approach to a diploma course for in-service teachers, studying to become Pedagogical ICT facilitators and how they through a process of production of an educational multimedia programme have been challenged with making reflections on the didactics of using and integrating multimedia in their teaching, as well as reflections on the design and communication strategies for presenting it.

This study is based on action research methodology involving 3 classes and a follow up study a a year after the finished course which involves 6 students based on qualitative inquiry with research interviews.

Research questions have emerged that are related to the development of new competencies and a didactics for new media.

How may the pedagogical imagination of the teachers be engaged in the construction of learning environments for their students?

How may this process be supported by a blended learning approach ?

Background

Basic to the didactic approach for the introductory course is a learning cycle involving experience as well as analysis and production, leaving space for reflexivity relating to the learners experiences as well as sharing it with teams of fellow students. The experiential learning cycle has been described by Kolb and others (Kolb 1984) as having four stages: Concrete Experience, Reflective Observation, Abstract Conceptualisation and Active Experimentation. This cycle may happen over a period of time, and include second order cycles within it. Basic to it is a view of learning as a transformation of experience into knowledge. (Kolb 1984)

Part of this experiential approach to a didactics for pedagogical ICT -facilitators, is to use new media in a pedagogical context through a process, which draws on experiential learning methodologies and through an initial multimedia production allows for an articulation of experience and reflection on it.

The use of a project-based multimedia production done by teams that collaborate on the internet, combined with seminars that provide cognitive tools for the reflection on this experiential learning process provides the basic experiences on which to anchor the didactics for the teachers further implementation of a learning new paradigm and the potentials it may offer for the integration of ICT in the curriculum.

It can also provide valuable experiences that may serve as a reference point in the development of a didactics for multimedia, both in the planning process through the use of pedagogical scenarios and the production process. In the design process, it has significance that the students having been through an actual production process, in which they have had to develop a structure reflecting their ideas through a process of articulation. This articulation then enters into a learning cycle as the material for further reflection.

Towards new ways of implementing ICT

The teacher's role in this context is seen as a facilitator and coach rather than as transmitter of knowledge to be passively absorbed by students. One of the ways to facilitate this constructivist approach and build skills and competences that may further this is to focus on the role of individual expression and articulation through a process of design, which is enabling a learning-by-doing approach. It also puts a focus on the need for support of different learning strategies and different preferences for learning. One of the strategies for moving beyond the present limitations of most conference based e-learning systems is to integrate approaches that goes beyond the mere text-based approaches and integrates multi-medial approaches while also allowing for the creation of more ambient environments.

The experiences of the primary and secondary school teachers who were studying to become ICT-facilitators brought a wide background of didactic experiences from the classrooms with children with different needs into the production scope as actual target groups. This also brought forth a number of different design strategies, some of which were explicitly targeting special needs groups as well as focusing on the different intelligences and different preferences of children (Gardner 1993). Some of these designs did represent novel and imaginative ways of engaging children though different web-based programmes, as well as cd-rom based programmes. Some productions did for instance provide an interactive learning environment with a rich media use, involving sound, video and text, each supplementing the other – to provide children with different challenges, based on different preferences or skills. Through this support in web-based learning environments it was made possible for the teachers to free up resources to further assist children in the classroom, with special or different needs. In this way a blended-learning environment afforded differentiated teaching and learning in the primary school.

The teacher's experiences with this design process were carried out in a blended learning environment, constituted by a blend of seminars and a first-class conference, with teams of teacher's planning and developing actual productions. This project based learning environment afforded experiences with e-learning as well as actual meetings with fellow students and the sharing of projects and experiences with projects, which helped anchor the learning into a web-based community.

In this learner centred and project-based course, the communication strategies and scope of the production were be defined and argued for by the students based on their communications strategies for the production thus calling for reflection on the choices made in the production.

It further served to provide the prospective ICT-facilitators with an interpretive and hermeneutic perspective that may transfer into their own perceptions and future roles as catalysts for implementing a new learning paradigm involving the use of ICT within a reflexive pedagogical framework.

References:

Bruner, Jerome. (1996). *The culture of education*Cambridge: Harvard University Press

Gardner, Howard (1993) *Multiple Intelligences. The Theory in Practice.*New York

Kolb (Ed.). (1984). _*Experiential Learning: experience as the source of learning and development.* New Jersey: Prentice-Hall

Tiller, Tom (2000) *Forskende partnerskab. Aktionsforskning og aktionslæring i skolen*. København. Kroghs Forlag.

The Impact of Technology and Distance Learning on Higher Education

Susan J. Goetz, Ed.D.
MAED via distance learning
The College of St. Catherine
United Stated
Sjgoetz@stkate.edu

Abstract: The promise of distance education to provide education programs that can be undertaken anywhere and at any time is not new. With the rapid advances in technology, higher education today can offer educational services where learners choose the services they need for their own educational and training needs. Higher education is presented with the choice of implementing and delivering quality models where each student receives an educational experience customized to his/her individual learning abilities versus a high-volume or quantity model where the information conveyed is directed to a non-specific, abstract student. In such a high-volume model, the variance among the individuals who constitute the class would have to be ignored. This paper discusses how institutions are resolving the quality-quantity trade-off in their distance-learning, technology-based educational programming while supporting a goal of effectively generating net revenues.

Introduction

The promise of distance education to provide education programs that can be undertaken anywhere and at any time is not new. Correspondence study programs were offered early in the 20th century with great enthusiasm, but they quickly faded from favor because they were perceived as designed around quantity rather than quality.

With the recent advances in technology, higher education today can offer educational programs where students choose the services they need and want for their own educational needs. Students can decide when and where they learn. However, higher education again must visit the choice of implementing and delivering quality programs where each student receives an educational experience customized to his or her individual learning abilities versus a high-volume, quantity programs where the information conveyed is directed to a non-specific, abstract student. In the high-volume model, the range of differences among the individuals who constitute the class would have to be ignored.

History of Correspondence Education

Before the Internet, the only ways to learn outside the classroom were enrolling in correspondence courses, watching educational videos, software designed around specific content, or self-study through reading books and journals. None provide frequent opportunities to interact with teachers and other students – the community building so evident in the classroom (Strehle, 2000).

With the introduction of the GI Bill after World War II in the United States, and an increasing emphasis upon the value of a college degree in the marketplace, student enrollments increased in colleges and universities. This had the effect of creating mass lecture courses, particularly in introductory classes. These mass lecture courses dramatically increased the number of students that could be reached, which severely sacrificed quality for the sake of quantity in higher education. This is a model of education that achieves substantial efficiency – if efficiency is measured in terms of cost per student – but it does so at the expense of quality. There are few teachers who would not tell you that it is virtually impossible to establish a relationship with each student in a large class. However, to compensate for increasing class sizes at the introductory level, students expected reduced class sizes in more advanced coursework. It was hoped that as they moved to higher grades, they would begin to experience small classes resembling seminars. Here efficiency would be sacrificed for quality, and relationship building could be recovered.

Today, however, as the cost of higher education increases more rapidly than public support for higher education, colleges and universities are faced with the necessity to both increase revenues from other sources and to become more cost-efficient. "Budget reductions and general resource constraints have become commonplace, while institutions are being asked to serve increasing numbers of students and constituencies" (Alexander, 2002, p. 1). Such pressures make it difficult for colleges and universities to cut down the size of their classes.

To help generate additional revenues, some colleges and universities are looking at distance education as a way to provide subject-matter experts who deliver programs using the latest technologies. However, if the underlying rationale for utilizing distance education is to generate significant financial revenues, distance learning is doomed to the same fate as correspondence education. Students who found it difficult to travel to specific sites at specified times for their education was attracted to correspondence education. Quality would be maintained through frequent written submissions that would be rigorously critiqued by the subject-matter expert. While such a model prevents student and teacher from meeting face-to-face, a relationship can be built upon frequent correspondence between learner and teacher. This model, as it was designed, proved to be too expensive and did not generate significant net revenues. The process required large amounts by the teacher spent critiquing the students' work. The model then evolved to one where the subject-matter expert designed the correspondence courses, but then turned them over to cheaper sources of labor such as graduate students, adjuncts, and instructors to facilitate the instruction. Even this model proved to be unsuccessful, however, as facilitators found the process too labor intensive. The students' work was not carefully and rigorously critiqued, no relationships were build and maintained, and the demand for correspondence education decreased significantly with a resulting decrease in net revenues generated from this source.

One can see that if distance education is designed with the same goal of generating significant revenues, its future may mirror the experience of correspondence education (Herema & Rogers, 2001).

Definition of Distance Education

Distance education as we know it today is a relatively new technology. Its major goal is to provide education to many kinds of populations, especially to some geographically distributed groups.

Distance education is emerging as a viable and vital force in educational delivery systems in recent years, especially in higher education. Much of the growth comes from a rapidly growing demand for educational opportunities directed toward and designed for some specific target groups (Garrison, 1986; 1987; Gaspar & Thompson, 1995). Just as Amundsen and Bernard (1989) pointed out, "...the definitive characteristic of distance education is the separation between 'teacher' and learner and among learners. As a result, interpersonal communication is not a natural characteristic of distance education" (p. 7). According to Gaspar and Thompson (1995), distance education integrates correspondence, instruction, use of periodicals and teaching aids, mass media, audiovisual lessons, social interactions, computer-assisted instruction, and various technologically-advanced formats. In the perspective of Keegan (1986), distance education has six major features: (a) the separation of teacher and learner, (b) the role of the educational organization, (c) the place of the technological medium, (d) two-way communication, (e) the separation of learner and the learning group, and (f) industrialization. In sum, distance education establishes a system that provides learning opportunities to various groups of learners who have no access to the traditional, higher education institutions.

In addition, according to Bates (1986), there are two basically different approaches of distance education. One is based on structured, pre-programmed learning materials and the other is based on the computers' communications functions. These two approaches have completely distinct philosophies of education. The former is called the black box approach. This approach views the computer as a black box to substitute for the traditional face-to-face (FtF) teacher. Therefore, it is the computer or black box that teaches the students. The frequent example is computer-assisted learning (CAL) software. The latter view is called networks approach. This approach views the computer as a channel of communication between learners and teachers. The frequent example is computer-mediated communication (CMC) systems. Therefore, it is the teacher who teaches the students, only with the computer as a channel of facilitating the two-way communication between teachers and students, online but at a distance and asynchronously. These two approaches are not mutually exclusive. They can be combined to become a powerful medium for distance education. Lauzon and Moore (1989) called the integration of these two approaches the fourth generation distance system that has no barriers of time and place.

The Demand for Distance Education

The diversity in America's higher education institutions has led to a wide variety of approaches to using electronic methods both to enhance on-campus learning and to provide distance learning. Although such on-campus uses are frequently a first priority, distance learning is still growing about 30 percent a year if measured by the number of students.

The development of new technologies is creating a revolution in education and training in the United States. Our on-campus students are already receiving information and educational materials for many of their courses through the Internet. They often communicate with teachers and fellow students by e-mail. Based on a recent survey, universities see technology for on-campus uses as a higher priority than distance learning. The two applications are, in fact, closely linked. The best of the on-campus programs provide a growing source of web-based materials for conversion to distance learning.

When one views the future for distance learning, one must make an assumption about the overall size of the higher education market. Glenn Strehle from the Massachusetts Institute of Technology recently posed the question: "do you believe that the total number of students will not be affected by the increased opportunities for receiving an education through distance learning? If you do, then any growth in distance learning must come from a reduction in the number of students learning in the classroom. Distance learning becomes a substitute for classroom learning." Strehle went on to say: "if, instead, you assume there is a global demand for learning that cannot be met by our campus-based universities, then you come to a different conclusion. Distance learning will increase the number of students and, as a result, enhance real economic growth and create a more educated population" (Strehle, 2000, p. 214).

Based on the number of students enrolled in courses, distance learning is growing at a rate of about 30 percent a year in the United States. A survey by the U.S. Department of Education reported there were about 55,000 distance learning courses with over 1.6 million students enrolled in our 1998 academic year. Since many students were taking more than one distance learning course, the number of actual students was about one-half that number. Looking at more recent estimates, the number of courses may be growing faster than the number of students. This is not surprising as many institutions, particularly public universities, are trying to offer a full curriculum of distance learning courses to be combined with their degree programs.

A survey shows that 90% of public four-year institutions were offering, or expected to offer, distance learning courses by next year. By contrast, only 41 percent of private institutions expected to do so, with many of the remainder being colleges with relatively small enrollments. There is a strong correlation between the size of an institution and its offering of distance learning courses. Ninety-five percent of those institutions with more than 10,000 students, both public and private, expected to be offering some distance learning courses by next year.

About 92 percent of the nation's distance learning students at the undergraduate level, including both four-year and two-year colleges, are taking their courses from a public institution. By contrast with only 8 percent at the undergraduate level, private institutions have 42 percent of the distance learning students at the graduate and professional level. Public institutions have the other 58 percent.

Highly selective private universities do not usually offer distance learning programs toward an undergraduate degree. Their faculties see the campus learning experience as particularly important, including the opportunity for learning in the laboratory. These universities, like MIT, have enhanced many on-campus courses with technology while limiting distance learning to selected graduate and non-degree programs.

There can be a difference in the way that technology is used for undergraduate and graduate education. Undergraduate distance learning programs mostly use text-based Internet delivery and are limited by the bandwidth into the homes of their students. By contrast, it is expected that graduate programs will take greater advantage of streaming video, synchronous two-way conferencing and other uses of broadband technology to create some aspects of the live classroom and seminar. Professional and graduate courses delivered at a distance are expected to grow rapidly. For many, the need to earn credit toward a degree will be less important than the need to develop competence in a subject within a minimum time and at the learner's convenience. Many of the students in graduate and professional courses have access to broadband technology at an institutional location or at their workplace (Strehle, 2000).

What Works in Distance Education

Learning at a distance is not easy for many students. The isolation from both the teacher and other students, the unfamiliar format and need to self-pace their learning can be discouraging. While we are aware of outstanding scholars and public leaders who were largely self-taught, we also recognize that this is very difficult for almost all of us. Motion pictures, television and videos were all predicted to have a major impact on education and found only limited success. Is on-line learning just the latest in a series of new technologies that will fail to meet the educational goals of its advocates? This may be true if we fail to develop frequent opportunities for interaction with the teacher and other students.

Most successful examples seem to have one common factor: the opportunity for students to feel they are part of a community of learners. One successful exception is those educational forms that permit the student to be interactive with the learning, although it is all on-line. Even with these tools, students have to be motivated to learn when using self-paced forms of delivery rather than the rigid schedules of on-campus courses (Strehle, 2000).

The academic performance of distance learning students, relative to on-campus students, provides some assurance that the learning is about the same as measured by tests. Learning at a distance may not be the best way to educate either the next generation of teachers and researchers or those that can benefit from the socializing experience of a campus. For a great many people, however, it is either distance learning or no learning. For others, the sacrifices involved in acquiring on-campus learning may be avoided at some benefit to both the learner and the learning. The search is to identify those methods of distance learning that are achieving success and seeing what works well and what doesn't. We need to bring our research rigor to understanding distance learning.

Summary and Conclusion

What is going to drive the development, growth, and change in distance learning? It will take careful planning with a goal first and foremost of providing quality education to the student. Planning by colleges and universities means responsive policy-making, working with faculty to develop positive attitudes toward distance learning and helping them to adopt the technology, listening to the reactions of the learners. If distance students show a marked preference for one form of delivery over another, there will be colleges and universities who will do it their way. If the free market works the way it was designed to work in the United States, then student attitudes, experiences, and innovation that leads to positive learning outcomes will determine the future of distance learning programs. And in order to create and maintain successful distance education, higher education institutions may have to include many of the techniques of successful businesses, including effective marketing, highly reliable distribution, quality assurance and the ability to quickly adopt what works and quickly drops what doesn't - in short, a focus on the customer rather than the supplier.

References

Alexander, F. K. (2002) Financing university performance in the United Kingdom and the United States, *The University: International Expectations*, McGill/Queen's University Press

Amundsen, C. L., & Bernard, R. M. (1989). Institutional support for peer contact in distance education: An empirical investigation. *Distance Education, 10* (1), 7-27.

Bates, T. (1986). Computer assisted learning or communications: Which way for information technology in distance education? *Journal of Distance Education,* 1 (1), 41-57.

Cerny, M. G. & Heines, J. M., Evaluating distance education across twelve time zones, Massachusetts Institute of Technology, Center for Advanced Educational Services, 2000.

Garrison, D. R. (1986). The role of technology. In R. G. Brockett (Ed.), *Continuing education in the year 2000* (pp.41-54). San Francisco: Jossey Bass.

Garrison, D. R. (1987). The role of technology in continuing education. *New Directions for Continuing Education*, 36, 41-53.

Gaspar, R. F., & Thompson, T. D. (1995). Current trends in distance education. *Journal of Interactive Instruction Development, 8* (2), 21-27.

Glass, Gene V (1976). Primary, secondary and meta-analysis. *Educational Researcher 5(10)*, 3-8.

Gottesman, B. & Jennings, J., Peer coaching for educators, Technomic Publishing Co., Lancaster, PA 1994.

Heerema, D. L. & Rogers, R. L., Avoiding the quality/quantity trade-off in distance education," *T.H.E. Journal*, Indiana University, Indianapolis. Dec. 2001.

Keegan, D. (1986). *The foundations of distance education*. Dover, New Hampshire: Croom Helm.

Lauzon, A. C., & Moore, G. A. B. (1989). A fourth generation distance education system: Integrating computer-assisted learning and computer conferencing. *The American Journal of Distance Education, 3* (1), 38-49.

Liv, Y. & Ginther, D., Cognitive styles and distance education,
Department of Psychology and Special Education, Texas A & M University, 2002.

Strehle, G. P., Distance learning in America: how institutions and corporations are stimulating growth, MIT Center for Advanced Educational Services, September 26, 2000.

Io, Database Driven Web Art-Work

Nan Goggin and Joseph Squier
Narrative Media Program
School of Art and Design
University of Illinois @ Urbana-Champaign
n-goggin@uiuc.edu, j-squier@uiuc.edu

Abstract: Network-based electronic databases are finding expanded application in the worlds of research and commerce. But artists are increasingly putting this tool to new and unexpected uses. This is not a new phenomenon, but rather the latest iteration of a longstanding tradition of artists appropriating technology in unexpected ways. This paper will explain the database engine that drives a project titled *Io*, and discuss the implications of database technologies for future research into new storytelling forms as well as demonstrate the art piece.

io is based on a Greek myth in which a young maiden, who has attracted the amorous attention of Zeus, is punished by being transformed into a calf. She eventually regains her human form by using her hoof to scratch her name in the sand. The story deals with language and writing as fundamental traits of what is means to be human. The io project explores the boundary between consciousness and machine intelligence.The title refers back to the Greek myth of the same name. The piece is an image/text poem comprised of a database of single words, sentences, short paragraphs, images and sounds and a set of rules for analyzing the statements viewers write.

Intoduction

Network-based electronic databases are finding expanded application in the worlds of research and commerce. But artists are increasingly putting this tool to new and unexpected uses. This is not a new phenomenon, but rather the latest iteration of a longstanding tradition of artists appropriating technology in unexpected ways. This paper will explain the database engine that drives a project titled *Io*, and discuss the implications of database technologies for future research into new storytelling forms.

Database technologies hold much the same promise as earlier technologies from the 19th and 20th Centuries. After all, photography as an art form emerged from the discoveries of entrepreneurs intent on capturing the market for mass-produced realistic pictures. The moving image was born in the research laboratory, and was understood initially as simply an improved tool for scientific observation; that is until artists got their hands on the technology and invented the language that today we call cinema. Database technologies, in the hands of artists, may also yield new communication languages. More than just a container for cataloging inventory, customer information, or research data, networked databases have the potential for exploring new constructions and understandings of narrative and storytelling. This presentation will highlight one such example of artists and programmers working collaboratively to appropriate database technology for its poetic rather than its practical application.

Description

io is based on a Greek myth in which a young maiden, who has attracted the amorous attention of Zeus, is punished by being transformed into a calf. She eventually regains her human form by using her hoof to scratch her name in the sand. The story deals with language and writing as fundamental traits of what is means to be human. The io project explores the boundary between consciousness and machine intelligence.artwork they were creating titled *Io*. The title refers back to the Greek myth of the same name. The piece is an image/text poem comprised of a database of single words, sentences, short paragraphs, images and sounds and a set of rules for analyzing the statements viewers write

It's concept is an extension of a simple AI program called ELIZA, which was developed in 1967 by computer scientist Joseph Weisenbaum. In *Io*, unlike ELIZA, the inherent division between audience and author dissolves, and viewers enter into a creative collaboration with the machine." Therefore, *Io* brings us a step closer to realizing the concept of the cyborg; combining human consciousness with machine logic, it becomes part muse and part confidante. Professors Squier and Goggin saw *Io* as a journey into a world of memory and identity, dreams and desires, faith and trust, metaphors and fossil clues.

Project Background

The original *Io* was written several years ago as a Java Applet, which constrained it's interaction and did not make use of current technical advances, We began by exploring the possibility of using programming as a "toolset" to create a better means for people to interact with a machine. At that time, it was only a text-based interactive system. We realized that we could replace the old Java Applet component of *Io* with a database using flat data files.

Our shared interest was to re-design *Io* to communicate using several multimedia elements. Together we devised plans to allow *Io* to respond to particular words typed by the viewer, or to allow the viewer to select text from the screen. We also decided that the user should be given a set of options for viewing the information. *Io* became a platform for inventing a rich interactive system utilizing new technologies. Conceived as a web-based image/text/sound hybrid, the *Io* project explores the boundary between machine intelligence and human consciousness. Utilizing simple artificial intelligence and database concepts, *Io* has been constructed to accept keyboard input and can recognize and respond to a vocabulary of keywords. Each user elicits a different 'performance' of *Io*, creating a multimedia collage of poetic text fragments, images, and audio clips. The resulting narrative addresses issues situated at the frontier dividing flesh and machine: history, memory, vision, and desire.

Project Process

Io involves storage of and access to hundreds of data files–word, text, image and sound files. Each of these data formats are quite different, which means that Io must be able to communicate across these file formats so that it can retrieve, display and update the files quickly. Therefore, scalability and flexibility of software became the most important criteria for selecting our system architecture. MySQL + PHP + Flash was our third architecture model, and became the choice we decided to integrate.

Programs used: Mysql, PHP, Flash, Photoshop, Soundedit,
Hardware: Macintosh g4, Dell

But how does this model work? (a sample scenario)

When a user opens Io [image1: front page] and types a keyword into the input box, {image: interface input box] this word is sent back to the server. This triggers a PHP file named 'readIO.php'. This file checks whether the word is in the database system. It executes a query to repeatedly search for this word in a table. If it finds the word, the PHP file will return a true statement, otherwise it will return as false. If a false value is returned, an error message will be sent back to Io to inform the user that Io cannot understand the word, and the user will be asked to try another word. [image of Io not understanding the word] If a true value is returned, the PHP file will find the corresponding text for that word and temporarily store it in a variable. It then searches for any corresponding images and sounds. Because the image and sound data files are located on the web server rather than in the table, the database merely stores a url pointing the PHP file to the correct file on the web server. All this information, as well as the x and y coordinates for where to place the image, is sent back to Io for display in a browser. As long as the Io gets this message package, it will call upon it's many different functions to show text, display image and play sound.

After finalizing our choice of a system architecture by choosing MySQL as the DBMS for the Io project and with the scripting language being MySQL; we were ready to create the database organization.

Xi Zhang created totally 6 tables in which he labeled 'ww', 'wi', 'ws', 'il' and 'userinfo' respectively. Table below shows the function and schema of different database tables.

. ww was used for storing text information for each keyword
fields: keyWord, outputWord, i

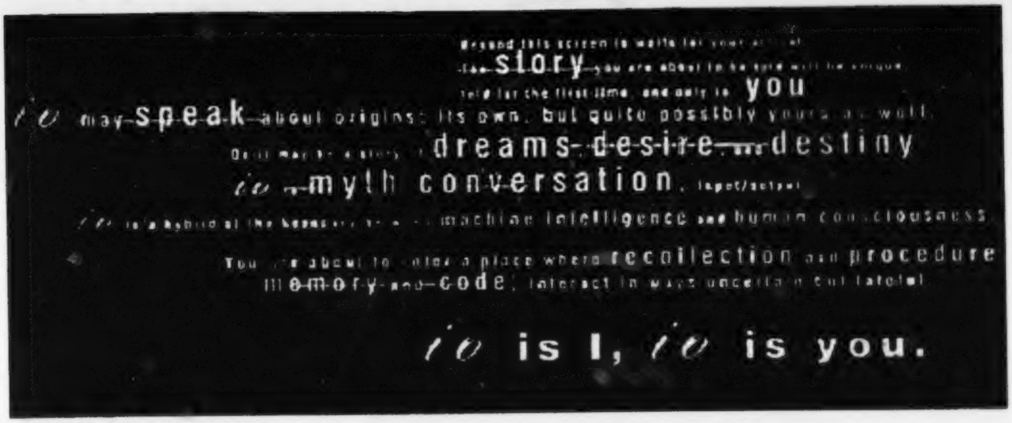
. wi used for storing image url pinter information for each keyword
fields: keyWord, outputImage, imageType, i

. ws used for storing sound url pointer information for each keyword
fields: keyWord, outputSound, i

. il used for storing xy coordinate values for different image type
fields: imageType, x1, y1, x2, y2, x3, y3, x4, y4, x5, y5, x6, y6, x7, y7

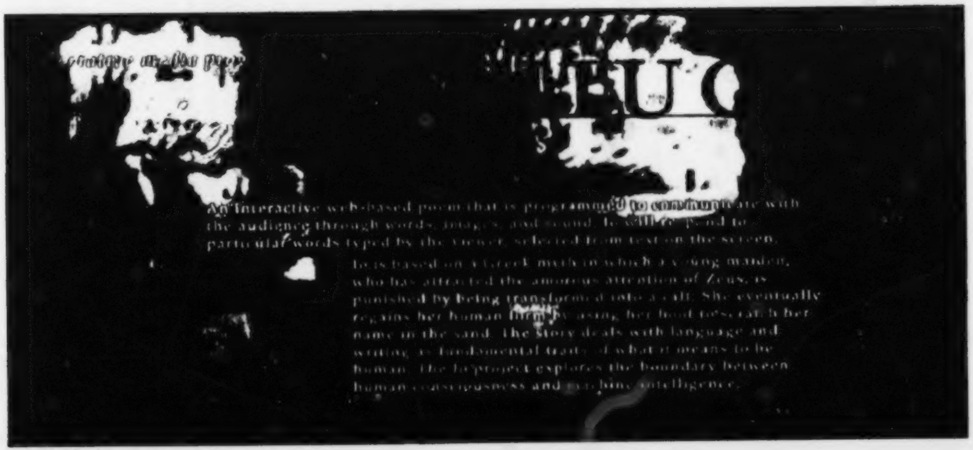
. userinfo was used for storing users's profile
fields: userID, userName, userPass, lastAccess, lastText, userEmail, isNew

PHP accesses these tables and how they relate to each other. For each PHP scripting file, there are a total of 8 files that sit on the server waiting to process incoming requests and output them as Flash files. The 8 type files are:serverCheck.PHP, readUser.PHP, checkUser.PHP, registrateUser.PHP, emailUser.PHP, readIO.PHP and logoutUser.PHP.



Beyond this screen io waits for your arrival.
the story you are about to be told will be unique,
told for the first time, and only to you
io may speak about origins: its own, but quite possibly yours as well.
Or it may be a story of dreams, desire and destiny
io — myth conversation. input/output
io is a hybrid at the boundary between machine intelligence and human consciousness.
You are about to enter a place where recollection and procedure, memory and code, interact in ways uncertain but fateful.

io is I, io is you.



An interactive web-based poem that is programmed to communicate with the audience through words, images, and sound. Io will respond to particular words typed by the viewer, selected from text on the screen.

Io is based on a Greek myth in which a young maiden, who has attracted the amorous attention of Zeus, is punished by being transformed into a calf. She eventually regains her human form by using her hoof to scratch her name in the sand. The story deals with language and writing as fundamental traits of what it means to be human. The Io project explores the boundary between human consciousness and machine intelligence.

art work: io
artists: joseph squier, nan goggin, xi zhang, eunah kang
url: 128.174.50.18/io/download/html

BEST COPY AVAILABLE

The Collaborative Study in the Virtual Classroom, Some Practices in Distant Learning Carried Out in a Mexican Public University: Universidad Autónoma Metropolitana-Azcapotzalco (UAM-A), México City.

María Dolores González-Martínez
mdgm@correo.azc.uam.mx
Tatiana Sorókina
t_sorokina@hotmail.com
Miguel Ángel Herrera-Batista
mherrera@correo.azc.uam.mx
Universidad Autónoma Metropolitana
Campus Azcapotzalco, México City

***Abstract**: We discuss the results of two e-learning experimental courses carried out in Mexico City which are a part of a research project whose goals are: to experience the teaching learning process through the electronic media via Internet. We worked focused on collaborative working and learning with new pedagogical models based on directed group work by means of assignments, goals, questions and problem solving. Some students manifested anguish as a result of the absence of face-to-face professors; there were differences in personalities, participation and collaboration, aspects that will have to be taken into account for future courses. The conclusion is collaborative work among participants must be promoted, not only letting everybody's interventions to be displayed but also encouraging participants to converse about these courses in public working together in solving problems, elaborating team projects, including evaluating each other.*

Introduction

After the second half of Twenty century problems in educational systems were perceived. Specialists in the subject started to articulate with more emphasis the low effectiveness related to the teacher-centered classes. At the same time, the educational theories were in search of methods and new practices primordially oriented towards a more personalized process of teaching learning, in which the students take the initiative of their own learning. With these goals in mind, the digitalized technology was considered adequate for the innovative education.

Nowadays the cyberspace offers on one hand, the individualized process of teaching learning; on the other, allows the development of certain skills of study and work in group. In the past, an expert professor used to meet these same goals in a traditional setting (a live class, for example), however, the current *modus vivendi* demands to exchange the chalk and blackboard for a different tool; that is to transform the theoretical-conceptual frame and the pedagogic practice. With these modifications, a number of aspects in the learning process will be possible to change, giving as a result a new educative experience.

The use of technology by faculty members

In our university we find a number of middle age professors who avoid the use of computing and Internet systems. The possible reasons are the insufficient amount of computers on campus and the lack of cyber culture among this age group. Besides, the current system of information on campus is still using printed handouts to give instruction to its members. Trying to promote cultural changes in the way of communication in the academic system, a group of professors from UAM-A in the Design Department in collaboration with Humanities Department, started to develop courses in an experimental manner in order to implement changes in the professors' abilities and attitudes. The first one, cost free, was the training of professors in the area of design education via Internet, form April to August 2001. The objectives of the course were: to test the distant learning model and to experience the teaching learning process through the electronic media, to develop the necessary skills to utilize the Internet' s main tools: navigators, email, FTP, distribution lists, chats and navigation browsers; to let the students know the basic characteristics of the computer systems and the necessary electronic infrastructure to access to the Internet. For this experience a limited private web page Discussion Forum was opened, in which the work plan, the location of the reading material and the modalities of participation where annotated. The most difficult aspect was the monitoring of the participants and activities. After four weeks of the course initiation, a decrease in participation was noted. It was necessary to apply the participants a survey to investigate the cause. Technical problems in the professors' offices' computers discouraged the participants from regularly attend in the class. The desertion rate was high, which probably is an indicator of the lack of interest for the use of computers. Other problems inside the campus facilities were related to the system and connections, lack of adequate browser versions, and some associated with a lack of knowledge of the system itself. The students manifested anguish as a result of the absence of face-to-face professors who usually push them to fulfill their obligations and to turn in papers in a given deadline. It is necessary to continue insisting that professors and mentors direct attention to each student in Mexico; to know why someone is behind, to answer all their e- mail messages, to stimulate those who are dropped the class and to pay attention to the causes of desertion. In spite of that, the results were encouraging in the sense that professors became aware of the need to face changes in the way of working and studying. It is desirable to repeat the experience with participants who come from other distant institutions or places and who will have to pay a fee for the course to see if the results of the experiment change.

Teaching face to face with online support

The second experimental course was about reading and written expression. This course, which lasted from September to December 2001, was addressed to graduate students of design. In an experimental manner the participant professors tried to monitor the students, their attitudes and performance through two forms of deliver courses: the traditional one and the e-learning. Our goal was to explore the possibilities to integrate both; to develop an application of the pedagogical model, which was proposed by our research team in which some part was delivery face to face but count on the support of a virtual classroom. We did it with the ***Blackboard*** software (www.blackboard.com) in its free version. This software is an e-learning environment with technical infrastructure and various means of academic support that link technology and pedagogy, such as chat, discussion forum, links to web sites, a place to offer the course material and evaluations and statistics of participation. ***Blackboard*** constitutes one more working option for the e-courses proposed within our group as an element of communication and feedback for students. During the month of December a collaborative practice was made with the purpose of trying to unify the students' opinion about specific and important subjects for the class. The class contribution for team of professors was the experience of an e-class formed by a significant number of students with specific assignments; where differences in personalities, participation and collaboration, creativity, enthusiasm and state of mind were observed.

Trying collaborative working on the virtual environment

Finally, during the period from January through March 2002, we worked in the preparation of the course *Introduction to the e-study in the Improving of Professors*, which took place between June and August. We practice with another e-environment: *Nicenet* software (www.nicenet.org), also free, more limited than *Blackboard*, nevertheless more agile and faster. The collaborative effort among professors to create the course has been quite arduous. We have tried first individual work that later will be reviewed by other members of the team who will subsequently contribute with comments and/or changes to the original text. The first sessions ended up in almost total disagreement. After long hours of discussion and the exchange of texts through the e-mail we thought the work was progressing.

Practice showed that we need to develop certain aptitudes and abilities that in each culture are revealed differently. In our case what is important was the presence of the virtual counselor (conceptually different of the traditional trainer) during all the period, therefore emerged the need of share out the content of the course and that each one of the teachers take the responsibility of their part but maintaining the interaction in all the activities; for example: in the interventions of the forum, in the epistolary exchange, with link suggestions, etc. In this step is precisely when the exigency of the collaborative work between the teachers was expressed.

In particular, Faculty should remain in mutual collaboration with students and among themselves. In this way students get involved and participate actively in their learning management. If we understand the management as a set of processes, actions and procedures aimed to fulfill a number of determined objectives, we could talk about formative self-management. In a distant course the collaborative work among participants must be promoted, not only letting everybody's interventions to be displayed but also encourage participants to opine about these courses in public. Other additional collaborative activities may be working together in solving problems, elaborating team projects, debating subjects democratically, including evaluating each other and learning from the process.

From a cognitive point of view, propitiating the unbalance of the individual's mental models will generate the necessary conditions for learning. Such unbalance may be generated by confronting the individual with two options related to the use of computers: databases supported by hypertext and the synchronic or asynchronic interaction assisted by computer. The former is constituted by the databases supported by the hypertext, such as elibraries, interactive educational material, simulators, on line courses, etc. It is also necessary to pay attention to the need to create new writing systems, which allow a more dynamic reading to get to more amount of information.

Our project is focused on the synchronic or asynchronic interaction assisted by computer to exchange knowledge and dialogue with other members of the class through e-mail, discussion groups, video links, etc. These practices allow to enrich the learning experience in a significant manner since they stimulate not only the acquisition of factual knowledge but also emphasize the o interacting in remote places which facilitates the sharing of common goals.

Conclusions

Our discussion centers on the question: how can we establish a collaborative environment? Some possible answers are making the individual work of students stronger, overcoming isolation, characteristic of crowded live courses, promoting the construction of learning with pedagogical models based on directed group work by means of assignments, goals, questions and problem solving. All these learning activities are based in the principle of learning as a permanent process. Knowledge is acquired in the social process of interaction; the active experience empowers learning. However, it is necessary to evaluate each member of the class to prove that learning has taken place. We have been working on this aspect of distant learning and we hope to organize the last experimental course and from here to draw some conclusions.

References

Delacôte, Goéry (1998). *Enseñar y aprender con nuevos métodos. La revolución cultural de la era electrónica.* Barcelona, Gedisa.

Landow, George P. (1992). *Hypertext. The convergence of contemporary critical theory and technology*. Baltimore & London, The Johns Hopkins University Press.

McLuhan, Marshall (1994). *Understanding Media. The extensions of Man*. Massachusetts Institute of Technology.

Negroponte, Nicholas (1995). Ser digital. México, Océano.

Palloff, Rena M. & Pratt, Keith (1999). *Building Learning Communities in Cyberspace. Effective Strategies for the online classroom*. San Francisco, Jossey-Bass Publishers.

Spiller, Neil (ed.) (2002). Cyber_Reader. Critical writings for the digital era. London, Phaidon Press.

Conquering the Digital Divide in Higher Education Attitudes

Valerie Kesner Greenberg
Communication Arts
University of the Incarnate Word
United States
Greenber@universe.uiwtx.edu

Abstract: Defining the digital divide as an important civil rights issue goes beyond social science to make a political and moral statement about the role communications technology plays in fostering a more inclusive and egalitarian America. Students with a good sense of Internet Literacy and who have Internet access, are able to effectively engage in the global village through access to the global economy, meaningful participation in political discourse, and interaction in a social way within the global village. People who refuse to embrace and use computers with Internet access risk being left behind, disconnected from the global village, the political process, and the global, information-driven, market economy. University faculty are primary change agents for inclusion of the Internet in American society, yet many are hesitant to embrace its use in their own classrooms. This paper is a report of a qualitative study which examines the causes for faculty negative attitudes towards technology inclusion in the classroom.

Introduction

Research has shown that a person's beliefs in their own achievement possibilities determine an individual's success in learning. This key personal variable is *self-efficacy* or belief in oneself to achieve goals. Self-efficacy can influence such achievement behaviors as choice of tasks, effort, persistence, and performance. Compared with learners who doubt their capabilities, efficacious students are more likely to engage in tasks, expend effort, persist to overcome difficulties, and perform at higher levels (Bandura, 1997; Pajares, 1995; Schunk, 1996; Zimmerman, 1994).

Within our fields we are experts and as such have an easy attitude towards learning our subject matter. But when the roles are reversed, and we become novices, then the playing field becomes more difficult.

Although research on general skills (e.g., problem solving and decision making) has a long history in cognitive psychology, the study of expertise within a very specific problem domain (e.g., chess, medical diagnosis) is a relatively new research area. A large portion of this work is descriptive; that is, expert behavior is described and often compared to novice behavior. Glaser (1996) summarize characteristics of expertise that are robust and generalizable across a variety of domains:

Teaching recognition of the role differences between experts and novices can help ease expert professors into the unappetizing role of novice learners of technology incorporation into their classrooms.

Learner's beliefs in their efficacy can be enhanced in several ways. One of the most powerful ways is through mastering challenges. A resilient sense of efficacy requires experience in overcoming obstacles through persevering efforts. Another source is through vicarious experiences. Social modeling serves as a way of building a sense of efficacy. Competent models transmit knowledge, skills, and strategies for managing environmental demands. Seeing people similar to oneself succeed by sustained effort raises the observers' beliefs in their own capability.

The third way is through social persuasion-- that is structuring learning activities for learners in ways that bring success and do not place them prematurely in situations where they are likely to fail. Social persuasion can also increase efficacy through correction of negative perceptions concerning subject matter.

Combining these methods might help to provide a classroom atmosphere conducive to a learning experience filled with grace and ease and most especially the intake of knowledge and skills.

Personal variables and environments also affect one another. According to Bandura (1986), human functioning comprises a series of reciprocal interactions between behavioral, environmental, and personal

variables. When learners with high self-efficacy try to complete an academic task in a distracting environment they may increase their concentration (personal variable) to make the environment less distracting. This type of personal influence has been described as *volitional control*
(Corno & Kanfer, 1993)

Perhaps faculty who have experiences other than excellent with technology have personal influence variables which cause them to think more practically about the integration of technology into their teaching methodologies.

The Study

Six faculty members from liberal arts disciplines at two universities were interviewed concerning attitudes towards incorporation of technology into their classrooms. Instructors ranked from assistant professors to full professors between the ages of 32 and 65 . Some had attended several classes in technology incorporation into the classroom while others had not attended any yet. Some instructors used technology (defined as electronic teaching materials or assignments which included overhead transparencies, online projection systems, Internet research tools, web based postings and chats, and the electronic learning service, Blackboard) heavily-- on a daily basis, while one instructor had never used any of these devices. Most used technology moderately to replace previous versions of non electronic instructional tools, such as paper handouts.

Findings

From interviews and observations conclusions were drawn as to the extent and nature of faculty avoidance of technology use. For many, the increased effort necessary to incorporate technology into their class room did not equate to the amount of noticeable improvement in student learning and interaction with presented materials. F says that after spending many hours posting material normally presented as hard copy handouts, his students told him that they preferred the non electronic version of the material. Many faculty declined workshops or tutorials based on anxiety concerns with appearing inexperienced or foolish in their classrooms, a domain in which they normally are the "expert". Experts and novices learn in different fashions, thus feeling inexperienced at mastering new material felt uneasy to the instructors. C states that many faculty in the blackboard (electronic learning environment) workshops she teaches express a fear of failure and avoidance of domains other than their own subject manner of which they are expert, " What is really interesting is that in a sense this is a real role reversal . Here they are the expert in their field, they have a doctorate, they know their fields backwards and forwards. Usually, it has been a long time since they have been in school. And now they are in a class where they know very little. It can totally overwhelm someone."

No wonder then, that a novice in the field of teaching with technology might experience overwhelming feelings of defeat when trying to incorporate the necessary skills to radically change teaching habits.

Novice technology users teaching in the classroom begin to experience a role reversal or what G referred to as "walking in our students' shoes" with feelings of helplessness and sensations of being overwhelmed with incompetence and low skill abilities to complete assigned tasks.

Conclusions

In order to gain the self confidence necessary to believe that one can absorb and effectively complete the "how" of any learning goal, a student must obtain high levels of self-efficacy necessary to succeed in completion of the task.

Our level of self-efficacy influences the choices we make, the effort we put forth, how long we persist when we confront obstacles and how we feel if we fail.

Belief in one's personal efficacy spurs our actions. Unless people believe that they can produce desired effects by their actions, they have little confidence that they will achieve their goal. Self-efficacy buffers the learner's disappointments with failure and provides an unshakable belief in their personal efficacy and a firm belief in the worth of what they are doing. This powerful internal resource enables them to withstand adversity. The slow inclusion of paced innovative additions to classroom technology can help instructors overcome fears of being non-expert. As more technology is placed within their teaching regime, a comfortable level and sense of what is appropriate for their teaching style and what is inconsequential should emerge, raising confidence levels. As confidence is increased, so is usage. When instructors feel competent with the value and competence of their skill level they will begin to model and encourage use among their students of the tools necessary to begin bridging the digital divide.

References

Anderson, Cheryl. Interview. *University of the Incarnate Word, April 1*, 2002

Bandura, Albert. "Perceived Self-Efficacy in Cognitive Development and Functioning." Educational Psychologist 28.2 (1993): 117-148.

Baxter, Gail P., Anastasia D. Elder, and Robert Glaser. "Knowledge-Based Cognition and Performance Assessment in the Science Classroom." Educational Psychologist 31.2 (1996): 133-140.

Pajares, Frank, and John K. Bengston. "The Psychologizing of Teacher Education: Formalist Thinking and Preservice Teachers' Beliefs." PJE. Peabody Journal of Education 70.3 (1995): 83-98.

Dale H. Schunk, and Barry J. Zimmerman, eds. Self-Regulation of Learning and Performance: Issues and Educational Applications. Hillsdale, NJ: Lawrence Erlbaum Associates, 1994.

Schunk, Dale H., and Barry J. Zimmerman. "Social Origins of Self-Regulatory Competence." Educational Psychologist 32.4 (1997): 195-208.

Sweany, Noelle. Interview. *University of the Incarnate Word*, May 1, 2002.

Wicker, Frank. Interview. *University of Texas at Austin*, May 15, 2002.

Multimedia Instruccional Design *VS* Learning Objects Development
A dynamic process of educational content creation in Open and Distance Learning

Albert Sangrà, Academic director and Director of Edu Lab (UOC)
Lourdes Guàrdia, Director of Multimedia Instructional Design Dp. (UOC)
Francesc Santanach; Multimedia Instructional Designer and computer engineer (UOC)
Xavier Mas; Multimedia Instructional Designer (UOC)
Universitat Oberta de Catalunya, Avda.Tibidabo, 39-43, E-08035 Barcelona
Tel: 34-932532300 http://www.uoc.es

The role of Multimedia Instructional Design (MID) applied to the new information and communication technologies substantially changes in those teaching and learning models based on Open and Distance Learning.

> An intrinsic link exists between instructional design (ID) and open distance learning (ODL). Their inextricability in the real world raises specific problems of interest in the field of ID. In no other teaching/learning situation is ID essential as in ODL. The conditions of ODL make it a necessity to have long-term instructional planning, cost, analysis, curriculum and course development, instructional materials development and maintenance, delivery plans, and detailed evaluation rules. Without all of these components, DL simply could not happen. It took some time for this necessity to be acknowledged, as can be seen in the history of ODL. (Bourdeau, J. and Bates, T.)

The term *Instructional Design* is usually used to describe the process in which:

- the learning needs and the environment where they will manifest are analysed;
- training needs are defined;
- the most appropriate resources regarding the learning processes are chosen:
- contents and activities are developed;
- evaluation is designed

However, this concept becomes much wider when referring to ODL. We are nowadays facing the challenge of making good use of the possibilities of multimedia technologies in order to offer much more significant learning than those which traditional educational materials would facilitate; so, it is necessary to take into account all the elements intervening in the instructional design of a concrete training action for ODL. In that sense, the coherence of the materials and the teaching strategy, together with the functionalities of the virtual environment and the relations that will be developed will be fundamental.

Gillespie (1995) recently contented that a well-designed piece of courseware should incorporate the most appropriate aspects of each learning theory (Phillips, R.):

> This is what we as instruction and learning environment designers ought to be striving for, using our expertise and knowledge of behaviourist, cognitive, and constructivist learning theory to combine with expertise in other disciplines (multimedia, human factors, systems engineering, telecommunications, etc.) to design and deliver the most appropriate solutions for our performance improvement and learning situations.

The ideal piece of courseware incorporates the most appropriate parts of both theories, and the balance will be different for every application.

Our experience in distance learning has shown us how important it is to have well structured materials which are designed from a pedagogical point of view, and keeping in mind what, how and when we want to teach or encourage learning.

Dr. Michael Moore -the president of American Center for the Study of Distance Education (ACSDE)- said in his last conference, in June 2001, in Barcelona (at UOC) *"It's necessary to invest more in design than in technology...the learning outcomes are related also to design of the course and the tutor's support"*

This implies training the authors (usually specialists in a field of science or other areas of study) in how to elaborate teaching material for distance learning.

Thus, some professors may need to expand their own material or prepare new one. This implies, again a training task, centred not only in the understanding of the distance teaching-learning process, but also in the knowledge of resources and tools to make the elaboration of material easier.

This need will force many distance learning institutions to plan the creation of tools which allow tutoring and continuous training for teachers and authors; so that learning objectives in an ODL model in which technology brings us new opportunities, are fully guaranteed.

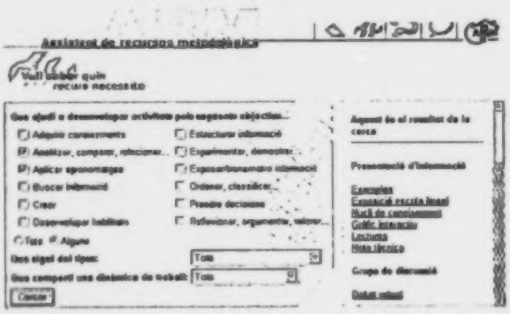
BEST COPY AVAILABLE

In our case, at Universitat Oberta de Catalunya (UOC), the ARM (Methodological Resources Assistant) was created to answer the above mentioned needs.

1. What is the ARM?

The ARM is a system for the design and elaboration of methodological resources adapted to different objectives and training needs, in a virtual learning environment.

Its aim is to provide a wide range of distance learning methodological resources as well as tools to facilitate material creation, for professors and authors.



2. What can be found there?

The ARM enables:

- Looking for resources: The user can carry out resource or activity type searches from different criteria using a very simple and intuitive interface.
- Accessing to a concrete resource report by selecting its name.
- Acquiring ideas/Offering ideas. This is a project open to all the new incoming resources and activities that may appear with new needs.
- Consulting methodological aspects.
- Creating instructional activities.
- Giving guidelines or advice of pedagogical use

See in detail each chapter:

- Looking for resources

The user can carry out resource or activity type searches from different criteria using a very simple and intuitive interface. The route that takes the users to the resources that would best fit their needs depends on the desired objectives, the kind of activity and the work dynamics they prefer.

- Accessing to a concrete resource report by selecting its name

Every resource report provides information about the typology or category that the resource belongs to, the goals that can be reached with it or the activity given; the resource description – structure, stages, functioning, etc.-; the application – guidelines or directions to improve the possibilities the resource offers; the work dynamics to follow; the view of concrete examples; the elaboration guidelines for the resource; the bibliography reference; and templates and programs to create resources easier.

- Acquiring ideas/Offering ideas

Our idea is to fulfil the potential users' needs in advance. This is a project open to all the new incoming resources and activities that may appear with new needs.

This is why we offer a double use: you can access ARM knowing what you want, and therefore going directly to a concrete resource or you may access to look for new ideas. Every resource has got concrete examples that will help you to decide what you want.

- Consulting methodological aspects.

The functional ARM includes important aspects such as strategy offers to teachers and authors in order to define goals, select contents, make guidelines for material, follow style indications, etc. You can access to ARM methodological contents in various ways: as a course to be followed or as a consulting space for concrete questions.

- Creating activities: the programs and templates

ARM objectives are not only to select resources but to facilitate the creation of new activities. In order to achieve it when choosing a resource, we can access to a template in the shape of a form or other systems, where the necessary steps to create an activity would be given.

Once the form has been filled in, you can print it out and save the written content before being sent to a general database where the technicians in charge of the activity of implementation would give it the corresponding format.

There is a double aim behind these programs and templates. On the one hand, their aim is to help in creating new activities, and on the other hand, to facilitate their later implementation, given that the model's goal is to ensure that every requirement is met for later implementation.

BEST COPY AVAILABLE

- Giving guidelines or advice of use

We can access the assistant knowing which resource we are looking for and then obtain some guidelines or advice on how to use it in distance learning. Thus, there is a report for every resource with this kind of advice.

3. What is its structure?

The ARM is structured as a system composed of different elements:

- A communication space (forum, FAQs, consulting mailbox...)

In this space the users find a forum and a mailbox for asking questions about or giving their opinion on what ARM provides.

- Help or Guidance about methodological aspects

It helps methodological design explaining, for example, what we are referring to when talking about objectives, how to take decisions about what resources to use, how the learning guide is structured, what is evaluation and how to treat it.

- The searching form

The searching form is the tool that helps the professor or the author to know the best resource features for their material elaboration. The result of the searches is a list of the resources that best suit the user's requirements.

- The resource reports

From the result list you can access to the resource reports, which include the previously mentioned sections. The main aspects are the guidelines for resource elaboration, the examples and the elaboration templates and tool that make the process easier for the author.

> The recent growth of the field of interactive multimedia may be attributed in part to the availability of courseware authoring, which gives the course-ware developer who has no expertise in programming in high-level languages the ability to control the full range of presentation functions.(Inglis, A., Ling, P. and Josten, V.)

4. What's the future?

After working in this system of design for the last two years, we are just starting and adding a new concept of how to conceptualise learning materials in terms of educational knowledge management (EKM). In this sense, the instructional design is based on learning objects and consists in structuring the educational contents thinking of the interactions between users profile, learning resources and the virtual environment.

Also the EKM tries to consider the artificial intelligence techniques in order to get information about students previous knowledge and to assure the interactions between the learning objects, learners and teaching staff offering learning resources, strategies, and contents that the students may need. An analytical model of teachers' cognitive-interactional activities within an experimental reflective teaching situation would be an interesting research to do.

> In order to carry out educational activities successfully, teachers need to draw on a wide variety of knowledge, such as students' knowledge, the curriculum, teaching methods, classroom organisation, educational goals, and subject matter… we focus on the nature of teacher's knowledge of student's knowledge and on the understanding how teachers acquire it in a form that is appropriate to the specific activity in which they are engaged. (1999, Lund, K. Baker, M.)

The EKM system that our institution is planning to implement has a determinant impact in the creation and edition of learning materials, concerning the optimisation and agility of the process, as much as the increase in the security.

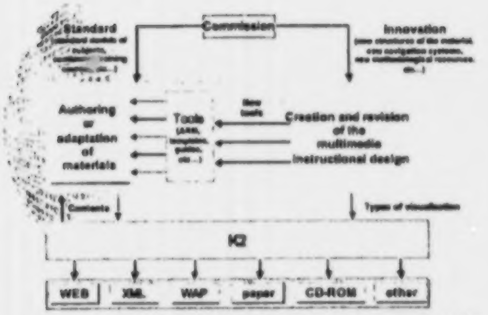
Our interest focuses on assuring the structure of the materials and their pedagogical adequacy, lessening production times and guaranteeing that the original work from authors is being delivered in the best condition.

This is the reason why we need to design certain processes and tools which allow us to reach the stated objectives, by generating contents according to the knowledge management system (standardised -tested- and innovative elements) and that which can be presented on different support systems.

The organising axis of all this is the Methodological Resources Assistant, a pedagogical portal for any educational development of the institution that facilitates all the necessary information, tools and guidance for the creation of learning and teaching resources.

See the graphic below:

BEST COPY AVAILABLE



Disseny FormatiuMultimèdia. Universitat Oberta de Catalunya. April 2001

With the creation of this tool, the Knowledge Management system and the constant work as instructional designers in UOC – an institution offering total virtual training – we may firmly contribute to the evolution of the concept of instructional design as a guarantee of pedagogical innovation in learning processes in ODL.

Bibliography

Bates, T.; Bourdeau, J. (1996). "Instructional Design for Distance Learning". *Journal of Science Education and Technology* (Vol. 5, núm. 4).

Edu Lab Documents. The contribution of the Universitat Oberta de Catalunya to the ICDE. Vienna, June 1999. 19th World congress of the International Council for Open and Distance Education (ICDE)

Guàrdia, L. *El diseny formatiu: un nou enfocament de diseny pedagògic dels materials didàctics en suport digital.* Duart. J.M., Sangrà. A. (eds) Aprenentatge i virtualitat. Disseny pedagògic de materials didàctics per al WWW. Ediuoc i Pòrtic, Barcelona, 1999

Hall, B. (1997) *Designing courses for the web.* Web-Based Training Cookbook Wiley Computer Publishing,

Hannafin M.. *Designing Resource-Based Learning and Performance Support Systems*

Hill, J. R. (2000). Web-based instruction: Prospects and challenges. In R. M. Branch & M. A. Fitzgerald (Eds.). *Educational Media and Technology Yearbook*

Inglis, A.; Ling, P.; Joosten, V. (1999). "Delivering Digitally. Managing the Transition to the Knowledge Media". London: Kogan Page Limited

Lajoie, S.; Vivet, M. (Eds). (1999). Lund, K. *Teachers' collaborative interpretations of students' computer-mediated collaborative problem solving interactions.* "Artificial intelligence in education. Open Learning Environments: New Computational Technologies to Support Learning, Exploration and Collaboration." The 9th international conference on artificial intelligence education (AA-ED'99), IOS Press, Ohmsha

Merrill, M. D. (1994). *Instructional Design Theory*. Englewood Cliffs: Educational Technology Publications.

Phillips, R. (1997). "The Developer's Handbook to Interactive Multimedia. A practical guide for educational applications". London: Kogan Page Limited

Ritchie, D.; Hoffman, B. *'Web-Based Instruction*. Educational Technology Publications 1997
Rowntree, D. (1994). "Preparing Materials for Open, Distance and Flexible Learning. London: Kogan Page Limited

Wilson, B.; Ryder M. (1998). "Dynamic Learning Communities: an alternative to Designed Instructional Systems". Denver: University of Colorado.

Links

Bren Wilson home page (professor in information and learning technologies (ILT) at the University of Colorado at Denver)

http://carbon.cudenver.edu/%7Ebwilson/index.html

Web-Based Instruction Examples

http://www.wested.org/tie/dlrn/examples.html

The American Center for the Study of Distance Education (ACSDE)

http://www.ed.psu.edu/acsde/aboutacsde.asp

International Council of Distance Education

http://www.icde.org

BEST COPY AVAILABLE

Course Development for Distance Learning Using PowerPoint

This paper describes the process and procedures for the development of a distance learning course using PowerPoint as the design software.

Multimedia and Distance Learning for Business in Borovichi, Russia funded by the United States Department of State was a grant to provide course materials for Russian business education. These materials were developed by individuals from Broome Community College, in Binghamton, NY and the American - Russian College of Commerce "InterBiz," in Borovichi, Russia. The materials used in the demonstration course were developed by faculty members at Broome Community College (BCC) in Binghamton, N. Y. Anne Blakeslee, Professor of Business at BCC (Blakeslee_a@sunybroome.edu), was responsible for course content; while Alice McNeely, Director of the Teaching Resource Center (mcneely_a@sunybroome.edu), and myself, George Guba, Multimedia Instructional Designer, organized and designed the technical aspects of the project.

The grant required the trainers from Broome Community College and the instructors from Interbiz College in Borovichi, Russia to develop distance learning courses that could be delivered via the Internet, a computer network, or via CD-ROM. An additional requirement was that the materials be convertible to HTML. PowerPoint was chosen because it was available to the grant participants in both locations. It met the requirements for potential tools to: provide the required means of delivery, be available to the Russian instructors, be available in Russian language software, be easy to use, and have a relatively low learning curve.

The sample course, Small Business Marketing, was designed to be instructor paced, with the lectures and most of the supporting materials contained within the course on the CD-ROM. Some of the examples used were selected to fit the Russian culture and included case studies of businesses in Borovichi. The material on the CD- ROM was also designed to coordinate with an available Russian language textbook. The pluses and minuses of the software will be discussed along with course and template design and evaluation.

Contact with the course's instructor was designed to be flexible based on the accessibility, needs and abilities of the students. The course was designed for multiple means of delivery to meet student needs. The content was designed to allow for the possibility of delivery via multiple channels including the Internet, computer networks, CD-ROM, and print.

BEST COPY AVAILABLE

An Evaluation of an On-line Anatomy Course by Lab Instructors: Building on Instructional Design

Guo, X
Faculty of Kinesiology
University of Calgary
Canada

Katz, L.
Faculty of Kinesiology
University of Calgary
Canada
Email: katz@ucalgary.ca

Maitland, M.
School of Physical Therapy
University of South Florida
United States

Abstract: On-line learning is becoming more popular and realistic with the development of distributed network technology. However, the methods that take advantage of technology and integrate on-line learning into conventional classroom teaching remain controversial. Laboratory instructors evaluated an on-line anatomy lab course at the University of Calgary through questionnaires and direct interviews. Four lab instructors and one professor participated in this study. Results showed that to effectively integrate technology into the curriculum, it was perceived by the instructors as important to set clear teaching objectives, an appropriate amount and depth of information for the level of the students, and teaching strategies related to students' learning style and motivation. Laboratory instructors felt that the dynamic and interactive 3-D animation was motivating for students.

The Study

With the development of distributed internet technology, on-line learning is becoming more prevalent. However, the methods that can take advantage of the internet and integrate it with conventional classroom teaching remain controversial.

There are potential benefits of the Internet for teaching students. The Web:

- is a flexible, dynamic learning environment (Hackbarth, 1997; Ross, 2000)
- allows for multimedia presentations (Palloff & Pratt, 1999; Ross, 2000)
- provides students with access to a potentially rich, collaborative, and powerful learning environment (McGreal, 1997; Ross, 2000).

Kulik's (1994) meta-analysis of the findings of 97 studies on effectiveness of computer-based instructions concluded that students usually learn more in classes that received computer-based instructions, especially in elementary and high school.

However, there are many reports of ineffective distance on-line learning programs (Horton, 1999). Technological possibilities do not automatically transfer into effective teaching and learning (Loveless, 1996; Zhao, 1999). Designing and delivering instruction on the web requires thoughtful analysis and investigation of how to use the Web's potential in concert with instructional design principles (Ritchie & Hoffman, 1997).

There does not appear to be a consensus about the best method to evaluate on-line learning. Traditional evaluation models have concentrated on the empirical and quantitative procedures (Stufflebeam & Shinkfield, 1985; Worthen & Sanders, 1987; Simonsen, 1997). More recently, evaluators of distance education programs have begun to propose qualitative models incorporated with naturalistic methodologies frommore holistic perspectives.

Therefore, a qualitative study of the on-line anatomy lab course in the University of Calgary was conducted from the perspective of instructional design and teaching strategy. The on-line anatomy lab course, which was incorporated into the Kinesiology curriculum, was designed to offer students a wide range of learning media to supplement their study. The website of the program is: www.kin.ucalgary.ca/anatomy.

The on-line computer lab includes four labs (see figure 1). Lab I is an introduction to the computer lab and includes procedures for using this material. Labs II, III, and IV follow the same five-part format (see figure 2): introduction, surface anatomy, dissection, movement and testing. The dissection part is a completely separate program that has been incorporated into the Lab designed specifically for Kinesiology students.

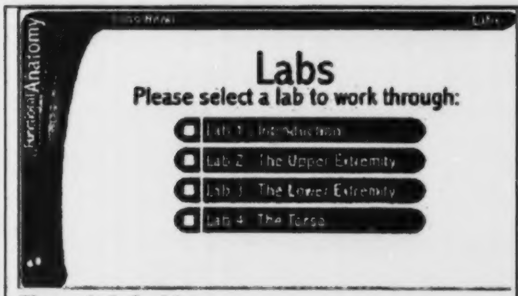

Functional Anatomy
Labs
Labs
Please select a lab to work through:
Lab 1 Introduction
Lab 2 The Upper Extremity
Lab 3 The Lower Extremity
Lab 4 The Torso

Figure 1: Labs Menu

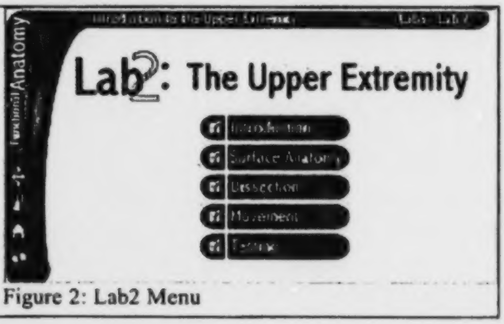

Functional Anatomy
Introduction to the Upper Extremity
Labs : Lab 2
Lab2: The Upper Extremity
Introduction
Surface Anatomy
Dissection
Movement
Testing

Figure 2: Lab2 Menu

Methods

Participants

Four lab instructors fromthe on-line lab course participated in this study.

Instruments and its validity

A five-point Likert scale and ten interview questions were used. The five-point Likert scale is based on Ross' study where he used compared conventional teaching and on-line teaching (Ross, 2000). Some of the interview questions are selected from the reviewed literature and the study of the Integrated Learning system (ILS) in an Alberta middle school conducted by M. Jacobsen (1996). The interview questions were presented under the following four sections:

- demographic information
- comparison with the conventional cadaver laboratory teaching
- students' interaction with other students and lab instructor
- teaching strategies

Procedure

After completing an informed consent form, participants were asked to answer a questionnaire on a five-point Likert scale and then interviewed. All interviews were recorded anonymously on tape.

Analysis of the results

A descriptive statistical analysis was performed on the questionnaires. The interview recordings were transcribed and cross-referenced for both common and unique responses.

Conclusion

Computer technology has provided many new educational possibilities such as distance accessibility, and interactive, dynamic multimedia learning environments. Effective use of educational

BEST COPY AVAILABLE

technology should take into consideration numerous elements. Results of this study highlight the need for instructional design, content, and teaching strategies that take into consideration learner characteristics as well as the classroom environment.

In this study, according to the lab instructors, the 3D animation and interactivity of web-based labs appear to have attracted student attention. Moreover, they suggested that the following factors be taken into consideration in order to develop World Wide Web tools to support classroom activities:

- course content should be current and relevant to learner needs
- expected learning outcomes must be clearly described
- too much text on one page should be avoided
- students should not be overwhelmed with information
- increased access to the Internet, and voluntary lab assignments should be encouraged.

Future study of student work-load and its impact on knowledge mastery, and student comfort with using technology as it relates to performance and attitude, is recommended.

References

Horton, W. (1999). *Designing Web-Based Training.* John Wiley & Sons, Inc. New York, NY.

Jacobsen, M. (1996). *A descriptive study of the implementation of an integrated learning system in an Alberta middle school.* Ottawa: National Library of Canada, repr.1996, c1995.

Kulik, J.A. (1994) Meta-Analytic Studies of Findings on Computer-Based Instruction. Technology Assessment in Education and Training. E. L. Barker & H. F. O' Neil. Lawrence Erlbaum Associates, Hillsdale, New Jersey. (pp9-33)

Loveless, T. Why Aren't Computers Used More in Schools? *Educational Policy,* 10(4), 448-467.

McGreal, R. (1997). The internet: A learning environment. In T.E. Cyrs (Ed), *Teaching and Learning at a distance: What it takes to effectively design, deliver and evaluate programs.* (67-74). San Francisco: Jossey-Bass .

Pallof, R.M. & Pratt, K. (1999). *Building Learning communities in cyber space.* San Francisco: Jossey-Bass.

Pennell, R. (1997) Managing online Learning. In Proceedings of the second Australian World-wide Web Conference. [Available On-line]. http://elmo.scu.edu.au/sponsored/ausweb/ausweb96/educn/pennel/papers.html

Ritchie, D.C. & Hoffman, B. (1997) IncorporatingInstructional Design Principles with the World Wide Web. In Khan, B.H. (Ed.). *Web-based Instruction: What it is and why is it?* Educational Technology Publications, Englwood Cliffs: NJ, USA.

Ross, J.L. (2000). *An exploratory analysis of post-secondary student achievement comparing a web-based and a conventional course learning environment,* PhD thesis, University of Calgary, Canada.

Simonson, M.R. (1997). Evaluating Teaching and Learning at a Distance. In T. E. Cyrs(Editor), *Teaching and Learning at a distance: What it takes to effectively design, deliver and evaluate programs.* (pp 87-94). San Francisco: Jossey-Bass

Zhao, Y. (1998). Design for Adoption: The Development of an Integrated Web-Based Education Environment. *Journal of Research on Computing in Education.* Spring 1998: Volume 30 Number 3. pp307-327.

Using Technology to Aid in the Creation of High-Quality Corporate E-Learning

David A. Guralnick, Ph.D.
Kaleidoscope Learning
386 Park Avenue South
Suite 1900
New York, NY 10016
dguralnick@kaleidolearning.com

Abstract: E-learning has the potential to make a huge impact on the corporate learning field,, but this potential has not yet been realized. In theory, e-learning can provide high-quality, individualized, easily accessible, on-demand, interactive learning and performance support. But in practice, most attempts to migrate to an online learning model have resulted in poor, inefficient training. I suggest that the primary reason for e-learning's failure to this point lies in the focus on technology rather than on learning. In this paper I propose a three-part plan to employ technology differently, with the end result being a focus on high-quality learning.

1. Introduction

E-learning has the potential to make a huge impact on the corporate learning field, but this potential has not yet been realized. In theory, e-learning can provide high-quality, individualized, easily accessible, on-demand, interactive learning and performance support. But in practice, most attempts to migrate to an online learning model have resulted in poor, inefficient training. I suggest that the primary reason for e-learning's failure to this point lies in the focus on technology rather than on learning. This has resulted in the following specific problems:

- People who are skilled in learning theory are often less involved, or not involved, in creating training; rather, the role of computer programmers and graphic artists is increased
- Technical structures often are allowed dictate the design of an e-learning piece, rather than the other way around
- Lack of software tools for trainers—most authoring tools are "pseudo-programming" tools which still require the user to think in terms of programming logic rather than focusing on pedagogy.
- The Web and corporate intranets are typically viewed simply as information repositories, thus failing to take advantage of what technology can offer: personalized, interactive, just-in-time training and performance support
- Technical implementation details take time, preventing trainers from focusing on content and pedagogy.

2. Technology and Pedagogy: Must They Be at Odds with One Another?

There often seems to be a war of sorts between the technology side and the learning side. I suggest here that this conflict is to a large degree unavoidable: there's a huge communication gap between the groups, and there is no easy way around it. These groups have different skills and essentially speak different languages, and their design and development styles often are at odds by their very nature. While an admirable attempt at finding a middle ground, today's authoring tools are "pseudo-programming" tools, designed to let people build Web sites and programs without actually programming—but in practice that means "without writing actual code," rather than "without thinking in terms of programming logic and technical details"; the users of such tools do need to create programming logic even if they do not need to know programming language syntax. Given this difficult situation along with the temptation to garner the benefits of e-learning, many trainers today are trying to "catch up" by following one or more of several plans:

- Outsourcing their e-learning projects
- Hiring a programmer or programming team to help them

- Learning to use authoring tools, which themselves generally fall into two categories: those with a steep learning curve and a programming-like feel; and those which are simple to use but create only very simplistic products with little likelihood of teaching effectively.

The first option, outsourcing, is expensive, and over time also becomes inefficient if the vendor needs to be involved in the updating process as well. The second option, a programmer or programming team, is also quite costly, and it is very difficult to create a good quality product with such a project team; the technical details end up dictating the learning rather than the other way around. The third option, authoring tools, provides trainers with the greatest control over the learning experience; yet the amount of work required is substantial, and much of the work is necessarily focused on technical rather than learning issues. The learning design part is already difficult to do well, and while it is the trainers' core area of expertise, if they spend their time handling technical issues, their skills are going to waste. Imagine if a trainer wanted to produce a print manual and needed to understand how a printing press worked—building training with today's authoring tools can seem just as nonsensical.

What can we do about this problem in order to allow quality e-learning on a large scale? In this paper I propose a three-pronged method to creating effective e-learning on a large scale, and describe some elements of this approach. The three components are:

- "Learning Architectures": technology designed specifically to support good training
- A technical engine, invisible to the users, to support personalization and customization
- An e-learning creation "control center," with authoring methods that are intuitive to trainers, and support tools to help trainers organize and understand their content.

In the following section, I describe this new method in more detail, and draw from real-life examples of works that are either in the prototype stage or have already been deployed.

3. The Approach

3.1 Learning Architectures

Sound learning architectures that make use of the interactive capabilities of the medium are key to creating successful e-learning. In many ways, this is the next logical step in the development of online learning; whenever a new technology is introduced, its first uses closely resemble products designed for old technologies, which fail to make use of the new capabilities. Elearning has remained in that stage for too long. The idea here is to create learning architectures, beyond online manuals or Flash animations. These architectures are built around the learners' goals and, while good training design and good content are also necessary (and the responsibility, as well as the core skill set of the trainer), the architectures provide conceptual building blocks for sound training. Examples of learning architectures include:

Procedural learn-by-doing simulations

- **Goals**: Learn by practicing a real-life task.
- **Description:** The learner is given realistic scenarios and a simulated environment, and must work through them. A teaching component provides guidance and feedback, as a real-life coach would.
- **Uses**: This architecture is best for procedural tasks where there's some notion of a recommended way or ways to do things—examples include operating software or equipment and script-based soft skills such as many customer service jobs.
- **Sample Training Applications:**
  - **Laser Radio Terminal (LRT) Training**: Retail employees use handheld LRT scanners to track store inventory and locate product. The LRT terminals run a set of software applications, and mistakes made by employees can have drastic consequences on the accuracy of the data. The LRT Training simulations present users with real-life tasks in which they must perform actions with LRT software, using a simulated LRT on their computer screen.
  - **Guest Service Video-based Simulation**: Here, retail employees learn about customer service skills and store policies and procedures, by handling customers who appear in video, with realistic consequences played out for each action.

Rate-and-Review training activities

- **Goals**: Learn by observing the performance of a task, reflecting, and discussing it with others.
- **Description**: Users watch a task being performed by someone, generally through video or audio, ad rate the performance along several dimensions, and compare their thoughts with those of peers and experts.
- **Uses**: This is best for tasks which are visual, and/or expensive or difficult to simulate, such as coaching employees, where body language and personal style weigh heavily.
- **Sample Training Applications:**
  - **Coaching Training**: Retail employees watch videos of coaching situations based on real-life problems that they may face in their own jobs. They rate the video coach along several dimensions, then compare their ratings with the way their peers and some experts viewed it. They then can read explanations and see the same situation handled in a better way.
  - **Crisis Training**: Corporate employees watch a crisis situation unfold in video, and see how the company handled the crisis. Again, they rate the quality of the response, and can discuss with peers and experts. The learning goals here are for the users to become more proficient in handling crises.

Solid learning architectures in conjunction with a good trainer can produce excellent e-learning end-products. But the end-product itself is only a piece of the overall puzzle. If we want a way to produce quality e-learning on a large scale, two other areas must be addressed.

3.2 The Technical Engine

The goals of this technology piece are to support customization and personalization—so that content can be reused but in a way that always feels relevant to the user and the situation. For example, suppose a retail chain wants to teach their supervisory employees how to coach their staff. The audience however, is made up of employees with very diverse responsibilities and skills.

Generic coaching tips and instructions will not work - learners are notorious for deciding quickly "that doesn't apply to me." On the other hand, it is ridiculous to expect the trainer to create several entire coaching pieces from the ground up, such as "Coaching Cashiers," "Coaching Unloaders," and "Coaching Food Service Employees."

The basic underlying structure of the technology must allow the trainer to include both general information (in this example, coaching principles such as "coach positively as well as negatively," or "give feedback in private") and position-specific information that makes the training relevant to each different audience. Then, the technology must integrate the two seamlessly when the site is accessed so the end-user, for example, the cashier supervisor, doesn't notice or have to wade through information and examples relevant to the unloading supervisor.

In addition, learners need to be able to quickly and easily find the information, training, or other on-the-job support they need, which requires a good search engine, sound indexing of the content (as opposed to a plain text search which pulls up far too many results to be useful), and a clean interface for the end-user.

Up through this section, with a technical implementation adhering to the above guidelines, we now have the ability to have good training for a large group, including efficient content reuse, when they need it, in a personalized and customized way.

3.3 The Trainer's Control Center

In order for this approach to work, trainers need to be able to actually employ it—on their own, without programmers or outsourcing vendors. This means that they should be able to build e-learning while using minimal technical skills, and also maintain, study, organize, and customize the training and content. A software tool for trainers to do these things requires a focus on content and training rather than a focus on technical structures. The technical structures in section 3.2, along with the learning architectures in section 3.1, combine to form the underlying basis for this approach, but the training development platform itself should support a trainer in the following ways:

- It must have a natural, intuitive interface
- It should use a vocabulary of training and content, not of the technical world—for example, trainers can build "simulated tasks" rather than "branching models".
- It must offer support tools to make the trainer's development process simple and error-free. These tools come in two varieties:
    1. Basic quality assurance, such as spellcheck.
    2. Complex, content-centered tools, such as detailed reports describing the content of a training site.

The Control Center toolkit is currently a work-in-progress and will be completed in December, 2002. For the future, the next generation of these tools can include features that support the learning design process by training the trainers to design better online learning environments.

4. Conclusion

Technology and pedagogy can indeed coexist, and can join forces to create the e-learning that has been long discussed. In order to reach this point, we need to make changes in the way the two fields view each other and work together. Only then can large scale e-learning truly have an impact. Under the plan described here, trainers would still need to become expert at some new skills in order to create training under new, more-complex learning architectures. But these are natural evolutions of the trainer's current skill set. Technology, under this plan, plays a background role and supports and assists in the creation of sound learning, available just-in-time to end-users. With such a learning-focused plan, the true potential of e-learning can be realized on a large scale.

5. References

Guralnick, D. (1996). *An Authoring Tool for Procedural-Task Training*. Ph.D. Dissertation, Northwestern University.

Guralnick, D., & Larson, D. (2000). Using the Web to Improve Manager Performance at Target Stores. *Interactive Multimedia 2000*, American Society for Training and Development, Orlando, FL 65-76.

Guralnick, D. (2000). A Step Beyond Authoring: Process-Support Tools. WebNet 2000, Association for the Advancement of Computing in Education, San Antonio, TX.

Guralnick, D. (2002). The Art of Creating Useful Content and Effective Online Learning. InfoToday 2002, New York.

ESTABLISHING A PEDAGOGICAL PLATFORM FOR DELIVERING POST GRADUATE EDUCATION AS BLENDED E-LEARNING.

Author: Andrew Hall
Institution: University of Manchester, School of Nursing, UK
Email : andrew.g.hall@man.ac.uk

Abstract: This paper focuses on the implementation of a blended e-learning resource-based learning and tutoring approach for post graduate study and the implications of this for on-campus and off-campus students. In particular the paper address issues of appropriate pedagogy and the use of new media to expand and improve on the traditional lecture based approach.

The project

The conversion of traditional Masters level modules in research methodology for health professionals, which form a key unit of study for postgraduate students, too distributed learning materials for flexible off or on campus delivery. The project has made extensive use of streaming media and use of a VLE. During the project each aspect of teaching and learning has been explored, the pedagogy questioned and the content examined. The process has been of benefit to both staff and students in relation to the nature and content of the learning materials.

Traditionally each unit was delivered through a series of six lectures or teaching sessions over a period of six weeks. After review and development each unit is now a half module and can standalone or be integrated into other study packages and is delivered as blended e-learning over one semester. The core learning material is available on the web; students access this and then undertake individual & group activities, face to face if on-campus, by use of asynchronous web based communication if on-line. After each block of study, students present a review of their work in academic seminars if on-campus or online if not. Assessment is by a summative assignment supported by a portfolio of selected coursework with reflective statements.

The pedagogy

For Candy (1991) self direction is a process where learners gradually take control of their learning as well as an environment that encourages travel towards an ideal end point of self direction. During the development of materials it be came clear that this is a multi layer model with each layer built on a similar principles; the programme of study was designed to encourage the students to be more independent at the end than at the beginning Caffarella (1993), as was each module and each learning session. The structure of the learning material, the nature and content of the resources, wording and nature of the tasks all encourage the development of inquiring and analytical study and the exploration of other related routes of investigation with the assumption that the independence of the learner would grow. Knowles (1980) provides criteria that can be used to judge the value of the learning material in reach this end. In particular do the learning materials promote the ability to formulate questions that are answerable through inquiry and to generalize, apply and communicate the answers to question raised.

Tennant (1997) identifies assumptions within the humanistic concepts of self-development and self-direction, which, he argues, the evidence base does not fully support. The project team had some sympathy for Tennant's argument that there is inherent in the assumption of *self-directed*, a contextualization of the self that is often not addressed in these debates. By placing the self-directed elements of study after more structured elements context could be provided by the expertises that lie within the knowledge and work of the content experts, not in a traditional didactic fashion but through the shaping of tailored learning. As such the self enters a world where initially the context of study is apparent. The student is therefore expected to develop at multiply levels: as a subject expert; as a learner; and as a professional within a given context. The development of open ended linear routes, which draw on the knowledge and experience of the subject expert, guide learners through a pattern of predetermined resources and activities, promote both subject focused learning and the skills of the independent learner, and lead to more open explorative study, provide a framework for such an approach.

Weil & McGill (1996) argue that the experience of the learner has value and that learning should be active, meaningful and relevant to the agendas of the learners; Laurillard (1998) identifies a conversation framework as key to the development of a critical perspective, necessary for academic understanding. These principles were employed in the structure of the learning materials and assessment. At each key stage students are presented with a number of resources and an activity that is undertaken in two parts. The first allows for consideration and reflection on the requirements & resources and the second requires students to engage with tutor and peer group to consider the contributions made. Within this facilitated dialogue, learning is an active process in the construction of meaning with the experiences and knowledge of the student cohort contributing to knowledge base of the group and its understanding of the issues under investigation. The method rewards collaboration and this is enforced by part of the assessment process being linked to the outcomes of the discussion. The ability to be responsive in this element allows the tutor to develop themes that the students have identified as of particular interest and if so desired to communicate these to the wider group. Additionally at this stage the tutor can facilitate the students learning to learn Wallace (1996), how to learn and direct themselves through information, concepts and tasks. Activities are built around problem solving, knowledge sharing, the construction of an analytical approach and the production of knowledge and as such work focuses on what Salmon (2001) identified as stage 4 skills.

New Media

Much work has been done on the potential of low bandwidth streaming media both video and audio in production of learning resources. A key benefit of which has been the potential for personalisation of the learning programme. Resources can be produced that address the needs and interests of different cohorts of students within the same pedagogical framework. Students of Nursing, Public Health, Socialwork, Medicine and others can view case studies and new media resources particular to their field and then engage with learning materials that draw on areas common to research methodology. This form of personalization would not be possible in a traditional setting and together with the acknowledged advantages of web based delivery in relation to accessibility, provides a strong driver for such development.

Conclusions

Through the development of this project we hope to address the major current pedagogical themes in the delivery of education through new media. In particular we hope to have established an adaptive educational framework which can support and influence the delivery of other post graduate programmes and programmes at other levels of study. We have drawn on elements of different theoretical approaches to develop a methodology that we feel is appropriate to the students in our institution and that may have generalisable outcomes. The course runs live in Sept 2002; we have obtained funding for a two-year research project into the educational experiences of different student cohorts.

References

Caffarella, R. (1993) 'Self-directed learning', in Tennant (2002) 'Psychology & Adult Learning', London: Routledge
Candy, P. (1991) 'Self direction for lifelong learning', San Franciso: Jossey-Bass
Knowles, M (1980) 'The Modern Practice of Adult Education' ', in Tennant (2002) 'Psychology & Adult Learning', London: Routledge
Laurillard, D. (1998) 'Rethinking University Teaching', London: Routledge
Salmon, G. (2001) 'E-Moderating: the key to teaching and learning online', London: KoganPage
Tennant, M. (2002) 'Psychology & Adult Learning', London: Routledge
Wallace, M. (1996) 'When is experiential learning not experiential learning?' in Claxton, G., et al (Ed.) Liberating the Learner' London: Routledge
Weil, S. & McGill, I. (Ed.) (1996) 'A Framework for making sense out of Experiential Learning' Buckingham: SRHE & OUP

Development of a Web-based Learning System for Teaching Web Design and Development: A Problem-Based Progressive-Scaffolding Approach

Richard H. Hall
Information Science and Technology
University of Missouri – Rolla
United States
rhall@umr.edu

Aram Digennaro
Psychology
University of Missouri – Rolla
United States
aram@umr.edu

Jessica Ward
Psychology
University of Missouri – Rolla
United States
Jessica@umr.edu

Nicholas Havens
Biological Science & Psychology
University of Missouri – Rolla
United States
nhavens@umr.edu

Joseph Ricca
Information Science and Technology
University of Missouri – Rolla
United States
jricca@umr.edu

Abstract: This paper describes a model for design of web-based learning system which is guided by two fundamental, and somewhat contrasting, design themes: problem-based interactivity; and progressive scaffolding. It is proposed that effective systems should be built around core problems, which require the active engagement of the learner. It is also proposed that the learner should be provided with scaffolding to support problem solution in a progressive manner going from the most general and minimal guidance to the most specific and detailed. It is then up to the learner to select the tool at the necessary level for problem solution. A prototype system for teaching web design, which was designed to examine the two fundamental components of this approach, and on-going usability testing of the prototype are also discussed.

Introduction

Although the number of web-based learning systems that have been developed in recent years to support distance and face-to-face classes has grown exponentially in recent years, research indicates that much of the promise of these learning systems has not been realized (Reeves, 2002). There are a number of reasons for this. A primary reason is that little thought or effort goes into design and research before the tools are implemented (Hall, Watkins & Ercal, 2000, April). A fundamental characteristic of effective learning environments is that they promote and encourage active learning; and many web-based distance courses, and even elaborate multimedia simulations are simply used to display information, without requiring students to interact with them. At the same time, research in hypermedia learning systems indicates that it is also very important to provide a learner with some level of guidance(Shin, Schallert & Savenye, 1994), and this too, is often lacking in these web-based systems. Finally, the ineffectiveness of these tools is almost surely partly due to the lack of research on these web-based learning technologies (Dillon & Gabbard, 1998). The vast majority of web-based courses and modules have not been pilot tested or evaluated prior to their introduction into the curriculum.

Computer based learning systems and the World Wide Web afford us an opportunity to move education to a new level, both to enrich traditional instruction and to provide instruction at a distance. However, such a transformation can only be realized through the application of systematic principles of instructional media design and through close interaction between content providers and web designers (Hall, Feltrop & Davis, 2001, April).

The purpose of this paper is to: a) Introduce a model for such a Web-Based learning system; b) Describe an example of such a system for teaching Web Design and Development currently under development; and c) Describe an initial usability study currently in progress.

Problem-Based Progressive -Scaffolding

The system currently under development is guided by two fundamental, and somewhat contrasting, design themes: problem-based interactivity; and progressive scaffolding.

At the core of each module is a problem, which requires that the learner actively integrate knowledge from multiple sources and apply basic methods and procedures for its solution. A large body of educational research indicates that learners learn most effectively when they are activity engaged in learning, as opposed to passively reading or listening (Brooks, 1997). Further, problem solving is at the core of meaningful learning.

"Progressive scaffolding" is the term we use to refer to a systematic method of providing learners with and optimal level of guidance(Hall, Watkins & Eller, in press). The system is designed in such a way that supporting materials are offered in a progressive fashion, from the most general and minimal guidance to the most specific and detailed. It is then up to the learner to select the tool at the necessary level for problem solution.

A Prototype System

We are currently developing a series of learning modules based on the system described above for teaching Web Design and Development. The system is intended to support a face-to-face class at the University of Missouri-Rolla on this topic, but it is also intended to be appropriate as a component of a distance learning class.

To begin development of such a system, we first created a prototype module, which is a step-by-step description for how to create a fairly elaborate web page, using the web development tool *Dreamweaver©*. To create the page, the user must apply a number of general procedures including: setting up a site; adding tables & graphics; using tables for page layout; inserting text; creating hyperlinks; creating image rollovers; and creating a disjoint swap image behavior.

This initial system is straightforward and is intended to examine the key components of the model above, so the initial interface is very straightforward in design. The progressive scaffolding is provided in the form of different levels of information for displaying each step in the development process: a) Text; b) Graphics; c) Narrated Video. A screen shot from this prototype system, which is currently under examination is displayed in Figure 1.

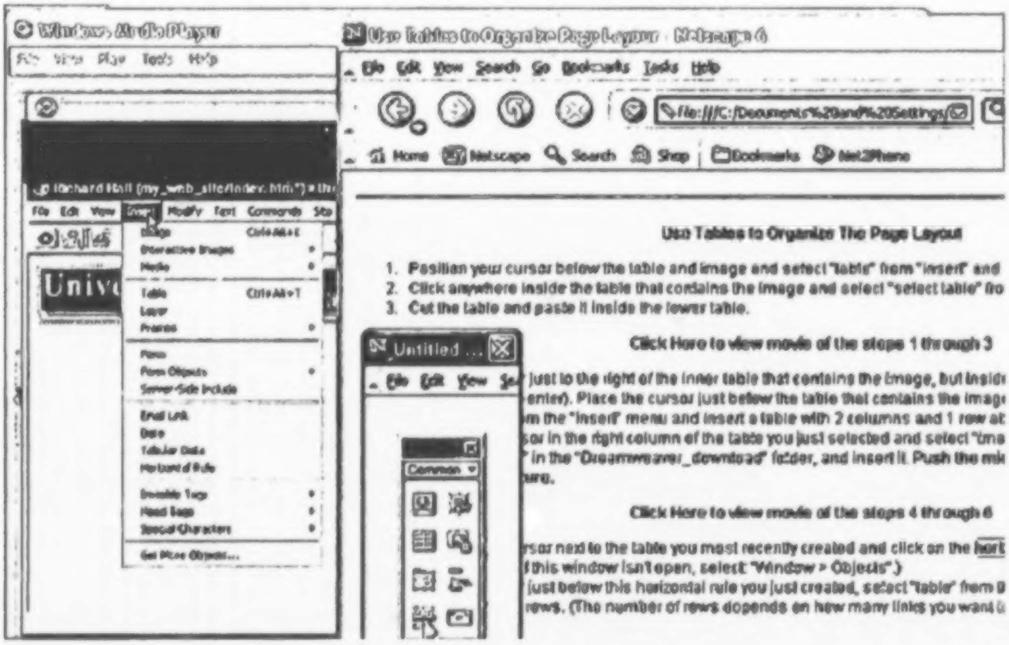
Usability Testing

This system is currently undergoing usability testing with students in General Psychology classes at the University of Missouri-Rolla serving as participants. Each student works with the system for forty-five minutes with the specific goal of recreating a model web page that includes all of the components cited above. Each participant's session is recorded including dynamic screen video capture, user facial expressions and audio; using a typical usability testing scenario (Dumas & Redish, 1999).

The principles questions that are being examined in the analysis of these session recordings are:

1. To what degree were students successful in creating the page using this prototype interface?
2. To what degree did students utilize each of the progressively complex types of guidance (text, graphics, and video)?
3. What is the relationship between 1 and 2?

Of course, any other trends or themes that emerge with regard to participants' traversal through the stages of the task and it's relationship to performance are also being noted, and, most importantly, recommendations for the continued development of the Web-Based learning system are being delineated.


Windows Media Player
File View Play Tools Help
Edit View Search Go Bookmarks Tasks Help
file:///C:/Documents%20and%20Settings/
Home
Netscape
Search
Shop
Bookmarks
Net2Phone
File Edit View Insert Modify Text Commands
Univ
Untitled ...
Common

Use Tables to Organize The Page Layout

1. Position your cursor below the table and image and select "table" from "insert" and
2. Click anywhere inside the table that contains the image and select "select table" fro
3. Cut the table and paste it inside the lower table.

Click Here to view movie of the steps 1 through 3

just to the right of the inner table that contains the image, but insid
enter). Place the cursor just below the table that contains the imag
m the "insert" menu and insert a table with 2 columns and 1 row at
sor in the right column of the table you just selected and select "ima
" in the "Dreamweaver_download" folder, and insert it. Push the mi
ure.

Click Here to view movie of the steps 4 through 6

rsor next to the table you most recently created and click on the hor
f this window isn't open, select "Window > Objects".)
just below this horizontal rule you just created, select "table" from
rows. (The number of rows depends on how many links you want

Figure 1: Screen Shot of Prototype Web-Based Learning System Interface

References

Brooks, D. W. (1997). *Web-teaching: A guide to designing interactive teaching for the world wide web*. New York, Plenum Press.

Dillon, A. and Gabbard, R. (1998). Hypermedia as an educational technology: A review of the quantitative research literature on learner comprehension, control, and style. *Review of Educational Research 68*: 322 - 349.

Dumas, J. S. and Redish, J. C. (1999). *A Practical Guide to Usability Testing*. Exeter, England, Intellect.

Hall, R. H., Feltrop, E. J. and Davis, R. L. (2001, April). *The web-based multimedia courseware development process at UMR's instructional software development center*. Paper presented at Higher Education Learning and Information eXchange (HELIX), Osage Beach, MO.

BEST COPY AVAILABLE

Hall, R. H., Watkins, S. E. and Eller, V. E. (in press). A model of web based design for learning. The Handbook of Distance Education. M. Moore and B. Anderson. Mahwah, NJ, Erlbaum.

Hall, R. H., Watkins, S. E. and Ercal, F. (2000, April). *The horse and the cart in web-based instruction: Prevalence and efficacy*. Paper presented at the Annual meeting of the American Educational Research Association, New Orleans, LA.

Reeves, T. (2002). *Faculty productivity and the World Wide Web*. Paper presented at Annual Meeting of the American Educational Research Association, New Orelans, LA.

Shin, E., Schallert, D. and Savenye, C. (1994). Effects of learner control, advisement, and prior knowledge on young students' learning in a hypertext environment. *Educational Technology Research and Development 42*: 33 - 46.

Acknowledgements

This research was supported by the University of Missouri – Rolla's Instructional Software Development Center.

A return to education as usual: learning complexity in the design and evaluation of a university mathematics course

Tony Hall, Liam Bannon
Interaction Design Centre,
Department of Computer Science and Information Systems,
University of Limerick,
Limerick, Ireland
tony.hall@ul.ie, liam.bannon@ul.ie

Eamonn Murphy
Department of Mathematics and Statistics,
University of Limerick,
Limerick, Ireland
eamonn.murphy@ul.ie

Abstract: In this paper, we describe the design and multidisciplinary evaluation of a new university course for teaching complex topics in probability and statistics. The course combines traditional third-level instructional elements, lectures and tutorials with interactive Internet instruction[1] and quick response e-mail support for students' urgent queries. The design of interaction for the course marks a return to *education as usual*, and a turn from the *Big education* (Stevens, 2002), *business as usual* approach to learning. *Big education* is concerned with using ICT[2] to automate education, premised on the simplistic assumption that learning is simple. This new math course was designed however on the basis that learning is complex and that effective use of ICT in higher education necessitates going beyond simply posting lecture slides to the Web, and furthermore that effective teaching can be supplemented, but not substituted by ICT. In addition, the new course was designed with the intention of preserving and enhancing traditional, but effective aspects of the course pedagogy. However, the new course is at the same time not quite a return to *education as usual* in the sense that its designers wanted with this new course to create a complementary combination of ICT support and offline interaction to try to overcome some limitations traditionally faced in trying to teach the course's complex subject matter to a very large group of students. In evaluating the new course we adopted a multidisciplinary approach, drawing for our critique of the new course on three different perspectives: collaborative learning and work, HCI/usability analysis and instructional design. We document how adopting this particular, 'tripartite' approach helped us to gain some significant perspective on the complex design and delivery of the course. We document also how this approach has enabled us to envision possible improvements to instructional and organisational aspects of the new course.

Introduction – Big education, big possibilities

> *This has become an era of intense efforts around standards, accountability, and socially consequential tests for the masses. It has become an era of aspiring technology millionaires for whom education is an enormous open market. In short, it has become an era of Big education.*
>
> (Stevens, 2002:269-270)

In the age of *Big education*, there are big possibilities. But we need to ensure these possibilities are big for learning. ICT, the Internet and related technologies promise much for education but their real value is to be found, not in determining how they can be used to replace teaching, but how, in combination with more effective teaching and more effective conditions for learning, (within and without the school), these technologies can serve as valuable adjuncts to learning.

> *The Internet is just one component of a new socio-technical system with great learning potential. Just as it matters which books students read, it matters which Internet software*

> *they use. And it matters what activities and social practices surround the process of Internet use in schools and at home.*
>
> (Bruckman, 2002:60)

The designers of the new mathematics course aimed to use ICT in concert with more effective teaching to create better conditions for student learning. They also intended "not to use the new media to do the old thing" (Papert, 2001) but to use ICT in combination with face-to-face and other ancillary student support to overcome some of the difficulties of teaching complex mathematics topics to a very large class.

Description of new mathematics course

197 undergraduate students take the MA4704 course in the spring term, each academic year. The course is a required credits course for the students, who all study in cognate disciplines: computer science, engineering and applied mathematics. The course is for many students their first experience of statistics; the presumed knowledge for the course is second-level or K-12 mathematics. Some of the students will previously have studied statistics in other courses or colleges. A multidisciplinary team developed the interactive instructional Web site for the new course. The team-members came from a range of backgrounds, including graphic design, biology, multimedia, computing, science teaching, and computer-based training. The team was composed of an instructional designer; two graphic designers; a software engineer; a Web specialist; a project manager; a content quality assurance lead; one teaching assistant; one tutor; and the lecturer. The Web site for the new course took approximately 9 months to design and implement. Students normally access the site from computer labs in the university; they can also access the site from home. Tutorial sessions are run twice weekly for students and in these they work through problem sheets related both to content in the lectures and to topics on the Web site. If students are experiencing particular difficulties with course topics, they can use the Dr. Dr. e-mail support: they can e-mail a query to the course TA and she will reply within 24 hours. Students can also attend additional help sessions in the Maths Learning Centre, located in the Mathematics and Statistics Department, where they can receive further, one-to-one or small-group tutorial assistance.

Our multidisciplinary approach to evaluation

For our evaluation of the course, we took elements from three disciplinary perspectives, from collaborative learning and work, HCI/usability analysis and instructional design. We had three concerns: (1) to assess the instructional effectiveness and usability of the course tool, the interactive Web site; and (2) to get some sense of the overall pedagogical efficacy of the novel course. And, in addition to our interest in the collaborative work of students, we were also interested in the collaborative work practices of the course designers and teachers, (3) with a view to generating some insights into how these practices might be better supported.

Usability analysis and evaluation of instructional design

We applied the Thinking Aloud protocol in assessing the usability of the Web site. For this part of the evaluation, we asked three students to follow the protocol as they completed a new topic on the Web site. We used an online questionnaire (http://richie.idc.ul.ie/tony/questionnaire_ma4704.html) to supplement the feedback we received from the Thinking Aloud evaluation with the small sample of students – we intended to garner some specific results with feedback from the class group in general about instructional and usability aspects of the site. We also held short semi-structured interviews with the three students to get their reflections more generally on the course and its instructional approach. 101 of the 197 students responded to the online questionnaire. In assessing the instructional design of the course Web site, we drew on aspects of Merrill's (2002) First Principles for Effective Instruction, including, for example: is the courseware presented in the context of real world problems? And, are there techniques provided, which encourage learners to integrate new knowledge or skill(s) into their everyday life?

Getting through the 'Net

We found in our evaluation that students can get through the topics online without really having to think critically about them. Asked about the Web site, one of the interviewees said: "more searching questions need to be asked". Examples are the self-tests on the site, which loop continuously until the student gives the right answer. A number of the students we interviewed said that in the self-tests they often just kept trying different answers until they 'got the right one', without reflecting on why it was the right answer. The self-tests also create the fundamental usability problem that the user no longer has control - if a wrong answer is proffered the navigation buttons disappear. And there is also the pedagogical issue that this having to keep doing something until you give the right answer is too traditionally pedantic. One of the interviewees commented: "It's like school, being forced to give the right answer." Of the online animations and the course generally, the students in the interviews and questionnaires reported that they found this a much more interesting and meaningful way to teach statistics. One student remarked: "This is a much better and more interesting way of teaching prob and stats than normal lectures which can be very tedious." However, while students said the new course certainly gave them much more of a sense of how statistics can be applied in the real world, which should help them to integrate their new knowledge of statistics concepts and principles into their future internship or professional work, we found from the interviews, questionnaire and Thinking Aloud evaluations with students that there is perhaps too little *synthetic* interactivity available for students on the Web site. There is not enough, it seems, of a challenge and opportunity for students to actually do (*synthesise*) statistical work and reflect critically on it. To illustrate the use of instructional technology to facilitate creative or *synthetic* interactivity, and to help elicit critical thinking, Merrill (2002) gives the example of courseware that involves the learner in using MS Excel to prepare previous month's sales figures for a friend's shop. The instructional technology facilitates the learner in working through a real world problem. The courseware replicates Excel and the learner creates the workbook; enters the data; and creates the calculations and finally the financial report. In using the instructional technology, the learner is necessarily required to focus and reflect on spreadsheet concepts. The courseware also supports instruction with *non-examples*, which means the learner can make mistakes or take a problematic path through the scenario but she receives feedback on where she is going wrong. Another problem we found from our interviews concerned students' submission of answer sheets over the Web. The response page only informed students their data had been submitted without telling them what they had submitted. Furthermore, when they got back their results, they were just told their mark, and they were not told what they had gotten right or wrong nor why they had gotten certain things right or wrong. We would argue that the instructional design for the course Web site, while generally very good in aesthetic terms and in terms of usability and clarity of explanations, could be changed to better support critical thinking about statistics. In general, instructional artefacts should be designed to facilitate the development of learners' critical aspect and inquiry skills by supporting them in asking the right kinds of questions, and not with giving right answers *per se* (Koschmann, 2002; Hall & Wright, 2002). This change in the site design would need to be complemented with changes in the way feedback is provided on the Web site - students would need to receive feedback as they work through topics, and not just feedback on what they are getting right or wrong, but moreover why they are getting things right or wrong.

Online collaboration - beyond the *electronic soapbox*?

One of the problems we found with the course is the lack of support, ICT or other, for collaboration among students. We argue that online collaboration could be useful pedagogically, particularly for those students who access the course Web site off-campus, to give them some support where peers or tutors are not physically accessible for ideas or to take questions. Some online collaboration, like computer programming developer fora on the Web (for example, see http://forums.internet.com/), where students can post questions and post answers and solutions to problems, and where they can see how other students are approaching problems related to course topics. This online collaboration would be used to complement the critical aspect and real world focus of students' interaction on the Web site. This forum would require moderation but a Netiquette for the forum could be developed so that students use it appropriately. A chat room or unstructured e-mail discussion might not be that useful as we have found these can deteriorate into *electronic soapboxes* – that is students log on and contribute various unrelated comments that lack cohesive or logical threading. Also an online forum could be useful in further grounding statistics for students and in relating it to real world applications by using the Web to link students to practising statisticians in the workplace. It could be used to involve professional mathematicians and statisticians in discussions and in helping students to work through real world statistical scenarios on the Web site. This *community of practice* approach has previously been tried with some promise in teaching Computer Support for Co-operative Work (CSCW) (Eales et al, 2002). Our evaluation also revealed that there is a need to consider again in general how the Web site content sits with the lecture material. One of the students commented: "very useful but all of the information should be on it [Web site] instead of being at 1 level on the web and another in the lectures this was very confusing." In terms of helping students pace their own learning, overall the course has proven very successful As one student noted: "I found this method very interesting, I could work through it at my own pace and attempt questions before looking at the answers. I could also take detailed notes at my own pace."

Conclusion

The design and delivery of the new MA4704 course marked a turn from *Big education* and the simplistic principle that learning is simple. The new math course was designed on the premise that learning is complex In this paper, we have attempted to illustrate how a particular multidisciplinary approach to evaluation of this new course helped both to highlight problematic aspects of the course's design and delivery, and to provide insight to possible ways to improve these. Notwithstanding, subsequent research is warranted to investigate how this specific evaluative approach might be enhanced through meaningful combination with other disciplinary perspectives, or elements from. The combined approach we adopted worked well in helping to assess and uncover possibilities for the design of interaction and ICT in the context of a university math course. But different educational settings are likely to require different combinatorial or multidisciplinary approaches to evaluation, appropriate for the respective contexts of learning.

References

Bruckman, A. (2002) The Future of e-learning communities. *Communications of the ACM*, Vol. 45, No.4 (April 2002), pp. 60-63.

Eales, R.T.J., Hall, T., & Bannon, L.J. (2002) The Motivation is the Message: Comparing CSCL in different settings. In the proceedings of CSCL '02. (Ed. Stahl, G.) New Jersey: Lawrence Erlbaum Associates, pp. 310-317.

Hall, T., & Wright, T. (2002) Guess who's coming to lunch? The innovative lunchtime sessions organised for the student volunteers at the CSCL 2002 conference, Boulder, Colorado, US, 7-11 January 2002. *ACM Crossroads Special Edition on Human-Computer Interaction*, Fall 2002, (forthcoming).

Koschmann, T. (2002) Dewey's Contribution to the Foundations of CSCL Research. In *the proceedings of CSCL '02*. (Ed. Stahl, G.) New Jersey: Lawrence Erlbaum Associates, pp. 17-22.

Merrill, D. M. (2002) "A Pebble-in-the-Pond Model of Instructional Development", Guest Lecture, University of Limerick, Ireland, April 12th 2002.

Papert, S. (2001) "The Future of Learning – Let's be serious", MIT MediaLabEurope Guest Lecture, St. Patrick's College of Education, Drumcondra, Dublin, Ireland, June 19th 2001.

Stevens, R. (2002) Keeping it complex in an era of Big education. In *CSCL2 – Carrying forward the conversation*. (Eds. Koschmann, T., Hall, R., and Miyake, N.), Mahwah, New Jersey: Lawrence Erlbaum Associates, pp. 269-273.

---

[1] Course Web site: http://www.ul.ie/~e-stats;

[2] By ICT (information and communications technology), we mean the panoply of technologies that can be used by people to share information electronically: for example, the Internet and elated technologies like email, instant messaging and the World Wide Web.

An Assessment of Synchronous Online Audio Conferencing for English Language Instruction

Sandy McIntosh
English Language Program, Faculty of Extension
University of Alberta
Canada
sandy.mcintosh@ualberta.ca

Elizabeth Hanlis
TELUS Centre for Professional Development
University of Alberta
Canada
elizabeth.hanlis@ualberta.ca

Abstract: This paper is a report on the findings obtained from a pilot study using a synchronous online audio conferencing tool (CentraOne) for English as a Second Language (ESL) instruction. The study examined the responses of ESL students towards the use of this medium for the purposes of discussion. Students' responses varied, but overall they were positive; they seemed to feel quite comfortable with the tool and enjoyed the discussion, especially when they were broken up into smaller groups. However, many of the students found that inconsistent volume levels and lack of non-verbal cues, hindered communication.

Introduction

The Faculty of Extension's English Language Program (ELP) endeavors to deliver effective distance courses for ESL instruction that include the traditional four language skill areas in online course design: reading, writing, speaking and listening, as well a consideration for academic critical-thinking skills. The existing text-based resources do not meet the requirements for speaking and listening when incorporated into online instruction. While a number of synchronous instructional tools offer multi-point audio conferencing, it is not yet known how well these products work in the instruction of ESL or whether they offer an adequate replacement for existing face-to-face instructional methods. To better understand the strengths and weaknesses of these types of products for online ESL instruction, as well as the appropriate instructional methods for their use, it is necessary to perform careful evaluation of these tools. A pilot study was conducted as an initial step in this evaluation process; it provided a realistic pedagogical context for the evaluation of a multi-point synchronous online audio conferencing tool.

Review of relevant literature

Numerous studies deal with the more general issue of computer and Internet mediated communication for education (Gibson & Herrera, 1999; Seagren & Stick, 1999). At the present time, new elements of technology and pedagogical design continue to emerge in language education, resulting in varied program configurations. This inconsistency in design is reflected in Salaberry's (2000) report on a project to determine best practices in computer-mediated communication, specifically for second language learning.

The pilot test in question focused specifically on synchronous, online audio conferencing with both instructor-directed and peer-to-peer activities. Recent studies have examined the effects of synchronous video and audio-based online learning environments (Voice-over-Internet Protocol). In a study of synchronous online instruction with one-way video and two-way audio, Hofmann (2000) observed that the technologies became transparent in the learning process, and content, rather than the medium, became the focus. According to Appelt and Mambrey (1999), synchronous virtual learning environments seemed to increase the quantity and quality of student-to-student and student-to-instructor interaction, subsequently establishing a network of communication and collaboration among participants.

Overview of the Project

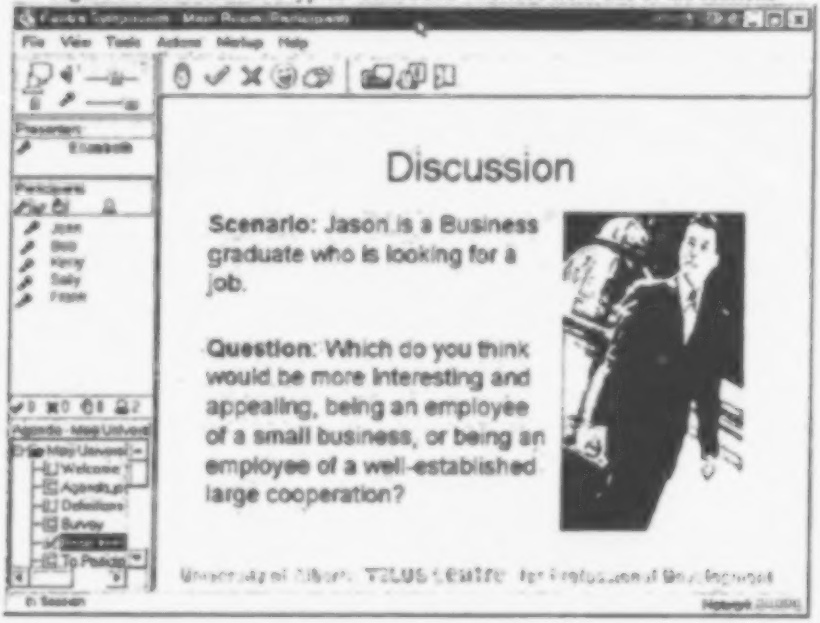
The TELUS Center for Professional Development was responsible for the planning and delivery of a pilot project comprising four (4) synchronous online sessions using CentraOne. These sessions were used to supplement the speaking and listening portion of an English as a Second Language course (Business English), at the Faculty of Extension. Participants were international students, mostly in their early 20s, whose ESL proficiency was rated as "advanced." The Business English course was designed as a terminal course, for students who intend to use English in their professional work.

Other participants in the sessions were: a CentraOne facilitator, the project coordinator, and the ESL instructor for Business English. The facilitator was a specialist in Educational technology and offered assistance in both the technological and pedagogical aspects of the project. The project coordinator was a specialist in program development for post-secondary education. The instructor, a specialist in classroom based ESL, provided the students with 20 hours per week of ESL instruction, including one hour per week in the pilot sessions. Apart from the pilot sessions, all ESL instruction for Business English were classroom based.

CentraOne is a web-enabled learning and collaboration environment using Voice-over-Internet Protocol (VoIP) software tool for synchronous conferencing (See Figure 1). Only some of the capabilities of CentraOne were utilized for the project. Specifically the following tools were utilized: audio, chat, whiteboarding and graphical slides, break out rooms, surveys, and evaluation. In the sessions, each participant was assigned a computer with headphones and a microphone, which could be used to speak to the group through the online medium, with permission from the facilitator. Only one participant could speak at a time, but all other participants could hear the speaker. In addition to audio conferencing, participants could communicate freely and synchronously with brief written messages and could also take part in simple communication such as voting or requesting permission to address the group by clicking on various icons.

Each synchronous online session was approximately one hour in duration. An average of 15 students participated in each online session. The first session, which took place near the end of March 2002, consisted of orientation instruction in the use of the tools and a brief discussion session. The remaining sessions occurred once per week during the month of April 2002. The course instructor, students, and facilitator actively participated in these sessions.

Figure 1: Screenshot of a typical CentraOne interface from one of the sessions



Discussion

Scenario: Jason is a Business graduate who is looking for a job.

Question: Which do you think would be more interesting and appealing, being an employee of a small business, or being an employee of a well-established large cooperation?

Overview of the Process

The project consisted of two main phases: 1) Planning, 2) Delivery, and 3) Evaluation.

During the planning phase the facilitator set up the synchronous online sessions. For each session, the facilitator created user accounts, created and managed events, and uploaded the agenda and content. The Business English instructor, in collaboration with the students, delivered the content for the sessions verbally or through documents e-mailed to the facilitator. The facilitator spent a maximum of two hours per session preparing the

BEST COPY AVAILABLE

content for synchronous online delivery, uploading the content and preparing the event. For the first session the instructor completed an orientation rehearsal with the facilitator to detect and resolve any potential problems, prior to the actual event, in addition to the instructor, to become comfortable with the technology.

During the delivery phase, the facilitator assisted the instructor and students in the delivery of the synchronous online sessions, giving the microphone to the students and instructor as appropriate. A brief orientation was provided to students at the beginning of the first two sessions. This was intended to familiarize them with the CentraOne tools and to make them feel comfortable with the unfamiliar computer based technology.

Aside from making observational notes of the proceedings, the project coordinator assisted students with start-up, as needed. Both the facilitator and the instructor monitored and participated in the discussions. The facilitator participated in the sessions online and was only accessible to the other participants through the medium of CentraOne. The instructor was physically accessible but participated solely online. The students worked in one computer facility, with the instructor and the project coordinator. The computer facility was designed with limited sight lines that discouraged physical interaction between participants, outside the medium of CentraOne, and interaction was minimal during the sessions.

The assessment process focused on student approval ratings and comments. As simplicity and immediacy were considered to be desirable characteristics of the process, students were given the evaluations as a closing activity for each session. Student responses to rating scales and comments regarding approval or disapproval of the virtual classroom software were recorded within the medium of CentralOne. Ratings and comments were collected throughout the entire project and aggregated over time for analysis. In addition to the collection of data from student surveys, the project coordinator, the facilitator, and the instructor recorded observation notes during each session for the duration of the project. An informal debriefing session for the observers was held at the conclusion of each instructional session. Observational data were compiled and recorded from the three observers, over the duration of the project.

Findings

The pilot study examined the reaction, attitude, and comfort level of ESL students in using a synchronous online audio conferencing tool for discussion purposes. Based on the feedback gathered from the students at the end of each session, the majority of students indicated that they enjoyed using this tool for the purposes of discussion and were comfortable enough with the technology to complete and participate in the sessions.

It was observed that the students' and instructor's levels of enthusiasm and apparent confidence around the technology increased with each session, over the duration of the project. Specifically the students appeared to enjoy the use of break out rooms for smaller group discussions, compared to having larger discussions as a class within the tool. They also found the technology appropriate for communication of ESL students at a distance. Some of the negative comments around the tool focused on the varied microphone levels and the lack of non-verbal cues, which made communication difficult at some points.

An interesting phenomenon was that the From "Session 1" to "Session 2", the "Very Comfortable" rating declined from 27% to 23% and the "Not Very Comfortable" rating increased from 0% to 23%. This may be attributed to variations in lesson formats between the two sessions, as students were asked to participate more actively in the second session than in the first one by being assigned the responsibility of leading parts of the discussion. While they seemed to enjoy being leaders and moderators of the discussions, students found this role quite challenging. By the end of the term satisfaction ratings had almost returned to the original levels, however 10% of the participants emerged to express strong dissatisfaction. By ESL standards, the quality of discourse improved weekly.

BEST COPY AVAILABLE

Recommendations for Designing and Delivering Synchronous Online Sessions

The following recommendations are based on synthesis and analysis of the data collected from the project:

1. Orientation lessons at the beginning of each may need to be extended across many sessions throughout the course, to ensure that they feel comfortable with the technology. Orientation should include checking microphone and headphone volume levels.
2. The instructor should be given personalized technical assistance throughout the project, as needed.
3. Students should be placed in "break-out rooms" to provide opportunities for discussion in small groups with three to five participants.
4. Students should be given opportunities to lead discussions in a way that empowers them to solicit increased participation from other students. Training for student discussion leaders may be beneficial.
5. Courses using multi-point audio conferencing tools should be scheduled over an extended period of time. This would allow participants to become comfortable and proficient with the delivery technology in the early stages of a course.
6. It is important to engage the instructor in a pilot project early in the planning process. The support and cooperation of the instructor are necessary for the success of a project.

Conclusion and Suggestions for Further Research

As a first step to integrating synchronous online conferencing into ESL instruction, attitudes and the comfort level of students were examined and evaluated. The results from the study were encouraging and useful. However, further research needs to be conducted to determine how well synchronous online audio conferencing tools work in ESL instruction. There are many issues that need to be addressed in further research on this tool; the following are suggestions for further research:

1. Determine if ESL students of a different age group and, with different proficiency levels would respond to the tool in the same manner.
2. Examine the responsiveness of ESL students using a synchronous online audio conferencing tool at a distance for a class/course.
3. Examine the achievement of students using a synchronous online audio conferencing tool over an extended period of time.

References

Bump, J. (1990). Radical changes in class discussion using networked computers. Computers & the Humanities, 24(1), 49-65.

Gibson, J. W. & Herrera, J. M. (1999 January). How to go from classroom based to online delivery in eighteen months or less: A case study in online program development. T H E Journal, 26. 6 (57).

Honeycutt, L. (2000). Comparing e-mail and synchronous conferencing in online peer response. Written Communication, 18 (1), 26-60.

Salaberry, M. R. (2000 March). Pedagogical design of computer mediated communication tasks: Learning objectives and technological capabilities. Modern Language Journal, 84. 1(28).

Seagren, A. T. & Stick, S. L. (1999 June). Enhancing quality through distributed education. Phi Delta Kappan, 80. 10 (793).

Sorg, J., & McElhinney, J.H., (2000). A case study describing student experiences of learning in a context of synchronous computer-mediated communication in a distance education environment. (ERIC Document Reproduction Service No. ED 447 794).

Web Access Evaluation and Repair Tools - Automation and Integration

Laurie Harrison
Adaptive Technology Resource Centre, University of Toronto

An increasing number of software utilities to support web accessibility are now appearing on the market, all claiming to automate the process of evaluating and/or repairing Web pages. These tools assist the author in identifying the changes needed in the HTML code in order for the pages in question to conform to standards to ensure access by people with disabilities. Recent developments in this market demand particular attention to two areas: 1) models for integration of evaluation and repair within the html authoring tool and 2) models for integration of authoring tool support within the courseware environment.

There are two sets of standards that are generally used by developers of these evaluation and repair products to set benchmarks for compliance. The first is the Web Content Accessibility Guidelines 1.0 from the Web Accessibility Initiative (WAI) of the World Wide Web Consortium (W3C).[i] and the Section 508 requirements, amended in 1998."[ii] While these two sets of standards provide the context for evaluation and repair, further attention must be paid to the role of authoring tools, such as HTML editors, in development of accessible resources. A grassroots approach including integration of accessible authoring practices and validation processes into the design phase would reduce the need for the evaluation and repair tools. However, as yet, only preliminary steps are evident in the HTML editors currently on the market. An example of this strategy is the 508 Accessibility Suite from UsableNet Inc. for Macromedia Dreamweaver and UltraDev, a downloadable software extension that supports HTML authors in testing Web s ites and making them accessible. [iii]

Automation addresses the two key factors that are significant in the current prolific production of inaccessible Web pages. The first is lack of awareness, or more specifically, the possibility of authoring Web pages with little or no understanding of accessibility issues related to HTML programming. A second problem is the lack of motivation to do repetitive, complicated or time consuming activities that may be viewed as unimportant. The key to increasing the accessibility of the Web is to leverage the power of computers to do the repetitive and guideline intensive work instead of asking people to scrutinize and change their own authoring habits. With the proliferation of GUI word processor style HTML editors, a unique opportunity for including accessibility automation presents itself.

In recent years the education sector has witnessed an exponential growth in the area of courseware authoring tools, or learning content management systems (LCMS) to assist in presentation of Web-based curriculum and in performing class management tasks. Significant gains can be made if courseware authoring tool developers take steps to eliminate barriers to access in the web pages generated automatically by their programs, as well as those uploaded from an external source.[iv]

Considerable work in this area has already been completed by WAI in the form of the Authoring Tool Accessibility Guidelines (ATAG) 1.0 .[v] The associated guidelines and checkpoints in the WAI document provide a useful framework for consideration of the current challenges and the opportunities at hand for courseware authoring tool developers. In this paper, the ATAG guidelines have been used as criteria for analysis of several courseware products reviewed in a recent study at the Adaptive Technology Resource Centre, University of Toronto[vi]

Guideline 1. Support accessible authoring practices.

> *1.1 Ensure that the author can produce accessible content in the markup language(s) supported by the tool. [Priority 1]*
>
> *1.2 Ensure that the tool preserves all accessibility information during authoring, transformations, and conversions. [Priority 1]*

Compliance with checkpoints 1.1, 1.2 and 1.3 relates to two types of HTML authoring. In some cases the products reviewed allow online editing of HTML through a text field in the client browser, allowing the author complete control of the HTML markup. However, a more recent trend toward online WSYWYG editors, based on Java technology is more problematic as the underlying code is not apparent to the author. Courseware products generally allow the course designer to upload documents authored outside of the courseware tool without alteration to the HTML markup or compromising of the accessibility information inherent in the pages. In this latter instance, clearly the author determines how the HTML code will be written or edited.

BEST COPY AVAILABLE

> *1.3 Ensure that when the tool automatically generates markup it conforms to the W3C's Web Content Accessibility Guidelines 1.0 [WCAG10]. [Relative Priority]*
> *1.4 Ensure that templates provided by the tool conform to the Web Content Accessibility Guidelines 1.0 [WCAG10]. [Relative Priority]*

Checkpoints 1.3 and 1.4 are indeed one of the main areas where developers of courseware authoring tools need to focus their efforts. In most cases, material generated through automatic functions or templates cannot be easily edited by the designer, if at all. Potentially, this may act as a barrier to accessible design. However, with some further effort, it could as easily become an important support in the creation of accessible resources, with no need for specialized knowledge or training on the part of the designer.

Of particular importance is the integration of accessibility features into tools used for synchronous communication. The ATRC has developed a prototype of an accessible chat utility, designed with specific attention to the needs of screen reader users. [vii] E-College has also created an alternative interface for text -based rendering of chat content, which will also be highlighted.

Guideline 2. Generate standard markup.

> *2.1 Use the latest versions of W3C Recommendations when they are available and appropriate for a task. [Priority 2]*

Some of the W3C standards recommended in the context of Checkpoint 2.1 may be seen by courseware authoring tool developers as unfeasible because they are not yet well supported by mainstream browsers. Standards mentioned in this section of the Authoring Tool Guidelines include: MathML, XHTML, CSS and SVG. Even if mainstream browsers are unable to render new standards, they facilitate support accessibility by non-standard browsers and alternative output formats. By ensuring that the authoring tool recognizes and preserves elements that are defined in the relevant specification(s), usability may be enhanced for all users, as legacy documents are used in contexts that support newer standards.

> *2.2 Ensure that the tool automatically generates valid markup. [Priority 1]*
> *2.3 If markup produced by the tool does not conform to W3C specifications, inform the author. [Priority 3]*

Checkpoint 2.2 is another crucial signpost for courseware authoring tool developers. While deprecated elements and nonstandard mark up may produce graphical rendering in a satisfactory manner for mainstream browsers, accessibility issues may arise if content is transformed to an alternative modality based on the users preferences. Examples of common practices include use of a header to change the font size, or BLOCKQUOTE to indent a paragraph. Using markup improperly may create a barrier preventing users with specialized software or preferences from understanding the organization of a page, and navigating through it effectively.

Guideline 3. Support the creation of accessible content.

> *3.1 Prompt the author to provide equivalent alternative information (e.g., captions, auditory descriptions, and collated text transcripts for video). [Relative Priority]*

In addition to supporting authors in creation of materials using standard markup Checkpoint 3.1 recommends support through tools and prompts that further enhance accessibility for students with disabilities. An example can be found in WebCT, a company that has taken steps in recent releases to prompt the author for a description when uploading images to a database.

> *3.2 Help the author create structured content and separate information from its presentation. [Relative Priority]*

Checkpoint 3.2 suggests that courseware developers use new standards such as Cascading Style Sheets, XHTML and XML to separate information from its presentation. While these technologies are relatively recent, it is anticipated that they will become more and more common, as we are faced with management of large web sites and dynamic, database driven resources.

3.3 Ensure that prepackaged content conforms to the Web Content Accessibility Guidelines 1.0 [WCAG10]. [Relative Priority]

Recent developments in the publishing industry may increase the significance of this guideline for courseware developers as they are called upon to partner with companies that have traditionally provided educational resources in print formats. Recognizing the need to move digitize educational materials to meet the demands of today's learner, publishing companies such as McGraw-Hill Ryerson and Pearson have taken steps to offer textbooks as content within a courseware environment.

3.4 Do not automatically generate equivalent alternatives. Do not reuse previously authored alternatives without author confirmation, except when the function is known with certainty. [Priority 1]
3.5 Provide functionality for managing, editing, and reusing alternative equivalents for multimedia objects. [Priority 3]

Issues related to Checkpoints 3.4 and 3.5 may be very simple, or quite complex, depending on the nature of the graphical or multimedia components included in the course. Current products all allow the designer to upload files to be used as course content. Examples where alternative equivalent would be required may range from simple ALT text for an image file to captioning or text transcripts for a video or audio file.

Guideline 4. Provide ways of checking and correcting inaccessible content.
4.1 Check for and inform the author of accessibility problems. [Relative Priority]
4.2 Assist authors in correcting accessibility problems. [Relative Priority]
4.3 Allow the author to preserve markup not recognized by the tool. [Priority 2]
4.4 Provide the author with a summary of the document's accessibility status. [Priority 3]
4.5 Allow the author to transform presentation markup that is misused to convey structure into structural markup, and to transform presentation markup used for style into style sheets. [Priority 3]

The checkpoints found in the *Authoring Tools Accessibility Guidelines* related to automation and provision of a validation and repair process are as yet unresolved by courseware products currently on the market. Online tools such as Bobby[viii], or services such as RetroAccess AccessEnable™ [ix] demonstrate the feasibility of providing such support, potentially within a web-based environment. By including the validation and repair process within the upload utility, content added to the courseware could be monitored for compliance with accessibility benchmarks.

Guideline 5. Integrate accessibility solutions into the overall "look and feel".
5.1 Ensure that functionality related to accessible authoring practices is naturally integrated into the overall look and feel of the tool. [Priority 2]
5.2 Ensure that accessible authoring practices supporting Web Content Accessibility Guidelines 1.0 [WCAG10] Priority 1 checkpoints are among the most obvious and easily initiated by the author. [Priority 2]

At such time as prompts, validation tools and repair tools are integrated into a courseware product, it is hoped that, as recommended by Section 5 of the Guidelines, the interface will be integrated with the overall look and feel of the program. Accessibility should be seen as an essential part of the authoring process, not as an add on to the program or an "extra" external step in the process. In the future, courseware products should use models such as these as they move to include tools to support accessible authoring practices.

Guideline 6. Promote accessibility in help and documentation.
6.1 Document all features that promote the production of accessible content. [Priority 1]
6.2 Ensure that creating accessible content is a naturally integrated part of the documentation, including examples. [Priority 2]
6.3 In a dedicated section, document all features of the tool that promote the production of accessible content. [Priority 3]

Checkpoints 6.1, 6.2 and 6.3 indicate that, in addition to automation of accessible design, validation and repair processes through integration of prompts and utilities to support the page author, help and documentation must

BEST COPY AVAILABLE

include explanations of accessibility problems, and should demonstrate solutions with examples. This will support Web authors who may not be familiar with accessibility issues that arise when creating Web content.

Guideline 7. Ensure that the authoring tool is accessible to authors with disabilities.

7.1 Use all applicable operating system and accessibility standards and conventions (Priority 1 for standards and conventions that are essential to accessibility; Priority 2 for those that are important to accessibility; Priority 3 for those that are beneficial to accessibility).
7.2 Allow the author to change the presentation within editing views without affecting the document markup. [Priority 1]
7.3 Allow the author to edit all properties of each element and object in an accessible fashion. [Priority 1]
7.4 Ensure that the editing view allows navigation via the structure of the document in an accessible fashion. [Priority 1]
7.5 Enable editing of the structure of the document in an accessible fashion. [Priority 2]
7.6 Allow the author to search within editing views. [Priority 2]

This final section of the Authoring Tool Accessibility Guidelines addresses issues related to the designer user interface, emphasizing the importance of providing components and utilities that can be accessed by an author using assistive technology. While it is critical to ensure inclusion of learners with disabilities in development of the student interface, it is equally as important to provide support for the educator, instructor or designer with a disability.

While development of "offline" HTML editing software requires consideration of traditional user interface design standards and conventions, provision of the authoring process through a browser instead requires consideration of Web content accessibility standards. A client browser authoring tool offers many of the access advantages inherent in Web-based delivery, including flexibility in presentation, input and output modalities. Using their browser or adaptive software, the author can enlarge the font, navigate the content and utilize authoring utilities, provided the interface has been designed in compliance with WAI *Web Content Accessibility Guidelines*.

Summary:
In summary, authoring and courseware tool developers face challenges, but also have a great opportunity to improve access for all learners. Given that content developers and instructors rely on these tools to create and delivery content, they play an essential role in ensuring the accessibility of educational resources on the Web. As noted in the *Authoring Tool Accessibility Guidelines* it must be recognized that the Web is "both a means of receiving information and communicating information," and "it is important that both the Web content produced and the authoring tool itself be accessible."

---

[i] Web Content Accessibility Guidelines 1.0 from WAI of W3C (http://www.w3.org/TR/WAI-WEBCONTENT/)

[ii] Guide to the Section 508 Standards for Electronic and Information Technology (http://www.access-board.gov/sec508/guide/index.htm)

[iii] UsableNet - The Macromedia Partnership (http://www.usablenet.com/macromedia/index.htm)

[iv] Harrison. "The Role of the Courseware Authoring Tool Developer". Adaptive Technology Resource Centre, University of Toronto. (http://snow.utoronto.ca/initiatives/access_study/ATrec.html)

[v] Authoring Tool Accessibility Guidelines 1.0 from WAI of W3C (http://www.w3.org/TR/2000/REC-ATAG10-20000203/)

[vi] Inclusion in an Electronic Classroom – 2000 (http://snow.utoronto.ca/initiatives/access_study/inclusion.html)

[vii] Accessibile Chat Utility (http://snow.utoronto.ca/chat)

[viii] Bobby online validation from CAST (Center for Applied Special Technology), (http://www.cast.org/bobby/)

[ix] RetroAcess from AccessEnable™ (http://www.retroaccess.com/)

One World, One Ethics: Lessons Learned Designing an International E-learning Curriculum for Research Ethics

Mary Harvey
PriorityX Internet Services
United States
mary@priorityx.net

Bob Rice
Field, Information and Training Services
Family Health International
United States
rrice@fhi.org

Abstract: Research ethics training is mandated by many funders supporting research that includes human participants. Most programs are developed specifically for a U.S. audience and almost exclusively reference local institutional policies and U.S. regulations. Family Health International (FHI) developed a ***Research Ethics Training Curriculum*** as an interactive e-Learning aid for international researchers that is easy and fun to use. This curriculum is directed at the "lower end" of computer hardware, common in many international locations. The curriculum is written in non-technical language, was field-tested in four international settings, and is intended and designed for both individual and group educational settings. All materials needed for a group presentation are available "ready-to-go" so that the presenters' preparation work is kept to a minimum. The materials are available as either a stand alone CD-ROM or online through the FHI website at www.fhi.org.

Overview

Family Health International (FHI), an international research and training group that works in the reproductive health field, in collaboration with PriorityX, a web development company, created a *Research Ethics Training Curriculum* (*RETC*). This curriculum is designed to meet the needs of international audiences of biomedical and social science researchers. The curriculum addresses basic elements of research ethics, including the principles of human research ethics, international guidelines, informed consent and ethic review committees. The *Research Ethics Training Curriculum* was developed as an interactive e-Learning aid for international researchers that is easy and fun to use.

This curriculum is directed at the "lower end" of computer hardware, common in many international locations. The curriculum is written in non-technical language, was field-tested in four international settings, and is designed for both individual and group educational settings. The materials are available as either a stand alone CD-ROM or online through the FHI website at www.fhi.org.

To work effectively in low technology settings, no plug-ins, multi-media or single platform programming were used. The program was written entirely in HTML. For the interactive online post-test to store answers and give a final score, JavaScript was utilized. *RETC* was designed for Explorer 3.0 and Netscape 3.0, since those versions are still in use throughout the world. For the web version, large files were divided into smaller files for download purposes keeping in mind 28.8 speed modems. Interactivity was created using pop-up windows for the case study responses to actively involve the learner. Interaction between the learner(s) and the course material is further encouraged via "learner notes" that ask the learner to respond to questions before moving to the next section of the curriculum.

The main messages in the *RETC* are that:

BEST COPY AVAILABLE

Research is good
Research is a privilege
Social progress requires research
Society must trust its researchers
Researchers earn society's trust

Rational

In October of 2000 the World Medical Association (2000) revised the Declaration of Helsinki. Parts of this controversial reaction were in response to placebo-controlled research in the developing world. In April of 2001 the U.S. President's National Bioethics Advisory Commission (2001) issued a comprehensive report on issues in international research. The report, which included research considerations suggested by FHI, offered sweeping recommendations for those sponsoring and conducting research outside the United States.

Ethics in research involving human participants is important as comments from international research sites indicate:

CIOMS (1993): "the ethical implications for research involving human subjects are identical in principle wherever the work is undertaken"

Sharif, S.K. (1998), Kenya: "one of the major problems in the Third World is the weak ethics and scientific committees that review scientific studies"

Benatar, S.R. (2002), South Africa: "the need to build capacity in research ethics as part of the research endeavor"

The *RETC* employs provocative and culturally interesting reproductive health case studies developed by FHI researchers to highlight and discuss various ethics issues with the training participants. The Council for International Organizations of Medical Science (CIOMS, 1993) Guidelines and World Health Organization "Operational Guidelines for Ethics Committees That Review Biomedical Research" (WHO, 2000) are cited as key sources; complete copies of these documents are included in the reference section of the curriculum. Since publication in June 2001, FHI has received numerous positive comments from international research groups about the curriculum's local relevance and applicability. The *RETC* is now a recommended educational tool for organizations such as United States Agency for International Development (USAID), the Centers for Disease Control and Prevention (CDC) and the National Institutes of Health (NIH), among others.

The goal for this e-Learning program is to verify that research investigators, Internal Review Board (IRB) members and staff maintain continuing knowledge of relevant regulations and institutional policies for the protection of human participants.

Design

For the organizer of the group presentation, the *Research Ethics Training Curriculum* is "ready to go" in that very little preparation time is needed on the part of the facilitator. PowerPoint was selected as the presentation format as it is becoming more available around the world, and is fairly easy to use (and allows the facilitator to tailor slides to the specifics of the audience). All needed programs are supplied on the CD-ROM version of *RETC*, including Internet Explorer, Acrobat Reader and Microsoft PowerPoint Reader.

Case studies, learner notes, and the post-test are structured to encourage interaction between the viewer/learner and the subject matter. Examples include shaded learner notes, pop-up windows for case study answers, and a computer graded self-test. Of course, adults learn best and remember what they have learned longer when they actively participate in the learning experience. After completing the course material, learners are encouraged to contact FHI to receive a "certificate of completion" and to be included on a mailing list that will allow them access to research results and materials appropriate to their field of study. The "certificate of completion" is important to participants as it credentials the attendee of the training course, and is a noteworthy wall decoration in a resource-poor setting.

The *RETC* is attractive and visually appealing. Visual images were selected that appeal to an international audience. For example, the lotus flower graphically highlights the main sections of the RETC as it symbolizes "purity and perfection" in many cultures—the goal of a research design when it is implemented.

The *RETC* is available as either a three-ring binder, a CD-ROM, or on the web, catering to different learning/presenting styles. All three choices "interact" with the audience and demand participation—thereby enhancing retention on the part of the learner(s).

The *RETC* is user-friendly. It uses a tabbing system in both the three-ring binder and the navigational layout of the CD-ROM/web site. The objectives, learner notes and self-evaluations are displayed so that the learner is able to quickly and effortlessly identify the key messages. A post-test helps the learner retain important concepts.

The draft *RETC* was reviewed by a number of international research ethics experts at WHO and other research agencies. After thorough review, the *RETC* was field-tested in India, Kenya, Philippines, Zimbabwe and the U.S. The *RETC* uses simple English, given that many of the users of the curriculum will speak English as a second, or even third, language. For example, during the field-testing it was suggested that the word "oversight" was more authoritarian than a local researcher would expect—hence the word "supervision" was substituted instead. Several words and concepts were modified as a result of the field-testing experiences. The *RETC* is now being widely disseminated, mostly in English-speaking countries, including the WHO collaborating centers. Translations in French, Russian, Chinese, Portuguese, and Spanish will be available soon.

PriorityX collaborated with FHI to develop the Training-of-Trainers program (TOT) to insure that facilitators are well prepared to deliver the *RETC* in their research site. In the TOT package, exercises are presented to encourage training rather than presenting, teaching to different kinds of learning, and utilizing the group's knowledge resources.

E-Learning Conference

At the conference, the presenters intend to present and discuss, in a participative, adult-centered educational format, representative pieces of the *RETC* including the Self-Study guide in action, sample best practices from the Training-of-Trainers guide, sample slides from the PowerPoint presentation for presenters and the post-test. Additionally, attendees will receive copies of the *RETC* CD-ROM.

References

Benatar, S.R. (2002). Reflections and recommendations on research ethics in developing countries. *Social Science and Medicine*, 54 (7) 1131-1141.

Council for International Organizations of Medical Sciences (CIOMS) (1993). International Ethical Guidelines for Biomedical Research Involving Human Subjects. Geneva, Switzerland: World Health Organization.

Sharif, S.K. (1998). Letter to the editor. *The New England Journal of Medicine*, 338 (12) 838.

U.S. President's National Bioethics Advisory Commission (2001). Volume I: Report and Recommendations of the National Bioethics Advisory Commission. Springfield, VA: U.S. Department of Commerce.

World Health Organization. Product Research and Development Team (2000). Operational Guidelines for Ethics Committees That Review Biomedical Research. Geneva, Switzerland: World Health Organization.

World Medical Association (2000). Declaration of Helsinki: Ethical Principles for Medical Research Involving Human Subjects. Edinburgh, Scotland: WMA.

Acknowledgements

This publication was funded by:
U.S. Agency for International Development (USAID)
Andrew W. Mellon Foundation
National Institutes of Health (NIH).
The information contained in the publication does not necessarily reflect FHI, USAID, the Mellon Foundation or NIH policies.

RETC was written by Roberto Rivera, David Borasky, Robert Rice and Florence Carayon.

RETC web site was designed and created by Traci Knight, Mary Harvey, Jeff Martin, Rance McDaniel and the team at PriorityX Internet Services, Houston, Texas.

Special thanks to David Borasky and Roberto Rivera for research assistance.

Introducing the Idea of Sustained Query Exposure in the Context of Language Vocabulary Learning

Daniel C Heesch
Department of Computing, Imperial College
180 Queen's Gate, London SW7 2BZ, England
dh500@doc.ic.ac.uk

Abstract: This paper describes and motivates the novel idea of sustained query exposure as a form of passive knowledge consolidation and illustrates its use in the context of a basic pool-sink vocabulary model. The effectiveness of this technique hinges on a well-designed graphical user interface (GUI) that extends and facilitates the interaction between user and query objects. One such GUI is presented in this paper.

1 Introduction

Most of what we learn is forgotten after a short period of time. Considering the amount of largely redundant data with which our cognitive apparatus is continuously bombarded, this tendency to forget is a blessing and deserves being ranked as a chief adaptation against information overload. It becomes a curse, however, whenever there is a need for selective long-term memorization. As was first described by the German psychologist Ebbinghaus, recall ability decreases at an exponential rate (Ebbinghaus **1913**), a relationship that has been validated ever since (see for example Bahrick **1984** and Bahrick **&** Phelps **1987**). Methods devised to overcome this degradation tend to belong to one of two learning paradigms, namely associative learning and staggered learning. The latter is based on the observation that each time a periodical review takes place of the information to be learnt, recall ability does not only jump to its initial level but, more importantly, the rate of subsequent decay decreases such that retention is ensured for progressively longer intervals (Bahrick et al. **1993**). The positive effect of staggered learning on recall ability can be enhanced by excluding from reviews items the student has successfully recalled during previous reviews, a learning mode known as selective learning. **A** few software systems exist that provide support for such selective, staggered learning of foreign language vocabularies (see for example Raedle **2002** which is based on a cardboard predecessor (Leitner **1984**)). Typically, queries that are answered incorrectly are retained in the system for subsequent reviews. For most of its life cycle, a query is hidden away from the user's sight and it is only for brief moments that it is brought back to the attention of the user. In the pre-computer era, practicality may have offered itself **as** a plausible rationale for this property. However, recognizing the flexibility that can be offered by graphical user interfaces, this seems like an unnecessary constraint and more like a relict of the cardboard era. We instead advocate an approach which we shall refer to as sustained query exposure. The principal idea is to display every query previously answered incorrectly in the periphery of the user interface until that query is posed again and answered correctly. By thus keeping incorrect queries visually accessible following their explicit exposure, further interaction between user and query becomes possible, providing potential for the query to "sink in" further.

This visualization is built around a language learning model which has the desirable property that the number of incorrectly answered queries held back for a subsequent review is kept relatively constant (sink size constancy).

The report is organized in two parts. The first part introduces the underlying model, in particular the method used to achieve sink size constancy, and discusses performance measures that can be derived from it. The second part provides a description of the graphical user interface.

BEST COPY AVAILABLE

The system presented here is based on a simple pool-sink learning model as depicted in Figure 1. The queries are Spanish verbs which initially reside in a pool that is accessed to obtain a new query with probability p. If the query is answered correctly, it is marked as successfully learnt and excluded from the learning session. If the answer is incorrect, the query enters a sink which is accessed during each round with probability $q = 1\text{-}p$. We can thus distinguish between two kinds of queries which we shall refer to as type A (pool) and type B (sink) queries.

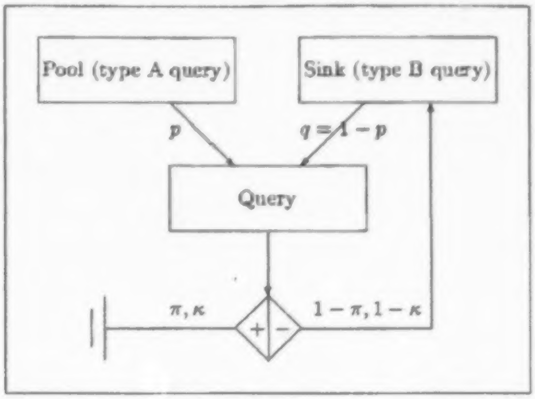


Figure 1: Queries are either drawn from the pool (new queries) or from a sink (incorrectly answered queries). The variables determining the word flow are the probabilities p, q, π and κ (see text for details).

2.1 Fixed sink capacity

The sink is assigned a fixed capacity and the word flow through the system is regulated with the aim of keeping the sink level close to its capacity. This system constraint is desirable not only for the purpose of visualization. For staggered learning to be effective, the user ought not to be exposed to a type B query until some time after the first encounter (time between exposures = TBE). This requirement of a minimum TBE can be met by ensuring that a certain number of queries may enter the sink before they are retrieved. It is not desirable, however, to allow the unlimited accumulation of queries as this would lead to an unacceptable prolongation of the TBE, thus the need for an upper bound. Keeping the sink level constant means that, for a competent user, pressure on the sink is low and TBE will be long. For a less competent user, pressure on the sink is higher and queries need to be retrieved more frequently. Hence, TBE increases with the competency level of the user.

The system variable that regulates the flux through the system is the probability, p, of a query being drawn from the pool. The external variables that affect flow characteristics and on which we have little influence relate to user performance. Specifically, they are the probabilities π and κ of the user correctly answering a query of type A and B, respectively. p, τ and κ provide a complete description of the system. Our aim is to achieve a dynamic equilibrium of the system with the sink level remaining stable and the rate of inflow of new queries being balanced by an equal rate of outflow of correctly answered queries. Let s_t be the sink level at time t, then the state of the sink at time $t+1$ is given by the stochastic equation

$$s_{t+1} = s_t + \mathrm{w}\,, \quad \text{where w is a random variable with}$$

$$\mathrm{w} = \begin{cases} 1 & \text{with probability} \quad p(1-\pi) \\ -1 & \text{with probability} \quad (1-p)\kappa \\ 0 & \text{with probability} \quad 1-p(1-\pi)-(1-p)\kappa \end{cases}$$

At equilibrium, the expectation of w, $E(w)$, is zero, that is $E(w) = \mathrm{p}(1-\pi) - (1-p)\kappa = 0$ and hence

$$p = \frac{\kappa}{1-\pi+\kappa}. \tag{1}$$

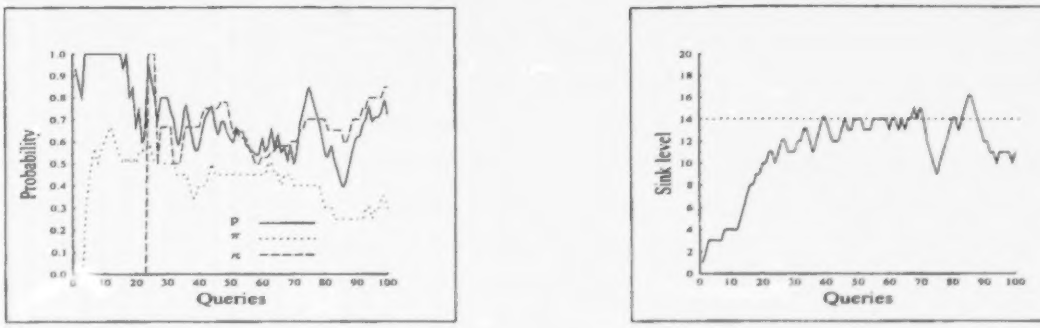


Figure 2: Left: a typical learning session over 100 queries. Initially, a query is likely to come from the pool (p is high) so as to fill the sink. As the sink approaches its capacity, p decreases. Right: sink level constancy is achieved by continuously updating the probability p of a query being obtained from the pool.

As the user performs better on either type of query (increase in κ or π), the probability p of presenting a fresh query in the next round increases. To ensure that the system reaches the equilibrium in the first place and finds back to it when being displaced (as a result of variations in κ and π), we first introduce the random variable w_i, representing the value of w on the $(t+i)$th trial. Then,

$$E(s_{t+n}) = s_t + \sum_{i=1}^{n} E(w_i)$$

and since the random variables w_i are independent and have the same distribution as w, this is just $E(s_{t+n}) = s_t + nE(w)$. To reach the capacity c after d steps, we want to choose p such that

$$E(s_{t+d}) = s_t + dE(w) = s_t + d(p(1-\pi+\kappa) - d\kappa) = c \qquad \text{and thus}$$

$$p = \frac{c - s_t}{d - d\pi + d\kappa}.$$

The more the current state lies below the capacity, the greater is the influx of new queries. Updating p thus requires knowledge of the values of π and κ. In the present model these performance values are obtained by determining the running average over the last 20 queries of either type.

2.2 Measuring performance

From this model we can derive a simple performance measure, namely the value of the variable p. The higher p the greater the proportion of queries answered correctly. It follows from the sink capacity constraint and directly from equation 1 that $p = 1$ implies that all queries are of type A and are answered correctly ($\pi = 1$), while $p = 0$ implies that all queries are of type B and are answered incorrectly ($\kappa = 0$). p varies during any one particular session owing to user/query specific variations in π and κ. The mean value of p over all queries during one session thus provides an estimate of overall performance while the variance in p is an indicator of the extent of inter-query consistency in performance. The variations in p, π and κ during a typical learning session are depicted in Figure 2. It also illustrates how continuous adjustment of p helps to keep the sink level within narrow bounds around the sink capacity ($c = 14$).

3 Sink visualization

With the sink level thus being kept relatively constant, the stage is now set for a visualization of the sink content. The center of the display accommodates three text fields to display a query, enter a reply and inform the user about correctness and possible alternatives. Incorrectly answered queries are displayed as spheres on a concentric circle around this center as shown in Figure 3. The query string is printed across each sphere and for aesthetic purposes, the radii of the query spheres vary with query length.

To increase interaction between the user and the periphery, each query is assigned an electric charge, with the charge depending on query length and thus the radius of the sphere. Spheres repel each other and whenever a new query is taken up into or leaves the set, the new set of queries are allowed to find a stable arrangement subject to the electrostatic forces acting between them. The movement towards equilibrium is recorded and displayed as a short animation sequence of one to two seconds after which the user is provided with a new query. In addition to thus drawing the user's attention towards the periphery and thereby facilitating interaction between user and incorrectly answered queries, it also gives the user a form of immediate visual feedback. If the current query was obtained from the sink and is again answered incorrectly, the set remains unchanged and no animation sequence will be shown. Instead, the colour of the respective query sphere will turn darker as shown in Figure 3.

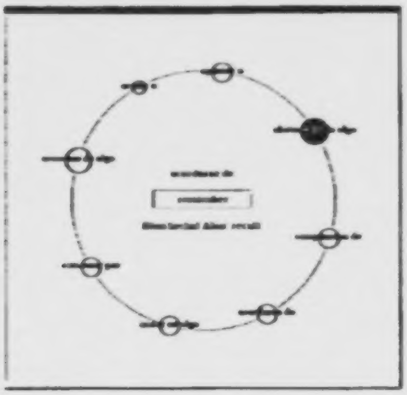


Figure 3: User interface and sink visualization. Animation and colour changes are included to facilitate interaction between user and periphery. See text for details.

4 Outlook

This paper introduces the idea of sustained query exposure and illustrates its potential use in the context of a staggered learning model for Spanish verbs. At this stage comparative performance evaluation becomes a key necessity in order to corroborate our claim about the potential effectiveness of this proposed technique of passive knowledge consolidation. Additional information that may be of interest concerns the precise scope and type of visual interaction between user and interface. This information, which could be gathered using existing eye-tracker technology, is likely to motivate further improvements of the interface.

References

Bahrick H.P. (1984). Semantic memory content in permastore: fifty years of memory for Spanish learned in school. *Journal of Experimental Psychology: General,* 113(1):1-37.

Bahrick H.P. et al. (1993). Maintenance of a foreign language vocabulary and the spacing effect. *Psychological Science,* 4(5): 316-321.

Bahrick H.P. and Phelps E. (1987). Retention of Spanish vocabulary over 8 years. *Journal of Experimental Psychology: Learning, Memory and Cognition,* 13(2): 344-349.

Ebbinghaus H. (1913). *Memory: A Contribution to Experimental* Psychology. Teacher's College, Columbia University (New York).

Leitner S. *Asi se aprende.* Herder (Barcelona).

Raedle P. (2002). V train. *http://www.pauZ-raedle. de/vtrain/sci.htm*

BEST COPY AVAILABLE

E-Literacy for the Workforce: Designing Effective Instruction

Heather Hemming
School of Education
Acadia University
Canada
heather.hemming@acadiau.ca

Sonya Symons
Department of Psychology
Acadia University
Canada
sonya.symons@acadiau.ca

Lisa Langille
School of Education
Acadia University
Canada
0146391@acadiau.ca

Abstract: To address the increasing demands placed on adults entering today's workforce, this study involved the development of an instructional approach designed to teach adults strategies for writing effectively in an electronic context through a combination of face-to-face and electronic-based tutorial sessions. The instructional approach was developed based on a reciprocal teaching framework and a goal was to situate the learning within a meaningful, work-related context through electronic discussions. Specifically, the objectives of this study were 1) to understand the experiences of participants enrolled in workforce literacy programs, 2) to assess the impact of an instructional protocol, developed to teach how to express or explain a viewpoint, ask pertinent questions, and write effective responses, on the quality of writing, and 3) to examine if changes occurred in participant attitudes toward writing using computers.

Introduction

Writing in electronic spaces has changed most workplaces. For example, a poll conducted by the Gallup Organization, Inc. estimates that ninety percent of large companies, sixty-four percent of mid-sized companies, and forty-two percent of small firms currently use e-mail systems. The same poll found that more than forty million employees correspond via e-mail, and the number is expected to increase by about twenty percent each year (Kopp, 1998). Further, "e-mail has become the most-used communication tool on the job" in the United States and in Canada (Merrick, 2000, p.17). In addition to the steady increase of e-mail in today's workplaces, there also has been an escalation in the need to write in electronic contexts.

With the continual increase of electronic writing in various workplaces, it becomes evident that workforce literacy programs must begin to reflect the changing demands of today's workplaces to more adequately assist adult learners in finding and maintaining employment. However, given the growing need to communicate effectively within an electronic environment, it must be recognized that computer exposure is not adequate preparation for adults entering the workforce. Research is needed to establish an instructional design that may support individuals in learning how to use literacy skills effectively within a technological context.

The term Digital Divide came to public attention after a 1995 study by the Markle Foundation revealed that the "same divergence found in society along cultural and racial lines is found online and offline" (CNET News.com, 1997). Many participants in workforce preparation programs are involved in these programs because of barriers to maintaining employment. Although these barriers may occur for a variety of reasons, those attending the programs are often dealing with issues of unemployment. Research suggests that patterns of technology access often mirror existing inequalities rather than mitigate them (Schofield & Davidson, 1998) and if corrective steps are not taken, technology may worsen rather than solve equity disparities (Serim, 1999). Thus, it is essential that workforce literacy programs address these issues and provide opportunities for this gap to be lessened. Reddick, Boucher, and Groseilliers (2000), in their report on technology in Canada, stated "the levels of awareness and the use of these new technologies and services are highly polarized along social class and generational lines, creating the digital divide" (p.1).

Technology integration within workforce preparation programs is needed, especially after long-term repercussions are considered in the case that adult learners are not given adequate preparation for electronic environments in the workplace. For many adults attempting to enter or re-enter the workforce, the addition of new technological demands within workplaces only further multiplies the obstacles to overcome. Unfortunately, many workforce literacy programs typically have not adapted their instruction and curricula to reflect the ever-increasing presence of technology within today's workforce, which therefore may impact participant ability to successfully maintain employment. This study involved the development and assessment of an e-learning context designed to provide instructional support for developing strategies for effective e-literacy writing to adults enrolled in workforce preparation programs.

The Study

The goal of this research was to design and assess an elearning instructional context aimed at facilitating the development of skills for writing in electronic spaces. This study involves the development of an instructional approach designed to teach adults strategies for writing effectively in an electronic context through a combination of face-to-face and electronic tutorial sessions. The instructional approach was developed based on a reciprocal teaching framework and the goal was to situate the learning within a meaningful, work-related context through electronic discussions. The objectives of the study include the following: to understand the experiences of participants enrolled in workforce literacy programs; to assess the impact of an instructional protocol (developed to teach how to express or explain a viewpoint, ask pertinent questions, and write effective responses) on the quality of writing and; to examine if changes occurred in participant attitudes toward writing using computers.

Twenty-two participants (ages 18-48, mean 29.8) from the Annapolis Valley Work Centre took part in this study. All participants had some form of barrier to employment; further, all had been either out of employment for a significant period of time or had never been employed and were receiving social assistance. In all cases, participants felt they would be better prepared for employment if they could improve their ability to communicate electronically.

Basic computer instruction was provided to the participants using IBM Thinkpads, which they used throughout the study. When participants felt comfortable using the laptop computers, they completed an introductory session prior to instruction, which involved making an entry into the electronic discussion group after examining a case study.

Instruction was based on a reciprocal model of instruction and consisted of eleven forty-minute sessions, summarized in Table 1, which focused on three specific writing strategies used when making electronic discussion entries. Instruction was also founded in context pertinent to workforce preparation. Strategy modeling tutorials were primarily grounded in face-to-face interaction. Guided practice sessions involved both face-to-face and electronic instruction and strategy use. Independent practice tutorials consisted of electronic instruction and strategy implementation. Session 10 entailed face-to-face guidance in addition to electronic strategy use while session 11 involved electronic, independent strategy use.

During the instructional phase, participants worked in heterogeneous small groups with a research assistant during their regular class hours at the Annapolis Valley Work Centre. Throughout this time, participants received a protocol for instruction for the three writing strategies. The gradual shifting of responsibility in reciprocal teaching (Palinscar & Brown, 1984) was embedded in the nature of the sessions. Participants used worksheets and study guides prior to making their electronic discussion group entries throughout the tutorial sessions.

Table 1

Description of Instructional Protocol

Session #	Strategy	Description
1	Explaining/Expressing a Viewpoint	Modeling of Strategy
2		Guided Practice
3		Independent Practice
4	Asking Pertinent Questions	Modeling of Strategy
5		Guided Practice
6		Independent Practice
7	Writing Effective Responses	Modeling of Strategy
8		Guided Practice
9		Independent Practice
10	All 3 Strategies	Guided Use of Strategies
11		Independent Use of Strategies

Findings

A computer usage survey completed prior to instruction reflected participant experience with, and attitude toward, computers. Sixty-eight percent of participants had used e-mail while 41% had used chat groups prior to this study. There was also diversity in the frequency of computer use among participants. For example, 14% of the participants categorized themselves as heavy computer users, another 14% felt they were light computer users while another 14% considered themselves to be infrequent users. Additionally, although 59% of the participants had used a computer within seven days prior to participating in the study, 62% of those participants had used a computer for playing games while only 38% used a computer for word-processing and 46% for writing an e-mail message. These findings may suggest that although some participants are using computers, they are not necessarily gaining sufficient experience communicating with computers. Further, at the beginning of the study, 36% of the participants specifically identified writing as a significant barrier for them with regard to finding and maintaining employment.

The instructional protocol was based on reciprocal teaching, in which there was a combination of face-to-face and electronic tutorial sessions, as depicted in Table 1. This blend of instructional delivery proved to be an effective method for teaching adult learners writing strategies necessary for eliteracy. Throughout the sessions, participants consistently requested information regarding computer use. The prompts were aimed primarily at basic computer skills needed to participate in electronic discussions. This suggests that the participants' limited computer experience and comfort level may have prevented independent participation in the instruction, had it been offered without the face-to-face component. One participant's comment reveals the importance of the face-to-face interaction received throughout the instruction: "I liked that you didn't just throw us in there and expect us to know what to do right away."

To assess change in writing quality after instruction, the electronic discussion entries created during an introductory session and entries made during the final independent session were compared. Pre- and post-instruction number of words did not differ (pre-instructional mean 79 and post-instructional mean 68, t $(20) = 1.77$, $p = .092$). However, participants used an increased number of sentences after instruction than they did prior to instruction (pre-instructional mean 3.5 and post-instructional mean 4.9 (t $(20) = 3.24$, $p =$ .004). This suggests that writing processes were changing; it appeared as though participants began to make more intentional, thoughtful decisions about their writing. Further, the comparison of these two groups of entries showed that 95% of participant entries contained an increased amount of explanation to support viewpoints generated. These findings suggest improvements to participants' written communication; relevant viewpoints were explained instead of including irrelevant, isolated opinions. Overall quality of participants' writing was scored using a modification of the TOWL-3. Results suggest significantly higher scores following instruction (pre-instructional mean 19.2 and post-instructional mean of 22.9 with 29 being the maximum score, $t\,(20) = 2.43$, $p = .024$). Explanatory quality of the participants' arguments was also assessed using a 5point scale. This reliable scale indicated that arguments were stronger after instruction than before (pre-instruction 1.5 and post-instruction 4.7, $t\,(19) = 12.58$, $p = .001$).

Participant attitudes toward writing also appeared to change. Prior to the study, some participants revealed hesitation surrounding the writing process, as they were concerned with the aesthetics of their handwriting (some experienced difficulty with the mechanics of letter formation). After participating in the electronic discussions as a part of the instructional protocol, those same participants described writing using computers as being much more enjoyable than writing via the more traditional methods.

Conclusions

Workforce literacy programs must provide opportunities for learners to gain experience using technologies hat are prevalent in the workforce, as it may directly increase participants' chances of successfully finding and maintaining employment. However, it must also be recognized that adequate instruction is needed to assist learners in using these technologies effectively for communication, as a certain level of communication skills is essential to use various components of technology such as e-mail and electronic discussion groups. Due to the overwhelming population of adult learners who do not yet possess the necessary skills to independently participate in electronic instruction, it becomes evident that face-to-face and electronic instruction complement one another through reciprocal teaching and may provide adult learners with an optimum opportunity to gain experience using communication technologies within a meaningful, work-related context while engaging in the process of becoming e-literate for the workforce of the 21st century.

References

CNET News.com. (1997, March 14). *Society's digital divide*. Retrieved June 7, 2002, from http://news.com.com/2100-1023-278007.html

Kopp, K.P. (1998, Summer). Electronic communications in the workplace: E-mail monitoring and the right of privacy. *Seton Hall Constitutional Law Journal*, 1-30.

Merrick, B. (2000). E-mail replaces the water cooler. *Credit Union Magazine*, *66*(11), 17.

Palincsar, A. S., & Brown, A. L. (1984). Reciprocal teaching of comprehension-fostering and comprehension-monitoring activities. *Cognition and Instruction*, *1*, 117-175.

Reddick, A., Boucher, C., & Grosseilliers, M. (2000). *The dual digital divide: The information highway in Canada*. Ottawa: The Public Interest Advocacy Centre.

Schofield, J. and Davidson, A. (1998). The Internet and equality of educational opportunity. In T. Ottmann and I. Tomek (Eds.). *Proceedings of ED-MEDIA and ED-TELECOM 98-World Conference on Educatioanl Multimedia and Hypermedia and World Conference on Educational Telecommunications* (pp.104-110). Charlottesville, VA: AACE.

Serim, F. (1999). Beyond Y2K: Bridging the digital divide. *Multimedia Schools*, *6*(5).

Acknowledgements

This research was funded by a grant provided by Social Sciences Humanities Research Council. The information presented is solely the responsibility of the authors.

Exploring the Effect of Visual Complexity on Music Interval Recognition Tasks Involving User-Generated Images

George J. Henik[1] and Christopher Allen[2]
Educational Communication and Technology Program
New York University
United States
ed.ss.webmaster@nyu.edu[1] and allenchg@shu.edu[2]

Abstract: 36 volunteers were assigned to either a high (19) or low (17) visually complex (VC) treatment group and are given an online drawing environment in which they are to generate images based on musical intervals. They are then tested on their recall of the intervals by using their own images as choices. While the low visually complex group significantly improved, several factors including time may have played a more important role. Results are explained with respect to dual coding theory (Clark & Paivio, 1991; Paivio, 1971, 1990) and the generative theory of reading comprehension (Wittrock, 1990).

When examining multimedia learning environments, the most noticeable omissions occur when applied to music. One of the largest obstacles to designing effective music software has been hardware; that is computers that were being used for instruction were not capable of effectively reproducing authentic sound. Though the hardware has improved, there is little research on how to effectively use computers to teach music. In attempting to design instructional software that seeks to teach any aspect of music (performance, composition, history, or theory), it is imperative to understand how one processes music and how that information relates back to an effective design of musical educational media.

This pilot study will investigate the effect visual complexity may have on music interval recognition tasks to assist in future design decisions. Through the use of user generated images possible connections between aural information, visual information, and verbal information may be explored. By making a connection between these modalities, a more effective method for designing music education software may be possible.

Theoretical Foundation

There are a number of educational theories currently attempting to explain how individuals process new information. Mayer proposes a Cognitive Theory of Multimedia Learning alternately referred to as the Generative Theory of Multimedia Learning (Mayer, 1997, 1999; Mayer & Sims, 1994; Moreno & Mayer, 2000) in which he merges dual coding theory (Clark & Paivio, 1991; Paivio, 1971, 1990) and the generative theory of reading comprehension (Wittrock, 1990). Within the theoretical framework of the Cognitive Theory of Multimedia Learning, an individual perceives the information to be processed in one of two formats: words (verbal) or images (nonverbal) (Mayer, 2001). As the information is received either visually or aurally the learner selects the pieces that are pertinent to their knowledge acquisition. Depending how the individual originally learned or coded the information, either as a word or image, depends on how that information is subsequently recalled.

Cognitive load theory attempts to explain how an individual appropriates a level of mental processing energy to a specific amount of information (Cooper, 1990). In attempting to learn new information, the learner is placed in an environment where they are receiving a variety of information stimuli in potentially different modes. The amount of cognitive load can increase depending on the information itself, the presentation of the information, or the situation in which the learner is engaged. As cognitive load increases the learner becomes frustrated, makes mistakes, and generally performs poorly on the task they are attempting to complete (Keyes & Krul, 1992).

Increasingly, online multimedia systems are integrating greater amounts of visual information and potentially increasing the level of complexity within the information architecture. According to Keyes & Krul (1992), this complexity refers to "the number of information items into the number of relationships among them" (p. 122). Visual complexity is circumscribed as the amount of visual item interactivity contained within an image and limiting that information to the primary representation or more simply how much visual information is "packed" into the primary image. This information is generated through the intersection of lines, colors, tones, and texture gradients (Gibson, 1979). It is therefore believed that by incorporating more information within an image, the greater the level of visual complexity.

Considering cognitive load is increased as the amount of information being processed increases, the conjecture is that visual complexity will affect cognitive load. The greater the visual complexity, the greater the cognitive load. However, there is the possibility that a lack of visual complexity will also affect cognitive load in that the viewer will be required to expend mental energy to fill in the information not being provided.

The research involving educational implications of musical auditory processing with respect to images is scarce. Many studies look at how verbal and visual information are connected (Mayer, 1997, 1999; Mayer & Sims, 1994; Moreno & Mayer, 2000) or verbal and nonverbal information (Clark & Paivio, 1991). Other research indicates a deeper semantic connection between the visual and auditory modalities (Datteri 2000).

Clark, Stamm, Sussman, and Weitz (1974) examined recall of sounds that could be labeled, such as water or a saw, versus those that could not be easily labeled, such as a lathe or a calculator. The designation of "labelable" (p. 177) sounds was determined through a pilot study. When these sounds were mixed in with other sounds and subjects were asked to indicate whether or not they have heard that sound before, the "labelable" sounds were selected significantly more than "nonlabelable" sounds. They concluded that dual coding theory (Clark & Paivio, 1991; Paivio, 1971, 1990) could be expanded to sounds as well.

Lipscomb and Kendall (1994) examined the interaction between music soundtracks and film, suggesting that a model of motion picture perception must focus on the "*source* of meaning within both the auditory and visual modalities" (p. 88). The decisions of the appropriateness of a film score is based on the listener's past experience and is therefore "individual-specific." (p. 91).

In another study that examined verbal labels to music, Hiraoka and Umemoto (1981) used 19th and 20th Century classical excerpts to examine how verbal labels affect the memory recall of musical passages. Creating four groups (three with titles and one without), each group was given a booklet with the six titles. Each passage was played, and the subjects had to read the title of that passage, and then listen to the passage, forming an image of the music based on its title. Participants described their images on paper, and rated the "vividness of the image" on a scale from 1 to 5, with 5 being very vivid, followed by a post-treatment test. The study concluded that since these subjects made their own imagery they seemed to use it as a retrieval cue that resulted in the higher recognition scores.

So it seems that there may be a dual coding process that exists within the auditory modality, and that by having the user generate meaning or images, a stronger connection can be made. Wittrock's generative theory of reading comprehension (1990) discusses the importance in generative meaning through reading. Could this process be similar to verbal information in the sense of language?

There are several known facts about processing music. Whereas the visual modality is distributed spatially the auditory modality is distributed temporally. Also, the assumption that music is processed in the same way as language is far from clear. Sloboda (1985) expounds a clear comparison of music versus language, and finds that the perception in music is not as complete and automatic as it occurs in language, even for trained musicians. In this sense there seems to be two different systems that exist within the auditory modality, one for verbal information and one for auditory information.

Even if there are two different systems that exist, perhaps there are similarities in the way information is processed. Based on these points, it seems that if a user was able to generate an image based on a music interval, then a stronger connection could be made between the visual and aural modalities that would result in the user learning the intervals more effectively. What is the effect of user-generated images on interval recognition? What is the effect of high and low visual complexity on music interval recognition tasks?

Methods

Research Questions:

1. What is the effect of user-generated images on musical interval recognition tasks?
2. What is the effect of high and low visual complexity utilizing user-generated images on musical interval recognition tasks?
3. What is the relationship between user-generated images in high and low visual complexity groups for interval recognition and a) prior music knowledge, b) prior drawing knowledge, c) music interest and d) drawing interest?

Sample: The sample consisted of 36 graduate students who do not have a strong music background though do have a mixed background in graphic design. There were two intact groups from two semesters, each group was assigned to either a high (19) or low (17) visually complex treatment.

Materials: The experiment involved the use of a web-based drawing program developed in Macromedia's Flash 5.0. The user-generated images based on musical intervals were saved in a database and used later to test the participants' interval recognition. One group will have a very simple interface (Low Treatment

Group-LTG) while the other will be more complex (High Treatment Group- HTG) using more elements of interactivity such as a working keyboard (HTG) vs a sound button (LTG), tab-type pallets (HTG) vs all pallets laid out (LTG), and the option to continue (HTG) vs a timed treatment (LTG). Other variables were prior music and drawing experience, the number of times the keyboard or music buttons were pushed, and the time of the second treatment group. Each computer used had access to the Internet, a set of headphones for each user, and the Flash 5 browser plug-in.

Procedures: Learners were given three different musical intervals to memorize (Major 3rd, Perfect 4th, and Tritone). The low visual complex group had 5 minutes for each, while the high VC group could continue at any time. While listening to the intervals they were asked to draw a picture that represents to them what that interval sounds like. After having drawn pictures of all three, a post-test was administered, but this time each user had their own picture that they used as a cue to choose an answer. The entire experiment took between 25 and 35 minutes, with all the data collected through the use of an online database.

Results

For the first question, "What is the effect of user-generated images on interval recognition?" a paired t-test was conducted, using the interval pre- and post- tests as the dependent measure and the drawing program as the independent measure for each group. While the low visually complex group significantly improved (t=2.759, $\underline{p}$=.014), the high visually complex group did not (t=.965, p=.349).

For the second question, "What is the effect of high and low visual complexity utilizing user-generated images on musical interval recognition tasks?" an unpaired t-test was conducted between the pre and post-test scores of each group. The pretest was not significant, though the posttest showed the low visually complex group was significantly larger (t=2.156, $\underline{p}$=.038).

For the third question, "What is the relationship between user-generated images for interval recognition and a) prior music knowledge, b) prior drawing knowledge, c) music interest and d) drawing interest?" a multiple regression was conducted for the first group using answers from the questionnaire to rate prior music and drawing knowledge as the independent variables, and their answers from the post-test as the dependent measure. A series of multiple regressions for the low visually complex group yielded a significant model ($\underline{F}(4, 12) = 4.284, \underline{p} = .022$) with $\underline{r}^2 = .588$. Based on a correlation table that yielded no significant results, multiple regressions were not conducted on the high visually complex group.

Conclusions

For the low treatment group, the treatment was effective in using the generated images as a visual cue for auditory information, and adds to the body of research that addresses the effectiveness of Web-based instruction. In this sense, there seems to be a system that helps connect auditory information and visual information without either one having a designation of "verbal information" as in dual coding theory (Clark & Paivio, 1991; Paivio, 1971, 1990). This connection is made through the user generating an individually meaningful chunk of information (Wittrock, 1990), in this case an image.

An inverse relationship existed between the level of treatment group and performance, indicating that by increasing the level of visual complexity, instruction degraded. The discrepancy between the groups may be explained through two other ways, however. The biggest difference in the two interfaces was time. In the LTG, the participants were forced to wait a full 5 minutes before being able to go on to the next interval. Meanwhile, the participants in the HTG could continue at their discretion. While some participants in the HTG spent approximately 8 minutes on the treatment section, others spent less than 1 minute; far below the 15 minutes the LTG spent on the actual memorization and drawing tasks.

Another possible explanation for between the LTG and HTG results was the class mindset when the treatment was administered. When students in the HTG were administered the treatment, the classroom was very hot and the treatment date fell during a more stressful point in the semester whereas the LTG received the treatment in a relatively comfortable room during a less stressful time in the semester. This might account for some of the more random answers, and helps to explain why some students spent less than a minute on the entire treatment.

Based on the exit surveys in both groups, students were asked to comment on their experience. Qualitative analysis of these comments revealed that many of the students felt the instructions leading up to the treatment were too verbose and could have been accomplished in a more concise manner. However, the ability to understand the goals of the treatment were mixed. Some individuals understood exactly what was expected of them while others felt the requirements were unclear. Clarity appeared to be a continuous theme in many comments, whether it was the clarity of the directions or how to use the interface.

One of the primary differences between the two treatment groups was a change in the interface. In the first treatment individuals indicated problems associated with the fore and background color panels being spaced too close together. This problem seemed to be alleviated in the second treatment by modifying the interface design because no comments focused on a problem differentiating between the two color palettes. In the second treatment, while individuals did comment on difficulties with the interface, these stemmed from problems associated with the aforementioned directions.

While difficult to assess, because of the minor changes associated with an already difficult interface and complex information structure, the addition of a keyboard as a visual cueing mechanism seemed to have no effect on the overall treatment. However, this is supposition considering individuals in the second treatment were not forced to spend a predetermined length of time on each treatment and could skip ahead.

Considering the element of time, a question raised by this study is exactly what effect does time have on the treatment. One final question how would the results differ if this treatment were run with music students as the participants. Considering there is an incentive to learn and not merely gloss through the treatment the potential to understand the basics of the treatment as well as actually incorporate imagery as a learning method would prove interesting. Since the learners generated their own images, the potential for them to undergo a deeper cognitive process may eventually lead to a more effective method for ear training and music education in general.

For an expansion on this article, working demonstrations, and any other research conducted by the authors, please visit http://www.georgehenik.com/

References

Clark, J. M., & Paivio, A. (1991). Dual coding theory and education. *Educational Psychology Review, 3*(3), 149 - 210.

Clark, M., Stamm, S., Sussman, R., & Weitz, S. (1974). Encoding of auditory stimuli in recognition memory tasks. *Bulletin of the Psychonomic Society, 3*(3A), 177-178.

Cooper, G. (1990). Cognitive load theory as an aid for instructional design. *Australian Journal of Educational Technology, 6(2),* 108-113.

Datteri, D. L. (2000). *Music, figures, and words, oh my! The influences of music on stick figures and word perception: An audiovisual gestalt investigation.* Unpublished Dissertation, Texas Christian University, Fort Worth.

Gibson, J.J. (1979). *Ecological approach to visual perception.*_ London: Houghton Mifflin Co..

Hiraoka, I., & Umemoto, T. (1981). The effect of titles on the memory for music. *Psychologia, 24,* 228-234.

Keyes, E. & Krull R. (1992). User information processing strategies and online visual structure. SIGDOC'92 Proceedings. Tenth Annual International Conference. Toronto 121-128.

Lipscomb, S. D., & Kendall, R. A. (1994). Perceptual judgment of the relationship between musical and visual components in film. *Psychomusicology, 13,* 60-98.

Mayer, R. E. (1997). Multimedia learning: Are we asking the right questions? *Educational Psychology, 32*(1), 1-19.

Mayer, R. E. (1999, April). *When multimedia works: Designing multimedia for meaningful learning.* Paper presented at the American Educational Research Association, Montreal.

Mayer, R. E. (2001). *Multimedia learning.* New York: Cambridge University Press.

Mayer, R. E., & Sims, V. K. (1994). For whom is a picture worth a thousand words? Extensions of a dual-coding theory of multimedia learning. *Journal of Educational Psychology, 86*(3), 389-401.

Moreno, R., & Mayer, E. (2000). A coherence effect in multimedia learning: the case for minimizing irrelevant sounds in the design of multimedia instructional messages. *Journal of Educational Psychology, 92*(1), 117-125.

Paivio, A. (1971). *Imagery and verbal processes.* New York: Holt, Rinehart, & Winston.

Paivio, A. (1990). *Mental representations: A dual-coding approach.* Oxford, England: Oxford University Press.

Paivio, A., & Lambert, W. (1981). Dual coding and bilingual memory. *Journal of Verbal Learning and Verbal Behavior, 20*(532-539), 532-539.

Sloboda, J. (1985). *The musical mind.* New York: Oxford Press.

Wittrock, M. C. (1990). Generative processes of comprehension. *Educational Psychologist, 24*(4), 345-376.

A Systematic Review of Technology to Support Adult Learning in Communities of Practice

Gyeong Mi Heo
Department of Educational and Counselling Psychology
McGill University
Montreal, Canada
gheo@po-box.mcgill.ca

Abstract: This paper presents a systematic review regarding how technology supports adult learning in communities of practice. It presents the systematic review procedure that was developed, based on NHS CRD (2001) protocol, from publication sources relevant to the topic. It includes the identification of research from an initial question that is how technology supports adult learning in communities of practice, a search strategy, a study quality assessment, a data extraction strategy and a synthesis of findings. Because most of the pertinent research is qualitative, a typology of qualitative research and a critical appraisal checklist for quality assessment were designed and are presented. The results presented are synthesizing evidence from studies that meet certain quality criteria and they are discussed in terms of (a) the kinds of technologies applied in communities of practice, and (b) successful features of the technology that seem to contribute to learning.

Introduction

The development of computer-mediated communications has led to rapid changes in learning environments. In the professional development literature, particularly, the concepts of "learning communities" and "communities of practice" with asynchronous and synchronous communications are emphasized. Even though many online learning communities and/or communities of practice are created and maintained (e.g., Brown & Gray, 1995; Burk, 2000), there is a lack of clear and helpful guidelines to increase meaningful learning in these contexts (Wenger, 1998). Most of the relevant literature offers models, programs, and projects in relation to online communities in learning environments. However, there are very few organized accounts of the significant, valuable, and reliable evidence regarding the effectiveness of on-line technology for fostering and supporting learning in communities of practice (Owen, 1998; Simich-Dudgeon, 1999). In this context, a systematic review, such as those currently being conducted in the medical and health care field[1] and considered seriously in education[2], seems to be an appropriate research method to produce general statements about the relationships between technology and learning through the synthesis of individual research results.

The research presented here is a systematic review whose purposes are (a) to present an application of the systematic review protocol in educational research on the question of web-based technology to support learning in communities of practice and, (b) based on the results of the systematic review, to examine the effectiveness of technology in communities of practice. This paper presents a preliminary review of the studies in order to test the systematic review process and its feasibility. The following two objectives are identified

- Objective 1: What kinds of technologies were applied to in communities of practice?
- Objective 2: What features of the technology seem to contribute successfully to learning?

The next section introduces the steps involved in conducting such a review.

---

[1] The Cochrane Collaboration (http://www.cochrane.org/)

[2] The Campbell Collaboration (http://www.campbellcollaboration.org/)

Systematic Review

The systematic review is "a review of the evidence on a clearly formulated question that uses systematic and explicit methods to identify, select, and critically appraise relevant primary research, and to extract and analyze data from the studies that are included in the review" (NHS CRD, 2001). The systematic review is a rigorous methodology that has emerged in the fields of medical and health care. The Campbell Collaboration was initiated recently to study the effects of social and educational policies and practices as a sibling organization to the Cochrane Collaboration that prepares and maintains systematic reviews of the effects of interventions in health care (Boruch, Petrosino, & Chalmers, 1999). According to the CRAG (1996), the characteristics of a systematic review in comparison with a traditional literature review are (1) it is more systematic and objective through whole review procedures, and (2) it makes possible to increase power by synthesizing the results of a number of related smaller studies.

Identification of research

As a first step, to develop a search strategy, the research question should be broken down into facets in terms of population (e.g., *adult learning* that includes university education, professional development and workplace training), interventions (e.g., *communities of practice* and *technology*), outcomes (e.g., unrestricted), and study design (e.g., unrestricted). The search conducted with these keywords in the ERIC database and 253 citations were obtained.

Selection of studies

In this step, the obtained citations were selected through two filters for inclusion and exclusion in order to have more retrieval of relevant documents. For an initial selection, abstracts of citations obtained from the previous ERIC search were scanned and selected using the initial criteria for inclusion and exclusion. The second selection was conducted by reading the full texts. At this stage, more detailed criteria were applied and 60 papers were selected for the next step which consisted in assessing the quality of the studies.

Study quality assessment

Next, the quality of the studies in the corpus thus obtained was assessed. For the quality assessment, at first, the type of evidence is characterized according to research methods in educational research – quantitative research and qualitative research. As for the qualitative research is, typically, needed to be subdivided, because most research papers those are included in the review form as the qualitative research rather than quantitative research and each research method has different report styles and required components. The types of qualitative research were: ethnographic research, action research, evaluation research, case study, and design experiments. Sixty citations were categorized according to the criteria for research methods. Among these citations, thirty-eight citations were classified under descriptive reports and/or opinions of experts, and those were excluded in the review. Among the remaining 22 citations, one was an experimental research with quantitative measures, and 21 citations relate to 20 studies were qualitative researches. Therefore, 21 research papers were included for quality assessment.

Then, a critical appraisal checklist was developed for this review to assess the quality of qualitative research studies in terms of credibility and reliability. Hence, the questions are focused on whether a research paper describes each expected component of a study within the category clearly, appropriately, and reliably. The famework underlying the critical appraisal checklist is largely composed of two parts, one regarding general features of research methods (e.g., Introduction, Methods, and Discussion / Implication), and the other for each specific research method. The remaining 20 research papers, other than the experimental study, were assessed through the critical appraisal checklist. According to the results, 11 qualitative studies and one experimental study were selected for inclusion in the review. Thus, qualified evidence was extracted and synthesized to answer the research questions.

Data extraction and Data synthesis

In this pilot review, initially, the author extracted data into a FileMaker Pro5 database, and then, collated and summarized the results of primary studies included.

Results & Discussion

Objective 1: What kinds of technologies were applied in communities of practice?

The technologies that were applied in 12 studies were e-mail, threaded message board, chat room, web pages, electronic bulletin board, forum, online network, mailing lists, web conferencing, listserv, electronic database. Representative examples of synchronous technology are chat room and video conferencing. However, there none of the studies considered video conferencing. In five studies (Fusco, 2000; Harmon, 2000; Milton, 1999; Ohlund, 1999; Powers, 1997), chat applications were used, and, also, these were combined with one or several asynchronous technologies, such as electronic bulletin board, mailing lists, listserve, and e-mail.

All studies report positive effects of technology in each practice. Technology seems to support learning in the following manners:

- To have multiple conversations (Owen, 1999).
- To expand learning experiences through online networks (Brett, 1997; Rusell, 1999).
- To develop an "out-of-class" classroom community (Burns, 1996; Brett, 1997; Edens, 2000).
- To develop collaborative work (Milton, 1999; Ohlund, 1999)

Objective 2: What features of the technology seem to contribute successfully to learning?

Eight of 12 studies were conducted in formal learning environments. That is, learning communities were built within university-based courses. As for the target learners, six studies involved pre-service and/or in-service teachers. Three studies (Edens, 2000; Milton, 1999; Owen, 1998) explored possible factors contributing to the development of an online learning community.

In conclusion, it is possible from the studies reviewed to synthesize the following features to take into account in order to develop an effective online learning community:

1. The purposes of the group should be determined. (Owen, 1998).
2. An atmosphere of respect is required. Participants should respect others' opinions and ideas (Edens, 2000; Owen, 1999; Harmon, 2000; Simich-Dudgeon, 1999).
3. The role of a moderator or facilitator is one of the critical factors (Edens, 2000; Milton, 1999; Owen, 1998).
4. The participation framework may effect the development of online learning communities (Edens, 2000; Owen, 1999; Harmon, 2000).
5. The strategies for facilitating learners' participation should be considered (Brett, 1997; Fusco, 2000; Hirtle, 2000, Harmon, 2000).
6. On the other hand, Edens (2000) and Milton (1999) indicate two difficulties regarding the use of technology in a community: (a) the problems of the software and network itself, and (b) the lack of non-verbal communication cues, such as eye contact and body expression, in electronic written communication.

According to the results of this systematic review, there are several findings having implications for follow-up reviews and further research. First, the search sources should be expanded, for example by deploying more systematical search strategies in the ERIC database, searching the WWW, and hand searching in proceeding papers or journals not included in ERIC search. Second, in order to increase the validity and reliability for the assessment of study quality, the critical appraisal checklist needs to be continuously developed and validated, and two or more researchers should participate in the review. Third, more research needs to be conducted in non-formal learning contexts emphasizing adult learning and various adult learners.

Conclusions

Computer-mediated communication (CMC) makes it possible to interact asynchronously and synchronously at a distance. It can facilitate sharing, negotiating, developing, sustaining, and building knowledge in communities of practice. During this process, learning can be achieved.

Based on the review of 12 studies, the major factors contributing to facilitate learning in communities of practice are: (a) well-defined purposes for the group, (b) an atmosphere of respect among participants, (c) a moderator or facilitator playing an active role, (d) a structured participation framework, and (e) strategies to trigger and maintain participation.

This systematic review shows the positive potential of the systematic review as an effective research method in educational research, at least in the area of educational technology in practice settings. That is, existing variations in practices and general relationships can be examined by synthesizing related qualified data in smaller studies. It suggests that conducting further systematic reviews in this area will be fruitful.

References

Boruch, R., Petrosino, A., & Chalmers, I. (1999, July). *The Campbell Collaboration: a proposal for systematic, multi-national, and continuous reviews of evidence.* Paper presented at the Planning Meeting on the Campbell Collaboration, School of Public Poliy, University College London, July 1999.

Brett, C. & Woodruff, E. (1997). *Communities of Inquiry among Pre-service Teachers Investigating Mathematics.* Paper presented at the Annual Meeting of the American Educational Research Association (Chicago, IL., March 24-28, 1997).

Brown, J. S. & Gray, E. S. (1995). *The people are the Company: How to build your company around your people.* Retrieved from http://www.fastcompany.com/ online/01/people.html#

Burk, M. (2000). *Communities of Practice.* Retrieved from http://www. tfhrc.gov/pubrds/mayjun00/commprac.htm

Burns, R. C. & Meehan, M. L. (1996). E-Mail Survey of the Interdisciplinary Teamed Instruction (ITI) Listserv Discussion Group: Exploratory Study of an Electronic Community of Learners. Appalachia Educational Lab., Charleston, WV.

Edens, K. M. & Gallini, J. K. (2000). Developing a Discourse Community of Preservice Teachers in a Technology-Mediated Context. *Teacher Educator.* v35 n4 p64-82 Spring 2000.

Fusco, J., Gehlbach, H., & Schlager, M. (2000). *Assessing the Impact of a Large-Scale Online Teacher Professional Development Community.* Proceedings of SITE 2000 (11th, San Diego, California, February 8-12, 2000). Volumes 1-3.

Harmon, S. W. & Jones, M. G. (2000). *A Qualitative Analysis of Situated Web-Based Instruction.* Paper presented at the Annual Meeting of the American Educational Research Association (AERA) (New Orleans, LA, April 24-28, 2000).

Hirtle, J. P., & McGrew-Zoubi, R. (2000) *New Horizons in Distance Education: Re-Mapping the Pedagogical Terrain.* Proceedings of SITE 2000 (11th, San Diego, California, February 8-12, 2000).

Milton, J., Davis, M., & Watkins, K. E. (1999). *Virtual Learning Communities: Creating Meaning Through Dialogue and Inquiry in Cyberspace.* In Qualitative Studies in HRD: Academy of Human Resource Development (AHRD) Conference Proceedings.

NHS Centre for Reviews and Dissemination. (2001). *Undertaking systematic reviews of research of effectiveness.* CRD Report Number 4 (2nd ed.) Retrieved from http://www.york.ac.uk/inst/crd/report4.htm

Ohlund, B., Andrews, S., Yu, C. H., Jannasch-Pennell, A., & DiGangi, S. A. (1999). *Impact of Asynchronous and Synchronous Internet-Based Communication on Collaboration and Performance among K-12 Teachers.* Paper presented at the Annual Meeting of the American Educational Research Association (Montreal, Quebec, Canada, April 19-23, 1999).

Owen, C., Pollard, J., Kilpatrick, S., & Rumley, D. (1998). *Electronic Learning Communities: Lessons from the Ether*. CRLRA Discussion Paper Series.

Powers, S. M. & Mitchell, J. (1997). *Student Perceptions and Performance in a Virtual Classroom Environment.* Paper presented at the Annual Meeting of the American Educational Research Association, (Chicago, IL., March, 1997).

Russell, M. & Ginsburg, L. (1999). *Learning Online: Extending the Meaning of Community.* A Review of Three Programs from the Southeastern United States. IN: National Center for Adult Literacy, Philadelphia, PA.

Simich-Dudgeon, C. (1999). Interpersonal Involvement Strategies in Online Textual Conversations: A Case Study of a Learning Community.

The Critical Reviews Advisory Group [CRAG] (1996). *Introduction To Systematic Reviews by ScHRR.* Retrieved from http://www.shef.ac.uk/~scharr/ triage/docs/systematic/

Wenger, E. (1998a). *Communities of practice: Learning, meaning, and identity.* New York: Cambridge University Press.

The Professional Development of Human Service Professionals in Rural and Remote Areas: Investigating the Affordances of the Internet

Anthony Herrington
School of Education
Edith Cowan University
Australia
a.herrington@ecu.edu.au

Jan Herrington
School of Communications and Multimedia
Edith Cowan University
Australia
j.herrington@ecu.edu.au

Abstract: This paper is a report of work-in-progress on a project that seeks to identify effective ways in which the Internet can be used to overcome the isolation of human service professionals employed in rural and remote areas. Professionals employed in rural locations in Australia will be surveyed and interviewed with regard to their needs, awareness, use and benefits of the Internet for professional development and support. Guidelines will be produced to document strategies for the design and delivery of effective use of the Internet to support and assist professionals in rural and remote areas.

Introduction

Retaining human service professionals—such as teachers and health care workers—is a huge problem in many rural and remote areas of the world. The overall objective of this paper is to report on work-in-progress that seeks to identify effective ways in which the Internet can be used to overcome the isolation of professionals employed in these remote regions. More specifically, the research described will use surveys and interviews to:

- Identify the *level* of professional development and support that is available through the Internet to professionals working in rural Australia;
- Assess the *use* of this professional development and support, and
- Identify the perceived *needs* and *benefits* of the professional development to the professionals in these remote areas.

The findings of this research will provide a basis for informed decision making on the design, development and provision of professional development and support through the Internet for a wide range of professions working in rural Australia as well as the training needs to access such support.

Background

There is a growing concern that reduced outcomes in health, education, employment and technology in rural Australia have the potential to undermine national cohesion (House of Representatives Standing Committee on Primary Industries and Regional Services, 2000; Regional Australia Summit Steering Committee, 2000). As a consequence, strategic support for rural and regional areas has become a national priority (Anderson, 2001). Recommendations from these reports document specific strategies for establishing improved social infrastructures and equity of services to enable improved health and education outcomes, better employment pathways and improved telecommunications. Attracting and retaining professional and paraprofessional staff in regional and rural areas is recognised as a significant factor in improving many of these outcomes.

Compared to their metropolitan counterparts, rural communities face a number of reduced health outcomes. These include higher mortality rates, higher incidence of cardiovascular disease, preventable accidents, cancer and diabetes, higher rates of youth suicide, higher rates of hospitalisation and reduced access to medical practitioners, nurses, midwives, pharmacists, dentists and other allied health professionals (National Rural Health Alliance, 2001). This trend is also observed in American rural communities (National Rural Health Association, 1998).

Similarly, educational outcomes are reduced for rural compared to metropolitan communities. Schools in rural Australia experience a higher turnover rate of staff than metropolitan schools (Tomlinson, 1994). A high turnover of inexperienced staff results in schools lacking stability and program continuity, with clear disadvantages for students (Human Rights and Equal Opportunity Commission, 2000). The commission has documented the reduced quality of educational outcomes achieved by rural students in respect of literacy, numeracy, retention rates and participation in higher education. While there are initiatives in place to attract professionals not enough research attention is being given to determining effective ways to retain them (Collins, 1999; Murphy & Angelski, 1996, National Rural Health Association, 1998).

The innovative use of information communication technologies (ICT) is argued by a number of researchers as a viable option for providing professional development and support for rural professionals in the areas of health (e.g., Striffler, & Fire, 1999; Sykes, & McIntosh, 1999). The National Rural Health Association (1998) in the United States argues that although much effort has been expended in placement of physicians in rural areas, relatively little has been done to enhance their retention. The association argues that professional isolation is often a reason to leave a rural area and, as in Australia, the association suggests that innovations in information technologies such as the Internet and teleinformatics can become resources for diminishing this isolation.

A number of websites have been developed to provide professional development and support to professionals in rural areas. For example, sites have been developed to provide information, resources and channels of communication for medical, nursing and allied health professionals working in the NSW public health system (Wensley, 1999). Shackcloth (1999) describes a CD-ROM and Internet interactive resource that provides professional development for dentists in rural and remote regions.

In response to the need for continuing professional contact for newly appointed teachers, Herrington and Herrington (2001) have developed a website entitled Mathematics Education on the Web (MEOW) to enable new teachers to keep contacts with their peers and lecturers, and to access curriculum resources. The site comprises: a discussion board, where issues of relevance can be discussed; lesson plan resources, where teachers can download lesson plans to use with their classes; exemplary teaching videos, where teachers can view a variety of teaching strategies demonstrated by expert teachers; and links to a variety of websites including mathematics and professional development resources.

There are some insights into the effectiveness of these and similar professional development and support websites. Watson, Bannan, Clark, and Timmerman (1999) report that in early trials of Internet use, web-based discussion forums proved unsustainable mainly because allied health workers appeared not in the habit of accessing them on a regular basis. However, email-based discussion lists (listservs) appeared to be more successful with participants indicating that this form of communication helped reduce their professional isolation.

Methodology

Using a variety of databases and direct contact with a range of individuals and organisations, the researchers are conducting a systematic review of the literature on the use of web-based resources for the professional development and support of professionals working and living in rural communities. This includes Australian and international literature, together with additional sources of information. The review of the literature focuses on such issues as:

- the professional needs and benefits in relation to web-based professional development and support,
- the factors that facilitate/hinder the professional use of web-based professional development and support

- the design and functionality of resources
- approaches to IT training for professionals

Professionals working in rural areas of Western Australia and Queensland will be selected for the study. These states have been chosen as they both have large remote areas with geographically dispersed rural communities, and both have a long history of responding to the special needs of these communities (as evidenced for example, by both states' extensive distance education and health initiatives). As such they provide a diverse sample from which generalisations can be made.

The professionals will be contacted by mail via relevant government agencies which include the Education Departments of Western Australia and Queensland, Health Departments of Western Australia and Queensland and the Aboriginal Medical Services. A postal questionnaire will be developed and sent to each professional identified as working in a rural area. Surveys will be undertaken to elicit information on:

- demographic data (e.g., age, qualifications, period of employment)
- needs, awareness, use and accessibility of professional development and support that uses ICT
- benefits/drawbacks of professional development and support that uses ICT
- their beliefs about the impact of ICT in ameliorating professional isolation
- perceived barriers to using ICT
- their IT competence

The initial data analysis will be conducted by profession, examining in detail the effectiveness of ICT on overcoming professional isolation. The analysis will:

- assess rural professionals' *use* of web-based professional development and support resources. For example, are they aware of relevant sites? Do they access these sites. What level of interactivity do they engage in?
- identify professionals' perceived *benefits* of web-based professional development and support resources. For example, are relevant sites helpful?
- identify professionals' perceived *needs* for web-based professional development and support resources. For example, what other resources and supports are needed? What further training do they need to benefit from these sites?

The findings from this research will be used to develop a broad analysis of the impact of the Internet on professionals working in rural communities, and its effectiveness in ameliorating professional isolation. In this part of the analysis, particular attention will be paid to:

- identifying any generic impacts of ICT on professions
- identifying impacts which are likely to be pertinent to specific professions
- identifying effective generic design and implementation strategies
- identifying effective design and implementation strategies specific to certain professions

The findings of the analysis will be the basis of a concise draft report that will be distributed to various stakeholders (State and Federal Government agencies, tertiary and higher education institutions, and professional associations) seeking further comments and suggestions. Such information may form the basis of a more informed approach to the retention of professional in rural and remote regions of the world.

References

Anderson, J. (2001). *Stronger regions, a stronger Australia*. Canberra: Commonwealth of Australia.

Collins. T, (1999). *Attracting and retaining teachers in rural areas*. Available: www.ael.org/eric/digests/edorc997.htm

Herrington, A., & Herrington, J. (2001). *Web-based strategies for professional induction in rural, regional and remote areas.* Paper presented at the Australian Association for Research in Education Conference, Fremantle, WA, December 2001.

House of Representatives Standing Committee on Primary Industries and Regional Services (2000). T*ime running out: Shaping regional Australia's future. Report of in inquiry into infrastructure and the development* *of Australia's regional areas.* Canberra: The Parliament of the Commonwealth of Australia.

Human Rights and Equal Opportunity Commission (2000). *National Inquiry into Rural and Remote Education (Australia): Emerging Themes.* Sydney: Author.

Murphy, P., & Angelski, K. (1996). Rural teacher mobility. *Rural Educator.* 18(2), 5-11.

National Rural Health Alliance (1998). *Fighting rural decay-Dental heath in rural communities.* Available: http://www.ruralhealth.org.au/

National Rural Health Alliance (2001). *2001 Election Charter.* Available: http://www.ruralhealth.org.au/

National Rural Health Association (1998). *Physician recruitment and retention* Available: www.nrharual.org/dc/issuepapers/paper13/html.html

Shackcloth, S. (1999). Using multimedia technology to overcome the tyranny of distance in delivering education and training in oral health. *5th National Rural Health Conference.* Adelaide Available: http://www.ruralhealth.org.au/

Striffler, N. & Fire, N. (1999). Embedding personnel development into early intervention service delivery: Elements in the process. *Infants and Young Children, 11*(3), 50-61.

Sykes, D. & McIntosh, W.A. (1999). Telemedicine, hospital viability, and community embeddedness: A case study. *Journal of Healthcare Management. 44*(1). 59-71.

Tomlinson (1994). *Schooling in rural Western Australia. The ministerial review of schooling in rural Western Australia.* Perth: Education Department of WA.

Watson, J., Bannan, G., Clark, S. & Timmerman, L. (1999). Strengthening connections in the Bush: On-line communications and collaboration in allied health. *5th National Rural Health Conference.* Adelaide Available: http://www.ruralhealth.org.au/]

Wensley, M. (1999). The NSW health clinical information access project (CIAP) website: Leaping the boundary fence via the Internet. *5th National Rural Health Conference.* Adelaide Available: http://www.ruralhealth.org.au/

Computer Assisted Simulation and Role Playing

Donald R. Hetzner

Department of History/Secondary Social Studies

State University of New York College at Buffalo, USA

Hetznerd@AOL.Com

Social studies education is the least empirical of all the subdisciplines in the social sciences. An influx of computers into classrooms has had little impact on the nature and direction of social studies instruction. E-learning in the social studies usually consists of using materials such as computer based games with simulated environments and the Internet as expository techniques carried out in very traditional classroom settings. This holds true in most classrooms whether there is a computer for every student or every ten students. The average social studies teacher has little experience in integrating e-learning into a complex curriculum that is undergoing mandated change. This is reinforced by college experiences where students model professors housed in traditional academic and professional departments. At most, social studies students are taught to produce Power Point presentations, and the basics of Internet research.

What forms does e-learning take in typical social studies classrooms? Much depends on the school "rules", the use of consumable supplies, and the nature of teacher. At Niagara Falls SHS, where every student has full-time use of a laptop, students are required to keep their computers in backpacks and only take them out at a teacher's request. Why? Because students play computer games, or leave messages for friends. Many schools control access to large numbers of computers by placing them in the library. Unfortunately, in many of those same schools the librarian does not let students sit next to one another. So, there is no such thing as class use of computers in those schools. In other schools there may be several computers or computers for all students but only one printer and that on the teachers desk. Some schools only issue one printer cartridge or one ream of paper to teachers each semester. Last, social studies is so conservative and tradition bound that teachers use computers in ways they recognize.

PowerPoint takes the place of notes and overheads in many classrooms. Teacher after teacher has happily related to me that "I have all my notes and overheads on PowerPoint now." A teacher of Honors Economics in a local high school was given a petition from her students, only half in jest, "no more PowerPoint" one day when I was visiting her student teacher. Teachers in a number of schools have received the same message.

You can tell when teachers are using the Internet rather than manipulative models for instruction. In the not too distant past 5th and 9th grade students built models of the Mesopotamian ziggurat at home and brought them to class. What models are in the rooms are dust covered and usually rather primitive and poorly constructed, the models that were so "dumpy" that students did not take them home. At least one wall is covered with poorly drawn ziggurats. Students search the Web for " ziggurat" and locate and view a rendering of the building and a discussion of ancient Mesopotamia. During this exercise usually at least one student asks, "what do I do now?" Most of the time the teacher's answer is "draw a picture of it!"

Friday is still AV day in the social studies class. Major movies on DVD's such as *Pearl Harbor*, *Enemy at the Gate*, *Band of Brothers*, *Saving Private Ryan*, and *Gladiator* are standard fare despite the on-screen cautions on use. Possibly even more blatant is the use of copyrighted photographs in extensive, 20-30 minute, PowerPoint presentations.

"Experiences in Simulation and Role Playing," a graduate course at the State University College at Buffalo attempts to cope with the above problems by presenting a model of e-learning that is interactive, data-based, and well-integrated with a variety of media. This is a model with the basic purpose of educating secondary social studies students to become active participants in a democracy. Graduate students, all of whom are NYS certified social studies teachers, are instructed in role playing and simulation through participation in activities such as John Gearon's "War or Peace?" and Barbara Olmo's "Pioneers in Arania."

Students are introduced to Statistical Package for the Social Sciences with a data bases from Nan Rothschild's *New York City Neighborhoods: The 18th Century* (Rothschild 1990), and the writer's *Historian: Building a New Nation in 1789* (Hetzner 2000). The Rothschild book focuses on the demographics of NYC Wards in selected years including 1789. *Historian...* is a proprietary database that focuses on the 1st Congress that met in NYC in 1789. It details the socioeconomic, religious, and ethnic backgrounds of the 95 legislators and their fathers, and voting behaviors and political attitudes toward the Constitution and George Washington. Essentially, it is an introduction to quantitative history and the basic evidence used in historical research. To teach students how to ask historical questions they are taught the basics of SPSS and questionnaire design. The process used in class is termed "interviewing the dead." Graduate students work with the database, which contains music clips, cartoons, reproductions of paintings...until they are familiar enough with the processes of historical investigation and materials design to produce their own computer-assisted simulations and role plays. The basic rules are that:

1. Databases must support the simulation/role play, be the basic stand-alone component of the exercise, or gather data from the secondary students on the results of the activity

2. PowerPoint may be used only to present information that would take too long or be awkward/impossible to present in another fashion

3. Audio is the preferred method for having a moderator communicate with participants in an autoinstrucional simulation/role play

4. The Eactivity must be designed to fit into or complement the NYS secondary social studies curriculum

What types of computer databases and simulations/role plays do secondary social studies teachers produce under these guidelines? Graduate students have submitted approximately 45 projects since the requirement for computer-assisted databases was added to course requirements. The following 5 descriptions are of typical student produced databases. Each of the databases is associated with a simulation or role play on the same topic.

1. Terrorism (a hypothetical situation). Following a terrorist incident the Draft is reinstated. The database simulates random selection of draftees and compiles demographics and physical attributes of those selected

2. Political involvement. This database explores the connection between students' political involvement, socioeconomic background, interests (including social studies), and knowledge of current events.

3. "Failure is Impossible" draws its name from the 75th anniversary celebration of the 19th Amendment. This database of women goes from Abigail Adams to Nellie Rodgers Schuler, and includes information on age, religion, politics, and marital state.

4. Conjoined twins. The author of this database and role play teaches 4th grade in a Catholic school-- data can be displayed by nationality, ethnicity, sex, and family background.

5. Heritage of church members. A class member who is an active member of a largely African-American Baptist church compiled, and is now expanding, a database on the history of the church that focuses on the demographics of parishioners. Family data has been gathered on church founders who moved from the South in the 1860's up to the present day. The database is being used in local elementary schools and in the church to foster community.

A more extensive project, carried out in collaboration with teachers who are former *Experiences in Simulation and Role Play* students, is planned for the 2002-2003 academic year. Arrangements have been made for an architectural firm to complete a reconnaissance study of the architectural/historical significance of 1000 buildings in a Western New York village using "Preserve New York" funding. During or following completion of that component, students in social studies and the leadership program at the high school will work with the writer and an associate to carry out an assets study of the community. Secondary students will design questionnaires and interview schedules, interview village residents, process data, and present the findings at a regularly-scheduled Village Board meeting

References

Rothschild, N.A. (1990). *New York City Neighborhoods: The 18th Century.* New York: Academic Press .

Hetzner, D. Historian: Building a New Nation in 1789. *Creative Interactive Teaching: Case Methods & Other Techniques*, 2000. World Association for Case Method Research & Application, Boston, MA. 487-493.

Computer Assisted Simulation and Role Playing

Donald R. Hetzner

Department of History/Secondary Social Studies

State University of New York College at Buffalo, USA

Hetznerd@AOL.Com

Social studies education is the least empirical of all the subdisciplines in the social sciences. An influx of computers into classrooms has had little impact on the nature and direction of social studies instruction. E-learning in the social studies usually consists of using materials such as computer based games with simulated environments and the Internet as expository techniques carried out in very traditional classroom settings. This holds true in most classrooms whether there is a computer for every student or every ten students. The average social studies teacher has little experience in integrating E-learning into a complex curriculum that is undergoing mandated change. This is reinforced by college experiences where students model professors housed in traditional academic and professional departments. At most, social studies students are taught to produce Power Point presentations, and the basics of Internet research.

What forms does E-learning take in typical social studies classrooms? Much depends on the school "rules", the use of consumable supplies, and the nature of teacher. At Niagara Falls SHS, where every student has full-time use of a laptop, students are required to keep their computers in backpacks and only take them out at a teacher's request. Why? Because students play computer games, or leave messages for friends. Many schools control access to large numbers of computers by placing them in the library. Unfortunately, in many of those same schools the librarian does not let students sit next to one another. So, there is no such thing as class use of computers in those schools. In other schools there may be several computers or computers for all students but only one printer and that on the teachers desk. Some schools only issue one printer cartridge or one ream of paper to teachers each semester. Last, social studies is so conservative and tradition bound that teachers use computers in ways they recognize.

PowerPoint takes the place of notes and overheads in many classrooms. Teacher after teacher has happily related to me that "I have all my notes and overheads on PowerPoint now." Interesting enough, A teacher of Honors Economics in a local high school was given a petition from her students, only half in jest, "no more PowerPoint" one day when I was visiting her student teacher. Teachers in a number of schools have received the same message.

You can tell when teachers are using the Internet rather than manipulative models for instruction. In the not too distant past 5th and 9th grade students built models of the Mesopotamian ziggurat at home and brought them to class. What models are in the rooms are dust covered and usually rather primitive and poorly constructed, the models that were so "dumpy" that students did not take them home. At least one wall is covered with poorly drawn ziggurats. Students search the Web for " ziggurat" and locate and view a rendering of the building and a discussion of ancient Mesopotamia. During this exercise usually at least one student asks, "what do I do now?" Most of the time the teacher's answer is "draw a picture of it!"

Friday is still AV day in the social studies class. Major movies on DVD's such as *Pearl Harbor, Enemy at the Gate, Band of Brothers*, *Saving Private Ryan*, and *Gladiator* are standard fare despite the on-screen cautions on use. Possibly even more blatant is the use of copyrighted photographs in extensive, 20-30 minute, PowerPoint presentations.

"Experiences in Simulation and Role Playing," a graduate course at the State University College at Buffalo attempts to cope with the above problems by presenting a model of Elearning that is interactive, data-based, and well-integrated with a variety of media. This is a model with the basic purpose of educating secondary social studies students to become active participants in a democracy. Graduate students, all of whom are NYS certified social studies teachers, are instructed in role playing and simulation through participation in activities such as John Gearon's "War or Peace?" and Barbara Olmo's "Pioneers in Arania."

Students are introduced to Statistical Package for the Social Sciences with a data bases from Nan Rothschild's *New York City Neighborhoods: The 18th Century* (Rothschild 1990), and the writer's *Historian: Building a New Nation in 1789* (Hetzner 2000). The Rothschild book focuses on the demographics of NYC Wards in selected years including 1789. *Historian*... is a proprietary database that focuses on the 1st Congress that met in NYC in 1789. It details the socioeconomic, religious, and ethnic backgrounds of the 95 legislators and their fathers, and voting behaviors and political attitudes toward the Constitution and George Washington. Essentially, it is an introduction to quantitative history and the basic evidence used in historical research. To teach students how to ask historical questions they are taught the basics of SPSS and questionnaire design. The process used in class is termed "interviewing the dead." Graduate students work with the database, which contains music clips, cartoons, reproductions of paintings...until they are familiar enough with the processes of historical investigation and materials design to produce their own computer-assisted simulations and role plays. The basic rules are that:

1. Databases must support the simulation/role play, be the basic stand-alone component of the exercise, or gather data from the secondary students on the results of the activity
2. PowerPoint may be used only to present information that would take too long or be awkward/impossible to present in another fashion
3. Audio is the preferred method for having a moderator communicate with participants in an autoinstrucional simulation/role play
4. The Bactivity must be designed to fit into or complement the NYS secondary social studies curriculum

What types of computer databases and simulations/role plays do secondary social studies teachers produce under these guidelines? Graduate students have submitted approximately 45 projects since the requirement for computer-assisted databases was added to course requirements. The following 5 descriptions are of typical student produced databases. Each of the databases is associated with a simulation or role play on the same topic.

1. Terrorism (a hypothetical situation). Following a terrorist incident the Draft is reinstated. The database simulates random selection of draftees and compiles demographics and physical attributes of those selected
2. Political involvement. This database explores the connection between students' political involvement, socioeconomic background, interests (including social studies), and knowledge of current events.
3. "Failure is Impossible" draws its name from the 75th anniversary celebration of the 19th Amendment. This database of women goes from Abigail Adams to Nellie Rodgers Schuler, and includes information on age, religion, politics, and marital state.
4. Conjoined twins. The author of this database and role play teaches 4th grade in a Catholic school--data can be displayed by nationality, ethnicity, sex, and family background.
5. Heritage of church members. A class member who is an active member of a largely African-American Baptist church compiled, and is now expanding, a database on the history of the church that focuses on the demographics of parishioners. Family data has been gathered on church founders who moved from the South in the 1860's up to the present day. The database is being used in local elementary schools and in the church to foster community.

A more extensive project, carried out in collaboration with teachers who are former *Experiences in Simulation and Role Play* students, is planned for the 2002-2003 academic year. Arrangements have been made for an architectural firm to complete a reconnaissance study of the architectural/historical significance of 1000 buildings in a Western New York village using "Preserve New York" funding. During or following completion of that component, students in social studies and the leadership program at the high school will work with the writer and an associate to carry out an assets study of the community. Secondary students will design questionnaires and interview schedules, interview village residents, process data, and present the findings at a regularly-scheduled Village Board meeting

References

Rothschild, N.A. (1990). *New York City Neighborhoods: The 18th Century*. New York: Academic Press.

Hetzner, D. Historian: Building a New Nation in 1789. *Creative Interactive Teaching: Case Methods & Other Techniques*, 2000. World Association for Case Method Research & Application, Boston, MA. 487-493.

Developing a Framework of Electronic Literacy for Post-Compulsory, Remote-Access, Virtual Learning Environments

Anne Hewling,
Institute of Educational Technology, The Open University, UK
a.hewling@open.ac.uk

Abstract

This paper reports on a study to develop a framework of electronic literacy for post-compulsory, remote access, virtual learning environments. The study acknowledges previous work on individual aspects of the online experience but seeks, through a variety of qualitative and quantitative techniques, to formulate an over-arching framework applicable to post-compulsory, remote-access education. This not only enables contextualisation of the many different elements involved but also enables further examination of their nature and relative importance in order that the framework may provide a flexible and robust tool for use in electronic instructional design.

Context

Increased global availability of computing technology, particularly of the Internet, offers the potential for collaborative interaction more or less 'anywhere, anytime'. Along with changes in workplace practices associated with global economic change and the consequent need for lifelong learning, these developments have led to a mushrooming of interest in the potential of virtual (i.e. online) learning environments (VLEs) as education delivery mechanisms.

Virtual Learning Environments

The 1999 Commonwealth of Learning (COL) report on a global evaluation of virtual education notes that *'virtual education is an extremely dynamic phenomenon'* (reported in Farrell 2001). Virtual Learning Environments (VLEs) range from local intranets used to supplement face-to-face and traditional education presentations, to entirely Web-based Internet dependent spaces which may have no terrestrial existence other than through the participation of students using the space. VLEs can be as large or as small as the available access technology, potentially offering a gateway to infinite numbers of learners. Barajas & Owen (2000), define VLEs as *'any combination of distance and face-to-face interaction, where some kind of space and time virtuality is present'*. Postle describes three types: *'supplemental or adjunct'* (online delivery is far from being the primary medium of instruction); *'mixed mode'* (online and face-to-face are both significantly important delivery media) and *'wholly online'* (online delivery is the only medium of instruction), (Postle 2002 p 4).

Electronic Literacy

Traditional and virtual classrooms alike require a certain level of literacy in users. In its most well understood form, literacy can be termed as the ability to read and write in a print-text-based environment. The virtual classroom, in common with the traditional one, is a text based environment but the text is situated within an amorphous electronic environment (Kaplan 2001) where sequence and structure are notably different (Richards 2000; Reinking). The dominance of text in both environments suggests that traditional literacy may form the backbone of electronic literacy. It is clear, however, that traditional literacy practices alone will not guarantee success in the electronic world. There is much debate on and around the nature of electronic literacy, most of it focusing on a single specific aspect. Some authors concentrate on its roots in traditional literacy (Koch 2001). Others, on the skills perceived as essential in a computer based environment (Tapper 1997), or as presented by the learner, in ideas of self-efficacy (Eastin & LaRose 1996; Wang & Newlin 2002). Yet others concentrate on adaptation to the specific nature of an environment which lacks social cues (Yates 2001); where presence cannot be assumed (Rourke *et al.* 2000) and where particular opportunities are afforded for constructivist design and practice (Laurillard 1993); collaborative activity (Garrison *et al.* 2000) and vicarious learning (McKendree et al. 1998). Some refer specifically to an academic literacy of the

BEST COPY AVAILABLE

online classroom. Others speak in terms of electronic *literacies* (Kaplan 1995; Warschauer 1999) implying that there is no one definition applicable to all situations and introducing the idea of literacy as social practice (Lankshear et al. 2002; Snyder 2001), in turn encapsulating the idea that an absolute definition of literacy must be *'preposterous'* since meanings are inherently amorphous (Semali 2001).

Background to the Study

Taking up the challenge, from New Literacy Studies, to broaden the traditionally narrow view of literacy and instead *'capture the complexity of real literacy in contemporary society'* (Snyder 2000 p118) where reading and writing *'are only part of what people have to learn to be literate'*, (Snyder 2001 p119; Barton 2001 p95), the primary aim of this research is to develop a framework of electronic literacy for post-compulsory remote-access virtual learning environments. The secondary aim is to begin the process of understanding the nature of the elements within; to determine whether these are primarily aptitudes or more abstract and conceptual; whether they can be defined purely in terms of skills or whether ideas, such as those of space (Cicognani 1998) and place (Mitra & Schwartz 2001), are implied. This will provide a three-dimensional depth to the study and develop understanding of the inter-relationships of the various elements. Consequent to these aims, the study seeks to map contours rather than to produce definitive answers, quantify elements or prescribe limits and will facilitate discussion of the central question –

> ***What does it mean to be an effective, electronically literate, post-compulsory student in a remote-access virtual learning environment?***

The Study

The study has two main stages. First stage data sources have been:

- *Case studies of electronic/online literacy* - an investigation of what researchers have deemed appropriate to explore or evaluate rather than the outcomes they have generated.
- *Examination of 'grey' literature* - in the form of institutional prospectuses and pre-enrolment materials such as suitability questionnaires and demonstration modules, as indicators of education providers' views of the scope of electronic literacy.

In both cases grounded theorising has been used to identify concepts to assist in mapping the overall scope of electronic literacy. Together with understandings from the researcher's own background and previous experience of online teaching and learning, these concepts have been used to inform:

- *Semi-structured interviews* - with online tutors which are being conducted online using synchronous chat facilities. Interviewees have been purposefully sampled from those working in *'wholly online'* and *'mixed-mode'* environments (Postle 2002)
- *A self-completion electronic questionnaire* – being sent to 100 online learners *undertaking 'mixed-mode'* or *'wholly online'* courses (Postle 2002). Questions seek to explore concepts emerging from ongoing analysis, in greater depth.

Responses to the above are being used to facilitate the development of the core categories which will become the elements of the desired framework of electronic literacy.

Emerging Themes

Any study of electronic literacy, as Tapper (1997) notes, requires consideration of an almost infinite number of variables. Analysis for this study so far has indicated areas receiving most overall attention to be:

- Previous experience of computers, not just word processing skills but experience which has developed positive learner attitudes towards, and tolerance of, technology
- Time and place management where learners not only have a sense of advance planning but also perceive the need to balance and contain online learning activity within other life priorities
- Self-sufficiency as a learner including self-motivation, self-discipline, determination and acceptance of the need for learner pro-activity
- Writing, including ability to write reflectively and convert conversational thought into coherent text
- Visual and semiotic understanding and interpretation
- Information processing, interpretation and evaluation

with different groups affording a range of priority ratings within any one area.

The key challenge in applying the outcomes of the later stages of analysis will be in creating a framework which is both robust and flexible enough to provide a useful tool for use in electronic instructional design. It will need to be tested against different groups of learners entering post-compulsory learning as the products of the ebb and flow of curriculum and resourcing tides within widely differing compulsory education systems.

References

Barajas, M. and Owen, M. (2000). Implementing Virtual Learning Environments: Looking for Holistic Approach, *Educational Technology & Society*, 3 (3), available online from URL: http://ifets.ieee.org/periodical/vol_3_2000/barajas.html accessed 5/10/2001

Barton, D. (2001). Directions for Literacy Research: Analysing Language and Social Practices in a Textually Mediated World, *Language and Education,* 15 (2&3), 92-104.

Cicognani, A. (1998). On the Linguistic Nature of Cyberspace and Virtual Communities, *Virtual Reality: Research Development and Application,* 3 (1), 16-24.

Eastin, M.S. & LaRose, R. (1996). Internet Self-Efficacy and the Psychology of the Digital Divide, *Journal of Computer-Mediated Communication,* 6 (1). available from URL: http://www.ascusc.org/jcmc/vol6/issue1/eastin.html accessed 28/11/2001

Farrell, G. M. (2001). *The Changing Faces of Virtual Education*, London, Commonwealth of Learning.

Garrison, D. R., Anderson, T. and Archer, W. (1998). Critical Inquiry in a Text-Based Environment: Computer Conferencing in Higher Education *(online)* available online from URL: http://www.atl.ualberta.ca/cmc/CtinTextEnvFinal.pdf
Accessed 22/11/2001

Kaplan, N. (2001). Knowing Practice: A More Complex View of New Media Literacy in *Proceedings of the International Conference on Advances in Infrastructure for Electronic Business, Science and Education on the Internet.* Available online at URL: http://iat.ubalt.edu/kaplan/ssgrr01.pdf accessed 28/11/2001

Kaplan, N. (1995). Eliteracies: Politexts, Hypertexts, and Other Cultural Formations in the Late Age of Print, available on-line from URL: http://iat.ubalt.edu/kaplan/lit/
accessed 7/12/2001

Koch, M. (2001). Information Literacy: where do we go from here, *TECHNOS Quarterly for Education and Technology,* 10 (1) Available online from URL: http://technos.net/journal/volume10/1koch.htm accessed 11/01/2002

Lankshear, C. Peters, M. and Knobel, M. (2002). Information, knowledge and learning: some issues facing epistemology and education in a digital age in Lea, M.R. and Nicholl, K. (eds.) *Distributed Learning: social and cultural approaches to practice,* London, Routledge Falmer.

Laurillard, D. (1993). *Re-thinking University Teaching: A Framework for the Effective Use of Educational Technology*, London, Routledge.

Mitra, A. and Schwartz, R.L. (2001). From Cyber Space to Cybernetic Space: Rethinking the Relationship between Real and Virtual Spaces, *Journal of Computer Mediated Communication*, 7 (1), (online) available from URL: http://www.ascusc.org/jcmc/vol7/issue1/mitra.html accessed 19/11/2001

McKendree, J., Dineen, F., Mayes, T. and Lee, J. (1998). The Vicarious Learner: discussion as learning resource and learning task, *ERCIM news online*, 33 available online from URL: http://www.ercim.org/publication/Ercim_News/enw33/mckendree.html
Accessed 9/11/2001

Postle, G. (2002). Emergence of Fourth Generation Technologies in *e-JIST,* (online) 5 (1) available from URL: http://www.usq.edu.au/electpub/e-jist/docs/html2002/gPos.html accessed 4/4/2002

Reinking, D., (undated). *Electronic Literacy,* available online from URL: http://curry.edschool.virginia.edu/go/clic/nrrc/reinking.html accessed 10/01/2002

Richards, C. (2000). Hypermedia, Internet Communication, and the Challenge of Redefining Literacy in the Electronic Age, *Language, Learning & Technology*, 4 (2), 59-77, available online from URL: http://llt.msu.edu/vol4num2/richards/default.html accessed 12/02/2002

Rourke, L., Anderson, T., Garrison. R., Archer, W. (2001). Assessing Social Presence in Asynchronous Text-based, Computer Conferencing, web-published paper from URL: http://www.atl.ualberta.ca/cmc/social%20presence%20May8.pdf

Semali, L. (2001). Defining New Literacies in Curricular Practice, *Reading Online*, available from URL: http://www.readingonline.org/newliteracies/semali1/index.html
accessed 26/11/2001

Snyder, L. (2001). A New Communication Order: Researching Literacy Practices in the Network Society, *Language and Education*, 15 (2&3), 117-131

Tapper, J. (1997). Integrating Online Literacy into Undergraduate Education: a case study, *Higher Education Research & Development*, 16 (1)

Wang, A. Y. & Newlin, M. H. (2002). Predictors of web-student performance: the role of self-efficacy and reasons for taking an on-line class, *Computers in Human Behavior*, 18 (2), 151-163

Warschauer, M. (1999). *Electronic Literacies: language, culture and power in online education*, Mahwah, New Jersey, Lawrence Erlbaum Associates.

Yates, S. J. (2001). Researching Internet Interaction: Sociolinguistics and Corpus Analysis in Wetherell, M., Taylor, S. and Yates, S.J. (eds.) *Discourse as Data: a guide for analysis*, London, Sage

Differential Indexing: A Problem-Authoring Method for Computer-Based Problem Practice

Tsukasa HIRASHIMA, Akira TAKEUCHI
Kyushu Institute of Technology, JAPAN
e-mail: tsukasa@ai.kyutech.ac.jp

Abstract: In this paper, a problem-authoring method is proposed and an example of the implementation of the method is described. In the problem-authoring method, a new problem is characterized using differences from the basic problem. In the problem-authoring environment, a user can make a new problem by changing the basic problem. The changes represent the differences between the new problem and the basic problem. The new problem is then characterized by the differences from the basic problem. We call the problem authoring method "Differential Indexing".

Introduction

Problem practice is a highly private activity. For example, the next problem in the practice should be decided depending on the student's knowledge, learning context, or mistakes. Computer-based problem practice is, then, a promising approach to deal with the private activity. To realize the elaborate form of the practice, the following three factors are indispensable, (1) student model, (2) practice strategy, and (3) practice material, that is, problems. Such computer-based problem practice is often called Intelligent Problem Practice. There are already many investigations for computer-based problem practice, but most of them are focused on the student modeling or practice strategy. However, we believe that the problems as practice material are the basis of problem practice. The abilities of a student model and practice strategy depend on the quantity and quality of prepared problems. From this viewpoint, how to describe problems and how to get the data are key issues to achieve the advanced practice [Hirashima 93; Ritter 98; Arroyo 00; Hirashima 01]. We call this issue "problem-authoring". There are several types of problem-authoring methods. Our current target is to make various problems that can be solved using the same solution method. We call this type of problem-authoring method "solution based problem-authoring". "Problem-authoring" signifies this "solution based problem-authoring" in this paper.

In this paper, a problem-authoring method is proposed and an example of the implementation of the method is described. In the problem-authoring method, a new problem is characterized using differences from the basic problem. In the problem-authoring environment, a user can make a new problem by changing the basic problem. The changes represent the differences between the new problem and the basic problem. The new problem is then characterized by the differences from the basic problem. We call the problem–authoring method "Differential Indexing".

In section 2, a classification of problem-authoring methods from the viewpoint of problem indexing is described. Then, a method of problem indexing, that is, Differential Indexing is explained. A problem-authoring environment as an implementation of Differential Indexing is also described in section 3.

Problem-Authoring

Level of Indexing

In problem-authoring process, a user usually makes problem sentences that are the body of the problem. However, it is difficult for the computer to interpret the problem sentences directly. Giving indexes to the problem and dealing with the indexes as the content of the problem is a useful as well as a popular way. In this paper, we also adopt this approach and propose an indexing method as a problem-authoring method.

Indexing methods are categorized in the following three levels: (1) flag level indexing, (2) keyword level indexing, and (3) problem structure level indexing. In the case of the flag level indexing, each problem has a flag representing a specific number or symbol. The courseware of the problem practice deals with any problems with the flags. In other words, the flag level index is used to identify a problem but doesn't describe the content of the problem. Therefore, problem-authoring and courseware designing cannot be separated. It is then very difficult

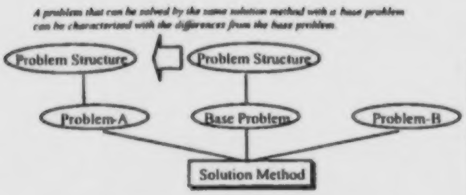

A problem that can be solved by the same solution method with a base problem can be characterized with the differences from the base problem.
Problem Structure
Problem Structure
Problem-A
Base Problem
Problem-B
Solution Method

Figure 1: Concept of Differential Indexing.

The number of legs of a crane is two.
The number of legs of a turtle is four.
There are cranes and turtles, 20 in total.
The total number of legs of the cranes and turtles is 48.
How many cranes are there?
How many turtles are there?

Figure 2: Problem-1: Base Problem of Crane-Turtle Method.

(Step1) :The supposed total number of legs when it supposed that there were only cranes.

*(the total number of cranes and turtles) * (the number of legs of a crane) = A*

(Step2):The difference in the above number and actual number of legs.

(the total number of legs of cranes and turtles) -A = B

(Step3): The difference of number of legs when a turtle is substituted to a crane.

(the number of legs of a turtle legs) - (the number of legs of a crane) = C

(Step4): Total difference(Step2) / Individual difference(Step3) is the number of turtles substituted to cranes.

B / C = (the number of turtles)

Figure 3: Crane-Turtle Method

to reuse the problem data with other systems.

In the case of keyword level indexing, indexes of a problem are composed of a set of keywords that describe the content of the problem. In the courseware of the problem practice using the keyword level index, problems that include required keywords are used. Therefore, if the problem author and courseware designer share the meanings of the keywords, the problem authoring and courseware designing can be separated. However, it is often difficult to make the meanings of the keywords clear systematically, because they often depend on the specific system.

If the indexes of a problem include enough information to solve the problem, we call it "problem structure level indexing". To realize such a level of indexing, a problem solving model should be prepared and the indexes should be described based on the model. In order to share the meanings of the indexes, the problem author and courseware designer have to share the model. Although the description ability of the indexes is restricted by the model, the model usually doesn't depend on the specific system and therefore sharing it with the author and the designer is easier. This problem structure level indexing is the target level of this research.

Concept of Differential Indexing

In this research, we give the indexes that describe differences from base problem to a problem. We call the indexing method "Differential Indexing". Figure 1 shows the concept of Differential Indexing. In this method, a combination of a base problem and a solution method is necessary. We call the pair the "Solution Model". This indexing method can then be used to make problems that can be solved using the same solution method with the base problem. For example, if Problem -A can be solved using the same solution method with the base problem, it can be characterized by the difference of problem structure from the base problem. Then, the differences are used as the indexes of the Problem-A. The differences decide the worth of the practical problems, like Problem-A, because all factors a learner has to overcome to master the solution method are included in the differences. Therefore, the index described as the differences is enough from the viewpoint of "solution based problem authoring". This is the concept of Differential Indexing. In the next section, the problem solving model used to describe these differences is explained.

Indexing Method

In Differential Indexing, the following two differences from a base problem can be categorized: (1) an instance difference, and (2) a structure difference. The structure difference is divided as (2a) a structure difference that can be complemented with fact knowledge, and (2b) a structure difference that can be complemented with operational knowledge. In this section, the aforementioned three differences are explained by using the crane-turtle method as an example. The base problem and the calculation procedure of the method are shown in

BEST COPY AVAILABLE

Figure 2 and 3.

Instance Difference

Figure 4 shows Problem-2 that can be solved using the crane-turtle method. In the problem, an octopus corresponds to a crane, and a squid corresponds to a turtle. This problem is different from the base problem in instances, but the problem structure is the same. This is an example of the instance difference. If this problem is difficult for a learner, it speculates the cause of the difficulty is in the instance differences.

Figure 5 shows Problem-3 that also includes the instance difference. In the problem, a boy corresponds to a crane and the score corresponds to the number of legs. Usually, people judge Problem -3 as more difficult than Problem -2. The cause of this distinction is in the quality of the instance changes. To deal with the quality of the changes, in Differential Indexing, a hierarchical structure of concept classes is prepared. The distance in the hierarchical structure from the class that the base problem belongs to describes the quality of the instance changes. When the distance is longer, a problem becomes more difficult.

Structure Difference

If the following two sentences, that is, "the number of legs of an octopus is eight" and "the number of legs of a squid is ten" are missing in Problem-2, there are structure differences between the base problem and this problem. Here, if a student has the knowledge about "the number of legs of an octopus" and "the number of legs of a squid", the differences can be complemented with them. Therefore, we call this type of the structure difference, "structure difference that can be complemented with fact knowledge". If a learner who can solve Problem -2 cannot solve the problem that includes this structure difference, it is estimated that the difficulty for the learner exists in the structure difference. We call this structure difference "the first-order structure difference", and a problem that includes only this type of structure difference, "the first -order problem".

When "the total score of the pupils" is omitted and then "the average score of the pupils" is given in Problem -3, the problem has another type of structure difference. To apply the crane-turtle method to the problem, "the total score of the pupils" is necessary. In this case, "the total score" can be derived by using both "the average score" and "the total number of the pupils". This is the structure difference that can be complemented by operational knowledge. We call this structure difference, "the second-order structure difference", and a problem that includes this type of difference, "the second-order problem". A problem that only includes the instance difference is called "the zeroth-order problem".

In Differential Indexing, the indexes of a new problem are described with instance differences and structure differences. In the problem-authoring environment described in Section 3, the indexes are represented by XML (eXtensible Markup Language) and the problem data can be made and used through the internet.

Problem-Authoring Environment

We have now implemented a problem -authoring environment. The main component is the problem-making editor where a user can make problems. It can also diagnose problems and acquire knowledge for the diagnosis through the problem-making process.

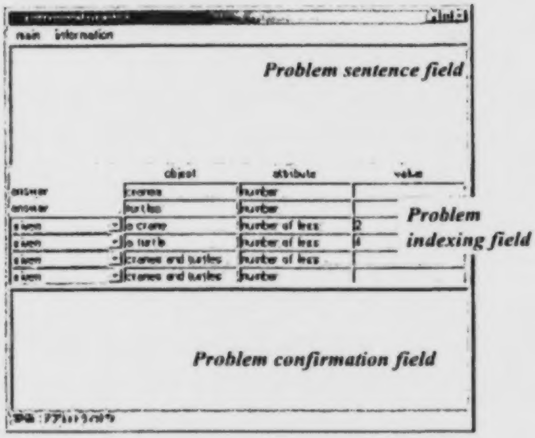
The main task of the problem-making process is to provide indexes for a new problem. Figure 6 is the interface of the problem-making editor. (Currently, only a Japanese version is implemented. Words in the figures were translated into English). The interface is composed of (a) a problem sentences field, (b) a problem-indexing field, and (c) a problem confirmation field. When a user selects a solution method, the base problem of the solution method is given in the problem-indexing field (in this section, a user means a problem author). In the problem-indexing field, each line is corresponding to a basic relation composed of an object, an attribute, and a numerical value. The left-hand column is the statement of the way to give the value. The "given value" is the value that is given in the problem directly. "Not given (fact)" is the value that is not given in the problem, but can be complemented by fact knowledge. "Not given (operational)" is the value that is not given in the problem, but can be derived by operational knowledge. This is the problem structure of the base problem. By changing the concepts or the statements, the problem structure of the new problem is generated. The indexes of the new problem are described as the changes.

The number of legs of an octopus is eight.
The number of legs of a squid is ten.
There are octopuses and squid, 20 in total.
The total number of legs of the octopuses and squid is 180.
How many octopuses are there?
How many squids are there?

Figure 4: Problem-2: An Example of Instance Difference.

There are 40 pupils in the class.
The total score of the test of the pupils is 2760.
The average score of the test of a boy is 65.
The average score of the test of a girl is 75.
How many boys are there?
How many girls are there?

Figure 5: Problem-3: An Example of Instance Difference.



	object	attribute	value
answer	cranes	number	
answer	turtles	number	
given	a crane	number of legs	2
given	a turtle	number of legs	4
given	cranes and turtles	number of legs	
given	cranes and turtles	number	

Figure 6: Interface of Problem-Making Editor.

Concluding Remarks

This paper described a problem-authoring method and a problem-authoring environment where the method was implemented. The environment is composed of Problem-Making Editor, Problem Database and Practice Editor. A user can make problem with the Problem-Making Editor. Problems made in the Problem -Making Editor are saved in Problem Database. In Practice Editor, a user can build a simple problem practice CAI by designing a problem sequence. These components can be accessed through the internet. Evaluation of this problem-authoring environment is our future work.

References

[Arroyo 00] Ivon Arroyo. "Animalwatch: an arithmetic ITS for elementary and middle school students", Learning Algebra with the Computer, *Workshop of Fifth International Conference on Intelligent Tutoring Systems.* Montreal, Canada. 2000.

[Hirashima 93] Hirashima, T., T. Niitsu, A. Kashihara and J. Toyoda. "An Indexing Framework for Adaptive Setting of Problems in ITS", *Proc. of AI-ED93*, pp.90-97, 1993.

[Hirashima 01] Tsukasa Hirashima Taichi Umeda, Akira Takeuchi, "An Intelligent Problem Authoring Environment on Web", *Proc. of ICCE2001*, pp.560-562(2001).

[Ritter 98] Ritter, S., Anderson, J., Cytrynowicz, M., and Medvedeva, O., "Authoring Content in the PAT Algebra Tutor", *Journal of Interactive Media in Education*, 98 (9).

Acknowledgements

This research was partially supported by the Telecommunications Advancement Foundation and Atrificial Intelligenced Research Foundation.

BEST COPY AVAILABLE

Problems and Perils for Digital Libraries in the K-12 Domain

Ellen S. Hoffman
Eastern Michigan University
Ypsilanti, MI USA
ehoffman@online.emich.edu

Marcia Mardis
Merit Network, Inc.
Ann Arbor, MI USA
mmardis@merit.edu

INTRODUCTION

The U. S. National Science, Technology, Engineering, and Mathematics Education Digital Library (NSDL) does not currently exist except as a vision and goal for the STEM community with initial funding from the National Science Foundation (NSF)—a vision that is different from any existing library today. Currently a set of multiple funded grant projects with formal and informal partnerships among universities, K-12 schools, professional organizations, government agencies, non-profit organizations, and corporations, the library is moving toward realization. When the NSDL opens its virtual doors in fall 2002, it will be the culmination of over a decade of research and collaboration among librarians, technologists, and educators in the public and private sectors (National Research Council, 1998; Wattenberg, 1998; Zia, 2001).

A community that is a special focus for the program is K-12, one that is in many ways a new challenge for the developers who are predominantly from higher education and the research community (National Research Council, 1999). As part of a project funded by the National Science Foundation, TeacherLIB has provided a review of the issues that arise if the library is to positively impact student achievement in K-12 mathematics and science (Hunter, Mardis & Hoffman, 2002).

A VIRTUAL LIBRARY VISION

Critical barriers for digital libraries today are as much human issues as technological ones. Even when good collections are developed, getting them known and used remains problematic in this age of Internet information overload. Today the Internet offers lots of "stuff," but finding the "right stuff" may be difficult or impossible even when it is available (Zia, 2001). This conclusion is reinforced by the research on search engines by Lawrence and Giles, who noted that popular Internet search engines "could be compared to a phone book which is updated irregularly, is biased toward listing more popular information, and has most of the pages ripped out" (Lawrence & Giles, 1999). Further, when confronted by the overwhelming amount of content, learners may not have the experience or basic knowledge to evaluate and use the resources that are found. Some studies of pre-college students have indicated that they spend increased research time looking for materials and less actually reading and analyzing web-based content.

A prime consideration in building digital libraries is ensuring that users needs are met, which implies that one size will not fit all. The NSDL is viewed as having many kinds of resources and services that go beyond the traditional books and journals of brick-and-mortar libraries, with resources including non-textual sources and educational

---

This material is based upon work supported by the National Science Foundation under Grant No. 0085866, TeacherLIB. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author and do not necessarily reflect the views of the National Science Foundation.

materials such as lesson plans, curriculum guidelines, and tutorials. "Beyond providing traditional library functions such as the intelligent retrieval of relevant information, indexing and online annotation of resources, and archiving of materials, the digital library will also enable users to access virtual collaborative work areas, hands-on laboratory experiences, tools for analysis and visualization, remote instruments, large databases of real-time or archived data, simulated or virtual environments, and other new capabilities as they emerge" (National Science Foundation, 2000).

While digital libraries have been widely discussed, the NSDL is different because of its focus on education. At workshops in 2000 organized by the current grant recipients (Manduca, McMartin, & Mogk, 2001), educational goals were defined including:

- Provide quality assurance of resources in the collections;
- Enable contextual learning;
- Empower critical literacy skills;
- Support new pedagogical approaches;
- Advance scientific knowledge and understanding;
- Enable inter- and multi-disciplinary educational opportunities;
- Implement the National Science Education Standards (National Research Council, 1996) and related SMET education reform programs;
- Support independent learning;
- Support learning that is active, and that involves inquiry and discovery;
- Foster a sense of excitement about life-long learning;
- Provide access for all;
- Empower users;
- Support communities of scholars.

CHALLENGES IN K-12 DEPLOYMENT

As the NSDL program moves forward, it moves from issues of creating a technical infrastructure to impacting learning in communities with structures and cultures that emerged long before the digital age and are not always well positioned to take advantage of new technologies. In an examination of those issues, researchers for the TeacherLIB project detailed a range of concerns that must be addressed before the digital library can become a primary tool in K-12 classrooms in the United States (Hunter, Mardis, & Hoffman, 2002). These include social, economic, cultural and technical barriers.

Many challenges are well understood as technology enters K-12 schools, including teacher time, training, skills, and attitudes, issues of access to appropriate hardware and software, technical support, and organizational structures that can make it difficult for teaching reforms to take hold. Further, issues of the digital divide may limit the reach of the new library to those who have the most to gain from new teaching tools.

At the same time there are some new challenges that are particular to envisioned library that are emerging as new structures are being tested. The following are not intended to cover all possible issues but to give a sense of some of the emerging issues that have been discussed as the library is moving towards reality.

Accommodating the diverse curriculum requirements of American schools: Despite a decade of developing national standards, each state (and often local district) has revised the standards to meet local concerns and priorities. Students are assessed through state-mandated tests rather than a national testing system, and increasingly curriculum is driven in K-12 schools to raise test scores. Teachers are pushed to adopt learning materials that are tightly aligned with local standards. As a result, learning materials that are not perceived to meet these needs may face a more difficult struggle in adoption. Can a national library find ways to tie in local standards effectively? Some projects are already examining ways to match state standards to library content so that it is customized for each viewer.

Access to the range of potential high-quality content: U.S. schools that receive federal funds for telecommunications (known as the Universal Service Fund or E-rate) are required by federal law to filter content to protect minors from unacceptable content. Studies of these filtering systems have shown that they may block content that is critical for teaching science or mathematics because it covers subjects such as sexually transmitted diseases or references to male or female anatomy. Library developers will need to work with schools and commercial manufacturers of filtering programs to ensure that the rich resources are available to all students.

Personal portals in a protected world: One of the most powerful concepts being developed for the NSDL is the personalized portal. Through customized portals that "recognize" each user, an individual learner has the potential to gain scaffolded assistance in their educational explorations. Under federal laws and regulations, however, the kinds of personal information that may be needed to make such portals highly effective cannot be released by American schools. As a result, tracking mechanisms that could potentially provide support for each learner may not be possible within this protected environment. Developers will need to find creative ways to advance such technologies while ensuring high levels of security for minors.

Incorporating legacy collections: Many excellent collections that are now in use by K-12 that are developed as the result of intensive local efforts or larger national reform projects were never designed to be used in a more structured library effort. These collections may have a mix of high quality materials and underdeveloped experimental materials that never reached conclusion. As teachers demand that their time be maximized so that they are not required to review hundreds of resources to find the right item for the age group and subject they are teaching, these materials may have insufficient metadata to assist teachers in limiting their search. New ways of labeling may be required that go beyond the traditional library catalog to assist users in finding materials that are reviewed and tested. As yet, the methods and data structures for such reviews remain to be developed and tested in real classrooms. Even further away are the tools that will allow such schema to be readily applied to materials that were not developed with such a labeling process in mind. In many cases, the personnel simply does not exist among these K-12 collections to develop high level metadata that may be needed for ready K-12 access.

FUTURES FOR E-LEARNING

Although technical, informational, and organizational challenges remain, NSDL continues to move forward towards its Fall 2002 launch date. The scope of the overall program is providing new hopes for reforming math and science learning for K-12 students. While the challenges are great, the potential continues to motivate the digital library community to develop new methods for deployment that will work well for children and provide new access to high-quality learning.

REFERENCES

Hunter, B., Mardis, M., & Hoffman, E. S. (2002). *K-12 education considerations for a national SMETE digital library* [PDF document]. Retrieved, from the World Wide Web: http://www.teacherlib.org

Lawrence, S., & Giles, L. (1999). Accessibility of information on the Web. *Nature, 400*, 107-109.

Manduca, C. A., McMartin, F. P., & Mogk, D. W. (2001, March 20, 2001). *Pathways to progress: Vision and plans for developing the NSDL* [PDF document]. Retrieved June, 2001, from the World Wide Web: http://www.smete.org/nsdl/index.html

National Research Council. (1996). *National science education standards.* Washington D.C.: National Academy Press.

National Research Council. (1998). *Developing a digital national library for undergraduate science, mathematics, and technology education: A report.* Washington D.C.: National Academy Press.

National Research Council. (1999). *Serving the needs of pre-college science and mathematics education: Impact of a digital national library on teacher education and practice. Proceedings from a National Research Council workshop.* Washington D.C.: National Academy Press.

National Science Foundation. (2000). *National Science, Mathematics, Engineering, and Technology Education Digital Library (NSDL), Program Solicitation* (NSF00-44). Washington, DC: National Science Foundation.

Wattenberg, F. (1998, October 1998). *A national digital library for science, mathematics, engineering and technology education*. D-Lib Magazine. Retrieved April 7, 2000, from the World Wide Web: http://www.dlib.org/dlib/october98/wattenberg/10wattenberg.html

Zia, L. L. (2001). Growing a national learning environments and resources network for science, mathematics, engineering, and technology education: Current issues and opportunities for the NSDL program. *D-Lib Magazine, 7*(3), (electronic).

An Examination of the Elements and Principles of the Visual Design of Web-Interfaces in the Context of Improving Accessibility for Older Adult Users

Charlotte Holland
School of Education Studies
Dublin City University
Ireland
charlotte.holland@dcu.ie

Abstract: This paper introduces elements and principles of visual design, and examines these in the context of designing web interfaces that are accessible to older adult users. It begins by looking at the background to the projected increases in the aged population and the physiological effects of ageing. The discussion continues by reviewing the elements and principles of visual design, and moves forward to focus on the possible impacts of visual impairments on visual interface interpretation. It concludes by outlining the next stages of this work-in-progress and some of the aspirations of this investigation.

Introduction

Improvements in the life expectancy rate has resulted in projections of a massive increase in the number of older adults in society of the near-future. "Thirty years from now, it is estimated that one in four people in the developed world will be aged 65 and over, an increase from one in seven today" (Preston, 1999).

The 1996 Irish Census (Central Statistics Office, 1996) showed that almost 29% of the population were aged between 25 and 44, with a further 11% aged between 45 and 54. By 2026, these two categories of the population will form the older adult community and, when the improved life expectancy rate is taken into account, this older adult community may represent over thirty-five per cent of the total Irish population.

In Ireland, as in many other countries, government and state agencies, (McCall, 2002), commerce and educational institutions are making significant strides in bringing a wide range of services from life events to career choices and leisure options online. The proliferation of information that is now communicated using web technologies in particular demands that all sectors of society gain access and interact with new technologies.

How accessible is this information transmitted using web technologies to older adults? The ageing process can result in diminished vision, hearing, hand-eye co-ordination and psychomotor impairments, (Vanderheiden, 2000). The most common of these physiological changes associated with longevity is the change in vision. "By age 65, most people have lost at least some of their ability to focus; have a reduced field of vision, ability to resolve images, distinguish colours and adapt to changes in light" (The AgeLight Institute, 2000).

The World Wide Web Consortium, W3C, published the Web Content Accessibility Guidelines 1.0, WCAG 1.0, in May 1999 with the aim of explaining how to make web content accessible to people with disabilities. The specification contained fourteen guidelines, (W3C, 1999), that address barriers in web pages which people with physical, visual, hearing and cognitive/neurological disabilities may encounter.

The White Paper published by the Age Light Institute in 2000 focused on maximising usability and accessibility in web-site design for seniors and older Internet users in particular. It highlighted general design elements to make websites more 'senior-friendly', and as such has "raised awareness of design parameters and usability considerations for the increasingly varied demographics and lifestyles of computer users" (The Agelight Institute, 2000).

Physiological Effects of Ageing on Vision

"As one ages, the likelihood of vision loss increases significantly. For those over age 65, one in nine people experience serious vision loss. This rate increases to one in four for those over 85" (Vision Loss Resources, 1997).

During the aging process, the average person will probably experience some of the following eye conditions and resultant vision changes (National Eye Institute, 2001):

- Yellowing of the Lens occurs when the fibres of the lens take on a yellow hue and results in difficulty in contrasting colours, in particular, blue, green or violet.
- Fixed Lens occurs when the lens becomes more rigid and loses its ability to focus on objects that are close. The lens may also become denser and cloudier, which cuts down on the light that is passed through to the retina, resulting in a loss of visual acuity.
- Loss of Pupil Expansion is where the pupil reduces its ability to expand resulting in less light entering the eye. This combined with a dense lens often means that older people need three times more light to see. It results in a loss of ability to adapt to glare, difficulty seeing in the dark and adapting to light changes, hence causing eye-strain or eye fatigue. "Resistance to glare is 2.5 times greater at 20 than at 65" (Flax & Luchterhand, 1995).
- Floaters are condensations of cells in the gel parts of the eye and take the form of tiny spots, specks or strings that float across the field of vision. "Floaters are very common in the elderly, patients with nearsightedness, diabetes and high-blood pressure" (Ohiolions Eye Research, 2000).

In addition to the age-related vision changes discussed above that occur for most older adults, some older adults will experience eye diseases and resultant effects on vision as outlined below (National Institute on Aging, 2002):

- Age-related Macular Degeneration occurs when the central part of the eye dies off creating a black hole or blind spot in the central field of vision. Whilst peripheral or side vision may be maintained, it leads to difficulty in reading, recognising faces or doing 'close-up' work.
- Cataracts results from the clouding of the lens inside the eye, which reduces light entering the eye, and can cause blurring across the entire field of vision.
- Glaucoma and Retinitis Pigmentosa are different diseases but both result in a gradual loss of peripheral vision, leaving a central field of vision or tunnel vision and eventually blindness.
- Diabetic Retinopathy occurs in long-term diabetics where damage can occur to the retina. The blood vessels leak creating large floaters that move across the field of vision.

Therefore, older adults may experience, in addition to eye-strain and eye fatigue, a reduced field of vision, blurred vision, reduced ability to resolve images, reduced colour discrimination, sensitivity to glare, night blindness, a degree of colour blindness and a loss of visual acuity.

How will these physiological changes in vision, brought about by the ageing process, impact perception of and interaction with the visual elements and principles of the web interface? In order to answer this, we first need to establish the constituents of visual design, namely, the elements and principles of visual design.

Elements of Visual Design

The main elements of visual design as described below are texture, form, line, value, colour, space and shape, (Crystal Production Company, 1996):

Texture refers to the simulated surface quality of artwork. *Form* describes the 3-D aspects of objects that take up place. *Lines* can be expressive and suggestive; they can be used to outline the edges of forms or shapes; they can be used to indicate action and physical movement; they can be used to create value and textures. *Value* refers to dark and light, it can be used to develop suitable contrast between foreground and background and to describe form. *Colour* has three properties; hue, value and chroma. The hue is the name of the colour: red, yellow and blue. Colour value refers to the lightness or darkness of the colour. Chroma is the intensity of the colour or the purity of the hue. *Space* can be empty or filled with objects. *Shape* is an area that is contained within an implied line, or is identified because of colour or value changes. Shapes are 2-D, and can be geometric or free-form.

Principles of Visual Design

The principles of visual design below include rhythm, emphasis, contrast, pattern, visual movement and balance (Crystal Production Company, 1996).

Rhythm is the repetition of the visual movement of each of the elements. It can be regular or irregular, staccato(abrupt and change frequently) or progressive(change size whilst moving). *Emphasis* is where the elements are emphasised to achieve dominance or to create a focal area of interest. *Contrast* is where elements are contrasted to achieve dominance. *Pattern* uses the elements in planned or random repetition. They increase visual excitement by enriching surface interest. *Visual Movement* can be used to direct users to focal areas (Vaughan, 1997), such movement can be along lines, edges, shapes and colours. *Balance* refers to the distribution of visual weight in a work and can be either symmetrical or asymmetrical.

Visual Design Considerations for Web Interfaces

Of elemental concern in the visual perception of the visually impaired older adult, would be the use of colour, value, texture and space. These elements would further be enhanced or detracted by the use of rhythm, pattern, emphasis, contrast, visual movement and balance.

For example, think of an interface that uses a font of appropriate size and colour contrast, but has a shadow added for emphasis. How will a visually impaired adult user perceive the 'shadowed' text? Depth perception difficulties may arise?

How about an interface that displays a font that is marginally lighter in colour than the background, will the adult user who has a loss in colour perception be able to perceive the difference? Are low value/contrast colours a good choice in this case?

What would a user with discoloration in the eye fluids and lens (or yellowing) experience when viewing visual elements on a colour 'co-ordinated' web interface? Would the colour contrast/ value still be significant?

What about the placement of the visual elements on the interface, is the amount of white space surrounding the block/s of text large enough, how will this impact on readability of the text for the visually impaired adult user?

Consider the interface that uses geometric textures/pattern in the background, how do these textures affect the contrast or readability of text/ images? Are organic textures/patterns a better option?

Now consider the web interface that incorporates moving text or images, how does the rhythm and/ or movement of these images affect the visually impaired adult user?

Next Stage

The sample questions above are among many questions that are currently under investigation in a review of the visual design of contemporary web interfaces aimed at the adult population in Ireland, tentative findings will be released over the next few months. It is hoped that this investigation into the impact of visual impairments on perception of visual elements and principles of web interfaces may help establish the current state of accessibility of such sites. Furthermore, it is desired that this investigation will raise an awareness of the need for more detailed research on all aspects of web interface design for an ageing population.

References

Central Statistics Office. (1996). *Census 1996*. Dublin: Stationary Office

Crystal Production Company. (1996). *The Elements and Principles of Design* http://www.snoqualmie.wednet.edu Accessed: 02/02

Flax, M.E. & Luchterhand, C. (1995). *Aging with Developmental Disabilities: Changes in Vision*. http://www.thearc.org Accessed: 07/02

McCall, B. (2002). *Connecting the Citizen*. Dublin: The Sunday Tribune 21/04/02.

National Eye Institute. (2001). *Eye Disease Simulations*. http://www.nei.nih.gov Accessed: 06/02

National Institute on Aging. (2002). *Aging and Your Eyes*. http://www.nih.gov/nia Accessed: 07/02

Ohiolions Eye Research. (2000). *Simulations*. http://www.ohiolionseyeresearch.com/simulati.htm Accessed: 07/02
Preston, P.G. (1999). *Gray Dawn*. New York. Times Books.

The Agelight Institute. (2000). *A Guide for Web Design Usability for users of All Ages*. http://www.agelight.org Accessed: 02/02

Vanderheiden, G. (2000). *Fundamental Principles and Priority Setting for Universal Usability*. http://trace.wisc.edu/docs/ Accessed: O6/02

Vaughan, L. (1997). *Understanding Movement* http://www.acm.org/sigs/sigchi/chi97 Accessed: 04/02

Vision Loss Resources. (1997). *Living with Low Vision Loss* http://www.visionlossresources.com Accessed: 04/02

World Wide Web Consortium W3C. (1999) *Web Content Accessibility Guidelines 1.0*. http://www.w3.org/WAI/GL Accessed: 02/02

Additional Resources

Arditi, A. (2000). *Effective Color Contrast: Designing for People with Partial Sight and Color Deficiencies*. http://www.lighthouse.org/color_contrast.htm Accessed: 05/02

Bearman, M. (1997). *Graphic Design, Interfaces & Usability*. http://www.med.monash.edu.au/informatics/ Accessed : 05/02

Color Matters. (2002). *Color Matters:Computers*. http://www.colormatters.com/ Accessed: 03/02

Department of Education and Science. (2000). *Learning for Life: White Paper on Adult Education*. Government Publications: Ireland

Percoco, G. & Sarti, L. *On the usage of graphics in ICAI systems*. (1996). Istituto Tecnologie Didattiche. C.N.R.

"Bringing Stars into the Classroom"- A unique model for virtual courses

Yona Holtzman-Benshalom, Yoav Yair and Dafna Raviv
TAMID Project, The Open University of Israel, Tel-Aviv, Israel

Astronomy teaching is a challenge even to the veteran science teacher. It is a dynamic and changing field of science, where the constant flow of new discoveries require rapid and continuous updating of the study materials. Alongside the enormous popularity of astronomy and space science amongst children, are found many misconceptions and misinformation about their basic facts. Children may conceive explanations for natural astronomical phenomena from popular resources such as science fiction movies, video games, television series and informal internet resources (mostly on UFOs and aliens). There is an extensive literature on misconceptions in astronomy and their origins, which includes pedagogical ideas and recommendations of how to avoid them, and the most suitable teaching strategies at each age. Since astronomy was introduced into the science curriculum in Israel 6 years ago, there has been an intensive effort to train teachers in this field.

The course we describe here was designed for junior-high school science teachers, who have not received any formal training in astronomy and who have never before taught the subject in their classes. It was a 12-weeks hybrid course consisting of a few face-to-face meetings, independent -learning, and extensive on-line activities, using the Open University's Opus LMS (an internally developed, non-commercial, Hebrew-based set of web tools).

Initially, the course was focused on teaching the subject matter and on forming a active learning community. This involved educating the participants in the use of the course web-site which forms the central axis of their learning, by means of ongoing mentoring and moderating by the course tutors in the forums. The method of using specific repetitive activities such as "Ask the expert" or "What's up in the sky" have helped teachers overcome their initial shyness and lack of confidence, caused by their feeling of "not knowing anything in astronomy". By giving legitimacy to their questions, a shared resource of answers was rapidly built, shared and later used by the teachers themselves as an extensive data-base. The constant dialog about current celestial events (we were treated to a beautiful comet and a rare planetary conjunction) generated the enthusiasm and motivation to report observations, and teachers soon began to harvest updated astronomy news from the plethora of web resources and the popular media in general. Additionally, teachers were asked to come up with lesson plans, suggestions for overcoming hurdles in teaching and to respond to and discuss the products of their peers

The teachers became "advocates of astronomy" among their colleagues and soon started teaching the subject in their classes. They presented the feedback and questions of their pupils in the course online forums, and these were discussed and shared amongst the participants. Suggestions, comments and even compliments from their colleagues created a positive learning atmosphere. Consistent accompaniment of the course by subject experts has greatly eased the burden of first-time teaching processes and experiences (of astronomy), and the on-line mentoring was the attribute most noted by the teachers as being central and essential to fulfilling their expectations of the course.

A self-generated model of "learning on-line while teaching in the field" can be successfully implemented in content area courses other than Astronomy, as long as constant concern and care are given in balancing the amounts of basic subject material and didactic activities, with implementation tools and motivating assignments . Essentially, in the Astronomy field, that is what the teachers really need and may use , in order to bring the stars from heaven above down into their classrooms.

"Bringing Stars into the Classroom":

(A Unique Model for Virtual Courses for Science Teachers)

Yona Holtzman-Benshalom, Yoav Yair and Dafna Raviv
TAMID Project, The Open University of Israel, Tel-Aviv, Israel

Astronomy teaching is a challenge even to veteran science teachers. It is a dynamic and changing field of science, with a constant flow of new discoveries that require rapid updates to the study materials. The enormous popularity of astronomy and space science among children is too often mixed with conceptual errors and misinformation about the basic facts in these sciences. Children may conceive explanations for the natural astronomical phenomena from popular resources such as science fiction movies, video games, television series and informal internet resources (mostly on UFOs and aliens). There is an extensive literature about misconceptions in astronomy and their origins, with ideas and recommendations of what pedagogy should be used in order to overcome them, and what teaching strategies are best for each age. Since the introduction of astronomy into the science curriculum in Israel 6 years ago, there has been an intensive effort to train teachers in this field.

The course we describe here was designed for junior-high school science teachers, who have not received any formal training in astronomy and who have never before taught the subject in their classes. It was a 12-weeks hybrid course which consisted of a small number of face-to-face meetings, self-learning studies, and extensive on-line activities, using the Open University's Opus LMS (an internally developed, non-commercial, Hebrew-based set of web tools). Initially, the course was focused on teaching the subject matter and on forming a vivid learning community. This involved educating the participants to the use of the course web-site as the center axis for their learning, through constantly mentoring and moderating by the course tutors. Focused and regularly repeated activities such as "Ask the expert" or "What's up in the sky" have helped teachers overcome their shyness and lack of confidence, expressed by the feeling of "not knowing anything in astronomy". By giving legitimacy to their questions, a shared resource of answers was rapidly built, shared and later used by the teachers themselves as an extensive data-base.. The constant dialogue about current celestial events (we were treated to a beautiful comet and a rare planetary conjunction) created enthusiasm and motivation for reporting observations accordingly, and teachers soon began to harvest updated astronomy news from the plethora of web resources and the popular media in general. Additionally, teachers were asked to come up with lesson plans, suggestions to overcome hurdles in teaching and to mutually discuss the products of their peers.

The teachers became "advocates of astronomy" among their schoolmates and soon started teaching the subject in their classes. They brought the feedbacks and questions of their pupils into the online forums, and these were discussed and shared among the participants. Suggestions, comments and even compliments from their colleagues created a positive learning atmosphere. The constant escort by subject experts has greatly eased the burden of first-time teaching processes and experiences (of astronomy), and the on-line mentoring was the attribute most noted by the teachers as central and essential to fulfilling their expectations of the course.

A self-generated model of "learning on-line while teaching in the field" can be a successfully carried out for both Astronomy courses and any other subject matter courses proposed, as long as constant concern and care are given to balancing the amounts of basic subject material and didactic activities, with implementation tools and motivating assignments . Essentially, in astronomy teaching that is what the teachers really need and may use, in order to bring the stars from heaven above down into their classrooms.

An Empirical Study of the Learning Motivation, Satisfaction, and Effectiveness among Web-based Learners in Taiwan

Ti Hsu

Department of Business Administration

Tamkang University

Taipei, Taiwan, R. O. C.

E-mail: th4657@yahoo.com

Chihua Wang

Industrial Technology Research Institute, Taiwan R. O. C

Hsiu Fei Wang

Da Yeh University and New York University

ABSTRACT The present study investigated the relationships among e-learners' behaviors in terms of their motivation, satisfaction, and effectiveness. 139 college undergraduates enrolled in a business course offered in an internet learning environment called the VICAS System voluntarily at the National Taiwan University. The system was developed in house and contains six major parts, including course materials, multi-media capability, interactive testing, discussion forum, message, and personal notes. The findings indicated that there displayed strong correlations among the learners' motivation, their learning satisfaction, and their learning effectiveness. In addition, "richness" of the system was singled out as a critical factor for e-learning.

INTRODUCTION

E-learning may become one of the most popular and cost-effective ways of learning with traditional students as well as lifelong learners. This is because with e-learning, the "same place," the "same time" and the "same pace" type of learning is a way of the past. The "learner" is in full control over the time and place of his learning as well as the pace of the learning. She may at a click decide to joint a virtual community for a collaborative learning. Over 70 million people, according to Cisco, were learning on the internet as of 2001. One day, training of all kinds in this world will be available on the Web. In a global society, where knowledge is being viewed as a source of nation's health as well as its economic competitiveness, how to offer the best possible education or training and how to take advantage of lifelong learning opportunities become crucial.

Cooperative (collaborative) learning is one of the strong points in advocating e-learning. In the past, collaborative learning was not widely accepted because academic excellence was defined by individual achievement via competition. However, collaborative learning is now back on campus (Johnson, Johnson & Smith 1998; Stein & Hurd, 2000). It is believed that e-learning is most effective in collaborative means via learning communities (Alavi, 1994; Azmitia, 1988; Dillenbourg, et al, 1994; Goeller, 1998).

E-learning is one form of the distance learning and can deliver instructional materials to those who would like to learn on the internet. There are lots advantages of using internet for instruction, learning or training. For one, it is not restricted by the time and place of learning. In other words, it is available anywhere and anytime. For another, learners have the full control of the learning process in terms of the speed, contents, subjects, place and time. For yet another, both the learning and the instruction can be interactive. Besides, e-learning may deliver accessibility, opportunity, and accountability.

As Leidner and Jarvenpaa (1998) indicated that learning would be best achieved through an active involvement. Other researchers (Alavi, et al, 1995) also stated that for learning to be successful, course designing must be in such a way to encourage active student involvement beyond passive note taking. Murray (1938) was one of the first to call for the attention to the need of achievement as the desire to perform things well, to accept difficult challenges, to overcome obstacles, to excel in something, or to surpass others. As a result, many researchers (Asbury, 1974; Atkins & Raynor, 1974; Clarke, 1973; Griffore & Lewis, 1978; Matthews & Chan, 1980; Waters & Waters, 1986) attempted to develop achievement motivation instruments. Chiu's (1997) the School Achievement Motivation Rating Scale was also one of

BEST COPY AVAILABLE

these attempts. Pintrich, et al (1991) investigated learning motivation strategies to compare private and public thoughts and behaviors that might contribute to successful learning.

"Motivation theories are built on a set of assumptions about the nature of people and about the factors that give inpetus to action (Deci & Ryan, 1985, p. 3)" Most psychologists like to use the word of "motivation" to describe the process to deal with four things when it comes to learning and education. Those four things are used to 1) arouse and instigate behavior; 2) offer direction and purpose to behavior; 3) allow continually behavior to persist; and 4) lead to choosing or preferring a particular behavior (Wlodkowski, 1985).

There are in essence two types of motivation, namely, the extrinsic motivation, which was established in 1971 and was based on findings of numerous researchers in psychology, according to Skinner (1953), and the intrinsic motivation, which was first advanced by Deci (1971). The former refers to choose an activity for no compelling reason, beyond the satisfaction derived from the activity itself, while the latter deals with motivation to engage in an activity as a means to an end. Individuals who are extrinsically motivated work on tasks because they believe that participation will result in desirable outcomes, such as reward, teacher praise, or avoidance of punishment. It is the intrinsic motivation that this study is intended to focus on.

Deci in 1971 argued for the first time that extrinsic rewards not only could not provide any positive motivation, but also could undermine the intrinsic motivation in some activities because those activities could be intrinsically motivated by their very own nature. His general findings were later replicated by Lepper, Greene, and Nisbett (1973). Nevertheless, this school of thoughts has been continuously considered as the focus of controversy by researchers and practitioners. While the debate continues, this line of thinking has been expanded and can now be classified into three major types of theories. They are motivational theories (Deci, 1971, Deci & Ryan, 1980, 1985, 1991; Ryan, 1982, 1995), behavioral or cognative theories (Scott, 1975; Dickinson, 1989; Flora, 1990; Carton, 1996; Eisenberg & Cameron, 1996), and attributional theories (Kruglanski, 1975; Lepper, 1981; Lepper, Sagoysky, Dafoe, & Greene, 1982; Higgins & Trope, 1990).

Under motivational approaches, rewards are considered to have conflict effects (Deci, Koestner, Ryan ,1999). On the one hand, it is considered as controlling, meaning it may thwart satisfaction of the need for autonomy, and it may also, on the other, be considered as informational, thus offering satisfaction of the need for competence. That is why additional factors have to be added in order to be able to predict the likely effects of such rewards. Those factors may include, but are not lmited to, reward contingencies (Ryan et al, 1983), verbal rewards (Deci, 1971; Ryan, 1982), Symbolic cue value (Harackiewicz, 1979; Harackiewicz, Manaderlink, & Sansone, 1984), and interpersonal contexts (Ryan, 1982 ; Deci, Nezlek, & Sheinman, 1981; Deci, Connell, & Ryan, 1989; Deci &Ryan, 1991; Ryan 1995).

The users' behavior and the effectiveness of e-learning will always be one of the most important considerations in the success of the learning system. However, very few, if any, efforts have been devoted to the understanding of the application portion of the Web-based learning systems and environments despite the fact that substantial efforts have been devoted to the development and design of those teaching/learning systems and their infrastructure. Basically, we know very little about the e-learners and their behavior. This is especially the case in Taiwan. Besides, mobile learning is expected to be the next wave in online education, understanding the types of contents and the behavior of learners will help e-learning instructors, instructional developers, and administrators, if not the system designers, to take the challenges that wireless e-learning technologies will bring in the very near future.

The present research was designed primarily to examine the relationships between the learning effectiveness and the motivation as well the satisfaction among Web based learners in Taiwan. More specifically, the study was intended:

1. to assess the relationships between the learning motivation and the learning satisfaction among e-learners;
2. to evaluate the relationships between the learning motivation and the learning effectiveness among Web-based learners; and
3. to investigate the relationships between the learning satisfaction and the learning effectiveness among internet-based learners;

RESEARCH METHODOLOGY

The Learning Environment - the VICAS System.

The system was developed by Prof. Ming Chou Hong of the National Taiwan University for learning/training on the internet and has been in use for several years now. It basically contains six major parts, including course materials, multi-media capability, interactive testing, discussion forum, message, and personal notes. The system has the following features: asynchronization, multi-direction, individualization, and self-monitoring.

Subjects.

The sample consisted of 139 undergraduates (51 males) at the National Taiwan University who enrolled voluntarily in an "Introduction to Management" internet course. Of the total, 98 were business majors and the other 41 were none-business majors. 67 subjects were upper-level students and the other 72 were either freshmen or sophomores.

Instruments

The study utilized three instruments. They included the learning motivation scale, the satisfaction questionnaire, and the learning effectiveness scale.

The learning motivation scale was developed by Pan (1997) for his master's thesis and has been used in a number of occasions in Taiwan. They were totally 12 items and scored on a 5point Likert scale with 1 being not influenced at all and 5 being very influenced. Cronbach's alphas for the 12-item in this sample ranged from 0.8131 to 0.8540.

The learning satisfaction questionnaire was developed after an extensive evaluation of five different scales (Wu, 1992; Cheng, 1995; Lin, 1997; Shiao, 1998; Cooper and Bradshwaw 1999). The instrument had 16 items. The first 12 items were related to specific questions, such as the interconnectivity of the system, the interactions between the instructor and the students, the way the information was shared, the richness of the course materials, the way the final grade was assessed, the instructor's general attitudes toward e-instruction, etc. The other four items were to evaluate the overall satisfaction in the learning performance, the course quality, the learning environment, and the instructional method. They were also scored on a 5-point Likert scale with one being not satisfied at all and 5 being most satisfied. The Fishbein's Satisfaction Model was adopted here to accommodate the use of the learning satisfaction question. More specifically, subjects were asked about their learning satisfaction in terms of their anticipated satisfaction level and the actual satisfaction level. Cronbach's coefficients for the 16-item scale were 0.8613 for the anticipated satisfaction level and 0.8823 for the actual satisfaction level.

The third instrument modified Pan's (1999) Learning Effectiveness Scale to come up with 10 items. The scale was to measure the domain knowledge and concept, the abilities of decision-making, thinking, analytic, and language expression, interpersonal relations, communication skills, negotiation skills, collaborativeness, and the overall learning performance. It was based upon a three-point scale with one being learned a lot and three being learned very little and two being the neutral one.

Procedure.

At the outset of the semester when students were gathered face-to-face in their very first class, they were explained about the study and were asked to provide some general background information, including sex, major, the class year, and prior experience with computers, etc.

When the students gathered again face-to-face for the last class of the semester, they were administered the learning motivation scale, the learning satisfaction questionnaire, and the learning effectiveness instrument. In addition, during the course of the semester, students' participation in the discussion forum of the VICAS were monitored and recorded automatically by the VICAS system via its self-monitoring feature.

RESULTS

The 12-item learning motivation scale and the 9item learning effectiveness questionnaire (not counting the overall performance item) were factor analyzed, respectively. The former generated three separate factors, whereas the latter came up with two distinguished factors.

The three learning motivation factors were: 1) learning flexibility, which included six items and explained 27.82% of the variance; 2) richness of contents, which consisted of three items and had a 24.75% of variance explained; and 3) lack of pressure in learning, which was composed of three items and was able to explain 17.69% of the variance. Collectively, the three factors explained 70.26% of the total variance.

The two factors derived from the learning effectiveness questionnaire were: 1) socialization, which had five items included and explained 29.52% of the variance; and 2) ability, which consisted of four items and was able to explain 27.99% of the variance. Together, they were able to explain 52.51% of the total variance.

Satisfaction on	Flexibility	Richness	Pressure	Socialization	Ability
Learning outcomes	0.245**	0.311**	-0.064	0.347**	0.387**
Instruction Quality	0.207**	0.366**	-0.161*	0.303**	0.391**
Learning Environment	0.171*	0.235**	-0.074	0.231**	0.256**
Instruction Style	0.033	0.300**	-0.013	0.218**	0.229**

**p<0.01 *p<0.05

Table 1 Pearson Correlation Analysis

Results of a Pearson correlation analysis between the three-factor learning motivation and the two-factor learning effectiveness indicated that a strongly positive correlation (r=.43, p<.01) existed between "richness" and "ability" and that "flexibility" was weakly correlated to "socialization" (r=.196, p<0.05) and moderately correlated to "ability" (r=.357, p<.01). "Pressure" was not found to be statistically correlated to either "socialization" or "ability."

Table 1 presents the results of a Pearson correlation analysis between the learning satisfaction of the Fishbein model in terms of the last four items, namely the overall satisfaction on the learning effectiveness, the instruction quality, the learning environment, and the instruction style and the three-factor learning motivation and the two-factor learning effectiveness.

SUMMARY

Based upon the findings presented above, it was clear that there were positive correlations between the learning motivation and the learning effectiveness, between the learning motivation and the learning satisfaction, and between the learning satisfaction and the learning effectiveness, respectively.

A number of implications for the findings may be discussed here. First, among the three factors of the learning motivation, the richness was found to be positively and strongly correlated with all four factors of the learning satisfaction, as well as the ability factor of the learning effectiveness. In other words, for learners to be satisfied with the overall learning performance, instruction quality, learning environment, and instruction style, there should be enough information sharing; the contents should be rich enough, and the instructor should have a different teaching style and attitude toward e-learning than the traditional face-to-face learning.

Second, since all four learning satisfaction factors were found to be strongly and positively interrelated to the two learning effectiveness factors, the implications were simple and straightforward. Learners were not satisfied of the learning experience unless the system provided an opportunity for them to improve their abilities in decision-making, thinking, analytic, and/or the domain knowledge and concept, collectively referred to as the "ability," as well as their skills in interpersonal relations, communication, negotiation, language expression, and collaborativeness, classified together as "socialization."

Third, the strong correlations exhibited between the ability factor of the learning effectiveness and the lack of any strong correlations, positively or negatively, between the socialization factor of the learning effectives and the three learning motivation factors could only be interpreted one way. Students signed up for the course primarily to enhance their "ability" factor, not to strengthen their "socialization" factor, which was secondary in their learning objectives in this course. Since the system did help them achieve their primary goal, i.e., to enhance their "abilities," and that is why they were satisfied.

Finally, the fact that the pressure factor of the learning motivation was found to be not correlated to either the four satisfaction factors or the two learning effectiveness factors was not surprising and was understandable. This is because the learning was supposed to be taking place at any time, any place, and any pace. We were not surprised that "pressure" was not found to be a critical factor at all.

REFERENCES (partial list due to limited pages)

Alavi , M., Wheeler, B .C ., & Valacich, J. S . (1995) Using IT to reengineer business education: An exploratory investigation of collaborative telelearning .MIS Quarterly ,19: 293-312

Azmitia, M. (1988). Peer interaction and problem solving: When are two heads better than one? Child Development 59:87--96.

Dillenbourg, P.; Baker, M.; Blaye, A.; and O'Malley, C. 1994. The Evolution of Research on Collaborative Learning. http://tecfa.unige.ch/tecfa-research/lhm/ESF-Chap5.text

Goeller, Karen E. Web-based collaborative learning: a perspective on the future. Computer Networks and ISDN systems 30(1998), pp.634-635

Johnson, D. W., Johnson, R., & Smith, K. (1998). Active Learning: Cooperation in the College Classroom (2nd Ed.), Edina, MN: Interaction Book Company.

Pintrich, P.R., and Smith, D.A. F., Garcia, T., & McKeachie, W. J. (1991) A Manual for the use of the Motivated Strategies foe Research to Improve postsecondary Teaching and Learning.

Acknowledgements

This research was supported by a grant from the National Science Council of the Republic of China in Taiwan to the first author. The data presented, the statements made, and the views expressed are solely the responsibility of the author.

Instructional Design, On-Line Classrooms, and Disability

Abstract:

Brief Paper: This brief paper will provide instructional designers with practical suggestions for assisting students with disabilities in college classrooms. Furthermore, it will examine the similarities and differences between the Americans with Disabilities Act (ADA), Section 504 and 508 of the Rehabilitation Act, and these laws affect on instructional design. Included in the brief paper will be suggestions for instructional designers when designing an on-line or web-based class.

Description:

Since the first FTP file was sent circa 1991, the United States and many other countries of the world have been investigating new ways to send information over the realm of the World Wide Web. Many persons can easily send E-mail, perform a Web Search, and design Web pages using a multitude of software products. Universities have begun to explore ways to utilize the World Wide Web to educate and inform their students.

For students at college and universities campuses the use of the World Wide Web by professors is becoming common practice; professors have homepages where students can view syllabi, download readings, and see adjustments to the class schedule. Another example of instructors integrating of technology into classrooms is a class list-server. List serves are mailing lists used by all students in a particular class to post and send information relating to class material. Some instructors require all students participate in discussion on the list-serve for part of their overall course grade. Also, some professors do not collect papers in class anymore; they require the students to submit the papers using email attachments instead. A final example of how technology is being integrated into college and universities course are on-line classes that been developed to allow students to be at a distance and attend classes. Typically these classes utilize software as classroom management tools and include the following areas: discussion posting boards, file exchanges, email applications, course readings posted to the internet, uploaded power point presentation.

These above examples demonstrate how technology is being integrated into higher education. If the information age continues to grow exponentially, the future use of the World Wide Web as an informational and educational tool can be endless for college students. For most students, and professors, this technological integration has made their life simpler; attending classes without leaving the house, getting another copy of a syllabus without visiting the professor, having students view a video tape shown in class, or a web-cast of a lecture they had missed. Yet, for some students the advancement of technologies in the classrooms, either virtual or traditional, has caused distress. Disabled students sometimes have difficulty with the new technologies professors are using in their classrooms to present their course material. Difficulties can stem from not being able to read power point presentations professors project onto a screen, not being able to hear a video playing in a class, and not being able to comprehend information that is presented in large chucks on a computer screen.

Today, there are more students with documented disabilities in higher education than ever before -- 140,142 freshmen reported having a disability in 1996 which represents over 9% of all freshmen (HEATH Resource Center, 1998), as compared with only 2.6% in 1978 (HEATH Resource Center, 1995). The growth in the number of students with learning disabilities has created a new challenge to professors and colleges. Over the years, there has been considerable resistance by professors to alter the way they instruct, particularly if such alteration were to accommodate a student with a mental, as compared to a physical, disability. Many professors prefer that all students meet the same set of requirements, within the same time period, and in the same way, and are ill-prepared either to adapt their instruction to address the individual needs of students or to identify appropriate, fair, and reasonable accommodations (Thomas, 2000). This situation can be improved by the assistance of a university's Student Disability Services (SDS), or similar unit. However, such units often are inadequately funded, given the growth in the number of students requesting accommodation, and seldom have experts on staff who are knowledgeable about the wide range of disabilities that colleges are now attempting to accommodate (Thomas, 2000).

The term disability was modified in 1990, and is broadly defined by congress as "a term that should be used to describe conditions such as perceptual handicaps, brain injury, minimal brain dysfunction, dyslexia and developmental aphasia." Furthermore, Congress has defined a qualified handicapped persons as "an individual with a disability who, with or without reasonable modifications to rules, policies or practices, the removal of architectural, communication or transpiration barriers, or the provision of auxiliary aids, and services meets the essential eligibility requirements for the receipt of services or the participation in programs or activities provided by a public entity." These definitions allow universities to determine if a disabled person is a qualified handicapped person, and if they are, the university must provide accommodations to qualified persons. Thus, these items an instructional designer should become aware of to ensure the materials used in classrooms accommodate disabled students as defined by the law.

The Americans with Disabilities Act (ADA) of 1990, Section 504 of the and Section 508 of the Rehabilitation Act, are laws that exist to protect disabled persons from being discriminated against, and to assure that persons with disabilities are provided with reasonable and proper accommodations. A common theme for each of these laws is they were created, and have been modified, to protect persons with disabilities. Even with this common goal, these laws do have several differences that will be highlighted during the discussion. For example, ADA is designed as an umbrella law, and all United States private and public agencies must comply with the rules and regulation of ADA. The provisions outlined in section 504 only apply to federal agencies and private agencies that accept federal funding (29 U.S.C. § 794(a)). An example of a private institution required to comply with section 504 is a research university that accepts National Science Foundation grants. Finally, section 508 compliance has only been set for federal websites, an example would be the National Aeronautic and Space Administration website.

The main goal of ADA, 504, and 508 are to provide disabled persons with reasonable accommodations and allow them to function at, or near, the same level of non-disabled persons. Currently, the interpretations of these laws intertwine with the moral obligations of society, and form a 'gray area'. In terms of an on-line environment, the moral issue of knowing the University must provide reasonable accommodations for disabled students enrolled in programs the University offers, yet there are no litigations which state technology used outside or during of a face to face is required to be assessable to students. Thus, an interpretation of the gray area can be "it has not been shown that not providing accommodations for disabled students who take classes with technological components is in violation of the law, thus we are doing nothing wrong."

In the context of this brief paper, technology will be defined as materials and devices used by the instructor that goes beyond the traditional lecture. Thus, this brief paper will examine how to modify advanced technology to ensure disabled students are provided the same learning opportunities as non-disabled students. Advanced technology would be considered data posted to websites, projected computer images, on-line classrooms, web-based learning, computer programming software, and list-serves.

The concentration of the brief paper will focus on advanced technology and the considerations instructional designers need to developing course that involves those types of technology. There are solutions, which fit these laws that instructional designers can utilize when technology is incorporated into learning environments to assist student who are visually impaired students, hearing impaired students, and students who have language-processing disorders. For example, when posting a reading to a class website, either in an on-line classroom or a traditional classroom, ensure that the information can be printed in Braille, if not add the proper HTML code to ensure students who are visually disabled can read the information. Another example would be to have all Power Point slides available in printable format for students prior to discussions. This would allow students with disabilities to have a copy of the material in front of them in a format in which they can follow along with the classroom discussion.

Instructional designers need knowledge of disability law so they are able to consider those aspects when designing courses that involve advanced technology. Furthermore, instructional designers need to have knowledge of what should be done to help disabled students in higher education classrooms. These two components will be the start of better instructional design that allows disabled students to excel in college classrooms.

References:

Americans with Disabilities Act of 1990, 42 U.S.C. § 12102 et seq. (1998); title II, § 12131 et seq. (1998); 28 C.F.R. §§ 35.101-35.191 (1998); title III, § 12181 et seq. (1998); 28 C.F.R. §§ 36.101-36.608 (1998); Appendix A to Part 36 (Standards for Accessible Design 1998).

HEATH Resource Center. (1995). College Freshmen with Disabilities. Washington, DC: American Council on Education.

HEATH Resource Center. (1998). Profile of 1996 College Freshmen with Disabilities. Washington, DC: American Council on Education.

Thomas, Steven B. College Students and Disability Law. The Journal of Special Education. Vol.33. NO.4. 2000, pp. 248-257.

The Value of Community Building in an Online Classroom

Debbie Hu

Higher education is changing. The method for education has begun to shift from traditional classroom delivery to at home delivery; better known as online learning. This paper explores changes occurring in the higher education system in relationship to online learning and community building. Many persons involved in traditional classes can have an easier time forming a community of learners among themselves and their professors. Yet, in online classes, variables such as proximity of students can cause difficulty in building community. If an online classroom lacks community it is more prone to students' failing, conflict, problems, frustration for both students and faculty (Lindner 2002). This paper explores some of the problems and solutions for building an online community, and the positive effects community can have on both the students and faculty in online classes.

The reality of online education is that it favors a transition from traditional notions of academic community toward a much narrower, transactions-based model; which is defined as the psychological and communications space between learners and instructors (Moore as sited in Rovai, 2002). Transactional distance is relative and different for each person. Thus, the pedagogy of faculty members in a distance education course needs to change from a teacher-centered approach to being student-centered (Strain, 1987; Beaudoin, 1990; 1998; Berge, 1998). In traditional higher education, a "community of scholars" was a place where the student was mentored as an apprentice and eventually became a co- investigator in research and creative activity. Though, from the student's perspective, the social and physical distance of online education seems to make students need clear, precise, objectives-oriented curricula which may represent a narrowing of education, and may make them unlikely candidates for collegial work on faculty research projects (Online Classrooms 1999). In 1997, T.H. Murphy noted that the instructional effectiveness of distance education is comparable to that delivered on campus. For distance education programs to be successful they must provide "for appropriate and sufficient synchronous and asynchronous interaction between faculty and students and among students" (Murphy, 1997, p. 8).

An obstacle for students in online classes is the physical separation of the students. Separation has a tendency to reduce the sense of community, giving rise to feelings of disconnection (Kerka 1996), isolation, distraction, and lack of personal attention (Edelstein 2002). This could affect student persistence in distance education courses or programs. Tinto (1993) emphasized the importance of community and theorized that students will increase their levels of satisfaction and the likelihood of persisting in a college program if they feel involved and develop relationships with other members of the learning community. The importance of community is supported by empirical research. Wehlage, Rutter and Smith (1989) found that traditional schools with exemplary dropout-prevention programs devoted considerable attention to overcoming the barriers that prevented students from connecting with the school and to developing a sense of belonging, membership, and engagement. The key finding of their report is that effective schools provide students with a supportive community. Finally, Ashar and Skenes (1993) discovered that learning alone appeared strong enough to attract adults to the program, but not to retain them.

Research provides evidence that strong feelings of community may not only increase persistence in courses, but may also increase the flow of information among all learners, availability of support, commitment to group goals, cooperation among members, and satisfaction with group efforts (Rovai 2002). Additionally, learners benefit from community membership by experiencing a greater sense of well being and by having an agreeable set of individuals to call on for support when needed (Rovai 2002).

It is important to clearly state what community means within the context of this paper. We will define community as: a group of people who are socially interdependent, who participate together in discussion and decision making, and who share certain practices that both define the community and are nurtured by the community. Furthermore, community is an environment in which people act in a cohesive manner, continually reflecting on the work of the group while always respecting the differences individual members bring to the group (Rovai 2002). Yet, an online education community can be viewed as what people do together, rather than where or through what means they do them, community becomes separated from geography, physical neighborhoods, and campuses (Wellman, 1999). Advocates of online education argue that an academic community of scholars could be enhanced through technology. Palloff hypothesized that in principle it is possible to maintain and extend values such as mentoring and co-investigation by means of telecommunications.

There are many advantages to creating a sense of community for the online student. This paper will discuss three advantages. First, students who are engaged in collaborative activities are more likely participate within an online community. For example, online discussions within small groups or learning sets offers a powerful environment for adult learning as it enables members to reflect on each other's experience and to engage in a collaborative tasks. In such groups there is likely to be a high sense of presence and a growing sense of community (Hammond 2000). Furthermore, Royal and Rossi (1996) suggest that learners' sense of community is related to their engagement in school activities, with students who have a higher sense of community being less likely to experience class cutting behavior or thoughts of dropping out of school and more likely to report feeling bad when unprepared for classes.

Second, students who have support are more likely to complete their online course and contribute to the online community. Aviv (2000) states that the supportive interaction process occurs when every member helps each other, gives feedback on processing, reflects on the effectiveness of the community, and advocates effort.

Finally, students who participate in online communities will be more receptive to other academic points of view. For example, Hammond's (2000) research on online discussion forums indicated students using community forums keep an open mind on the value of different types of knowledge, take a critical stance to theoretical knowledge, reflect and seek dialogue and debate with others in the community. These discussions can promote and support participation among students in the online class.

We explored online communities to help students become empowered to build online relationships with other participants in the learning environment. This paper examined three community building activities. First, using collaborative activities such as online discussions to increase a sense of community among students. Second, students gaining support from the community to increase interaction among students thus decreasing the student failure rate. Finally, using forums as a mean to support knowledge perspective taking among students.

References:

Aviv, R. (2000). Educational Performance of ALN via Content Anaylsis. *Journal of Asynchronus Learning Networks,* v4, n2.

Beaudoin, M.R. (1998). A new professorate for the new millennium. *DEOSNEWS* 8 (5), Article 98-00004. Retrieved June 30, 2002 from http://www.outreach.psu.edu/ASCDE/DEOS.html

Berge, Z.L. (1998). Changing roles of teachers and learners are transforming the online classroom. *Online-Ed* August 30, 1998, Article 74. Retrieved June 30, 2002 from http://www.edfac.unimelb.edu.au/online-ed

Edelstein, Susan, and Edwards, Jason. *If you Build It, TheyW ill Come: Building Learning Communities Through Threaded Discussions.* Retrieved July 3, 2002. http://www.westga.edu/%7Edistance/ojdla/spring51/edelstein51.html

Hammond, Micheal. *Communication with Online Forums: The Opportunities, The Constraints and the Value of a Communicative Approach*. Computers & Education; v35 n4. p 251-62. December 2000.

Kerka, Sandra, and Micheal E. Wonnacott. *Assessing Learner Online: Practitioner File.* " ERIC Clearing house on Adult, Career, and Vocational Education (ERIC/ACVE).

Lindner, James, Dooley, Kim, Kelsey, Kathleen. All for One and One for All: Relationships in a Distance Education Program. *On-Line Learning of Distance Learning Administration.* Retrieved July 3, 2002. http://www.westga.edu/%7Edistance/ojdla/spring51/linder51.html

Miller, W.W., & Webster, J. (1997, December). *A comparison of interaction needs and performances of distance learners in synchronous and a synchronous classes.* Paper presented at the American Vocational Association Convention, Las Vegas, Nevada.

Murphy, T. H. (1997). Five factors to evaluate distance education programs. *NACTA Journal, 42*(3), 6-10.

Creating Online Learning Communities. Online Classroom Apr 2002. p. 7. Feature Article.

Schifter, Catherine. Perception Differences About Participaitng in Distance Education. *On-Line Learning of Distance Learning Administration.* Retrieved July 3, 2002 from http://www.westga.edu/%7Edistance/ojdla/spring51/schifter51.html

Strain, J. (1987). The role of the faculty member in distance education. *The American Journal of Distance Education* 1 (2): 61-65.

Tinto, V. (1993). Leaving College: Rethinking the Causes and Cures of Student Attrition (2nd ed.) Chicago: University of Chicago Press.

Rovai, Alfred (April, 2002). Building Sense of Community at a Distance. *International Review of Research in Open and Distance Learning*: 3, 1

Wehlage, G.G., Rutter, R.A & Smith, G.A. (1998) *Reducing Risk: Schools as Communities of Support.* New York: Falmer Press.

Wellman, B. & Kahne, J. (1993) The Network Basis of Social Support: A network is More than the Sum of its Ties. In B. Wellman (Ed.). *Networks in the Global Village.* P. 1 – 48. Boulder, CO: Westview Press.

On-line Simulations for Health Care Providers

Introduction

This paper will describe the development and implementation of interactive on-line continuing education modules for health care providers. The interactive framework, extensive use of links, pre- and post-testing, and evaluation of outcomes will be featured.

The Internet has become a source for health related continuing education. However, continuing education for health professionals on the Internet must be critically evaluated by the user. Many of these offerings consist of reproduced journal articles or other text-based content. Some of the sites provide few links and offer little or no interactivity.

To address the need for quality continuing education of health care providers, on-line modules were developed as part of a grant-funded nurse practitioner learning project. The feasibility of on-line learning for health professions included the results of a nurse practitioner (n=187) survey of computer availability and skills, topic preference, and their potential for taking on-line continuing education. More than 80% of the respondents had Internet access, and 71% had basic Internet skills. The majority of the respondents indicated their computer met the minimum standards to access an on-line course. Fifty percent of the respondents were very interested in taking an on-line continuing education course. Although the modules were designed from the nurse practitioner data, the modules are appropriate for physicians, physician-assistants, and other allied health professionals.

Designing the Modules

Two modules were designed to be interactive, realistic, self-study simulations that closely resemble clinical practice. "Acute Low Back Pain," and "Common Dermatological Problems in Primary Care" were selected as the topics for development. A preview of the modules is available at http://www.nursing.twsu.edu/clp. This preview was designed to allow learners to explore the modules prior to registration.

The development of the learning materials includes identification of learning objectives, pre-test and post-test construction, extensive search of the Web for related sites, and development of a comprehensive bibliography for further study. In order to establish communication with the learners, the instructors include a brief biographical sketch with photographs. E-mail links for each instructor are provided. An optional area is provided for learners to input information about them and practice as well as questions and comments about the continuing education modules. This is an attempt to establish a learning community for potential communication with one another and the instructors. A "help" section is available for the students who may have technical problems with the program. This link is on-line directly to the educational specialist who assisted with the development of the modules. Following the construction of the modules, each module was submitted to a panel of expert reviewers. Revisions were made based on the expert reviewers' evaluation of the modules.

Learners are guided through the process from registration to completion with on-line submission of the post-test. The course overview presents the learning objectives, the instructors biographies, the module bibliography and related sites, and then explains the structure of the modules. The learner links to the on-line registration process which provides verification of credentials for awarding of continuing education credit. In addition, the registration questionnaire contains additional demographic information and on-line education preferences. The pre-test is automatically graded and the learners immediately receive their scores. The authors elected not to share the answers of the pre-test with the learners until completion of the post-test.

The learner is then directed to begin the case studies. The dermatology module presents 25 brief patient scenarios with presenting history and an image of the condition. The learner is asked to submit the diagnosis and receives immediate feedback. Links are provided for management, additional images, and patient information for each dermatologic condition. "Acute Low Back Pain" contains two extensive, interactive patient case simulations that take the learner through the assessment, diagnosis, and management of the low back pain patient in primary care. Following completion of the case simulations, the learner completes the post-test and electronically submits the answers. The learner must pass with an 80% rate in order to earn their continuing education credit. The modules have been further developed for academic graduate credit ranging from one to three credit hours.

Evaluation

The survey information obtained from the registration submission help to determine a demographic profile of users and motivation for on-line education. To date, 50 learners have completed the modules with others currently enrolled. All learners are Registered Nurses, ranging in age from 25 to 59 years, with learners residing across the United States and internationally. A broad range of nursing specialties are represented including staff nurses, graduate students, directors of nursing, clinical nurse specialists and nurse practitioners. Analysis of data reveals significant differences between the pre-test and post-test knowledge scores.

Learner comments are submitted electronically through an evaluation form and are reviewed for attitudes toward on-line continuing education, satisfaction with the completed module, and the potential for further use. Learners evaluated the modules as innovative, time saving, convenient, available, and economical. Learners particularly liked the case study approach, use of graphics, and the extensive links to other quality web sites. These comments provide feedback for revision of the current modules and future development of additional modules. Outcome data are currently being collected online and will be analyzed for efficacy of this delivery system for continuing education. These data will be analyzed and presented.

Conclusions

Competency-based learning is a preferred method in advanced practice nursing education. Through the use of interactive case studies, we were able to offer time pressed health professionals opportunities for continuing education. The future of on-line continuing health education is dependent on well-structured, interactive, and challenging programs as well as the accessibility and the skill of the user.

Web-Based Instruction—Its Impact on Higher Education

Pei-Wen Nicole Huang
National Huwei Institute of Technology, Taiwan
huang_nicole@hotmail.com

Yung-Hoh Sheu
Kung Shan University of Technology, Taiwan
uu2789@ms52.hinet.net

Abstract: A review of the literature and related research concentrates on the area of Web-based instruction is presented in this paper. An overview of Web-based instruction, including its impact on the higher education learning environment, emerging roles for instructors, synchronous and asynchronous learning environments, and creating learning communities are presented in the section.

Introduction

A review of the literature and related research concentrates on the area of Web-based instruction are presented in this paper. An overview of Web-based instruction, including its impact on the higher education learning environment, emerging roles for instructors, synchronous and asynchronous learning environments, and creating learning communities are presented in this section.

Impact on Higher Education Learning Environments

Web-based instruction (WBI) is defined as an innovative approach for delivering instruction to a remote audience using the World Wide Web as the instructional delivery.system (Khan, 1997). It has been used not only in exclusive distance programs but also in supporting face-to-face traditional classroom instruction. Angulo & Bruce (1999), stated in Innovative Higher Education that in 1996 the University of Georgia engaged WBI to supplement their traditional course offerings. Numerous other colleges and universities, such as the University of Colorado at Denver, the University of California system, State University of New York, Arizona State, and other independent "Virtual Universities" where students can apply for admission, register for courses, purchase books, and attend classes without ever visiting a physical place on campus, have launched similar or more extensive programs (Palloff & Pratt, 1999).

Corresponding to the statement by McIsaac & Gunawardena (1996) that distance learning is the fastest growing form of education, there will be a continued expansion of web-based technologies in higher education. As the web will be increasingly used as a teaching and learning medium, it is important to consider the emerging roles of instructors and its learning environment (Shotsberger, 1997).

Emerging Roles for Instructors and Learners in the Web-based Instruction

A number of authors perceived that the instructor's role in a Web-based setting requires a different set of skills than those employed in a traditional face-to-face classroom. According to McIsaac (1995), the role of the teacher of tomorrow will not be an actor of transmission of just consumption, but will become a facilitator of learning and research as a whole process. Duchastel & Turcotte (1996) argued that we may well see a tremendous growth in informal and out-of-class learning, and the impact of this growth will shift the power in the classroom where the instructor is no longer necessarily the expert. The role of the teacher will shift toward a greater emphasis on guidance and mentoring *(*Thiele, Allen, & Stucky, 1999; Duchastel & Turcotte, 1996*)*. The instructor no longer dispenses knowledge but, rather, guides the student's pursuit of knowledge and provides technical support as educational facilitator (Palloff & Pratt, 1999; Shotsberger, 1997). Rohfeld & Hiemstra (1995) also indicated that the most important role of the online instructor is to model effective teaching and accept "the responsibility of keeping discussions on track, contributing special knowledge and insights, weaving together various discussion threads and course components, and maintaining group harmony" (p. 91).

Those characteristics of instructor roles also corresponding to Berge & Collins' (1996) assertion that categorized the various tasks and roles demanded of the online instructor into four general areas: pedagogical, social, managerial, and technical. They described the pedagogical function as one that revolves around educational facilitation. The social function is the promotion of the friendly social

BEST COPY AVAILABLE

environment, which is essential to Web-based learning. The managerial function involves norms in course setting, pacing, objective setting, and decision making. The technical function depends on the instructor first becoming comfortable and proficient with the technology being used and being able to transfer that level of comfort to the learners.

Shotsberger (1997) mentioned that formalizing and tailoring the interactive environment in the Web-based instruction is considered one of the instructional roles. From a constructivist view, interaction is an important means by which learners construct meaning. Students with higher levels of interaction have more positive attitudes and higher levels of achievement (Thiele, Allen, & Stucky, 1999). By developing Web-based instruction, faculty can create an interactive learning environment that changes the old paradigm of instruction from one of "shoveling knowledge" at the students to one of guiding students through collaborative learning experiences (French, Hale, Johnson, & Farr, 1999; Denning, 1999).

Synchronous and Asynchronous Learning Environments

Eastmond (1995) proclaimed that learners should be given the opportunity to interact, to reflect, and to apply their individual experience in the learning. Also, interactive learning is taking place when the instructor merges both synchronous and asynchronous interactive teaching and learning methods in the Web-based instruction. Berge & Collins (1996) also pointed out that both synchronous and asynchronous interaction teaching and learning methods can be structured as one-to-one (email), one-to-many (listserver managed group), and many-to-many (bulletin boards and dedicated computer conferencing systems).

Relan & Gillani (1997) articulated that WBI offers a new sensibility and means of social interaction employed toward learning. With WBI, cooperative learning extends beyond one classroom to potentially every classroom. Synchronous communication that allows for live interaction (Berge & Collins, 1996) takes the form of interactive messaging systems like computer conferencing tools and chatrooms (Khan, 1997). All participants must be present online at the same time in order to interact. When many people do so, the text on the screen can scroll along at a furious pace with the discussion having much of the flexibility of the spoken word. Harasim, Hiltz, Teles, & Turoff (1995) stressed "The synchronicity of online interactions allows participants time to reflect on a topic before commenting or carrying out online tasks" (p. 27).

Asynchronous communication allows for time-independent interaction that ranges from simple email discussions between individuals that require only the participants have access to an electronic mailbox to feature-rich groupware programs like listserves or bulletin boards (Berge & Collins, 1996). Participants do not have to be online at the same time in order to interact and can do so from any location in which they have access to a networked computer with the appropriate client program.

Theoretically, Web-based learning is available at any hour in which the participant has the ability to access a networked computer. Participants who have access from work, home, or another convenient location may find courses taught by computer conferencing easier to accommodate around work and family responsibilities (Berge & Collins, 1996). Relan & Gillani (1997) also claimed, "the ability of the instructor and students to communicate privately or collectively in a synchronous or asynchronous manner lends a new dimension to the design of instructional strategies" (p. 45). In spite of providing interactive synchronous or asynchronous methods in the Web-based learning environment, Westrom & Pankratz (1997) further stated "the purpose of email, discussion groups, and web pages is to enable communication. These technologies, when combined with procedures designed to facilitate cooperative learning, can lead to the building of learning communities" (p. 2).

Creating a Learning Community

Palloff & Pratt (1999) described the importance of community in the electronic classroom: "In distance education, attention needs to be paid to the developing sense of community within the group of participants in order for the learning process to be successful. The learning community is the vehicle through which learning occurs online" (p. 29). They further concluded that in order to create a successful online learning experience, "the instructor in an online class is responsible for facilitating and making room for the personal and social aspects of an online community" (p. 76). Berge and Collins (1996) referred to this function as "promoting human relationships, affirming and recognizing student's input; providing opportunities for students to develop a sense of group cohesiveness, maintaining the group as a unit, and in other ways helping members to work together in a mutual cause" (p. 7).

Palloff & Pratt (1999) revealed that if a participant logs on to a course site and there has been no activity on it for several days, he or she might become discouraged or feel a sense of abandonment. The situation is related to Berge & Collins' (1996) assertion that

The advantage of computer conferencing includes interaction at a distance with other students and

> the instructor, rather than studying alone. A virtual community can be built that provides support and encouragement and promote sharing among the participants and can help overcome the isolations of remote areas. (p. 4)

A major finding of Gunawardena's (1995) research pointed out the crucial role of the instructional facilitators of computer conferences in creating a sense of community and collaboration among users. Hiltz (1994) also stated three basic principles concerning the instructor's role in distance instruction for establishing and maintaining a learning community: be responsive, be competent online, and organize the interaction. Hill & Raven (2000) recently conducted empirical research examining the best techniques/strategies to enhance learning and community building in WBI. Their results outlined four main categories: atmosphere, foundation, communication, and technology. The technique of atmosphere is to provide a safe on-line environment that learners perceive to be a space where open communication can occur. The foundation strategy is to create structural dependence and organization to assist learners in overcoming information overload, establish patterns, and set expectations to anticipate certain types of communication. Communication strategy is to encourage learners to keep in touch with others and apply technology techniques to provide flexibility in terms of facilitating multiple learning and interactions and minimize glitches.

Web-based learning is sometimes referred to as asynchronous interactivity or asynchronous learning network (Mayadas, 1997), and is defined as people network, anytime, anywhere learning. Romiszowski (1997) concluded the real meaning and importance of WWW networks consisting of computer networks, conversational networks, information networks, and conceptual networks.

Conclusion

Currently, WBI is growing faster than any other instructional technology. The potential collaborative and interactive benefits of WBI have recently caught the attention of institutions of higher education in a profound way. However, WBI is only a delivery mechanism for designing a learning context to individuals. The various aspects of quality, accountability, productivity, and access of WBI had been discussed constantly. Some authors were concerned that critical issues need to be examined before WBI is adopted into university practices, yet many pedagogical factors and theoretical guidelines involved in WBI require to be investigated fully for the success of WBI (Harasim et al., 1995; Berge, 1999).

Reference

Angulo, A. J., & Bruce, M. (1999). Student perceptive of supplemental Web-based Instruction. Innovative Higher Education, 24 (2), 105-125.

Berge, Z. (1999). Interaction in Post-Secondary Web-based learning. Educational Technology, Jan., 5-11.

Berge, Z., & Collins, M. P. (1996). Facilitating Interaction in Computer Mediated Online Courses. Paper presented at the FSU/AECT Distance Education Conference, Tallahassee, FL. [Online]. Available: http://www. Emoderators.com/moderators/flcc.html

Duchastel, P., & Turcotte, S. (1996). On-line learning and teaching in an information-rich context. Proceedings of the Ineti'96 International Conference, Montreal, Canada.

Eastmond, D. V. (1995). Alone but together: Adult distance study through computer conferencing. Cresskill, NJ: Hampton Press.

French, D., Hale, C., Johnson, C., & Farr, G. (Eds.). (1999). Internet based learning: An introduction and framework for higher education and business. Sterling, VA: Stylus Publishing, Inc.

Gunawardena, C. N. (1995). Social presence theory and implications for interaction and collaborative learning in computer conferences. International Journal of Educational Telecommunications, 1 (2/3), 147-166.

Harasim, L., Hiltz, S. R., Teles, L., & Turoff, M. (1995). Learning networks: A field guide to teaching and learning online. Cambridge, MA: MIT Press.

Hill, J. R., & Raven, A. (2000, October). Online learning communities: If you build them, will they stay? Poster session presented at the ITFORUM. [On-line]. Available: http://it.coe.uga.edu/itforum/paper46/paper46.htm

Hiltz, S. R. (1994). The virtual classroom: Learning without limits via computer networks. Norwood, NJ: Ablex Publishing Corporation.

Khan, B. H. (1997). Web-based instruction (WBI): What is it and why is it? In B. H. Khan (Ed.), *Web based instruction* (pp. 239-244). Englewood Cliffs, NJ: Educational Technology Publications.
Mayadas, F. (1997). Asynchronous learning networks: A Sloan foundation erspective. Journal of Asynchronous Learning Networks, 1 (19), 1-16.

McIsaac, M. S. (1995). Fusion of communications and computing technologies: Impact on Teachers' education. [On-line]. Available: http://seamonkey.ed.asu.edu/~mcisaac/emc523old95/gaby523/finrs.html

McIssaac, M. S., & Gunawardena, C. N. (1996). Distance education. In D. H. Jonassen (Ed.), Handbook of research for educational communications and technology (pp.403-437). New York: Simon and Schuster.

Palloff, R. M., & Pratt, K. (1999). Building learning communities in cyberspace:effective strategies for the online classroom. San Francisco, CA: Jossey-Bass Publishers.

Relan, A., & Gillani, B. B. (1997). Web-based instruction and the traditional classroom: similarities and differences. In B. H. Khan (Ed.), Web based instruction (pp. 41 - 45). Englewood Cliffs, NJ: Educational Technology Publications.

Rohfeld, R. W., & Hiemstra, R. (1995). Moderating discussions in the electronic classroom. In Z. Berge & M. P. Collins (Eds.), Computer Mediated Communication and the Online Classroom: Vol 3. Distance Learning (pp. 91-104). Cresskill, NJ: Hampton Press.

Romiszowski, A. J. (1997). Web-based distance learning and teaching: Revolutionary invention or reaction to necessity? In B. H. Khan (Ed.), Web based instruction (pp. 25- 34). Englewood Cliffs, NJ: Educational Technology Publications.

Shotsberger, P. G. (1997). Emerging roles for instructors and learners in the web-based instruction classroom. In B. H. Khan (Ed.), *Web-based Instruction* (pp. 101-103). Englewood Cliffs, NJ: Educational Technology Publications.

Thiele, J. E., Allen, C., & Stucky, M. (1999). Effects of Web-based instruction on learning behaviors of undergraduate and graduate students. Nursing and Health Care Perspectives, 20(4), 199-209.

Westorm, M., & Pankratz, T. (1997). Creating collaborative communities online. [On-line]. Available: http://star.ucc.nau.edu/~hauweb97/ papers/ westrom.htm

Breaking the unbreakable: addressing the need for cryptanalysis

William J. Hunter

Network security research

Some time ago, the world of Internet security was brought to life by the seminal work of Clifford Stohl, The Cuckoo's Egg. More recently, books have begun to appear that provide good general introductions to cryptography (e.g., The Code Book by Simon Singh) and to network security more generally (e.g., Secrets and Lies: Digital Security in a Networked World by Bruce Schnier. When Stohl told his story of uncovering a major espionage ring that was using university computers as conduits for the invasion of military computers, one of the most remarkable features of the tale was the complete absence of knowledgeable authorities within the police community, including military intelligence and the FBI. Another critical part of the story was the cavalier attitude of many university-based system administrators who might not even know that the computers they installed came with built-in accounts that had standardized usernames and passwords (which was well known in hacker communities).

Much has changed in the dozen years since Stohl's book was published. Singh's account of the history of "the evolution of secrecy from Mary, Queen of Scots to quantum cryptography" draws on resources from the Second World War that are only now becoming public knowledge. Schnier puts cryptography into a broader social context of network security that indicates both that we have come a long way since Stohl's adventures and that we are still a very long way from anything like adequate security in most computing environments. The questions are of sufficient general interest that a major novel, Cryptonimicon by Neil Stephenson, has drawn heavily on both public key cryptography and a fictionalized account centering on the cracking of Enigma in the Second World War. Finally, the fact that international baccalaureate student Aaron Suggs based his theory of knowledge essay (http://www.ktheory.com/write/extendedessay.htm) on this very topic is one concrete example of the potential for student interest in cryptography as an area of inquiry.

Objectives for a new line of inquiry

The current argument that public key cryptography has given us the capacity to develop unbreakable codes rests on estimates of the amount of computing power/time required to decode an encrypted message. The reasoning seems sound, but the assertion that unbreakable codes exist has been made repeatedly throughout history but eventually those codes succumbed to the efforts of analysts. Nevertheless, there is good reason to take the current claims seriously. If we do so and if we believe that a balance between code-breaking and code-making is important to the success of democratic systems of government (e.g., the ability to defeat Nazism or the potential to uncover terrorist plots), then it becomes important to consider what will be necessary to restore that balance. Among other things, we need to begin work that will

- develop network security as a new area of inquiry in educational technology,
- evoke discussion on critical issues regarding education for and about network security not only for education but for social and political policy,
- provide a basis for informed decision making regarding education for and about network security, and
- establish a body of work that would inform course development in this area.

Proposed directions

The lessons of Turing's Bletchley Park project suggest that many diverse talents can be put to use in the development of a cryptanalytic team. Likewise, it seems likely that cryptanalysis and cryptography could serve as useful integrative themes for an interdisciplinary teaching unit that might be used, with different levels of complexity, at several grade levels. There is already an existing body of children's fiction that is based on code-making and code-breaking concepts that dates back to Edgar Allan Poe's short story, The Gold Bug. Working from this literary base, it is clear that social studies questions around the nature of community, conflict, cooperation and crime could be developed. Further, the connections to history (Bletchley Park, e.g.,) are clear and intriguing as Aaron Scuggs work reveals. Similarly, the use of numeric and algebraic tools in the process of making and breaking codes would provide links to concepts in math curricula and the automating of algorithms for code-breaking is a natural introduction to computer science. Connections to DNA research could relate the study to both biology and chemistry. The final version of this paper will include a delineation of a potential curriculum plan.

Part of the rationale for developing such a curriculum is that it might serve to introduce more students to genuinely interesting and socially useful applications of mathematics. If we are to make a dent in the invulnerability of quantum cryptography, we will need to have substantially more bright minds considering the possibilities of new algorithms that would demand significantly fewer calculations, thus rendering it possible for computers to crack codes in a fraction of the times now projected. This is a long term project that, if successful, might see a payoff many decades into the future. It is thus even more important that the curriculum would raise awareness of the social issues involved in having totally secret communications systems.

Raising the level of concern and debate about such questions will be a prerequisite to developing the kind of problem solving culture the code-breaking will require, but it also would focus attention on the need to avoid succumbing to a sense of futility regarding the potential for evil-doers to benefit from unlimited secrecy. That is, a secure code is only a small part of a secure communications system. Governments will need to be aware of other possibilities for preventing or interrupting conspiratorial communications. A brief discussion of some such possibilities and their educational and policy implications will be a part of the final paper.

Much of this presentation has assumed that the readers have the benefit of good and benevolent government, but civil libertarians could be equally concerned about the potential for government secrecy (or government invasions of privacy) to be as problematic as the potential for crime or terrorism. This is an equally compelling reason for importance of restoring equilibrium (or at least tension) between our capabilities for cryptography and our capacities for cryptanalysis. It would seem, then, that objectives and directions proposed here would have near universal appeal; however, it is quite likely that this will not be the case at all. Strong cryptography has developed in recent years largely to meet the demands of commercial interests wishing to conduct business securely on the Internet. People involved in Internet commerce, both producers and consumers, are likely to see any weakening of the security of Internet transactions as a threat to commerce. While this may be true, I will argue that this threat is more perception than reality, that equilibrium serves commercial interests as well, and that, in the final analysis, commercial losses are a fair price to pay for the security of the social order.

ONLINE COURSES, TEACHING AND DEVELOPMENT EXPERIENCES

Larisa Enríquez Vázquez
Productos Interactivos
DGSCA UNAM
Mexico
larisa@piaget.dgsca.unam.mx

Alma Ibarra Obando
Productos Interactivos
DGSCA UNAM
Mexico
alma io@servidor.unam.mx

Berenice Ramírez Toledo
Productos Interactivos
DGSCA UNAM
Mexico
bere@piaget.dgsca.unam.mx

Abstract

We consider that there are two basic problems to solve when a face-to-face teacher decides to incorporate his course to an online system:

- the content's development and
- the role the teacher must assume because of the delivering technology.

Each of these have issues to be considered. While the content's development stage requires an interdisciplinary team to assist the teacher graphically, didacticly and ergonomically, the facilitator who instructs an online course deals with the student's new role and his personal circumstances as well as the new learning environment.

During this presentation we will talk about the main problems and solutions we faced to develop, deliver and instruct on-line courses.

Introduction

Distance education systems represent a huge opportunity for those people who, for whatever reason, cannot attend a classroom (geographic, health, work schedule limitations).

In this educational system, the computer and specifically the Internet, are becoming very popular. Secondary educational courses, masters degree programs, certificates, etc., are all offered as web-based courses.

The Academic Computer Center is, among other things, responsible for bringing computers and telecommunications training to the Mexican population. In order to reach more people from different states, as well as those who are unable to attend a classroom, training at a distance has become an important goal for the institution.

The Interactive Products department is focused on developing online learning materials as well as research and helping teachers adapt the curricula and its contents for the web.

Even though web-based courses are constantly increasing, we are just beginning to establish development standards as well as new didactic strategies focused on this media. We are aware that a lot of people are working on this objective and that is why we are considering the sharing of our experiences and ideas.

Content

The Interactive Products department was founded in 1997 with the goal to develop supportive online learning and teaching materials, for the face-to-face courses given at the Computer Centre.

The main reasons for this decision were:

- free teachers from spending too much time developing supportive materials
- facilitating teachers and students supportive materials accessible at all times
- research on educational applications using the new technologies

In two years, on-line tutorials, educational games, quizes and simulators were developed by the department.

The success obtained by the use of these enhanced the research and development of other educational materials. Teachers and researchers came to us for assistance and training to generate on-line materials. As time passed, we saw that training and teaching at a distance was a trend for the university, and becoming stronger each day.

Our first on-line course was a pilot project and was given internally in our department. Conceptual maps was the subject to be taught, in order to know a little bit more about the teaching strategy that teachers were talking about.

The first step was to collect data (from articles, books and on-line materials). Then we decided the curricula to be covered during the three weeks course (aproximately, 30 hours). The next important step was to write the introductory notes for each unit; they were brief notes along with articles, on-line resources and activities to enhanced independent study. At this point, we began to build the interface and to programm the interactive applications that were needed. A graphic designer, an interface designer and a programmer were responsible for these activities.

The website's architecture was simple and easy to use. There were basically two screens. The main screen had general information about the course, and the second screen (after logged in) had several options: instructions, agenda, group information, discussion forum, mail service to the teacher, blibliography, activities and units.

The course started with 20 people, most of them had never taken an on-line course before neither did we had taught at a distance either. The main problems the tutor had to deal with, were:

- Because the course was an obligatory one for all members of the team, some of them were not really interested on the subject.
- Even though all people in the department work with computers and Internet, they were not familiar interacting as a group through the web.
- Most of the persons were not used to studying independently.
- It was difficult to motivate students to interact through the forum and to follow discussions.
- Most people didn't pay attention to the agenda or the deadlines.

Taking into consideration these experiences, we built two more internal courses: UNIX and JavaScript. This time they were not obligatory and only those people interested in the subjects were registered.

We added another option for those students that wanted to review the units already seen and designed more activities to be done through the forum.

In order to offer the first three courses to the public, we had to answer some questions about online instruction.

- How do we administer our time in order to help all students?
- How many e-mails do we respond to daily?
- Which is the optimum way of moderating an online discussion?
- How do we promote students' interaction in the forum?
- How often do we need to participate or ask new questions to be discussed?
- When do we use the e-mail and when do we use the forum?
- How can we make students meet their deadlines?

Even though every online course is different and every teacher and student has their own teaching and learning style, we felt, based on our experiences, that there were some important issues to be considered and that will help answer the questions above:

Independent Study. The online courses we have developed are based on independent study. We encouraged students to read, analyze, investigate, experiment and discuss, in order to construct knowledge. That is why it is important to let the student face the problems, to be a facilitator instead of a tutor; he should provide guidance and not solve problems.

Follow-up. When a student sends an e-mail to the facilitator, it is very useful that he receives a "received message" from the facilitator. Another issue that needs to be tracked is "activity". It is common that at the beginning of the course, students start very enthusiastically, but as the course progresses, they participate less. It is then that the facilitator should encourage them to be active and not passive; by asking them if there are any problems or by proposing a discussion or an activity.

Discussion Forum. This space is designed for students to interact as a group; they will be able to exchange messages, experiences and doubts. It will help student feel part of the group along the course. The tutor follows the discussions and participates when he thinks it is necessary (solving a general doubt, bringing up new questions and maintaining the discussion).

E-mail. Students that need or want to interact exclusively with the tutor are encouraged to use e-mail, either to solve a specific question, to comment on any task or to send assignments. It is very important to specify, at the beginning of the course, the amount of time and specific hours that the tutor will be available, in order to have time to do other activities acide from tutoring.

Evaluation. In order to verify a student's progress and his achievement, several problems to be solved are presented; the level of complexity of each of them increases as the course advances and, at the end, they must develop a project that integrates the most important concepts reviewed and that are related to his daily activities.

Results

The results obtained were satisfactory, so we decided to establish this architecture as a model for the next online courses . At this moment we have seven online courses and four online tutors. It is important to mention that a face-to-face teacher tried to teach at a distance but did not develop the skills needed to interact with students and did not feel comfortable with online teaching. Also we found several teachers that did not finish developing the courses' contents because, either, lacked the time or lacked motivation and commitment.

The following table shows the average results obtained on six courses:

Registered students	111
Students that finished the course	83
Students that obtained the certificate	80
Students that registered on another course, after the first experience	11

Conclusions

- It is convenient to have an interdisciplinary team to develop online courses.
- It is important that institutions support teachers developing online content, giving them time and, in some cases, money for their work.
- An optimal learning environment involves not only instructional materials, but also the interface design, its usability and interactivity.
- Optimal learning environments enhance students to enroll again to an online course.
- Online facilitators must be trained.
- Feedback and interactivity are key elements to success in an online course.
- Even though students need to change their learning skills, they are ready to make the effort to adapt and incorporate to online courses.

Bibliography

Tony Bates (1997) *Technology, open learning and distance education*, Routledge studies in Distance Eduaction. ISBN 0-415-12799-8

Robert C. Bogdan, Sari Knopp Biklen (1998). *Qualitative research in education*. Allym & Bacon. ISBN 0.205-27564-8

David W. Brooks (1997) *Web-teaching, a guide to designing interactive teaching for the world wide web.* New York, plenum publishing. ISBN 0-306-45552-8

Manuel Gándara, (1995). *Desarrollar o no desarrollar: E ahí el dilema*, en Álvarez-Mailla y Bañuelos , Coords., pp. 17-42. CISE/UNAM.

Jakob Nielsen (1999) *Designing web usability: The practice of simplicity.* New Riders Publishing

Colin McCormack, David Jones *Building a Web-based Education System*, 1997, John Wiley & Sons ISBN 0471191620

The Web Learning Fieldbook: Using the world wide web to build workplace learning environments, Jossey Bass ISBN 0787950238

William K. Horton. *Designing web-based training: How to teach anyone anything anywhere anytime*. 2000, John Wiley & Sons

Preservice Teachers Assess Credibility and Cognitive Load Associated with Websites

Marie Iding
University of Hawaii
Department of Educational Psychology
Honolulu, HI 96822, USA
miding@hawaii.edu

Martha E. Crosby
University of Hawaii
Department of Information and Computer Sciences
Honolulu, HI 96822, USA
crosby@hawaii.edu

E. Barbara Klemm
University of Hawaii
Department of Teacher Education and Curriculum Studies
Honolulu, HI 96822,USA
klemm@hawaii.edu

Abstract In order to discover a potential relationship between instructional interventions and the judgments, confidence, and perceived cognitive load of preservice teachers, we performed a study to examine different instructional methods aimed at facilitating preservice teachers' judgments about the credibility and cognitive load aspects of Web-based resources. Participants were ask to rate whether the web sites were considered objective and accurate, mistaken, or purposely misleading and give reasons for their decision both prior to and after different instructional methods. We found that the confidence ratings varied considerably but the judgments themselves did not. This gives educators hope that evaluation skills may be taught that are general enough that students can apply them to a variety of web sites.

Introduction

As the use of resources from the World Wide Web become more prevalent in today's classrooms at all levels, the need for critical evaluation skills is increasingly important. In our research, we have examined differences between scientists' and preservice teachers' ratings of the credibility of different information sources for learning scientific information and found some interesting differences (Klemm, Iding, & Speitel, 2001). We have also carried out instruction in Web evaluation with high school biology students (Iding, Landsman, & Nguyen, in press) and university-level preservice teachers (Iding & Klemm, 2002), and we have examined differences between preservice teachers and computer science students in their judgments of credibility of Web-based resources (Iding, Auernheimer, Crosby, & Klemm, 2002). In the present paper, we briefly describe findings from this line of research and propose a new study that will examine an instructional intervention aimed at facilitating preservice teachers' judgments about the credibility and cognitive load aspects of Web-based resources.

Research Review

In previous research we compared preservice teachers and scientists' ratings of the credibility of a number of different kinds of information sources for scientific information, including weekly newsmagazines, information from the Internet and resources from museums (Klemm, Iding, & Speitel, 2001). We found interesting differences between scientists' and preservice teachers' ratings. For example, scientists attributed a higher level of credibility to a scientist researching a topic. In contrast, preservice teachers attributed higher credibility ratings to information sources like TV newsmagazines, while scientists rated them less highly. In our conclusion, we argued for the need for instructional interventions.

In subsequent research, we carried out several sessions of instruction with high school biology students about evaluating the credibility of Websites and the science information contained in them (Iding, Landsman, & Nguyen, in press). After instruction students reported that they would spend more time assessing the credibility of websites in the future, provided lists of criteria for assessing websites that were more comprehensive than when they were pretested, and reported increased confidence about their critical evaluation skills with respect to web-based science information.

In other research, we worked with university-level educational psychology and computer science students. We asked them to rate the accuracy and objectivity of information on websites (related to class topics) and their confidence in their abilities to effectively evaluate course-relevant information effectively on the World Wide Web and generally (Iding, Auernheimer, Crosby, & Klemm, 2002). We found that educational psychology students rated their ability to assess the validity of information in their field more highly than computer science students, but educational psychology students rated their ability to assess the validity of information on the Web less highly than computer science students. Notions of website authors' vested interests seemed particularly problematic for some students. We called for the importance of further instruction and research in this area (Iding, Crosby, Auernheimer, & Klemm, 2002).

In another instructional study, we worked with preservice teachers in educational psychology classes to determine what criteria they use when evaluating science websites for credibility and cognitive load (Iding & Klemm, 2002). To provide some background, the concept of cognitive load is particularly relevant to learning effectively with multimedia and media-rich environments, such as those presented on Websites. Chandler and Sweller's (1991) and Sweller and Chandler's (1994) work provides the foundation for much of the current work in this area. Specifically, they argued that cognitive load can be increased and negatively impacted when instructional formats create needless redundancies (i.e., "redundancy effects") or foster integration from multiple, separate information sources (i.e., "split attention effects"). Other factors can contribute to detrimental increases in cognitive load as well, including distracting multimedia effects.

Instructional Intervention

We believe that in addition to making effective judgments about the credibility or validity of information, it is also important for future teachers to be selective and informed about the most effective types of multimedia for students, as it cannot be assumed that because a website or other information sources. Therefore, in this study, in addition to studying we gave preservice teachers a brief introduction to aspects of cognitive load related to instructional formats.

First, we asked students to provide preliminary lists of criteria that they use when determining whether to use information from a website. We provided students with a brief introduction to the concept of cognitive load and to website evaluation criteria that we derived form the work of Farah (1995) and Rader (1998) and adapted in the work of Nguyen (2000) and Iding, Landsman and Nguyen (in press). Then, students worked in pairs to evaluate and rate actual websites for credibility and cognitive load, and in small groups, they engaged in a brainstorming activity around effective credibility criteria. Lastly, we asked them to create rubrics for students assessing the credibility of Website information, and for teachers determining the cognitive loads associated with Websites. Our findings indicated that students had some useful and interesting ideas for rubrics, however our instructional intervention was short and the rubrics created by some students for assessing cognitive load included credibility criteria as well.

In the present research, we describe interventions with preservice teachers. In these intervention methods, we provide specific instruction over several sessions for activities related to helping them develop effective strategies for assessing credibility and cognitive load/multimedia aspects of Websites. In addition to fostering effective credibility judgments (and effective ways to teach this important aspect of technological and scientific literacy to their students), our goal is to also investigate effective ways for them to assess cognitive load associated with websites and multimedia presentations that they might select for their students.

Acknowledgements

This research was supported in part by ONR grant no. N00014970578 awarded to M. E. Crosby and DARPA grant NBCH1020004. We appreciate the participation of graduate students at the University of Hawaii, Manoa.

References

Chandler, P., Sweller, J. (1991). *Cognitive load theory and the format of instruction. Cognition and Instruction, 8,* 293-332.

Farah, B. (1995). Information literacy: retooling evaluation skills in the electronic information environment. *Journal of Educational Technology Systems, 24(2),* 127.

Iding, M. K., Auernheimer, B., Crosby, M. E., & Klemm, E. B. (2002, May). Users' Confidence Levels and Strategies for Determining Web Site Veracity. *Proceedings of The WWW 2002: The Eleventh International World WideWeb Conference.*

Iding, M. K., Crosby, M. E., Auernheimer, B., & Klemm, E. B. (2002). Critical evaluation skills for web-based information: "Lies, damned lies" and web-based information. *Proceedings of the ED-MEDIA 2002: World Conference on Educational Multimedia, Hypermedia & Telecommunications.*

Iding, M., & Klemm, E. B., (2002, July). Teachers critically evaluate scientific information on the World Wide Web. Research presentation at the International Reading Association World Congress on Reading, Edinburgh, Scotland.

Iding, M., Landsman, R., & Nguyen, T. (in press). Critical evaluation of scientific websites by high school students. *WCCE (World Conference on Computers in Education) 2001 Conference Proceedings.* The Netherlands: Kluwer Academic Publishers.

Klemm, E. B., Iding, M., & Speitel, T. (2001). Do scientists and teachers agree on the credibility of media information sources? *International Journal of Instructional Media 28(1),* 83-91.

Nguyen, T. T. (2000). *OASIS: Student Evaluation Methods for World Wide Web Resources.* Unpublished master's thesis, University of Hawai'i, Honolulu, Hawaii, U.S.A.

Rader, H. (1998). Library Instruction and Information Literacy. *Reference Service Review, 26(3/4),* 143.

Sweller, J., & Chandler, P. (1994). Why some material is difficult to learn. *Cognition and Instruction, 12(3),* 185-233.

Trust and the Internet: Findings from the HomeNetToo Project.

Linda A. Jackson, Gretchen Barbatsis, Alexander von Eye, Frank Biocca,
Yong Zhao and Hiram E. Fitzgerald
Michigan State University

HomeNetToo is a longitudinal research project funded by the National Science Foundation to examine the antecedents and consequences of home Internet use in low-income families in the United States.[1] Participants in the project are African American and European American families who agreed to have their Internet use continuously recorded, complete surveys at multiple points during the 18-month project, and participate in home visits during which instruction on how to use the Internet was provided. In exchange, participants received home computers, Internet access, and in-home technical support. Among the antecedents of Internet use considered in the project were trust-related beliefs about the Internet. In this report we focus on relationships between trust-related beliefs, demographic characteristics and Internet use. Structural equations modeling is used to describe these relationships.

Trust has long been recognized as a core personal characteristic that influences a broad range of behaviors (Erikson, 1963). Yet despite recognition that trust is a "quintessentially human trait," much of the research on trust in a networked society has focused more on the technology than on the people who use it. Technological fixes to concerns about trust have filled research agendas. But as May argued (2000), this emphasis on "things" rather than on people will never resolve the central issues surrounding trust in a digital world. Similarly, Rosenbloom (2000) closed the introduction to the Communications of the Association of Computing Machinery special issue on trusting technology with this comment: "answers to questions about technology-mediated trust might ultimately depend on changing human attitudes and behavior - a challenge certainly greater than any of those involving technology alone."

Research and public opinion polls support the view that trust is a critical issue in the future of Internet, and in the use of technology in general. A Gallup poll (February, 2000) reported that half of U.S. Internet users have serious concerns about the trustworthiness of the Internet, particularly about privacy and security of information. A later report by the Pew Internet & American Life Project (August, 2000) found that both users and nonusers of the Internet have serious concerns about privacy. Similarly, the UCLA Internet Reports (2000, 2001) revealed deep concerns about privacy, the ease with which children can access inappropriate content, and the trustworthiness of information on the Internet. In the HomeNetToo project we examined trust-related beliefs about the Internet and how beliefs related to actual Internet use.

Methods

Participants and Procedures

Participants in the HomeNetToo project were 117 adult residents of a low-income, mediumsize urban community in the mid-western United States. Participants were primarily African American (67%), female (80%), never married (42%), and earning less than $15,000 annually (49%). The majority reported having some college education (49%) or earning a college degree (13%). Average age of participants was 38.6 years old. Surveys completed at pre-trial, three months, and nine months included measures of trust-related beliefs about the Internet and demographic characteristics. Internet use was automatically server-logged throughout the project period.

Measures

Four measures of Internet use are considered in this report: time online (minutes/day), number of Internet session (log-ins/day), number of unique Web domains visited (per day), and number of e-mails sent (per day). Internet use measures were divided into two time intervals: Time 1: months 1-6; Time 2: months 7-12.

The five trust-related beliefs about the Internet were as follows: There is no privacy on the Internet; Most of the information on the Internet is true; No one can find out what you're doing on the Internet; Children can come to harm if they use the Internet; Using the Internet can cause health problems. Five-point rating scales were used; higher values indicated stronger agreement with the belief statement. Because there was no change in trust-related beliefs between pre-trial and later assessments (i.e., three months and nine months), only pre-trial measures are considered in this report.

Also measured at pre-trial were demographic characteristics (i.e., gender, race, age, income, education) and previous experience using the Internet, assessed by four questions (e.g., How would you rate the extent of your experience with the Internet? 1=no experience, 5=a great deal of experience).

Results and Discussion

Relationships between trust-related beliefs and Internet use are presented in Table 1. During the first six months of home Internet access, believing that most of the information on the Internet is true was *negatively* related to all measures of Internet use. Believing that no one can find out what you're doing on the Internet was *negatively* related to number of Internet sessions and number of e-mails sent. Believing that using the Internet can cause health problems was negatively related to number of domains visited and number of e-mails sent.

Table 1: Relationships between trust-related beliefs and Internet use

	Time online (minutes)	Number of sessions	Number of domains visited	Number of e-mails sent
Time 1 (1-6 months)				
There is no privacy on the Internet.	.11	.15	.17	-.05
Children can come to harm if they use the Internet.	-.01	-.04	-.08	-.19
Most of the information on the Internet is true.	-.19*	-.28*	-.24*	-.30*
Using the Internet can cause health problems.	-.13	-.15	-.22*	-.36*
No one can find out what you're doing on the Internet.	-.09	-.20*	-.11	-.26*
Time 2 (7-12 months)				
There is no privacy on the Internet.	.20*	.20*	.22*	.20*
Children can come to harm if they use the Internet.	-.07	-.15	-.07	-.17
Most of the information on the Internet is true.	-.29*	-.29*	-.31*	-.55*
Using the Internet can cause health problems.	-.14	-.23*	-.20*	-.23*
No one can find out what you're doing on the Internet.	-.21*	-.24*	-.21*	-.22*

Note. Numbers are correlations (Pearson) between belief measures and log transformations of Internet use measures. *p<.05.

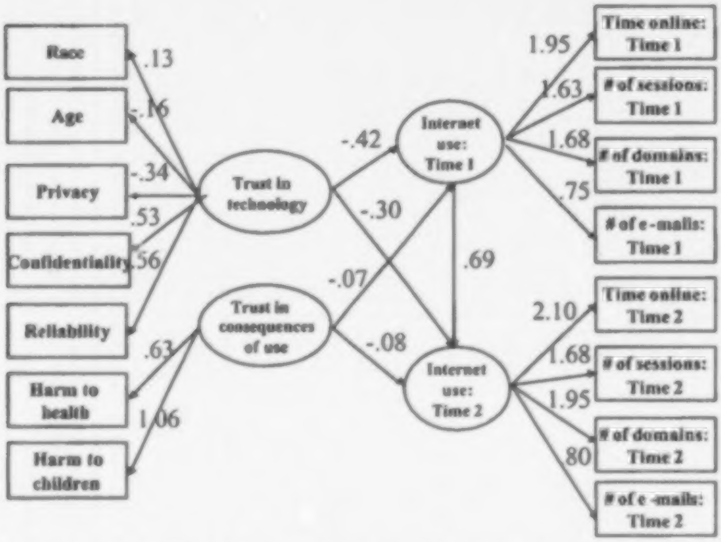
During the next six months, *negative* correlations between believing that most of the information on the Internet is true and using the Internet were stronger than during the first six months. Similarly, believing that no one can find out what you're doing on the Internet was again *negatively* related to Internet use, not only to number of sessions and number of e-mails sent, as during the first time interval, but also to time online and number of domains visited. Believing that there is no privacy on the Internet was related *positively* to all measures of Internet use during time interval 2, relationships that were not significant during time interval 1. Finally, believing that using the Internet can cause health problems was again negatively related to number of domains visited and number of e-mails sent, as in time interval 1, and also to number of Internet sessions.

Race differences in Internet use were obtained at both time intervals. During the first six months, African Americans participated in fewer Internet sessions (M=.70) than did European Americans (M=1.21; F(1,108)=6.83, p<.01). Race differences were more pronounced during the second time interval. African Americans spent less time online (M=38.08), participated in fewer Internet sessions (M=.41), visited marginally fewer domains (M=8.43), and sent fewer e-mails (M=.14) than did European Americans (Ms=45.61, 1.00, 15.61, .99, respectively; F(1, 114)=5.83, p<.05, F(1,114)=8.56, p<.01, F(1,114)=3.10, p<.08, F(1,114)=4.96, p<.05, respectively).

Age differences were only marginally significant during the first six months of home Internet access. Older participants (age 38 and above) engaged in somewhat fewer Internet sessions (M=.68), and visited fewer domains (M=7.94) than did younger participants (Ms=1.07, 12.27, respectively; F(1,108)=3.65, p<.06, F(1,108)=3.02, p<.09, respectively). Age differences were more pronounced during the second time interval. Older participants spent less time online (M=30.66), participated in fewer Internet sessions (M=.49), and visited fewer domains (M=8.80) than did younger participants (Ms=52.67, .74, 13.07, respectively; Fs(1, 114)=4.65, 4.60, 5.13, ps<.05).

Previous experience using the Internet was only modestly related to Internet use. During the first six months, participants with more experience spent somewhat more time online (r=.18, p<.07), visited more domains (r=.21, p<.05), and sent more e-mails (r=.25, p<.05) than did less experienced participants. During the second six months, more experienced participants spent more time online (r=.20, p<.05) and visited more domains (r=.20, p<.05) than did less experienced participants.

Structural equations modeling was used to explore relationships among trust-related beliefs, previous experience, demographic characteristics and Internet use (LISREL, 8.2, Joreskog & Sorbom, 1991). The model presented in Figure 1 is the result of exploratory rather than confirmatory analysis of a theory-based model. Nevertheless it provides a moderately good fit to the data ($\underline{P}^2(81)=166.81$, $\underline{p}<.01$, RMSEA=.096, AGFI=.76, NNFI=.85). Moreover, tests of alternative models indicated that none was statistically or conceptually a better fitting model (i.e., changes in PNFI < .06).


Race
Age
Privacy
Confidentiality
Reliability
Harm to health
Harm to children
.13
-.16
-.34
.53
.56
.63
1.06
Trust in technology
Trust in consequences of use
-.42
-.30
-.07
-.08
Internet use: Time 1
Internet use: Time 2
.69
1.95
1.63
1.68
.75
2.10
1.68
1.95
.80
Time online: Time 1
# of sessions: Time 1
# of domains: Time 1
# of e-mails: Time 1
Time online: Time 2
# of sessions: Time 2
# of domains: Time 2
# of e-mails: Time 2

In the model the effects of race and age on Internet use are mediated by their effects on trust-related beliefs about the Internet, specifically, beliefs about privacy, confidentiality, and reliability of information. African American and older participants were more trusting of the technology than were European American and younger participants (respectively), and this trust was related to less Internet use at both time intervals. There was also a tendency for participants who believed that using the Internet may have negative consequences for children and health to use it less, but these effects were not statistically significant. Thus, participants who distrusted the technology but did not believe that using it would harm children or health used it more than did participants who trusted the technology but were concerned about its impact on children and health.

References

Erikson (1963). Childhood and society (2nd Ed.). New York: Norton.

May, T (November 13, 2000). The Digital Economy's Future Banks on Trust. http://www.computerworld.com/cwi/story/0,1199,NAV47_STO53904,00.html

Pew Internet & American Life Project. (2000a). Trust and Privacy Online: Why Americans want to rewrite the rules. (August, 2000). Pew Foundation, 1100 Connecticut Avenue, Washington, DC. http://www.pewinternet.org/reports/toc.asp?Report=19

Rosenbloom, R. (2000). Trusting technology. Communications of the ACM, 43, 31-32.

UCLA Internet Report (2000). Surveying the digital future. UCLA Center for Communication Policy. University of California, Los Angeles, CA. www.ccp.ucla.edu

UCLA Internet Report (2001), UCLA Center for Communication Policy, University of California, Los Angeles, CA. http://www.ccp.ucla.edu/pages/NewsTopics.asp?Id=29

Footnotes

[1] This research was supported by a National Science Foundation-Information Technology Research Grant, #085348, September 1, 2000 to September 30, 2003. Linda A. Jackson, Principal Investigator.

[2] Additionally, 140 children of the adult participants described in this report participated in the project.

[3] Other server-logged measures of Internet use were obtained but are not considered in this report (e.g., names of domains and chats visited).

BEST COPY AVAILABLE

mSupport -- supporting the mobile student

Di James and Nathan Bailey
Flexible Learning and Teaching Program
Monash University

Abstract

Portals provide a valuable mechanism for providing a unified, personalised environment for accessing information -- a one stop shop for students to manage their relationship with the University. Increasingly, however, institutions are looking for ways to disseminate key information to students, while taking care to avoid information overload. This paper explores the way that technologies such as SMS (mobile phone text messaging) and workflow can allow students to direct crucial information, including academic information, in the way that is most convenient for *them* to receive them.

Introduction

Portals are a proven technology and are increasingly used in higher education for learning and teaching, research, staff and student support and administration. They will almost certainly be a part of any Information Technology architecture that is established in the higher education sector, to manage the appropriate, relevant and secure collection, storage, publishing and access and dissemination of information (Information Management). Other technologies that can contribute to the dissemination of information and provide efficient cost and time alternatives to email are emerging as adjuncts to institutional portals. The use of text messages sent to mobile phones (SMS) is an example.

Monash University now uses SMS to distribute examination results at the end of each semester, in conjunction with the online release of results accessed via the university portal. We propose to investigate the use of SMS for additional academic, administrative and social functions. We are however concerned that issues related to Information Management, including privacy and security need to be addressed.

mContact -- taking advantage of a highly 'mobile' demographic

The ownership of mobile phones in Australia is now 69% and there is a higher % ownership among young (15-24) and middle (25-49) age individuals.
(http://www.tnsofres.com/apmcommerce/product.cfm)

The use of text messages by young mobile phone users in Australia prompted an interest several years ago in testing the viability of this medium for communication with students. Consequently, Monash University piloted what was quite possibly a world-first in distributing unit results directly to student's mobile phones. SMS has now been successfully implemented as a cost effective and highly appealing distribution channel for student administrative information. This service continues to be one of the most popular services we offer to students, with continuing positive feedback every semester. Now institutions are starting to look at how to use this valuable avenue for disseminating other kinds of information.

We speculate that the very strong acceptance of text messaging by students could indicate that it has a role to play in other areas, as well as supporting additional administrative functions. General email to class lists requires login to a computer and is often ignored, but SMS is immediate and personal and has the potential to be a more attractive medium for communication with students. Uses might include communication of assignment information, topics, venues and social activities, by teaching staff within individual subjects or courses. It could also be used to comment on topics, readings or current events that come to hand during semester. Pilot programs are now being established to test the potential within higher education of SMS in conjunction with institutional portals to extend functionality and increase effective communication

Some of the issues that arise are related to security and privacy and to the emerging concern with information management systems within higher education generally.

Information dissemination

Much of our support for students is in response to their needs, rather than actually being proactive and taking the information they need to them. Messaging and workflow technologies provide the opportunity for students to profile the information they want, in they way they want it, thereby allowing the University to be much more proactive in information dissemination.

Some courses are beginning to establish announcement forums, either in email or discussion groups. However, such forums can be regarded by students as generic announcement emails, and students ignore them. It would appear that there is no sense of the gravity of the issues or the areas of interest to the recipients.

Technology offers two promising solutions toward this need – choice of content, and choice of forum. Some information is essential for participation in a unit of study (e.g. the time/location of the mid-semester test has changed), other information is merely helpful for those students who choose to pursue it (e.g. "there is another reading on this topic at this URL"). However, it is not always clear what information students regard as urgently important and what information they would prefer to browse at their leisure. Students need to be empowered not only to choose what information they receive, but how they receive it. Instead of them feeling overwhelmed with information that is only of passing interest to them, they should be able to process specific items exactly as they wish to.

This could be achieved using SMS messages (i.e. text messages to mobile phones) and Workflow (i.e. the workflow component on my.monash). In terms of workflow, many of the processes we complete both in our jobs and in learning and teaching can be set up as a series of steps that allow each person involved in the process to pick it up from their in tray, do their bit, and pass it on to the next person's in tray. Sometimes we do this by email, sometimes we do it by phone, but (sadly) often we do it by paper forms that are subsequently entered in to a computer!

Electronically supported workflow ensures that the information is stored electronically, the status of the task is identifiable to everyone involved in the process and the task is automatically distributed to the next person or group of people who need to participate in the process. In increasing transparency to the entire process, students can be sure that their form/request wasn't just "lost in the mail" but has actually been actioned with an identified outcome.

Such workflow could be useful for requesting/granting extensions, proposing/responding to social events (e.g. RSVP for course/department BBQ.

Advantages

Monash has 45,000 students enrolled over 8 campuses – 6 metropolitan or regional Australian campuses and 2 offshore (in Malaysia and South Africa) and frequently studying off campus. Mobile information dissemination is equally as important as mobile academic content delivery. The university portal, online content and use of SMS for administrative services provides for much of the successful management of information services including academic services. An exploration of the use of SMS to provide additional support for academic delivery and student/teacher communication is now seen as potentially beneficial for both enhancing communication and for cost effectiveness.

The cost of publishing to the web and bulk SMS services to nominated phone numbers is highly competitive, compared with the cost of producing and posting hard copy to students, particularly when many are off campus.

Issues

Some of the issues that arise are related to:

- the obvious requirement that technology supports, not drives, learning - core academic activity must be facilitated, not undermined, by technological developments – but innovation must be supported to determine the potential of new technologies.
- security - SMS messages are sent to a mobile phone number nominated by the student. There is some concern that unauthorised persons could have access to the phone and therefore to confidential information (eg exam results). This issue has been managed by ensuring that students read the

security and privacy information when they nominate to receive confidential information via SMS and sign off on a disclaimer.

- privacy – The matter of keeping records of transactions with students, their access to records and the somewhat 'ephemeral' nature of SMS is somewhat more difficult to manage. In this context, it *relates to more* general issues of information management that are currently of concern to higher education institutions - data storage, collection and dissemination, publishing and access to information etc.
- equity – Use of particular technologies that rely on student ownership of equipment must be considered in the context of any disadvantage caused by students choosing not to use, or being financially or physically unable to use the equipment
- the emerging concern with information management systems within higher education generally.

Conclusion

The use of SMS to mobile phones provides a cost advantage for the delivery of administrative information to students. While this is an obvious benefit to both students and the university and will continue to be used, the use of SMS and other emerging communications technologies for academic purposes needs to be considered carefully and creatively. The place of these technologies in the emerging Information Management systems architecture will also need to be considered along with appropriate policy development.

E-Learning Strategic Planning Utilising a Work Systems Framework

Sam Jebeile
Division of Economic and Financial Studies
Macquarie University
Australia
Sam.Jebeile@mq.edu.au

Associate Professor Robert Reeve
Division of Economic and Financial Studies
Macquarie University
Australia
Robert.Reeve@mq.edu.au

Abstract: This paper examines the various work system elements that should be considered by school administrators when developing e-Learning strategies in traditional teaching and learning contexts. Focus group interviews were conducted with teachers in a secondary school in Sydney, Australia in order to identify the work system elements involved when using the Web for student-centred learning activities. The findings of the analysis are provided and the associated implications for the development of school e-Learning strategies are also discussed.

Introduction

The 'information revolution' has forced most OECD economies into an era which demands 'knowledge workers' for the 'knowledge economy' (OECD 1996). As a result, schools are placed in a situation requiring reassessment of their methods of practice, adapting and improving teaching and learning for the changing needs of a global, digital, and networked economy. While global spending on e-Learning in educational institutions is increasing at unprecedented rates (OECD 1998), the pressing problem for school administrators is that the rate of adoption by teachers across all sectors of education has lagged significantly behind that of industry (Leidner & Jarvenpaa 1995). Latham (1998) suggests that any organisation wishing to make changes to their processes by incorporating information technology (IT) into their activities will require a strategy as an essential part of the management of change. She describes *strategy* in terms of creating a vision of the future and formulating the means and policies that will enable the organisation to reach that vision. Latham points out the potential for schools to effect strategic use of IT in such areas as curriculum delivery and the provision of students and teachers with access to knowledge bases. She argues that in order to achieve these strategic objectives, schools need to identify and develop an information systems strategic plan that should be based on business needs, and derived from an analysis of the business, its environment and business strategies. While most of the literature on information systems (IS) strategy relates to the business goals of making profits and surviving in a competitive environment, schools also have organisational goals and need to manage resources effectively in order to meet those goals. In order to develop IS/IT strategies, school administrators would benefit from adopting a framework for analysing the underlying work systems involved in various aspects of e-Learning.

Work Systems and E-Learning Strategy

Alter (2002) suggests that the use of the *work system framework* will assist organisations in the process of conducting a thorough systems analysis that will assist in the process of strategic integration of information and communication technology. Alter suggests that one common pitfall made in defining e business models, is that the business process is defined so broadly that it involves a wide range of products and customers and is difficult to analyse coherently. He argues that this pitfall can be overcome through a focus on *work systems* defined as "systems in which human participants and/or machines perform a business process using information, technology, and other resources to produce products and/or services for internal or external customers". Alter defines the eight linked elements that can be used to summarise any work system. *Customers* are the people who use and receive direct benefits from the products and services produced by the work system. *Products* are the combination of physical things, information, and services that the work system produces for its customers. The (business) *process* is the set of work steps or activities that are performed within the work system. *Participants* are the people who perform the work steps in the business process. *Information* is the information used by the participants to perform their work. *Technology* is the hardware, software, and other tools and equipment used by the participants to perform their work. *Context* is the organisational, competitive, technical, and regulatory realm within which the work system operates. *Infrastructure* is the shared human and technical resources that the work system relies on even though these resources exist and are managed outside of it. This typically includes human infrastructure such as support and training staff, information infrastructure such as shared databases, and technical infrastructure such as networks and programming technology.

As part of a larger study on eLearning in Australian schools, a small group of four Australian Mathematics, Science, Social Science, and Humanities secondary school teachers were interviewed to conduct an analysis of the work system involved when using the *Web* for student-centred learning activities. In this paper we provide a summary of this analysis and highlight the critical success factors that should be considered when formulating an e-Learning strategic plan in the context of this particular school.

Findings

Prior to conducting the analysis, we first considered the traditional means by which student-centred learning activities are performed and subsequently identified the *rationale* and *strategic goals* associated with the introduction of the *Web for student-centred learning* (Tab. 1).

Rationale: Instead of students going to traditional sources such as for books and/or journal articles in library, encourage them to access the latest information on-line from home, or during class via school computer network.
Strategic Goal: Develop student skills: use of IT and Web, independent learning, information literacy, 'knowledge work', and problem solving.

Table 1: Rationale and strategic goals of the Web for student-learning

The next step in the work system analysis involved the identification of the general work system elements, the associated critical success factors (Alter 2002), and some broad implications for school management when formulating the IS/IT strategic plan (Tab. 2).

Customer: Students use the Web for independent learning activities (research project). *Products:* Completed research project demonstrating student's ability to synthesise information into knowledge applied to the project. Development of students' independent learning skills and other generic skills. Teacher assessment and feedback on student Web research skills.

Success factors: Product design consistent with customers needs (Alter 2002). *Implications:* In this case, teachers will need to develop projects and student-centred activities commensurate with student information literacy and independent learning skills. The pedagogical implications and objectives of e-Learning will need to be understood by teachers and aligned with student research tasks and appropriate assessment guidelines. Therefore teachers require adequate training, prior research on topic, and alignment with overall curriculum and course objectives.

Process: Teacher sets Web research project. Student uses Web search engines and/or on-line journals from home or via school computer network. Student types in relevant key words and decides which information is relevant. Student analyses and sorts through relevant information and synthesises to produce project (product). Teacher assesses and comments on quality of products (project and student information skills). *Success factors*: Fit of process with other elements of the work system; Adequate resources for process; Effective operational management (Alter 2002). *Implications:* Teachers need skills in developing, managing and assessing these projects. They need to ensure students are adequately trained and have developed effective search strategies. For example, Boolean logic (the expressions *and*, *or*, and *not*) requires higher order skills. Teachers also need to ensure that sufficient time, adequate on-line resources are available, and equitable access is available to students conducting the research. Finally, teachers will need to ensure that IT support staff are aware of the process and are attentive to any system disruptions during the project time frame. Teachers therefore need training and support to ensure effective planning and management of student-Web research activities.
Participants: Students using Web. Teachers setting and marking research projects. IT-support staff. *Success factors*: Appropriate skills and understanding; Interest in doing this type of work; Motivation to do this work in this setting; Ability to work together to resolve conflicts (Alter 2002). *Implications*: Adequate training for both students and teachers will be integral to the success of the system. Well qualified IT support staff are required, along with accessible, functioning networked terminals. Management needs to foster a collegial working environment. Understanding of the learning implications for students is also crucial. If managed effectively, the above factors will also have implications on the motivation of the participants involved in the work system.
Information: Student gathers: information on research question. Key words for search. Hyperlinks to Web pages. Information on research question. Teacher inputs: Information on research project. Feedback to student on work. Assessment grade into school reporting system. *Success factors*: Adequate information quality; Adequate information accessibility; Adequate information presentation; Adequate information security (Alter 2002). *Implications*: Apart from the aspects of training, support and equipment discussed above. Teachers will need to ensure that the browsers, terminals and monitors are adequate for displaying information. Further, that the school network has appropriate security measures in place such as firewalls and up-to- date anti-virus software. Teachers also need to ensure that they have developed adequate methods for presenting students with assigned tasks and feedback.
Technology: Personal computer used by student with modem from home or on school computer network. Computers and networks used by the various search engines. *Success factors*: Ease of using the technology; Adequate technology performance (having enough 'horsepower'); Maintainability (how easy it is to keep the technology operating over time); Compatibility with technology in related systems (Alter 2002). *Implications*: The provision of adequate training, maintenance plan, and support staff. Careful consideration of the above factors when planning and acquiring hardware such as PCs and network components. Also important when selecting software, Web browsers, and subscription to ISP.

Table 2: Work system analysis for Web use in student-centred learning

The final step in our analysis involved analysis of teacher comments regarding the current context and infrastructure within which the work system is situated (Tab. 3). The analysis in Table 3 highlights several key *structural* problems related to the *context* and *infrastructure* within which this work system is currently situated. These issues need to be addressed by the highest level of school management as part of the strategic planning process and present major obstacles to the integration of the Web into student learning activities.

Current Context: The timetable (based on 50-minute periods); curriculum requirements; school culture; teacher IT training and skills; and classroom layout; are all consistent with the traditional teaching and learning environment in this secondary school. Student demographics also suggest that a large proportion of students currently do not have access to the Web from home and therefore equity issues affect teacher utilisation of the Web in this work system. *Strategic Implications for Management:* Top management support and initiative is required in addressing some of the organisational issues presented above. Management needs to work on changing the school culture to become more compatible with the new work system. They need to facilitate and foster cooperative decision-making regarding the adoption of the new work methods. They need to foster a teaching and learning environment that reduces the level of turmoil and distraction between the various contextual components addressed above and the new work system (Alter 2002). For example, one suggestion is the provision of a single dedicated classroom to each key learning area (e.g. Science) with appropriate layout and a high ratio of networked terminals. Combined with restructuring of the timetable to allow for at least one double period per week for each class in each subject. This set of initiatives would allow for decentralised lesson planning by teachers in each key learning area. Teachers in each faculty could coordinate their use of the room when required and organise integrated student Web activities during the double periods. If the single computers, currently under-utilised in each classroom, were placed in the dedicated classroom, it would potentially lead to more effective utilisation of existing resources.
Infrastructure: Web access exists through school computer network. However, the service is slow and while access is possible through dedicated computer labs and the school library, the facilities are often reserved for dedicated IT classes during normal school periods thus rendering it difficult to integrate with lessons in the other key learning areas such as science. At best, one networked computer may be available in the normal classroom and in many cases these are not functioning properly. Also, it is difficult to access IT support staff when problems arise and further the skills of the support staff do not seem to be sufficient to correct the problem in a timely manner. *Strategic Implications for Management:* Need to provide adequate *technical* and *human* infrastructure for the integration of the Web into student learning activities (Alter 2002). For example, at this school, more computers are required in classrooms, more powerful servers and greater bandwidth is required for this school network. A higher ratio of suitably qualified support staff is also necessary. While these issues are costly, the school management has a duty to provide these services in order to achieve the strategic objectives. Leasing arrangements may assist.

Table 3: Current context and infrastructure and strategic implications for management

The analysis in this study highlights the importance of work systems analysis as a framework for strategic planning for the integration of e-Learning in schools. The findings suggest that this framework can be utilised at various phases throughout the systems development process and has several implications including: the design and planning of educational technology courses for teachers; e-Learning resource location and acquisition; and information and communication technology infrastructure planning.

References

Alter, S. (2002). *Information Systems: The Foundation of E-Business* (4th ed.) New Jersey: Pearson Education Inc.

Latham, A. (1998). Strategic Information Systems Planning: a necessary evil for schools? *Journal of Applied Management Studies*, 7 (2), 267-274.

Leidner, D. E., & Jarvenpaa, S. L. (1995). The Use of Information Technology to Enhance Management School Education: A Theoretical View. *MIS Quarterly*, September, 265-291.

Organisation for Economic Cooperation and Development (OECD). (1996). *The Knowledge-based Economy.* http://www.oecd.org/dsti/sti/s_t/inte/prod/kbe.htm

OECD. (1998). *New Developments in Educational Software and Multimedia.*

Strategies for the Diffusion of E-Learning in Traditional Teaching and Learning Contexts: A Study of Web Adoption in an Australian School

Sam Jebeile
Division of Economic and Financial Studies
Macquarie University
Australia
Sam.Jebeile@mq.edu.au

Professor Mohamed Khadra
Pro Vice-Chancellor, Division of Science and Design
University of Canberra
Australia
khadra@scides.canberra.edu.au

Associate Professor Robert Reeve
Division of Economic and Financial Studies
Macquarie University
Australia
Robert.Reeve@mq.edu.au

Abstract: This paper reports the findings of a study which utilised diffusion of innovations theory to examine Web adoption by teachers in a secondary school in Sydney, Australia. Data collected through a survey questionnaire was used to examine teacher perceptions regarding various attributes of the Web as a tool for both teaching preparation and delivery. Our analysis of the data suggests that the innovation attributes of relative advantage, compatibility, visibility, ease of use, result demonstrability, and trialability should be considered by school administrators seeking to increase the rate of Web use by teachers in their schools. The image attribute did not emerge as significant in either of the contexts examined. Implications for the development of strategies for e-Learning diffusion are discussed including practical examples.

Introduction and Background

The adoption and effective utilisation of e-Learning is an important issue to educators around the world. In the context of Australian schools, Gibbons (2001) reports that 98% of teachers from K to 12 are using the Internet but only to perform basic tasks such as e-mail and research via search engines mainly for *teaching preparation*. Gibbons suggests that the majority of Australian teachers are still struggling to incorporate Internet applications such as Web publishing with traditional methods of *teaching delivery*. In this study we use *diffusions of innovations* (DOI) theory to examine factors affecting the *adoption* of the Web by teachers in an Australian secondary school.

Rogers (1983) DOI theory defines five attributes or characteristics of innovations which influence an individual's attitude towards an innovation during the adoption process. These attributes include relative advantage, compatibility, complexity, trialability, and observability. *Relative advantage* is the degree to which an innovation is perceived as better than the idea it supersedes. *Compatibility* is the degree to which an innovation is perceived as being consistent with the existing values, needs, and past experiences of potential adopters. *Complexity* is the degree to which an innovation is perceived as difficult to understand

and use. *Trialability* is the degree to which an innovation may be experimented with on a limited basis. *Observability* is the degree to which the results of an innovation are observable to others.

Based on DOI theory, Moore and Benbasat (1991) developed an instrument to measure an individual's perceptions about using an information and communication technology (ICT) innovation. Moore and Benbasat renamed Rogers' complexity construct as *ease of use*, consistent with Davis (1989). They also developed the *image* construct defined as the degree to which use of an innovation is perceived to enhance one's image or status in one's social system. Also, during the process of developing the instrument, they found that the construct of observability separated into two constructs: result demonstrability and visibility. *Result demonstrability* concentrated on the tangibility of using the innovation, including their observability and communicability. *Visibility*, on the other hand, focused on the physical presence of the innovation in the organisational setting. In the present study we are not concerned with teachers' perceptions of the Web as an IT innovation *per se*, rather we are concerned with teachers' perceptions of *using* the Web in two work-related contexts. We therefore use the instrument to separately examine teacher use of the Web for both *teaching preparation* and *teaching delivery*. The hypotheses tested in this study are:

Hypotheses: The seven adoption variables (relative advantage, compatibility, image, visibility, ease of use, results demonstrability, and trialability) will predict the dependent variables, teachers' future use of the Web for purposes of: (1) *teaching preparation* ; and (2) *teaching delivery*.

Data Analysis and Results

Multiple linear regression models were used to test the hypotheses. The unit of analysis was the individual teacher. The data was collected from one secondary school thus controlling for any between-school differences. All 75 teachers from the participating school were surveyed using a questionnaire that included the items from the short form of the Moore and Benbasat (1991) instrument. All questionnaires were returned and useable thus satisfying our sample size requirements and eliminating concerns of non-response bias. The questionnaire items measured teacher perceptions relating to each of the seven adoption variables forming the *independent variables* in this study. Two single item measures asking teachers about their intended use of the Web for (a) *teaching preparation* and (b) *teaching delivery* were used to measure the *dependent variables* in this study. All items were measured on a seven point Likert scale with polar anchors "strongly agree" and "strongly disagree". The Moore and Benbasat (1991) instrument has been used extensively in the literature demonstrating reliability and validity in a range of contexts. Tests for internal consistency reliability and construct validity provided strong support for the instrument in this study.

A multiple regression analysis (full model) was conducted of all seven ICT adoption variables on the dependent variables: (a) *Web use for teaching preparation* (TPREP); and (b) Web use for *teaching delivery* (TDEL). Tests were conducted to check the regression assumptions of normality, linearity, and homoscedasticity of residuals (Tabachnick & Fidell 2001). The tests revealed that the regression assumptions had not been violated.

Hypothesis 1: A multiple regression analysis (full model) was conducted of all seven adoption variables on the dependent variable *Web use for teaching preparation* (TPREP). The results indicate strong support for Hypothesis 1. The full model regression equation was statistically significant ($p < .0001$) and explained approximately 72% of the variation in TPREP (Adj. $R^2 = .718$). Model reduction techniques (Tabachnick & Fidell 2001) were then used to formulate a reduced model which included only the significant variables of relative advantage, result demonstrability, and trialability. The results indicate that the reduced model regression equation was statistically significant ($p < .0001$) and there was no significant difference between the full and reduced model in terms of their ability to explain variation in TPREP (Adj. $R^2 = .723$). In the reduced model, *relative advantage ($p < .0001$), result demonstrability ($p = .001$)*, and *trialability ($p = .012$)*, have a positive and significant relationship with TPREP.

Hypothesis 2: A multiple regression analysis (full model) was conducted of all seven adoption variables on the dependent variable *Web use for teaching delivery* (TDEL). The results indicate strong support for Hypothesis 2. The full model regression equation was statistically significant ($p < .0001$) and explained approximately 53% of the variation in TDEL (Adj. $R^2 = .531$). A reduced model was formulated that was statistically significant ($p < .0001$) and there was no significant difference between the full and reduced model in terms of their ability to explain variation in TDEL (Adj. $R^2 = .547$). In the reduced model, *compatibility* ($p = .003$), *visibility* ($p = .036$), and *ease of use* ($p = .006$), have a positive and significant relationship with TDEL.

The results also showed that *image* has a negative although not significant relationship with both TREP and TDEL.

Implications for E-Learning Diffusion

As hypothesised our empirical results show that DOI theory as operationalised in this study was successful in predicting the future Web use by secondary teachers for purposes of teaching preparation and teaching delivery. The most interesting aspect of the results was that in each of the two contexts of Web use by teachers three different factors emerged as significant. Of further interest to school principals is the fact that image did not emerge as a significant factor in either of the cases. This finding indicates that strategies that promote the status (or image) of teachers who are currently advanced in their use of the Web may not have any effect on the adoption behaviours of other teachers. Principals seeking to increase the rate of adoption of the Web by teachers should be better served adopting strategies that address the attributes of the Web found to be significant in this study. In the case of Web use for teaching preparation the three most important factors affecting teachers in our sample were relative advantage, result demonstrability, and trialability. This finding suggests that in the context of our sample, strategies to increase the diffusion of teachers' use of the Web for teaching preparation should specifically address these attributes. While in the case of Web use for teaching delivery, strategies should focus on the attributes of compatibility, visibility, and ease of use. The following discussion provides some examples of how this may be achieved in each case.

Strategies for Increasing Web use for Teaching Preparation

Relative advantage was concerned with the degree to which using the innovation is perceived as being *better* than using its precursor. The term *better* related to factors such as quality, efficiency, and effectiveness. Thus, one strategy to increase adoption in this context is to organise professional development programs that require teachers to prepare a lesson on the same topic (eg. The Solar System) using traditional methods followed by use of the Web. Teachers could then be asked to evaluate each lesson in terms of efficiency (ie. time spent), and the quality and effectiveness of the final lesson plan.

Result demonstrability represents the extent to which use of the Web provides teachers with clear, measurable, and observable results. In the case of teaching preparation the results are evident in the final lesson plan and the reaction of students. Therefore in the context of our sample, teachers should be encouraged to formally evaluate lessons that have been prepared with and without the utilisation of the Web. For example, a survey of student satisfaction at the end of each of these lessons may provide the teacher with greater insight and clear evidence regarding the results of using the Web when preparing lessons. In addition, principals could provide teachers with the latest research on student learning in technology rich environments.

Trialability represents the extent to which teachers can trial the use of the Web in teaching preparation prior to adoption. One strategy for increasing the trialability of the Web for teaching preparation is to provide teachers with convenient access to the Web in places where they are most likely to perform this activity. At school these areas would obviously include staffrooms, common rooms, and classrooms. It is also common for teachers to prepare lessons at home and therefore any scheme that subsidises teachers for the costs of Web access from home would increase opportunities for trialing the Web. Good quality peripheral devices, such as colour laser printers and screen projectors, should also be available for teachers to trial when using the Web to prepare lessons. Trial agreements with vendors of e-Learning related products and services could also be utilised to assist in this process. Finally, professional development sessions providing opportunities and advice for teachers to trial the Web for teaching activities would be beneficial.

Strategies for Increasing Web use for Teaching Delivery

Compatibility represents whether or not the innovation is perceived to fit teachers' existing values, needs, and past experience. In the context of our study, the move to teaching delivery through the Web represents a dramatic shift from the traditional face to face teaching methods familiar to most teachers. Organisational strategies will need to target this problem in order to increase teacher perceptions regarding the compatibility of this non-traditional teaching mode within their context. Teachers could be supported in this regard through professional development regarding the pedagogical implications of e-Learning. Radical structural changes may also assist increasing the compatibility of Web-based teaching in the traditional school environment. For example, school policy currently requires students and teachers to attend each class in the traditional mode, thus creating an inherent structural limitation for the diffusion of Web-based teaching delivery. That is, any Web-based delivery will be conducted over and above the existing face to face workload of both teachers and students. One organisational strategy to overcome this problem may be the rescheduling of the school timetable in order to facilitate a mixed delivery mode.

Visibility examines how apparent or visible the use of the innovation is in the organisation or school context. In the context of our sample, Web use for teaching delivery is a relatively more recent innovation than Web use for teaching preparation. At this early stage, increasing the rate of adoption of this innovation will require strategies that promote the physical presence of the innovation throughout the school. For example, vendors of Web-based delivery products could be invited by the school Principal to promote their products at staff meetings and most importantly provide sample content for teachers to access on the school network. Teachers in other schools involved in best practice in this area may also be invited to the school to share their experiences.

Ease of use is concerned with the ease of using, learning, and implementing the innovation. In the context of our sample, Web-based teaching delivery is relatively new to teachers and at this stage they may be unfamiliar with the technologies supporting this mode of learning. As such, the school Principal may adopt a number of strategies to assist teacher perceptions during this initial phase including increased time for professional development, the employment of competent e-Learning resource developers, and the provision of adequate user-friendly infrastructure to facilitate the implementation process. Another important strategic consideration is the identification and acquisition of existing e-Learning resources suitable to the teaching and learning context of the school. This process will allow teachers to build on existing modules thereby reducing difficulties of implementation.

References

Davis, F. D. (1989). Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. *MIS Quarterly*, 13 (3), 319-333.

Gibbons, P. (2001). Schools get deeper into the Web. *Business Review Weekly* 23(10), 86.

Moore, G.C. & Benbasat, I. (1991). Development of an Instrument to Measure Perceptions of Adopting an Information Technology Innovation. *Information Systems Research*, 2 (3), 192-222.

Rogers, E.M. (1983). *Diffusion of Innovations* (3rd ed.). New York: Free Press.

Tabachnick, B.G., & Fidell, L.S. (2001). *Using Multivariate Statistics* (4th ed.). Needham Heights, MA: Allyn and Bacon.

The Development of Computer-Based Simulation Laboratory for e-Learning : A Case Study of Non-Electrical Engineering Background at KMUTT in Thailand

Kalayanee Jitgarun
Surachai Suksakulchai
Khanchai Tunlasakun
Department of Electrical Technology Education
School of Industrial Education
King Mongkut's University of Technology Thonburi
Thailand
Kalayanee.jit@kmutt.ac.th
Surachai.suk@kmutt.ac.th
Khanchai.tun@kmutt.ac.th

Abstract: This paper presents the second phase of development of Computer – Based Simulation Laboratory (CBSL) for e-Learning especially for non-electrical engineering background. There were 14 lab sheets used in this study. Each lab sheet was divided into different components in order to help the students get used to the process of thinking properly. The steps of developing CBSL were as follows : 1) taking the students' opinions on CBSL (first phase) into account such as the correctness, and the completeness of the contents for making corrections on CBSL 2) design the computer program, and 3) get validated by 6 experts. The results of the study were that most of the experts were satisfied with CBSL at the good level particularly on the picture/image. However, there was still a need to improve the contents, and others. After all, CBSL was developed on CDR which introduces to the undergraduate students the engineering way of thinking. The computer-based simulation experiments were developed for beginners in science and engineering. Its objective is to facilitate students to experiment, solve problem, gather data, and to engage scientific interpretation in the early studies.

Introduction

What is engineering ? The word itself comes from the Latin word *ingenerare, to create*. It's art and communication, politics and finance, modeling and simulation, invention, approximation, measurement and estimation, and more. It's a way to think about problems. The laboratory is an important component of the lecture where students gain hands-on experience. Thus, to introduce the engineering student the way of thinking is to develop a *Virtual Laboratory*- a set of simulated laboratory experiments that we can perform over the WWW (Karweit, 2001). With the development of new computer technologies, the World Wide Web is now possible to simulate engineering and science laboratory projects on a computer. Computer lab activities such as pre- and post-lab exercises, can help support varied approaches to electrical education (Yaron, 2002). Experiences in laboratory experiments are difficult to provide in typical classroom settings because many interesting physical artifacts are expensive or dangerous to build and practice on. However, Computer-Based Simulation Laboratory (CBSL) will address these problems cheaply and safely. It will also provide coaching for students, in order to help them understand fundamental principles, to help them practice the skills needed to analyze, and to provide the kind of supervision that a good laboratory assistant provides by way of minimizing unenlightening aspects of student explorations (Forbus, 1999).

Findings

The study involved the steps of CBSL development as follows:

1. Design the components of CBSL as follows: 1) Lab Sheets, 2) Instructions on how to conduct physical labs, 3) Step by step guide through experiment 4) Analysis, and 5) Report Writing.

2. Select 14 labs for CBSL development according to the students' opinion particularly on the correctness and completeness of the contents (Jitgarun & Tunlasakun, 19-21 October, 1999) as follows:

2.1 *Compound Motor Laboratory*

A student will be able to adjust Variac, R1 and R2 easier than the real experiment and the output response can be seen promptly and clearly. The color of motor while spinning will stimulate the student's interest in doing the experiments.

2.2 *Series Motor Laboratory*

A student will be able to learn how to connect the circuit for series motor. Then, while adjusting Variac and R1, it is possible to make note of the starting point of the current to be six times while it is running.

2.3 *Shunt Motor Laboratory*

A student will be able to learn how to connect the circuit for shunt motor. Then, while adjusting Variac and R1, the starting point of the current will be six times while it is running.

2.4 *Alternator Laboratory*

A student will be able to adjust the load so that the loss and efficiency of DC Generator can be found.

2.5 *Induction Motor Laboratory*

To connect the control circuit and to test the circuit operation by pushing an *on-off* button, it will help move the motor in a clockwise or anti clockwise direction and/or using on-off lamp.

2.6 *DC Generator Laboratory*

A student will adjust R1, R2 easily and precisely and be able to observe the graphs. A student doesn't have to plot the graphs by him/herself. The colors of the graphs, the motor while working, the primover and the loads will help the student see the steps of operation clearly. This is how it can stimulate the student's interest.

2.7 *3 Phase Rectifier Laboratory*

The circuit will be 3 Phase Half Wave Rectifier. A student can adjust input voltage and graphs will be changed accordingly. Then, all of these graphs can be zoomed in and out. Thus, simulation will be safer for a student as well as the equipment. The different colors will help a student see the signals of different phases clearly.

2.8 *3 Phase Measurement Laboratory*

A student can adjust Variac or push the on-off button to show electrical power output and electrical current value in graphs and/or by the on-off lamps.

2.9 *Single Phase Rectifier Laboratory*

A student can adjust voltage input and observe the changes of voltage output of rectifier circuit which will be shown in graphs.

2.10 *Single Phase Transformer Laboratory*

A student can adjust Variac along with the changes of Volt meter and Amp meter simultaneously. The simulation of virtual lab will be safer for the student as well as the equipment while there are on-off loads and short circuit. It also motivates the student to do more experiments because it will show on-off lamps. However, when over current, there will be a warning with a dialogue box.

2.11 *Single Phase Measurement Laboratory*

A student can push on-off button and observe the changes of Volt meter, Amp meter, Kilo-Watt meter, KiloWatt-hour meter of which the load can be changed accordingly.

2.12 *3 Phase Transformer Connection*

A student can select secondary voltage at 127 V. or 220 V. and observe the changes of Volt meter, Amp meter of each phase.

2.13 *Star-Delta Laboratory*

A student can push on-off switch, setup time delay, and observe on-off lamps when time is over. Then, a student can also see output in the Amp meter as well.

2.14 *SCR Rectifier Laboratory*

A student will be able to adjust Vs (Supply) and Trigger Angle easily, precisely, and be able to see the changes of signal outs that takes place from Vs (Supply) and Trigger adjustment. What's more, the input and output signals are comparable to one another at the same time.

3. Design simulation kits on the computer screen.

4. Construct simulation laboratory instruction with Borland Delphi program, Adobe Photoshop, Visio Technique, and PSpice.

5. Develop the manual for CBSL.

6. Trained experts check for the accuracy which were as follows:

The responses of six trained experts' satisfaction upon CBSL were found to be at the good level with the pictures/images. The synchronous of the contents and their objectives, the simulation capability, the order of the contents, the promotion of thinking process, the convenience, the safety and the fastness were identified at the good level while the accuracy, the completeness, and the promotion of thinking rather than remembrance were still rated at the average level.

Discussion and Conclusions

As the results of the study on Computer-Based Simulation Laboratory (CBSL), the researchers would like to discuss and conclude as follows:

1. Technical educational institutions are crunched between demand for an effective education along with budget constraints. Their ability to deliver effective education can be greatly enhanced by laboratories equipped with modern technologies including computer hardware and software capable to perform data acquisition, statistical data analysis, control experiments, remote instrument control and network communication (Ursutiu, 2002). However, there are some problems in providing experimental instruction as follows: 1) Inadequate equipment and tools matching with the number of students, 2) High number of students in a group, 3) Insufficient teaching time, 4) Out of order equipment and tools used during the experiment, 5) Damage of equipment and tools used during the experiment, 6) Danger of the mistake in experiment for the experimenter, and 7) Too much time used in equipment and tools in the real operation.

Thus, CBSL is an environment in which the students may make *authentic* actions and receive *authentic* responses from the *virtual* equipment (Virtual Laboratory, 2002). There is no additional equipment besides the computer, monitor, and mouse necessary for this type of experience. A teacher creates CBSL where students can conduct experiments that they would otherwise not be able to do because the equipment are too expensive. Experimental results indicate that students who use CBSL prior to conducting the same experiments in a physical laboratory are able to complete the physical laboratory in a much shorter time, require less assistance, and also report that they are very satisfied with their laboratory experience (Mosterman et al., 2002).

2. Engineering sciences and physics education have always been dynamically interrelated with technology change. By solving control problems using software-based instruments and actual hardware, students gain an appreciation of the interaction of process instrumentation and computers. The interaction of instrumentation and networked computers running graphical software reduces manual data collection, analysis, presentation, storage, and transmission tasks, allowing supplemental material to be covered by the professor in the same time span.

3. "…there will be more CBSL in the future. Perhaps five years down the road, one-third of the experiments may be done virtually. However, the CBSL are not established to replace face-to-face teaching, but allow the students to carry out the experiment before or after the real session" (Ko, 2002). Pre-experiment *hands-on* experience for students before they go to the actual laboratory (Zhu,1997). A teacher has his students use CBSL as a pre-lab so that they can understand the basics of the lab before they actually do it. Thus, CBSL can only augment the lecturers' teaching tools. It can't replace them. While the results of any education are difficult to prove, sufficient evidence exists that CBSL provides a fresh and fun way to supplement traditional education. Though CBSL cannot replace traditional education in many tasks, it may be better than traditional education when used appropriately (VirtualChicago Project, 2002). Computers aid students in laborious data-logging and enable them to perform extensive experiments. Many of the students spent as much time modifying their CBSL as they did on the experiment. It should be emphasized that CBSL is not intended to replace the hands-on laboratory inquiry but to extend it into investigations that are not feasible in the classroom. As CBSL develops and more options become available, student inquiry will become more and more open.

4. Once CBSL has been set up, students or users will be able to conduct actual experiments from remote computers anywhere in the world twenty-four hours a day, as if they were working in actual laboratories. This technology greatly enhances the flexibility of laboratory education, and introduces

students to the new paradigm of remote experimentation (Ko, 2002). The term *CBSL* refers to any learning process that takes place in virtual reality, or a virtual classroom. The location where learning takes place is called *virtual* because it does not exist in reality. Since CBSL is a non-traditional form of education, students and educators should be prepared for different forms of learning.

5. Creating articulate virtual laboratories requires synthesizing advances involving several technologies such as *Qualitative physics* which provides formal representations for the tacit knowledge of scientists and engineers that connects their professional knowledge to their experience-based intuitions, enabling software to use methods and concepts similar to those deemed natural by domain experts;. *Compositional modeling* provides representations and reasoning techniques for computer-assisted modeling (e.g., how to apply professional knowledge of a domain to modeling real-world situations so that they can be formally analyzed); *Truth-maintenance systems* provide reasoning services and the raw material for constructing explanations of the system's results and reasoning in terms that help students understand the domain of study; *Symbolic algebra and constraint propagation* provide mathematical solutions; and *Analogical processing techniques* provide the ability to retrieve and apply results from libraries of worked out designs and examples to novel situations, in order to coach students (Forbus, 1999).

References

Forbus, K.D., Articulate Virtual Laboratories for Science and Engineering Education [Online], Available : http://www.qrg.ils.nwu.edu/projects/NSF/av1.htm [1999, April 22].

Jitgarun, K., & Tunlasakun, K. (19-21 October, 1999). Development of Computer-Based Simulation Laboratory : A Case Study of KMUTT Students in Thailand, A paper presented at Southeast Asian Forum on Technologies for the Classroom, SEAMEO INNOTECH, Quezon City, Philippines.

Ko, CC, Web-based Virtual Laboratories Go Online [Online], Available : http://www.eng.nus.edu.sg/Eresnews/9905/p9.html [2002, July 17].

Karweit, M., What is Engineering? [Online], Available : http://www.jhu.edu/~virtlab/index.htm [2001, August 31].

Mosterman, P.J., Dorlandt, M.A.M., Campbell, J.O., Burow, C., Bouw, R., Broaersen, A.J., & Bourne, J. R., Virtual Engineering Laboratories : Design and Experiments [Online], Available : http://www.op.dir.de/FF-DR-ER/staff/pjm/papers/eed94/p.html [2002, July 17].

Ursutiu, D., Teaching Physics on a Virtual Laboratory [Online], Available : http://rilw.emp.paed.uni-muenchen.de./98/Doru-pap.html [2002, July 17].
VirtualChicago Project, Virtual Education [Online], Available : http://vchicago.org/virtualed/ [2002, July 17].

Virtual Laboratory [Online], Available : http://tiger.coe.missouri.edu/~pgermann/projects2/Scilnq/Virtual_Labor…/virtual_laboratory.htm [2002, July 17].

Yaron, D., The irYdium Project [Online], Available : http://ir.chem.cmu.edu/irproject/lists/Default.asp [2002, August 8].

Zhu, D., Virtual Laboratory – Demo Site [Online], Available : http://www.civil.ubc.ca/home/coursew3/virlab [1997, February 21].

Modelling a Web-based Learning System using Wired and Wireless Technology

Jun H. Jo, Vicki Jones, Greg Cranitch and Kyung-Seob Moon
School of Information Technology
Griffith University, Gold Coast Campus
QLD Australia 4217
{j.jo, v.jones, g.cranitch, k.moon}@gu.edu.au

Abstract: Internet technology has been rapidly developed and had a significant influence on education. However, through implementations, online teaching systems have not shown sufficient flexibility, which is the key element to this new approach. The current use of wireless technology has triggered attempts to inject greater flexibility into e-learning. This paper will propose a new model incorporating wireless technology within an e-learning system. The integration of the new technology in the current hybrid system will be discussed. The system will employ Pull/Push technology to provide efficient communication between educators and students.

Introduction

A number of universities around the world have attempted to use Wireless Local Area Networks (WLANs) in order to provide learning environments with sufficient flexibility. However, the cost of establishing a WLAN system is significant and the flexibility is usually accomplished within the proximity and operational area of a connection point. By including the benefits of wireless technology, this research investigates a new e-learning system with greater flexibility, regardless of time and location. The new Wireless Web-Based Instruction (WWBI) system will integrate a mobile phone and a Personal Digital Assistant (PDA) within an existing online teaching system which has been developed and used at Griffith University in Australia since 1999.

Wireless and Mobile Technology

Wireless Application Protocol (WAP)

WAP was designed to handle the limitations of wireless networks, such as narrow bandwidth, and unstable and unreliable connections. The WAP forum set the specifications for the micro-browser requirements in mobile and wireless devices (Moon, 2001). A micro-browser, as defined by the WAP specification, is the ultimate thin client. In a handheld device, it can operate with a small amount of memory, which suits the limited resources of the device.

The proposed system is designed to deliver teaching materials using:

- Protocols: HTTP and WAP
- Markup languages: HTML for multimedia information and WML for simple text message
- Communication methods: *pull/push*

Wireless Markup Language (WML)

Although HTML is a relatively simple markup language it is still too complex for use with a WAP device. Because of the constraints associated with handheld devices, an alternate model was necessary and WML was developed in 1999. WML and WMLScript (an event-based language, based on JavaScript) provide the functionality needed to reduce the load on the CPU. As a result, WML is a highly simplified markup language, which follows strict XML specifications (Bulbrook, 2001). Like HTML, the use of WML allows designers to specify format and presentation of text, and control navigation through a series of hyperlinks between pages.

Pull/Push Messages

Currently WBI systems are based on pull technology, which means that users request, or pull, information to their handheld device. However, using this method, when information perhaps of an urgent or otherwise important nature needs to be sent to the user, it will not be received until the user logs in and requests information. An example would be: when the university needs to inform students of a change or cancellation of a lecture. The new elearning system will allow students to be contacted by both educators and other students, using pull/push technology. The pull/push technology (see Figure 1.) in the new system can provide an efficient way to transmit information.

The concept of pushing and pulling information is not new. It has been used in the finance industry for some time, in the form of financial paging services. Information is pushed to the user's pager. The user can then pull more information from the website or from call centres. However, in reference to WAP, Push (or WAP Push as it is sometimes called) is slightly different. Using WAP Push a notification message can be sent to the user, who can then pull more information using links embedded in the message. It is made easy to use by allowing the user to just click a button to go to the WAP site (Bellis, 2000).

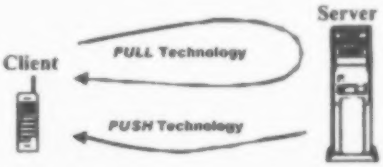


Figure 1: Pull and push technology

Personal Digital Assistant (PDA) Technology

Although some PDAs come with a small keyboard, PDA technology does not require a keyboard, and PDAs also come with a touch sensitive screen operated by a special input/output pen. The built-in graphical interface of a stylus-operated PDA uses both touch-pad technology and handwriting recognition, which allows the user to "write" on the small screen with the stylus pen. Some of the keyboard PDAs also have a pen and touch sensitive screen (Moon, 2001).

The advantages of PDA technology include:

- Convenience – easily accessible when needed
- Portability – easy to carry, small and light-weight
- AT/AP – easy to use the Internet anytime/anyplace
- Ease of use - management of personal information and tasks
- Display screen - generally reasonable and functional in size (capable of displaying thousands, or millions, of colours)
- Extra features - entertainment such as games and music (often includes MP3 and mpeg4 players)

The constraints (disadvantages) include:

- Limited battery life
- Limited CPU power
- Still relatively expensive – although prices will come down
- High running costs

Many PDAs include a wireless communication module, but if not, a mobile phone can be used as a wireless modem for data communication. There are three common methods of data communication: IrDA (Infrared Data Association - inexpensive with high transfer rates; Bluetooth (currently the most common communication method used in wireless communication) and RS232C serial cable (easy to implement, inexpensive, with lower distance limitations than parallel communication). These methods are also used to provide connection between PC and PDA.

Wireless Technology in Education

In the university environment the mobile phone is a common device for both mature-age and younger students. Yet there are significant limitations when using the mobile phone as a WBI device, such as: small screen, limited method of input, and lack of multimedia functionality. The new model aims at employing PDAs to overcome the limitations of mobile phone use.

Some of the promising aspects of wireless technology in e-learning include:

- *The rapid growth of mobile phone use:* There is an estimated 600 million wireless phone users worldwide. This exceeds the current Internet user base of about 420 million, of which 10 percent use wireless Internet (Bulbrook, 2001). The population of mobile phone users provides a significant infrastructure for wireless technology in e-learning.
- *Flexibility:* Many of Australia's tertiary students have part-time jobs, so flexibility is a key issue. However, on-line teaching cannot presently provide all the possible benefits of AT/AP. Wireless technology has the potential to enrich flexibility and offer significant increases in the number of resources available to students.
- *Easy Access:* Wireless e-learning may be an attractive alternative to attending face-to-face learning environments, especially in large metropolitan areas which suffer traffic congestion and lengthy commuting times.

A Hybrid System Model

The hybrid system provides two methods for students to access the main server:

- The use of a networked desktop/laptop PC
- The use of a mobile phone and a PDA

Figure 2 shows the Hybrid System Model. There are three main sections: Students, Mobile Base Station and Service Centre Module.

Students: Students can access the main server using a networked PC either from home or from the university's computer lab. From the computer lab, students generally have access to fast connections, with large memory and large computer screens, compared with access from home. Unless the student has broadband access the connection speed will be considerably lower than using this method. Therefore, to cater for all aspects of the learning environment, the learning materials are not only in text and picture formats but also in multimedia format such as movie, animation or real-time video streaming. The new model uses the online teaching system that Griffith University has developed and used since 1999 (Jones, Jo and Cranitch, 2000). This process is based on the Pull method for HTTP information.

Students can also access the system using a mobile phone and PDA. This feature aims at improving the flexibility of the system. Students can access the main server through the WAP gateway and browse the concise textual information such as: a Table of Contents (TOC), which includes teaching materials and MSN messages; and a Notice board (from educator or the university).

Push technology is used here and information is written in WML using WAP. When the student finds the required information in the TOC and wants to access it, the PDA can be used to display the information in either WML or HTML. This is especially suitable if using multimedia format. The mobile phone can be used as a modem and the PDA as a multimedia device.

Mobile Base Station: The Mobile Base Station is responsible for providing wireless connection to the student module as well as the wired connection to the service centre module. A mobile communication company provides this service.

Service Centre Module: The Service Centre Module shows the gateway, an ISP server and the University Web server. The *WAP gateway* is positioned between the Mobile Base Station and the University Web server. Its job is to transfer information via WAP and HTTP. When students use a PDA with a mobile phone as a modem, the format will be HTTP and does not need to go through the gateway. The use of various expansion cards enable PDAs to access the server or a Wireless LAN. Some expansion cards can also make a PDA act as a mobile phone. However, our system aims at all types of PDA and does not require any special expansion cards. The *ISP* server is the link used by students accessing the university server from home. It consists of a separate, possibly private, company that supplies Internet hours to the students. The *university server* is the main server holding all the data available for the educational learning module.

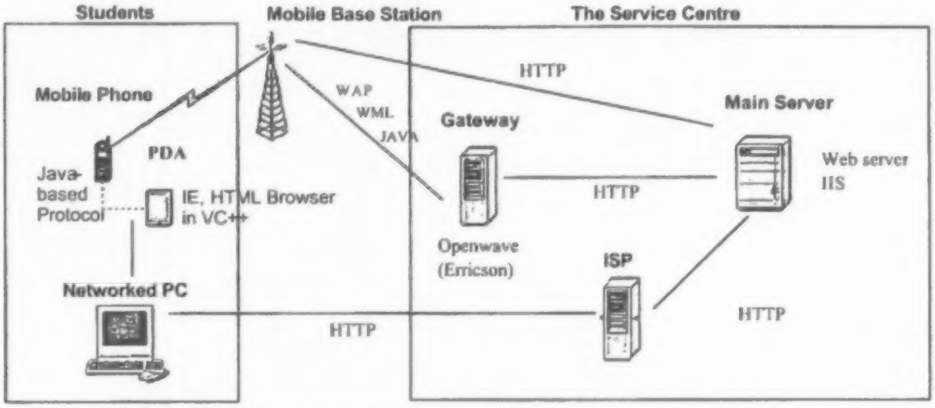


Figure 2: Hybrid System Model

Conclusion

This paper introduces a Hybrid Delivery System, which includes both wired and wireless technology. The aim is to provide the general online delivery system with more flexibility and to improve the student-learning environment. To overcome the limitations of using a mobile phone, the system has employed the use of PDA technology to provide a larger screen, improved computational functions and increase storage capacity. The new system will adopt *Pull/Push* technology to provide efficient and economical communication between educators and students. Currently, the wired part of the system is complete and is being implemented. The *Pull/Push* technology has been developed and emulated using Openwave and will be applied to the teaching environment in the near future.

References

Bellis, D. (2000) PUSH, *Infinite Technologies in Asia*, Ariel Communications Ltd, [http://www.asia.infinite.com/Solutions/WAP/PUSH.htm] April, 2002.

Bulbrook, D. (2001) *WAP A Beginners's Guide*, Osborne/Macgraw-Hill, CA, U.S.A.

Jones, V., Jo, J.H., and Cranitch, G. (2000) A Study of Students' Response to WBI within a Traditional Learning Environment, *Conference Proceedings AusWeb2K*,, 6th Australian World Wide Web Conference, Cairns, June 2000.

Moon, K. S. (2001) *Innovations in e-Learning with Mobile Phone and Personal Digital Assistant*, unpublished Honours thesis, Griffith University, Gold Coast.

Developing Web-Based Materials for Electronic Learning

Background:
The eMath initiative is one of the first national efforts to create and deliver innovative multimedia instructional mathematics developed by middle school mathematics teachers.. eMath meets state standards for middle school math through its development of state-of-the-art, customized program that changes fundamentally how teachers use multimedia and web-based resources in middle school mathematics classrooms. In particular it has looked to fundamentally change how middle school teachers teach mathematics and how teachers and students engage in the learning process.

Partner schools from seven rural, small school districts in East Texas teamed with the parent company of eSchool Online, ACTV Net, Inc., to produce 30 mathematics modules (10 per grade level) and three staff technology staff development modules that target student learning in identified areas of student high need and teacher professional development. The program uses blended technologies such as video, web-based material, collaborative exercises and imbedded assessment. The math content is being delivered through eSchool Online software optimizing the Internet to deliver not only instructional material but also professional development to approximately 8000 students and 85 educators (teachers, math specialists, administrators, and library media specialists).

Aspects of the Initiative:
The impact of this initiative is felt by teachers and students moving toward an engaged learning and problem based learning model. Each teacher accesses the curriculum through 30 interactive modules delivered on demand via the Internet. This integrative web portal provides for email, program resources, teacher administration, instructional and unit development and a proven project based learning model. Videotapes clips using real life situations are used to demonstrate the mathematics concepts. Module development is targeted toward Texas State performance standards Math objectives 9, 11, 13 as well as the development of algebraic concepts. Students and parents access the modules from their school libraries, classrooms, computer labs, public libraries, ad hojme computers.

Also a select group of 14 teachers have been involved in the development of all the materials through inception to completion. Middle School mathematics teachers were developers of the content of the discovery based materials, its formatting and presentation style. Working with and through math experts from across the state the teachers developed the materials and took enormous ownership in the project. All materials were matched to the instructional learning styles of middle school students and were scrutinized for appeal to all ethnicities and gender.

Presentation information
Initial first year data will be presented. Research questions that will be addressed from data collected from school district administrators and eMath middle school teachers are:

a) what types of changes in thinking about mathematics pedagogy have teachers had since beginning the development of these materials; b) has the interaction between teacher and student changed since beginning this initiative and if so why; c)hat types of skills do classroom teachers need to have to develop online materials; and d) what is it or what was it that significantly changed the way you taught mathematics?

The Technology Mentor Fellowship Initiative: A Study of Cross Generational Learning

The Need

Our fast moving world expects educators to prepare students and teachers for needed future skills, including technology application, which have been underused to date. The current focus of technology in education has moved to curriculum integration and practical uses of the technology to support e-Learning, rather that the former focus of computer skills and isolated application instruction. This change, along with continual change in technology, impacts education directly and requires innovative ways to deliver instruction. Not only do we look to innovative ways to deliver curriculum but we also look for innovative ways to develop preservice teachers who are well versed in technology and its use and who are confident with technology integrations (Elwood-Salinas, 2001; Macers, Browne, & Cooper, 2000; Gillingham & Topper, 2000' Stuhlmann & Taylor, 1999).

The design of this initiative, funded by the US Department of Education, is to address the need for increased faculty proficiency in technology while recognizing the challenge and the potential of the disparity between faculty and students in technology skills. The goals of the project were to facilitate faculty development through both approaches: building capacity and providing tech support. This was done by: 1) developing proficiency of the faculty in the Texas A&M College of Education (COE) in the use of various instructional and communication technologies (building capacity); 2) developing capacity within the Texas A&M COE in digital media that supports the NCATE standards and the International Society for Technology in Education (ISTE) (building capacity); and 3) providing support to faculty transitioning to the new teacher training program by providing support in the area of technology support and infusion into the curriculum and coursework (providing tech support).

Program Description

The Technology Mentor Fellowship Program (TMFP) draws upon successful strategies evolving from programs funded by the Technology Literacy Challenge, specifically the Generation www y program, Gen Y Challenge Grant-Olympia, Washington) and the Profiler and Trackstar tools developed in a partnership with the current High Plains Regional Technology in Education Consortia. Training materials supplied through a partnership with Intel and Microsoft (Gates Foundation) through the Intel Teach to the Future initiative provided additional training and support.

The scope of work for the TMFP is to: 1) Provide teacher education faculty (campus based faculty, cooperating teachers, early experience supervisors) a system for technology training that:

- Provides intensive mentoring and support to faculty, and cooperating teachers in the field from pre-service teachers experienced in the process of integrating technology into instruction at the K-12 level;
- Identifies the growing knowledge base within college and school organizations, among students and faculty, and supports the sharing of both skills and knowledge through collaboration and the development of specific, skill related instructional objects;
- Provides continuous assessment of competence for college and school teacher education faculty, in the area of integration of technology into instruction;
- Provides professional development activities tailored to the particular needs identified by teacher education faculty regarding technology skills/processes for technology integration.

2) Provide teacher education faculty and pre-service teachers access to a repository of instructional objects designed to:

- Develop and use basic technology skills, skills in the instructional application of technology;
- Use technology -congruent pedagogy, such as project based learning and continuous skills assessment;
- Be searchable by their application to specific issues related to the integration of technology into instruction across grade levels, content areas, and national standards.

3) Provide opportunities to organize instructional objects into web-based courses.

Findings

Findings from this study not only address issues related to intergenerational learning and cross-age and cross-gender teamwork but also issues related to organizational change to support technology utilization and faculty change regarding pedagogy used in their classrooms.

- Why use a technical assistance group that ranges in age from about 18 to 24 years of age? First we know that this age group is made up of predominately the Net Generation (sometimes called Generation Y). The Net Generation, having grown up with the new technologies, enters our institutions of higher education with a much better comfort level for technology than the existing university faculty who grew up with television and radio. Consequently an "Intergenerational Digital Divide" exists.

- To compound the problem, a second divide exists in our state: that is, the technology infrastructure gap between public schools and higher education teacher preparation programs in Texas. Texas schools have experienced substantial technology infrastructure changes over the past few years. Colleges of Education, however, are limited in their ability to provide substantial pre-service training in Internet-based technologies so that beginning teachers may take advantage of this increased infrastructure. Rather than presenting exemplary models of technology-enhanced instruction to pre-service teachers, most Texas institutions of higher education are struggling with integrating technology into courses and content areas and in offering of on-line courses.

- Certain structures must be in place organizationally to begin, support, and sustain, technology infusion. These beginning structures consist of such things as support from the Dean and support from each of the Department Heads in the COE. This support cannot only be in the form of verbal support but must also come in the form of monetary support to sustain the technical assistance structure. Included in the organizational structure for technology integration should be a system for rewarding faculty that achieve a certain level of expertise and then model that level of expertise in their teaching. Also in this organizational structure should be a plan to fund the technical support.

- To successfully utilize technology in their teaching situations university faculty must have a certain level of expertise and comfort with the technology. They must have a certain level of "executive control." That is faculty must be able to do particular technical functions without really having to think much about it and must be able to then understand its transferability to their teaching situation.

- Teaching with this new medium has drastically altered the role of the teaching faculty requiring a group, or team effort. When implementing technology we must involve numerous specialists including instructional designers, graphics and multimedia designers, and programmers. Few faculties have the time or enthusiasm to integrate technology without a support team. This support team should provide "just-in-time" assistance to the university faculty.

- In addition to learning to work as a member of a team, instructors may need to change their pedagogical approaches to teaching and learning, moving from being the presenter of information to a facilitator of learning.

- The COE should have a mechanism in place to assess educational technology competency for its preservice students. A number of assessments are on the market to do just this. When deficiencies are found then technical support must be provided to the preservice student either in the form of access to an educational competency course or individual technical assistance.

- Provide in-service teacher mentors to our preservice education programs. These K-12 mentors could provide ideas for collaborative project development with K-12 institutions and institutions of higher education.

References

Elwood-Salinas, S. (2001). Preservice Teachers' Perceptions (Values and Expectations) Regarding Technology-Integrated Experiences in a Secondary Methods Course. Published Dissertation, Texas Tech University.

Gillingham, M. & Topper, A. (1999). "Technology in teacher preparation: Preparing teachers for the future." Journal of Technology and Teacher Education 7 (4): 303-321.

Maceers, M., Browne, N., & Cooper, E. (1996). 60 in a 20 zone: Technology and teacher education. In N. Strader, D. Neiderhauser, & N. Hunt (Section Editors). Technology and Teacher Education Annual Proceedings. Allyn and Bacon: Association for the Advancement of Computing in Education.

Stuhlman, J.M. & Taylor, H.G. (1999). "Preparing technically competent student teachers: A three year study of interventions and experiences." Journal of Technology and Teacher Education 7(4): 333-350.

Writing for the Web

David Kim Juniper
Educational Media Development
Athabasca University
Canada
davidj@athabascau.ca

Abstract: The purpose of this brief paper is to explore how the World Wide Web differs from print and to give educators the tools they need to write effectively for this new medium. Topics covered range from paragraph length and sentence structure to fonts and the importance of a minimalist approach. As more educational institutions move their materials online and on CD-ROM, and more students expect digitally-based instruction, instructors are faced with a serious challenge. The first step in putting any written materials online is ensuring that the material is presented in the most usable way possible. As the pioneers of online education, it is up to today's teachers to forge a path that others will follow.

The World Wide Web is rich in pedagogical opportunity. As more educational institutions move their materials online, and more students expect digitally-based instruction, educators are facing an increasingly serious challenge. Unlike print, which has an established history and clear guidelines for its production, online materials are very recent and demand a different approach. Where do we, as educators, go from here?

The first thing to consider when placing educational materials online is the manner in which these materials will be read by the student. Are the materials intended to be read off the monitor or will they be printed by the student? This distinction is of paramount importance, and will inform the manner in which the materials will be presented, the structure of the document, etc. In the next few paragraphs, I will explore these two approaches and highlight the major aspects of each.

The "print" strategy involves using materials to be printed off and read at a later date. This approach will likely be the most familiar to many educators, as most of us have been trained in the print medium and are familiar with its conventions. As with most print-based material, the student will be expected to follow a linear approach to reading the printed document. Online students will navigate the text by scrolling and by using internal links, such as the "back to top" links often seen in longer html documents. Appropriately structured paragraphs and sentences give a sense of coherence to the material and maximize student understanding and retention. The document should be single-spaced, with a double space between paragraphs to enhance online readability.

Sub-headers assume a high degree of importance in longer documents, as they play a major role in its navigation. Using internal links, students can access individual sections of the document through a "Table of Contents" often found at the top of the page. Using the "Print Selection" option offered by most browsers, the student may print out sections of the document instead of the entire document.

Before continuing on the next online strategy, I'd like to take a moment to discuss the use of fonts online. Although a discussion of online typography could easily fill an entire paper in itself, I would like to touch on a few fundamentals with regards to usability. The default font used on the World Wide Web is Times New Roman, a font designed for both legibility and economy of space in the print medium (Bernard et al. 2002). Conversely, according to Ramsden (2000), the most widespread sans-serif font used on the World Wide Web is Arial, which also has a history based in print. The widespread use of these fonts online should not be mistaken for a "best-practice" however, as these fonts have since proven themselves less than efficient when read online.

Among the many alternatives to both Times New Roman and Arial, many designers and usability gurus have chosen either Georgia (serif) or Verdana (sans serif) as the best choice for online text. In an article in *Cre@te Online* magazine, Stuart Dredge describes how the low resolution on the monitor screens (72 dpi as opposed to 2400 in print) can play havoc with the readability of many print-based fonts. Options such as Verdana and Georgia come up winners because they were designed primarily for the monitor screen. In the following example, taken from a web page, you will see the differences between the fonts.

Times New Roman

Arial

Verdana

Georgia

Moving on from the world of print, the other approach to using the Web, and the one which poses the greatest challenge, is material intended to be read from the monitor itself. In addition to choosing the right font, the educator is presented with a host of other design challenges. Unlike traditional readers, the student who is reading online text is always on the verge of going elsewhere. The Back button, the Favorites or Bookmarks menus, all beckon the student to other digital destinations. The challenge then becomes how to capture and hold the student's attention.

There are a few core rules to follow when creating online materials designed to be read online. The foundation upon which these rules and guidelines rest is the fact that students rarely read online materials - they scan them (Nielsen 1997). Rather than reading the entire text in a linear fashion, online users are more likely to jump from paragraph to paragraph, searching for the main ideas or concepts they recognize, or stopping in areas which arouse their interest. Furthermore, because of the abbreviated attention span of many web surfers, large blocks of text are likely to be quickly discarded in favor of shorter more compact fare. To overcome these challenges, effective online text usually adheres to the following guidelines;

1. Keep the lines short. The flickering background of a computer monitor makes reading more difficult, so each line should not be longer than 10 - 13 words.
2. Short paragraphs of 150 words or less help ensure readers stay on task.
3. Make ample use of headers, sub-headers and bulleted lists.
4. Use the active voice rather than the passive
5. When appropriate, use different media such as images, animation as well as audio and video intermixed with the text.
6. Stay clear of cultural references that might confuse foreign students.

The aim in using the aforementioned guidelines is to create pages that will catch the reader's attention and maintain it. Much like journalistic writing, web writing makes good use of the snappy opening line, short paragraphs and sub-headers. Furthermore, web writing also often make use of the "inverted pyramid" strategy (Nielsen 1996). Starting the text with the conclusion, followed by the most important supporting information, ensures that the reader gets the most important parts of the article right at the beginning. Should the student desire more information, a hypertext link would lead to a more comprehensive treatment of the material which could be printed off and read at a later time. So, in this way we have the two strategies - read online and printed off - working together to provide the student with a quick, efficient online experience.

The Web is in its infancy, and will grow into a powerful force in education. As the pioneers of online education, it is up to today's educators to forge a path that others will follow. Simply transferring print-based materials directly to the Internet is not a viable solution, for different mediums have different requirements. By being aware of the idiosyncrasies and challenges of the online medium, educators can make a smooth transition to online learning and thus make full use of this powerful new pedagogical tool.

References:

Bernard, Lida, Riley, Hackler, & Janzen. (2002). A Comparison of Popular Online Fonts: Which Size and Type is Best? *Usability News* [online]. http://psychology.wichita.edu/surl/usabilitynews/41/onlinetext.htm

Dredge, Stuart. (2002). Getting the text message. *Cre@te Online*. Issue 027.

Nielsen, Jakob. (1997). How Users Read on the Web. *Alertbox* [online]. http://www.useit.com/alertbox/9710a.html

Nielsen, Jakob. (1996). Inverted Pyramids in Cyberspace. *Alertbox* [online]. http://www.useit.com/alertbox/9606.html

Ramsden, A. (2000).Font Surveys. *Annabella's HTML Help*. [Online]. http://www.annabella.net/fontface.html

Teaching or Producing?
Orientation and Motivation of Virtual University Team in the Development of Web Courses

Kirsi Karjalainen & Esko Kähkönen
Educational Technology Centre
University of Joensuu
Finland
kirsi.karjalainen@joensuu.fi
esko.kahkonen@joensuu.fi

Abstract: In this paper orientation and motivation of the Eastern Finland Virtual University Network content production team is studied. Based on a questionnaire, in analysis applying content analysis, the goal was to detect factors affecting understanding and realization of the process of developing web courses. A special attention was paid to the question of understanding the task as production or teaching. The survey shows that the team understands elearning as additional element in teaching, with new insights to the development of teaching. Awareness of pedagogical approaches was low, but respondents were in fact intensively looking for models for more interaction, collaboration, better tutoring and self-directiveness of the student. The production of the web courses was rewarding for the members of the team, especially for those with teacher experience. Small scale production model, where any member of the group was familiar with various tasks in the production process, in supervision of the teaching institution, was a garant for didactic consciousness, and after the first phase of course production team members saw the very importance of careful planning that in the beginning was somewhat neglected.

Introduction

The purpose of this presentation is to study and analyse orientation and motivation of the Eastern Finland Virtual University team in the development of web-based courses. A special accent is going to be given to the matter, how the professional members of the group comprising of fourteen instructional designers, teachers and technical supporting staff, stand to central issues affecting e-learning. Those are the background and attitudes of the team, grade of virtual learning in study courses, pedagogical approach, infrastructure and support services, and quality of learning. Special attention is going to be given to the question whether the virtual university personnel considers their task more from the point of producing digital study materials or adding to the traditional way of teaching.

Background

The Eastern Finland Virtual University Network (EFVU) started up at the beginning of 2001 as part of the Finnish Virtual University (FVU), financed by the Ministry of Education. The program is linked to the national ICT-strategy (Education, Training and Research in the Information Society 1999). In the content production team of the EFVU work around 15 persons in the fields of Computer Science, Applied Mathematics, Environmental Technology, Business Administration and Economics. Around 60 credit units /study weeks of web-based courses are being produced in the team.

The Study

In June 2002 a survey was conducted with the purpose to discover experiences and orientation of the virtual university team engaged in the development process of web based learning in the EFVU. Fourteen persons working in different areas of expertise and in technical and pedagogical support answered the questionnaire, most of them in a seminar intended for the team of the EFVU. Those unable to attend the seminar filled in the questionnaire afterwards. The questionnaire was submitted to contents analysis, but also some basic quantitative methods were applied. In the team there are experts from subject departments of the universities and from the Learning / Educational Centres. Nine out of fourteen persons represent subject departments and five these support units. At least some background as teacher do have six persons of the team.

Findings

During the first half of the three-year Eastern Finland Virtual University Network -project, half of the respondents, including both teaching staff and support persons, have produced web-courses carrying the main responsibility. Before the project of Eastern Finland Virtual University Network over one third (n=5) of the respondents had gained experience in web-course production, most of them in more than six courses. Two of this group had produced web-courses having the main responsibility of the production process. A clear majority of the respondents were familiar with various roles in the production of web courses.

The respondents' involvement in the development of e-learning was mainly due to the fact that web-course production was included in respondent's job description and respondent's own enthusiasm for web-course development. The next important motives were person's interest in pedagogy and ICT.

All the respondents consider web-course production very meaningfull or meaningfull. The respondents with a background as teacher (6) considered course development very meaningful (5/6), those in supporting activities somewhat less (3/8). Odd, though, that persons with teacher experience gave as the most important reason to their engagement in e-learning, their job description or order of the head of the department. On the third place was given the will to develop teaching. The reason to this order of importance is not clear, if general obedience or dependence on institutional structures, on the other hand, in the case of a new learning culture, a certain mental dependence could be an asset for the teacher himself/herself; as he/she knows to work on behalf of the Institution. [See Table 1].

In the light of the above it is, though, an interesting point that persons involved in e-learning before the project period of the EFVU, were strongly motivated and directed by their own enthusiasm, whereas persons without early experience placed almost to the top the duty character of their role in the development of e-learning. These persons are mostly the teachers of the team, as described above.

Interest in pedagogy *and* technology were in the group of persons with previous experience (n=5) even, almost at the top of the appreciation, whereas in the group of persons without previous experience (n=9), interest *either* in pedagogy *or* technology was not decisive at all (ranking 4-5). In this group pedagogy got just three mentions altogether, and just the place five on the list of seven factors. Considered that the group of team members without prior experience was greater than that with experience, the figures show a clear accent.

	Persons with previous experience (n=5)			**Persons with no previous experience (n=9)**		
	Mentions	*Range*	*Order of importance*	*Mentions*	*Range*	*Order of importance*
An order of a superior	1	8	7.	3	1-2	2.
Own enthusiasm for web-course development	5	1-3	1.	6	1-3	3.
Web-teaching is "trendy"	1	5	5.	1	4	6.
Previous experience in audio-visual production	1	6	6.	0	0	-
Web-course production included in job description	2	1-7	4.	6	1	1.
Interest in pedagogy	5	1-3	2.	3	2-5	5.
Interest in technology	5	1-4	3.	7	2-4	4.

Table 1: Reasons leading to engagement in web-course production.

The respondents assessed they have very good or good ICT-skills in creating and editing www-pages, in integrated use of different programmes (eg. text transfer) and in WebCT, which is the standard platform in the institutions of all team members. Skills in transferring video into the net and video editing were most often considered fair or poor.

Text is the most often used and most valued web-course tool. There are no differences between teachers and supporting staff in this place. Text is for them informative and available and readable with technical solutions of low level. Discussion, when related to the subject, enhances the learning process. It provides with social connections, which were considered very important in a web-course. Tests were appreciated as self-evaluation tools. Animation was considered informative and illustrative. Video was still quite little used and appreciated, due to technical limitations and lacking expertise.

As the most important advantage of a web-course was considered the possibility to study over distance and time. This enables eg. personal learning schedules. Diversified material can be included – if there are enough resources for production. Other advantages mentioned were the possibility to use experts from outside and to insert illustrative elements to a course (eg. animation, photos, video etc.)

The respondents rank very high the possibility to personal learning style and offering tutoring to the students, regardless of the respondents' background as teacher or support person. On the other hand diversity and personalized learning path was pretty poor taken into account in the courses already finished.

Half of the respondents, especially persons with longer experience, have constructed web-courses on a certain approach. Majority of teachers and supporting personnel considers web-based learning supportive to the face-to-face teaching. Awareness of the chosen pedagogical approach of a web-course is not very high, as about half of the respondents planned the course according to a specific pedagogical approach. There is practically no difference here between teachers and supporting staff. Opinions as follows were given as descriptive to the issue of pedagogical approach: *"Open, problem oriented, contextual"*, *"Learning by doing. Rapidly in to the practice"*, *"Exploratory learning."*

As to the issue of collaboration in the courses realised by the team members, a clear statement shared by almost all respondents was that just little, at the best some, collaboration was gained. As descriptive for collaboration were given such statements as "discussions in the web" (4 mentions), "shared goals in a group" (3 mentions).

The role of the teacher in web-based learning is a generally known issue. In this study the question was formulated as follows: "Which role at the best would be your choice: teacher, tutor, expert, service provider?" The respondents tended to appreciate the role of a tutor / mentor. After the role of a tutor, secondly that of a teacher and thirdly an expert was given without any great difference in the background of the respondent.

The survey shows that emphasis in course production has moved from technical and practical matters to careful planning, considering the course as an entity, its' structure and interactive elements as well as visualization. The role of technology has become less important, although technical matters are still carefully considered in order to find the best technical solution to each course. The goal is to produce web-courses with readable, illustrative and interactive content, which is technically reliable and easy to access. Thus the most time-consuming phases in course production are producing and editing material into electronic form, suitable for the chosen learning environment. This includes planning and producing course contents, examples and animations.

Over half of the respondents (n=8) have nowadays a little more positive attitude towards web-learning than they had in the past. Considered that the team members do their job out of their one choice, also when appointed by the institution, and find their task meaningful, this is not a surprise. One fourth (n=3) have nowadays a lot more positive attitude towards e-learning than before. Three respondents stated that their attitude has not changed. Experience in web course production seems to have no effect on the change of attitudes. The somewhat reserved attitude towards virtual learning, experienced by many respondents has not discouraged the team members, anyway. The colleagues at the respondent's department have a positive and curious attitude on web-based learning, but also prejudices towards "new and unknown". Also students have a positive stand with some reserve.

One factor that affects the experience in the team is the expectations towards quality of web based learning. Over half of the respondents (n=8) estimated that the quality of web-courses is fairly good compared to traditional learning. Six respondents argued the quality to be good or very good. Careful planning and production reflects to the quality. There are several critical factors related to the quality of web-learning. According to the respondents the material should be readable and illustrative. Technical solutions are not the main issue in course production, but should be considered carefully to find reasonable and functional solutions for each course. Material should be easily accessed over distance and time. Technical and pedagogical support for teachers is of crucial importance. Guidance and support of students has to be organized. ICT-skills of students and teachers reflect to the progress of the course. Although web-courses attach value to teaching being available over distance and time, a timetable and some dates have to be given according to the respondents.

BEST COPY AVAILABLE

Conclusion and Discussion

The group of respondents seems to take a cautious start in virtual learning. They combine the elements of traditional face-to-face teaching with the modern technical facilities, with the will to keep on personal contact, tutoring and collaboration. In the practice, anyhow, personal contact and collaboration was poorly realised. Altogether in the EFVU project it handles a small scale production of learning materials, where members of the team are familiar with various tasks. The task is generally seen very meaningful. In the present stage of development this seems a rational arrangement, also if there is, of course the question, how much academic staff should be involved in www-page productions etc. (See Ryan et al 2001, 71-72) In this form e-learning is an additional element in teaching. No meaningful differences were detected in different areas of the study in comparison between respondents with teacher background or supporting staff. For the first group developing web courses is more rewarding than to the others, though. The members of the team with longer time experience are strongly directed by personal enthusiasm, whereas newcomers see their job more regulated by the institutional side. This is a signal of a more institutionalized dimension and growing acceptance. The team members show quite little awareness of the pedagogical approach in web course design. A constructivist approach in pedagogy could be acknowledged as a primary orientation in the team (compare with Salmon 2000, 35-36), on the other hand this is not specific at all. It seems, anyhow, that after the first 1,5 years of work this could be changing, and more attention will be paid to careful planning, also with didactic aspects in the production process. On the other hand the closeness of web course production to the teaching and teaching institutions is a garant for didactic consciousness, a matter that not so easily could be detected through the questionnaire.

As noticed above, much attention should be paid to the careful planning. This is also a point Ryan et al (2001, 77-78) recommend, with the help of concept maps and such, for team members to facilitate project management. Documenting the process would also be of great importance.

Some of the findings above could be reflected to the general trends in web-based learning. The will to take diversity into account is somewhat similarly reflected by the team members as for instance the study of Institute for higher education policy (Quality on the Line 2000) shows. Major institutions in e-learning in their specifications do emphasize student centredness but leave personalised learning aside. One has to acknowledge, though, that learner style adaptation is a debated area also when in many ways learners are different, starting from visual, auditory or kinesthetic learning preferences (see McVay Lynch 2002, 16-17).

The role of the teacher is in a lively stage. The group concerned in this study might not be so far that they would name the teacher e-moderator (see Salmon 2000), but they are eager to find new approaches in teaching. The point of view is pedagogical, in any case, not just technological one.

The quality of web-based courses done in the team was not evaluated by any systematic criteria. The comparison between the traditional teaching was more a numerous matter, of credits given. The idea of e-learning quality as a matter of system including elements of student and faculty support, infrastructure etc (see Quality on the line 2000) were not thoroughly considered. The focus of this study, anyhow, was more to find out the orientation of the team members, after 1,5 years of work, and in this function the findings are useful for the further development and becoming conscious of factors important in the process.

References

Education, Training and Research in the Information Society. (1999). A National Strategy for 2000-2004. Ministry of Education, Finland. http://www.minedu.fi/julkaisut/information/englishU/2/1.html

McVay Lynch, M. (2002). *The Online Educatior. A Guide to Creating the Virtual Classroom.* RoutledgeFalmer Studies in distance education. London and New York.

Quality on the Line. Benchmarks for Success in Interner-Based Distance Education. (2000). Prepared by the Institute for Higher Education Policy. April 2000. (www.ihep.com)

Ryan, S., Scott, B., Freeman, H., & Patel, D. (2001). *The Virtual University. The Internet and Resource-Based Learning.* Kogan Page.

Salmon, G. (2000). *E-moderating. The Key to Teaching and Learning Online.* Kogan Page.

A Pervasive Computing Solution to Asset, Problem and Knowledge Management

Suman K. Kalia, Charles C. Tappert, Allen Stix, and Fred Grossman
School of Computer Science and Information Systems
Pace University, USA, ctappert@pace.edu

Abstract: A pervasive computing approach to asset, problem, and knowledge management reduced the average time to complete all major helpdesk tasks, and led to faster data availability, improved data quality, improved help desk effectiveness, improved help desk Return on Investment (ROI), lower overall Total Cost of Ownership (TCO), and increased user satisfaction. We describe the conceptualization, design, and construction of wireless laptop and PDA-based asset, problem and knowledge management systems. The systems work on a Lotus Notes/Domino-based server, supporting both wired desktops and wireless laptops and personal digital assistants (PDAs), to assist in the management of a divisional desktop support team across the U.S.

Introduction

The following quote (IBM Pervasive Computing Website 2002) indicates the importance of pervasive computing in managing information: "*Information is the new currency of the global economy. We increasingly rely on the electronic creation, storage, and transmittal of personal, financial, and other confidential information, and demand the highest security for all these transactions. We require complete access to time-sensitive data, regardless of physical location. We expect devices – personal digital assistants, mobile phones, office PCs and home entertainment systems – to access that information and work together in one seamless, integrated system. Pervasive computing can help us manage information quickly, efficiently, and effortlessly.*" Although the term "pervasive computing" is relatively new, its concept has historical precedence. Companies like IBM (IBM Redbook 1995) and United Parcel Service (Brewin 2002) implemented pervasive computing infrastructures as far back as 1982, and the IBM system was developed, as was our system, to improve the effectiveness of Field Technical Support personnel. Pervasive computing is all about access to your information, anytime, anywhere, from any device.

The system described here was developed for a company, hereafter referred to as ABC Company, that spends more than three billion dollars a year to procure technology. A major portion of this expense is for new desktops, servers, and associated peripherals. In spite of such a huge yearly investment, there has been no system to consolidate the technology procurement and to track the assets throughout their life cycle, making it difficult to compute the TCO of the assets. Also, there was no knowledge transfer of the kinds of problems encountered and the procedures followed by different support groups on such hardware/software throughout the organization. This is not only ABC Company's problem, but also one that is much broader and requires the attention of the industry

This paper summarizes a dissertation (Kalia 2002) that studied the effects of pervasive computing on the management of a technology Help Desk environment. The research activities included the conceptualization, design, and construction of wireless laptop and Pocket PC 2000 Operating System PDA based asset, problem and knowledge management systems to assist a divisional desktop support team across the U.S. The systems worked on a Lotus Notes/Domino-based server supporting both wired desktops and wireless laptops and PDAs. First, we created a baseline from our desktop computing Help Desk environment. Then, we established a pervasive computing implementation and measured the change in the quantity and quality of Help Desk calls handled. We hypothesized that the pervasive computing implementation would reduce the time to complete the helpdesk tasks, speed data availability, improve data quality, improve help desk effectiveness, improve help desk ROI, lower overall TCO, and increase user satisfaction.

Pervasive computing has its limitations, and one source (Grimm 2000) lists three scope-limiting areas: user interface and form factor limitations, network constraints, and multiplicity of administrative domains. We have removed, or at least lessened, the effect of these constraints by applying suitable limitations on the scope of our implementation. We addressed the user interface and form factor limitation by limiting the devices used to the Compaq iPaq PDA that uses the Pocket PC 2000 operating system, desktop and laptop computers running current versions of the Microsoft Windows operating system, standardizing the laptop selection on the IBM ThinkPad. We addressed the network constraints issue by limiting the network architecture to our corporate Intranet with its wired Ethernet and wireless 802.11b access, and no access was made available from outside this infrastructure. We addressed the multiplicity of administrative domains limitation by limiting a user logging on to the network from a desktop, laptop, or PDA to a single network identity (User ID and Password) for authentication.

Methodology

The project was divided into two phases: baseline and pervasive computing. For the baseline phase, January through December of 2001, we developed a suite of asset, problem and knowledge management applications in Lotus Notes and implemented them in a pure desktop-centric client/server environment. In the baseline phase, we captured the asset, problem and knowledge management data from the three sites: Tampa, FL, Boston, MA and New York, NY. In the pervasive computing phase, January through April of 2002, we used the handheld computers and collected similar data for comparison purposes. All data were replicated across the WAN at regular short intervals and made available across the country to 5,000 plus users through Lotus Notes.

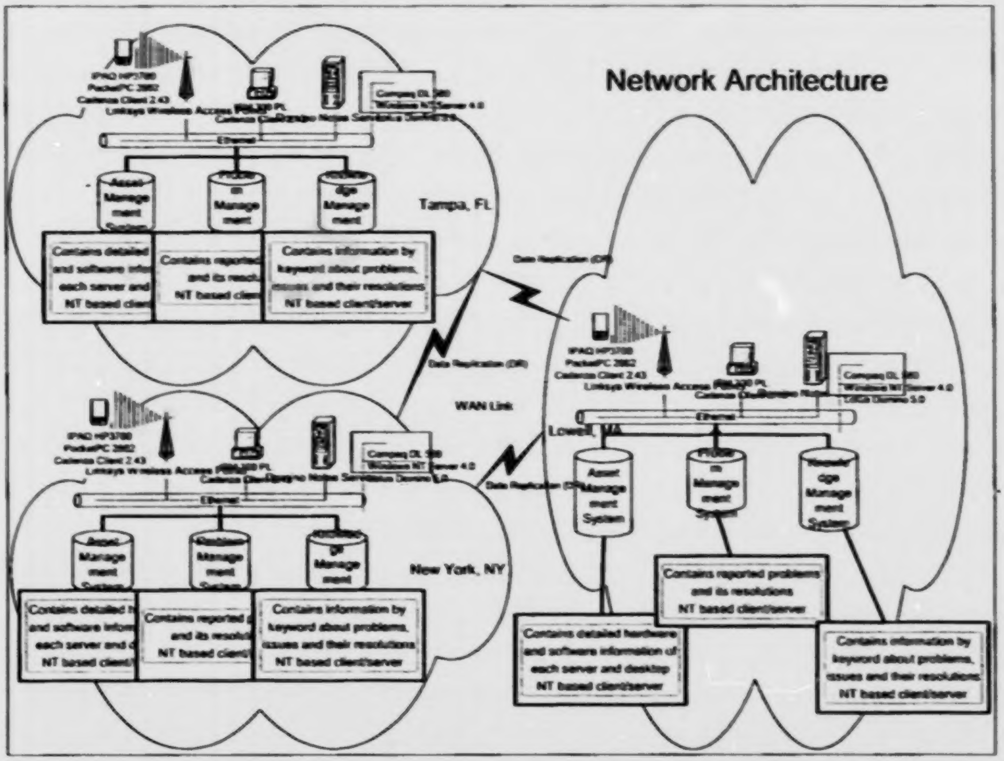

Network Architecture
IPAQ HP3700
PocketPC 2002
Cadenza Client 2.43
Linksys Wireless Access Point
Compaq DL 380
Windows NT Server 4.0
Ethernet
Asset Management System
Problem Management
Knowledge Management
Tampa, FL
Contains detailed hardware and software information of each server and desktop NT based client/server
Contains reported problems and its resolutions NT based client/server
Contains information by keyword about problems, issues and their resolutions NT based client/server
Data Replication (DR)
WAN Link
Lowell, MA
Lotus Domino 5.0
New York, NY

Figure 1: Network Architecture

Figure 1 shows the overall network architecture used for this application in the three supported locations, the configuration of wired Ethernet LANs at each location, and the Wireless Access Points that allow wireless laptop computers and PDAs to be an integral part of this network. It also indicates the positioning of the Lotus Notes servers that house the applications and databases, and the data replication topology used to keep the databases at all locations in synchronization. The PDA clients consisted of two models of the Compaq's iPaq PDA using the Pocket PC 2000 operating system. The desktop and laptop client application development was all done using Lotus Notes development tools. Lotus Notes is a workflow development tool, which integrates, e-mail, text databases, workflow, and forms. The downloading and reformatting of Lotus Notes data to fit on the smaller PDA screen was done using Cadenza, a PDA based Lotus Notes client developed by Common Time, Ltd., that reshapes the data presentation to fit on the smaller presentation area of a PDA screen to integrate with Lotus Notes.

Asset, problem and knowledge management systems were designed, developed, and deployed in a client/server environment to provide a suite of Help Desktop applications supported by a set of corresponding back-end Lotus Notes databases. The Asset Management System was developed to provide an on-going tool to capture desktop hardware and software asset information. We used Lotus Notes because all users had Lotus Notes on their desktops

BEST COPY AVAILABLE

and Lotus Notes servers were already present to support these applications. The Problem Management system is a workflow application developed in Lotus Notes and used to record all incoming desktop problem calls. Each desktop has a Problem Management icon to invoke the application. The application enables a desktop user to enter his own problem calls; or optionally call one of the helpdesk agents and have them record the call on his behalf. Once recorded, a call may be viewed from New York, Boston, or Tampa instantaneously. A recorded problem is also automatically reported to the assigned engineer for immediate action. An engineer has multiple ways to find out about, and address, a reported problem. He may use a hyperlink in the e-mail message to jump directly to the problem record in the Problem Management system, call up the Problem Management application itself and select only his calls, and/or he may even review and accept other people's calls and address them. The Knowledge Management system feeds off of the Problem Management database and is merely a reporting mechanism. It allows a Field Service Engineer to immediately retrieve information on past problems by category (printer problems, LAN problems, etc.), and provides a basis to perform more extensive analyses of problems, solutions, and trends.

The client/server architecture supported the suite of applications. Clustered Compaq servers hosted the various Lotus Notes/Domino servers that supported the Notes based applications. The components consisted of Lotus Notes/Domino Web Server clusters, LAN/WAN/Wired/Wireless Network infrastructure, and Clients. We chose to use the Lotus Notes/Domino servers as our data repositories and Web servers for simple seamless data replication across our locations, for faster development, and for easy future enhancements. The standard Lotus Notes E-mail architecture across the company made it a convenient platform for the research and implementation. The network infrastructure was based on the existing infrastructure at ABC Company, augmented with new wireless capabilities. Data synchronization was necessary to present the same view of the data at all locations, and was a key objective of this project. The three Lotus Notes/Domino server clusters were located on the ABC Company Corporate backbone and thus shared the same wide area network across the country.

Results

During the baseline and pervasive phases, we collected approximately 12000 Lotus Notes records, each corresponding to a help desk call and containing the following information: the engineer responding to the call, the date and time the call was initiated, the date and time the call (task) was completed, and the support category of the call. We downloaded these records into a spreadsheet and removed those of calls not completed within the day received – that is, where the date of the call did not match the date of completion – because they may not accurately represent the time to completion that we were interested in analyzing. We discarded about 2400 records through this data cleansing process, leaving 9662 records suitable for our comparison testing. The records were sorted by date and divided into two groups to represent the baseline phase (Jan-Dec 2001) and the pervasive phase (Jan-Apr 2002).

We then sorted the calls by category and found that more than ninety percent of the total 9662 records belonged to fifteen dominant categories according to total sample size, and that these categories were reasonably represented in both the baseline and pervasive phases. The remaining 731 records not in the fifteen dominant categories were consolidated into a single "catch all" category. Most of the categories (all but 3 and 4) fall under Gartner's technical support category (Berg et al. 1998). The sixteen categories are: LAN connectivity problems, Lotus Notes install, printing problems, hardware – equipment procurement, new software installations, LAN password resets, in-house application support, software – problems, hardware – new installations, Internet support, Lotus Notes ID creation, new user set-ups, LAN account lockouts, relocations, mobile PC support, and the remaining categories combined.

Table 1 lists the sixteen categories by descending sample size – that is, the sum of the number of help desk calls in both the baseline and the pervasive phases – and, for each category, presents the total sample size, the baseline sample size, the baseline average time to completion, the pervasive sample size, the pervasive average time to completion, the decrease in the average time to completion in moving from the baseline phase to the pervasive phase, the percent decrease, the corresponding Chi Square statistical test value, and the corresponding null-hypothesis probability (p) value as a decimal and in scientific notation. The totals and overall statistical test values (for all 16 degrees of freedom) are also shown at the bottom of the table.

All categories benefited from a decrease in the average time to completion of the tasks, with the percentage decrease ranging from 3 to 62 percent. From the p values it is clear that the benefit of moving from the baseline to the pervasive implementation is statistically significant for most of the categories; eleven of the sixteen category decreases were significant with $p < 0.05$, and most of these, as well as the total, were significant with much lower p values. Therefore, the move to the pervasive implementation to handle help desk calls was highly beneficial. The engineers spent less time commuting, worked on more complex problems, and their productivity increased to handling three times as many calls per month.

Task	Total Sample size	Baseline Sample size	Baseline Avg Time (sec)	Pervasive Sample size	Pervasive Avg Time (sec)	Time Decrease (sec)	% Decrease	Chi-Square	p (decimal)	p (scientific)
1	1544	827	2525	717	2363	162	6.4	1.47	0.22532012	2.25E-01
2	1419	555	5075	864	4678	397	7.8	5.29	0.02140613	2.14E-02
3	1068	521	5544	547	5031	513	9.3	5.12	0.02361844	2.36E-02
4	884	386	5982	498	5784	198	3.3	0.64	0.42231671	4.22E-01
5	809	321	4384	488	3014	1370	31.3	41.22	0.00000000	1.36E-10
6	808	541	1588	267	1006	582	36.6	11.24	0.00080256	8.03E-04
7	645	391	4769	254	3675	1094	22.9	12.58	0.00039088	3.91E-04
8	549	256	3990	293	3778	212	5.3	0.65	0.41972157	4.20E-01
9	375	180	7598	195	4440	3158	41.6	50.49	0.00000000	1.20E-12
10	252	95	3170	157	3016	154	4.9	0.23	0.63025296	6.30E-01
11	153	34	5075	119	1928	3147	62.0	45.81	0.00000000	1.30E-11
12	113	38	3837	75	2630	1207	31.5	5.62	0.01777955	1.78E-02
13	112	25	1492	87	813	679	45.5	5.30	0.02128186	2.13E-02
14	109	53	3550	56	2410	1140	32.1	4.04	0.04431985	4.43E-02
15	91	28	5458	63	3471	1987	36.4	8.99	0.00271397	2.71E-03
16	731	342	3368	389	3045	323	9.6	2.38	0.12312043	1.23E-01
Total	9662	4593	59805	5069	51082	16323	27.3	201.08	0.00000000	1.28E-34

Table 1: Average Completion Time of Baseline Versus Pervasive Phases for 16 Task Categories

Conclusions

We can now determine how closely our results match our hypotheses. From the statistical test results, there is no question that that the benefit of moving from the baseline to the pervasive implementation *reduces the time to complete the helpdesk tasks*. Compared to the first four months of the baseline period, the number of calls handled from the four months of the pervasive period tripled to *speed data availability and improve data quality*. A trend analysis showed that we could handle more calls because there is less commuting, a wider Knowledge Base, and remote access to all tools, *improving the effectiveness of the Help Desk*. The more effective Help Desk handled three times the number of calls with the same staff, clearly *improving ROI and TCO*. The increased number of calls is also a good indicator that the implementation of pervasive computing *improves user satisfaction*, which was verified by feedback from the engineers who worked during both the phases.

We provided an integrated suite of asset, problem and knowledge management applications and found that these three solutions, taken together, provided benefits greater than the sum of the benefits that these applications would have provided individually. With the TCO of a desktop computer estimated at $10,000, the non-purchase factors far outweigh the cost of purchase (Berg et al. 1998). The only way to reflect these costs accurately is to keep asset and problem management data together so that we can see how the cost of ownership increases as the hardware and software age.

As a further benefit of centralizing these data, we were able to evaluate the effectiveness of our Field Service Engineers. These data also provided a free source of training for them, since they could see the types of problems that they were likely to encounter in practice and the solutions to those problems, and this free training resulted in significant savings in training expense and enabled the company to utilize engineers with a lower skill set.

References

Berg, T., Kirwin, W., and Redman, B. (1998). *TCO: A Critical Tool for Managing IT*, Gartner Group research report.

Brewin, B. (2002). *UPS takes Wireless Application to Asia*, Computerworld, February.

Grimm, R. et al. (2000). *A System Architecture for Pervasive Computing*, Dept. Computer Science & Eng., Seattle State Univ.

IBM Pervasive Computing Website (2002). *What is pervasive computing?* http://www-3.ibm.com/pvc/pervasive.shtml.

IBM Redbook (1995). *An Introduction to Wireless Technology*, IBM Redbook SG24-4465-01.

Kalia, S.K. (2002). *A Pervasive Computing Solution to Asset, Problem and Knowledge Management*, Doctor of Professional Studies Dissertation, School of CSIS, Pace University.

Web*KANE*cts

Building on constructivism
to create
a learning-centred strategy
for e-learning.

Catherine Kane
Centre for Learning Technology / Information Sysytem Services
Trinity College Dublin
Ireland
Catherine.Kane@tcd.ie

Abstract: This research explores the development of a new strategy for e-learning. A strategy based on aspects of constructivism, that allows the learners to build their own learning environment based on new learning material, prior knowledge and experience. I call this new strategy **Web*KANE*cts**.

The methodology of Web*KANE*cts pulls together many existing ideas and strategies into a new focus for education. It is closely linked to the WebQuest strategy (Dodge, 2000). Resources to support the learning are designed as Learning Objects (Bannan-Ritland et al, 2000) and the environment is delivered using an Expert System, **Exesys Corvid** (http://www.exsys.com/1.2NR.html). My strategy takes what is best from other systems and makes the 'Web*KANE*ctions' necessary to empower the learner and the teacher.

An artefact has been developed for and tested by second year Botany students at Trinity College Dublin, Ireland. The strategy has also been examined by three experts working in the field of IT in Education.

Introduction

If we are to embrace the challenge Information Computer Technologies (ICT) in education presents us with, then I believe we need to examine new methods of learning and teaching. We need strategies that embrace these new technologies while still taking into consideration established theories on education and learning. I want to develop and test a strategy that enables the learner to compile his/her own learning objectives, where content, context and assistance support the learner and help him/her make sense of the ever more complex world we live in. This strategy should also encourage the learner to draw from his/her own experience and knowledge to create new knowledge. It should go above and beyond the use of educational theories used in traditional text-based learning environments.

Needs survey

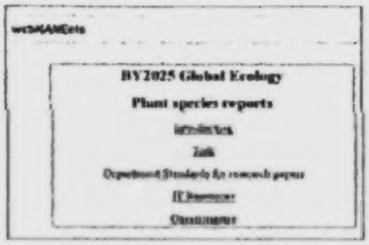
In the course of my profession as a Trainer in the Department of Information Systems Services, Trinity College Dublin, and from working with new entrant student annually, it has become apparent that many students enter College with little or no IT skills. Earlier research in this area (Kane 2001) had highlighted this problem. I hoped to build on this research while developing a new strategy for e-learning.

A needs survey of 200 second year Biology students showed the following results. 35.7 % of the students reported having no previous experience with e-mail, 27.1% reported having no Internet experience, and 22.1% reported no experience with Word Processing.

Based on this information I decided to develop an artefact that would support these students in the use of College computers to complete assignments.

Structuring the Learning Environment

I structured the artefact in the same format as a WebQuest.



BY2025 Global Ecology

Plant species reports

Figure 1 - Screen shot of system showing all sections.

The Resources section consists of IT resources that may be helpful in completing the task. These resources have been developed as individual learning modules. The student is asked to pick the modules he/she thinks will help them to complete the task. This is where the students build their own learning environment. If the student knows how to perform a task then he/she can choose not to select that module. Subject related resources could also be made available. For our test all resources were IT based.

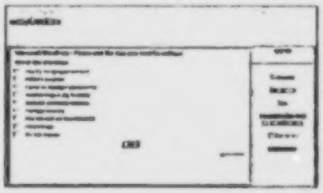


Figure 2 - Shows a list of Microsoft Word Help choices available to the student

Note: "Filestorage" in Trinity College is a protected central storage area independent of the networked computer from which files are saved. Each user is allocated 30 MB of private "Filestorage" space.

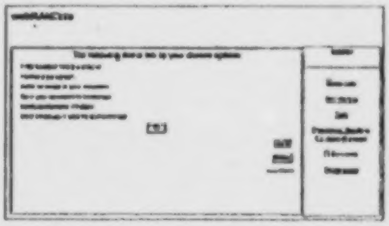
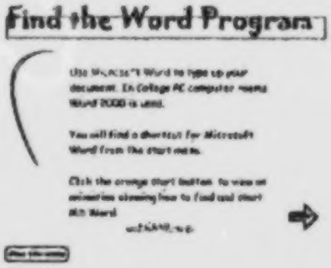


Figure 3 - A student's personal learning environment.

Each learning object deals with one small chunk of information. Text and animations are used to teach the procedure.



Find the Word Program

Use Microsoft Word to type up your document. In College PC computer rooms Word 2000 is used.

You will find a shortcut for Microsoft Word from the start menu.

Click the orange start button to view an animation showing how to find and start MS Word

Figure 4 shows a screen shot for the help item **Find the Word Program**.

Findings

Students were asked to fill in a questionnaire to establish how helpful they found the system

Taking a look at the number of times *not helpful*, *helpful* and *very helpful* had been selected across the full survey. There were a total of 161 responses. 90.7% of these responses had found the learning modules either *helpful* or *very helpful.*

Category label	Code	Count	Pct of Responses	Pct of Cases
Not Helpful	1	15	9.3	75.0
Helpful	2	94	58.4	470.0
Very Helpful	1	52	32.3	260.0
	Total responses	161	100	805

10 missing cases; 20 valid cases

In a second phase of testing three experts in the field of IT in Education were asked to examine the strategy. I asked them to use the system and at the same time talk about their experiences, feelings and emotions. This type of research is referred to as verbal think aloud analysis (van Someren M.W. et al, 1994).

The three experts were Dr Bryn Holmes, Ms Valerie Carroll and Ms Catherine Bruen. Dr Bryn Holmes is the course director of the M.Sc. in IT in Education at Trinity College Dublin and has a PhD in Information Technology in Education from the University of Cambridge. Ms. Valerie Carroll and Ms. Catherine Bruen are Educational Technologists at the Centre for Learning Technology, Trinity College Dublin.

All three experts had very positive things to report on the strategy. They highlighted the overall look and feel of the project as been very professional.

Holmes and Bruen both referred to the system as being like your friend or buddy.

> *This would be my buddy. Once I'd learn these 9 or 10 things I'd use them again and again for other assignments.*
>
> (Bruen 2002)

Both felt the students might turn to this system rather than asking a friend. Holmes suggested that this system might not be used as I had first envisaged but that students might be inclined to return to it later for short pieces of help when needed.

Holmes felt a system such as this that laid down what the task was, what standards should be followed and what needed to be done was comforting. She felt a strength of the system was how it was suited to both expert and novice users.

> *Although certain courses might be well suited to beginners and others to experts they tend not to be the same course, but this structure offers this advantage.*
>
> (Holmes 2002)

Holmes felt both novice and expert could use the system in the same room at the same time and while working on the same task. She added that while most people come to a subject with some experience a structure such as this allows them to build on that previous experience and motivates the learner to expand their knowledge.

Bruen said she would find comfort in having a system she could visit and revisit as needed. She liked the fact that the resources were limited to what was needed in order to complete the task and reported having difficulties at times with help systems built into programs.

> *...help never works. I can never find what I am looking for. This on the other hand is tailor made to support the task.*
>
> (Bruen 2002)

On a more negative note all experts reported finding the navigation slightly confusing. The students had been given a run through the system before they had to use it. Carroll suggested that the system relied too heavily on the students having attended this orientation session and that not enough help was built into the system. She suggested prompting the students with some questions such as:

> *Do you need to brush up on your computer skills? Then check out IT Resources.*
>
> (Carroll 2002)

BEST COPY AVAILABLE

As someone who has worked extensively with the WebQuest strategy she felt elements of the WebQuest strategy had not been utilised enough to guide the student, in particular the Process section.

Carroll also suggested that examples or sample reports that showed what was expected would be helpful. She suggested using the Evaluation Section for this purpose. She would also have liked some way to integrate this program into the task so the students could try things for themselves without leaving the environment.

> *I would like to be able to try this for myself. There should be some way to integrate this into the task.*
>
> (Carroll 2002)

Further Research

I believe that as technology becomes more available to our students and our institutions we have no option but to embrace this new tool and look for new ways to integrate it into our teaching and learning. Firstly our students must know how to use the technology and secondly the technology itself must be seen as a tool for teaching and learning in other disciplines. I am interested in embedding the transfer of IT skills through subject related topics. I believe my new strategy is one possible way of advancing this aim. I based this strategy on sound educational theories of constructivism and closely examined current trends, but I believe I have also pushed out the boundaries in search of something new.

The Department of Information Systems Services are supporting a team, lead by myself to develop a set of resources on using College Computing Facilities that will follow my strategy of delivery and design. These resources will support an already established induction course run by the department for new entrant students each year.

Once developed these resources will also be available to the Centre for Learning Technology for inclusion in projects that support the use of ICT in Education. Projects similar to the Botany project (the pilot for this study) will benefit. All resources will be developed as short modules dealing with specific tasks that can be compiled in different combinations for different contexts and to achieve different learning outcomes. Standards in design and implementation will be set to make the reuse of resources possible.

In order to establish whether or not this strategy is successful, I believe it is necessary to build many more learning objects and to test their use and reuse over several tasks and assignments. Records on how students are using the modules, whether they are building on previously used modules to solve new tasks or revisiting old modules, and establishing what connection they are making between old and new resources, will be necessary. This type of ongoing research will take time and cooperation from a target group of students.

I believe there is also a need to build a specific tool to support the construction of these learning environments. This tool might allow the student or the academic to build their own environments, allowing them to add resources that could be shared and used alongside built-in resources. Such a tool would need to be easy to use both for the Academic and the learner and I believe, should not be tied to any one content type or subject.

References

Dodge Bernie, (2001), *Online Retrieved: April 5th 2002, from the World Wide Web*
http://edweb.sdsu.edu/webquest/webquest.html

Dodge Bernie, (2002), , *Online Retrieved: April 5th 2002, from the World Wide Web:*
http://edweb.sdsu.edu/people/bdodge/bdodge.html

Kane C, (2001) *Online Retrieved: April 5th 2002, from the World Wide Web:*
http://www.cs.tcd.ie/Catherine.L.Kane/meta/essay/index.html

March Tom,(1998) '*Why WebQuests?, an introduction*', *Online Retrieved: 5th April 2002 from the World Wide Web,*
http://www.ozline.com/webquests/intro.html

Van Ryneveld L, http://hagar.up.ac.za/catts/learner/lindavr/lindapg1.htm *Online Retrieved: April 5th 2002, from World Wide Web*

Wiley, D. A. (2000). Connecting learning objects to instructional design theory: A definition, a metaphor, and a taxonomy. In D. A. Wiley (Ed.), *The Instructional Use of Learning Objects: Online Version. Retrieved December, 18th, 2001, from the World Wide Web:* http://reusability.org/read/chapters/wiley.doc

An Analysis of the Capabilities of a Self-study Support System for Network Education

Satoshi KASHIHARA, Shinichi FUJITA, ChunChen, LIN, Ming YIN Seinosuke NARITA
Waseda University
3-4-1, Okubo, Shinjuku-ku Tokyo, Japan
601c0319@mn.waseda.ac.jp

Abstract: A great number of pieces of research are being conducted on introducing computers into conventional face-to-face education to make it more effective. The present writers also have successfully developed a system for language lessons conducted at school as well as for reviewing the lessons. This system has the capability of providing learners with videotaped contents of language lessons, so that they can use them for their self-study. This system, however, has recently been confronted with a problem, which was raised by the learners, of being unable to provide them with excerpted information that they need. Although learners are required to spend more time on reviews than lessons or preparations in order to acquire a foreign language, no effective system for reviews has been proposed yet in reality. This thesis describes the present situation in which school education networks are being used, and also makes an analysis of the capabilities of the aforementioned network-based effective system for self-study, taking the state into consideration.

1. Introduction

Education, including e-learnig, may be classified into two types according to whether or not it is carried out under time constraints; education that is carried out under time constraints is categorized as synchronous education, and education that is carried out otherwise is categorized as asynchronous education. Synchronous-type education refers to education that requires every learner to simultaneously take part in lessons. There are two subcategories of education of this type; interactive synchronous systems, which include SCS (Space Collaboration System) (see [4] below), and pseudo-interactive synchronous systems, which include Waseda Learning Square (see [5] below). SCS is well-known as an interactive synchronous system that networks higher education institutions throughout Japan, including national, public, and private colleges, universities, and technical colleges, by the use of a communications satellite. Asynchronous-type education refers to education that allows learners to study whenever they like under no constraints of time, and includes paper-based correspondence education that used to be popular before the Internet gained popularity as well as WBT (Web-based training).

In the area of educational engineering, research is currently being conducted on asynchronous-type lessons, and there are some groups that are making practical use of this type of education. Education of this type, which allows learners to study at their own pace, is considered to be suitable for self-study for reviewing lessons, self-study that aims to acquire and fix knowledge, and drills that learners are required to do repeatedly. The writers have repeatedly mentioned this type of education has the advantage that it can be carried out under no constraints of time. At the same time, however, the writers cannot avoid pointing out the disadvantages of this type of education. In the concrete, there is apprehension that it may not make learners feel they are participating in lessons for the following reasons; teachers cannot easily grasp the situation with regard to each learner's understanding and learning, and learners cannot easily grasp the situation of other learners, either. Accordingly, this type of education may not key learners up to concentrate their attention on lessons. There is also apprehension that this type of education, which may not allow learners to know the situation of others, cannot easily raise motivation. Although there are some defects in the synchronous-type network education, it is still widely used .

Although the aforementioned synchronous-type network education is widely implemented, emphasis is laid, for the time being, only upon giving lessons through networks without any consideration of its functions. Particularly, there are few systems with a well-examined self-study system that can closely relate lessons to preparations and reviews that learners have to do. The following take the case of the self-study support system that was developed and has been practically used by the writers, namely, EDLIN, in order to discuss how to relate school-based lessons to self-study that has to be done by each learner.

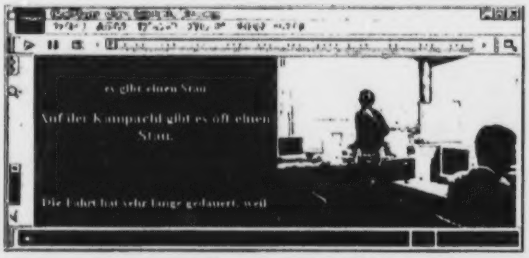
2. The Issue of EDLIN's Self-study Support System

The study group that the writers join developed a LAN-based integrated education support system named "EDLIN" (Educational system Developed for Learning on the Internet and an intraNet), and then has used it practically on the scenes of lessons.

According to the aforementioned classification, lessons conducted with EDLIN are categorized as synchronous-type education. EDLIN is intended for a lesson conducted at a computer room where a teacher and student are each provided with a computer on a LAN to communicate with each other, and aims not only to support the lesson being conducted at school but also to comprehensively help the students do their preparations for lessons as well as review lessons. In order to support the lesson being conducted at school, EDLIN includes various capabilities as follows. First, EDLIN includes the capability of serving as an electronic blackboard, which allows a teacher to input what should be written on a blackboard with a keyboard and then to distribute it to the students via an electronic medium, or the aforementioned network. Second, EDLIN includes the capability of transmitting data files, which allows a teacher to transmit data files necessary for his/her lesson. In addition, EDLIN includes the capability of allowing students to use electronic notebooks through keyboard entry, so that they can take notes of a lesson as they like, and that they can refer to them to review the lesson afterwards.

The following describe the aforementioned self-study system in a little detail. The study group the writers join constructed a self-study system, which aims to help learners do their preparations for lessons and review lessons at home, on a typical information providing system of the Internet, namely, the Web. Any student who has access to the Internet at home can use this Web-based system to do his/her preparations for a lesson as well as to review a lesson whenever he/she likes. This system also has the advantage that it enables those who have developed and used it to keep providing students with the latest version of the system by promptly updating a Web server with modifications made to the system. This is the outline of what the system realized by the writers is like and how students can use the system to do their preparations for lessons and review lessons at home. When the aforementioned system was practically used for preparations for lessons, students could study in advance what was going to be dealt with during the lessons at home or somewhere else by the use of its database system for words and grammar and its system for drills and exercises, both of which were made available to them on the Web by the aforementioned study group.

The system uses streaming distribution technology to provide, on the Web, students with not only videos of the lessons that were actually conducted but also data that was input on an electronic blackboard by a teacher, so that the students can review lessons with them. When the system was practically used, students could review lessons by getting access to the streaming data distributed on the Web. EDLIN includes the capability of synchronizing the images of ideotaped lessons and the text data prepared on an electronic blackboard with a teacher's application as well as the capability of automatically uploading the synchronized data to a Web server. These capabilities make it possible to create Web contents available for review almost automatically, and therefore save the teachers who use this system time and labor. This is an original feature of EDLIN.



es gibt einen Stau

Auf der Kampachi gibt es oft einen Stau.

Die Fahrt hat sehr lange gedauert, weil

Figure 1 window for review in EDLIN

Figure 1 shows a screen that displays the contents distributed by EDLIN. It is a real screen that was used for review. An electronic blackboard and an image of a videotaped lesson, both of which are synchronized, are displayed in the left and right sections of the screen, respectively.

EDLIN, which enables students to review the contents of lessons conducted at educational institutions such as schools by getting access to the Internet, was considered to be a very effective self-study support system. However, there occurred an issue concerning this self-study support system when students reviewed lessons with their electronic notebooks. The point at issue was that the students could not excerpt the part that they needed to watch again. In other words, the students had to watch the whole videotaped lessons from beginning to end in order merely to review the part they could not understand. In reality, the students must have wanted to excerpt the part that they regarded as questionable or the part that was regarded as related to the aforementioned part when they actually reviewed lessons with their notebooks. Taking this into consideration, the writers must admit that this system, which

BEST COPY AVAILABLE

compels the students to watch the whole videotaped lessons when they review, is extraordinarily inefficient. The writers are now determined to construct a better self-study system by drawing upon the analysis that has been made up to the previous paragraph. In the concrete, the writers intend to construct an education system that would be available to lessons as well as self-study through a network. This education system enables students to excerpt the images and sound of the part that is related to what they cannot understand when they review lessons while referring to the notes they took with their electronic notebooks during the lessons. This feature would help the students review lessons efficiently.

3. How a Self-study System for School Education should Function

The writers would hereafter discuss how a self-study system for school education should function, taking into consideration the results of the analysis of the capabilities of EDLIN's self-study system. The flow of a study system for school education can be divided into the following three steps; the first step that corresponds to a preview, the second step that corresponds to a lesson conducted at school, and the third step that corresponds to a review. In learning, each step is so important that any of them must not be skipped. Moreover, each step determines how learners relate to their teachers, how the system helps learners and teachers, and what role should be played by learners, teachers, and the system, respectively. When the self-study system being herein discussed is used in a lesson, it shall help one teacher and a number of students have bidirectional communication smoothly, so that a lesson can be conducted more efficiently. When the system is used for students to make preparations for lessons, it shall help them use their notebooks and skim through their textbooks, so that they can grasp the gist of what is going to be dealt with in the following lessons as firmly as possible. When the system is used for students to review lessons, it shall help them deliberate on what they have taught by their teachers and try to understand on their own. If there is anything ununderstandable to the students, they may wish to listen again to what their teachers have explained in order to get a grasp of it. In this case, the students may not wish to listen to the entire lessons but wish to focusing on what they cannot understand.

Up to now, EDLIN has helped students review lessons on their own by distributing the entire part of videotaped lessons on the Web. This method is very helpful to students who missed lessons and those who cannot understand the contents of the lessons at all and therefore wish to take lessons from beginning to end again. However, this method is not so helpful to students who need to review only several parts that they could not understand during the lessons. As stated before, such students do not need to listen to the entire part of what their teachers explained during the lessons but desire to listen to the excerpted part that they need to review. In order to "excerpt the required part", each videotaped lesson shall be given indexes of the following two types:

1. a time index that can be linked to each time point a student took a note with his/her electronic notebook during a lesson
2. a keyword index based upon the topics prepared by a teacher; this type of index can link each part of the contents of a lesson

Each student can use the former type of index simply by making his/her electronic notebook memorize the time he/she takes a note of a matter explained by his/her teacher. The electronic notebook is designed to record the time a note is taken in such a manner that the aforementioned time corresponds to the time period from the beginning of a lesson to the time point a note is taken. Accordingly, the student can pinpoint when the matter he/she took a note of was explained during a lesson. The electronic notebook has the capability of searching the notes that were taken with it. With this capability, the student can search for the matter that he/she needs to review, pinpoint when it was explained by his/her teacher with the index, and then directly access the applicable part of the videotaped lesson for reference.

The latter type of index is based upon the topics that would suggest what is being explained by a teacher. The teacher prepares these topics, and then marks the applicable part of the videotaped lesson with them, so that each topic can be timely linked to the applicable part of the videotaped lesson.

As stated up to now, it is required to construct a system that would enable each student to efficiently review the part that he/she could not understand during the lesson with his/her electronic notebook or by searching videotaped images for the applicable topic prepared by a teacher. See Figure 2 for reference.

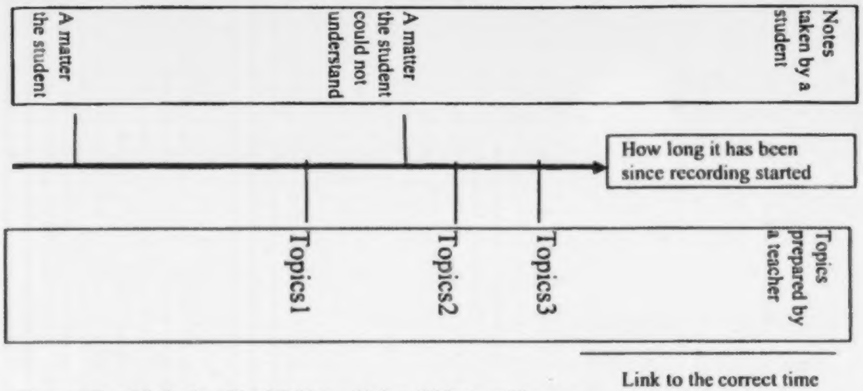

Notes taken by a student
A matter the student could not understand
A matter the student
How long it has been since recording started
Topics prepared by a teacher
Topics3
Topics2
Topics1
Link to the correct time

Figure 2 Two Methods of Establishing a Link to Videotaped Images

The following exemplify how the revised version of the present EDLIN is expected to function. The revised EDLIN may provide students with a system that would record each time a note is saved. Every time a student saves a note that he/she took on a matter explained in a lesson with the aforementioned system, the system would record the time, with which the student can establish a link to the applicable part of the lesson contents. The system is also expected not only to establish a link between the text data prepared by a teacher, such as the aforementioned topics, and lesson contents but to have the capability of searching the aforementioned text data. If these expectations are realized, it will become possible for each student to access the lesson contents that he/she really needs through the aforementioned link. As stated before, it is required to construct a system that would enable each student to efficiently review the part that he/she could not understand during the lesson by the use of his/her electronic notebook or by searching videotaped images for the applicable topic prepared by a teacher.

4. Conclusion

In this thesis, the writers have made an analysis of the capabilities of EDLIN, which they developed and have used, in order not only to discuss the importance of self-study as part of school education but also to examine the capabilities of the system that would usefully support self-study. Self-study is a stage of learning that cannot be skipped. It is no exaggeration to say that how efficiently a student can do his/her self-study may determine to what degree the student can understand the contents of a lesson. For the time being, most pieces of research being conducted are focused on how to use networks in order to conduct conventional-type face-to-face lessons at classrooms. Therefore, the writers must admit that there are few systems that relate the contents of lessons to self-study, and also that there are few systems that are constructed on the basis of a learning model of learners. Research on how to introduce computers and networks into conventional face-to-face education may be in the primary stage of the research on e-learning, and research of this kind has already become matured. It is high time for researchers to aim at developing a system that would help learners study with efficiency not only at classrooms but also at home. At the end of this thesis, the writers would conclude the system proposed hereinabove, which may allow learners to make the most of the contents of lessons to study by themselves, not only to keep up with the time but also to be very useful and considerate to learners.

5. References

[1] Makoto Nakayama, Integrated CAI System for Language Education, October 2000
[2] Keihide Kanenishi, Distance Learning in Information course
[3] ChunChen Lin, An examination of the functional capabilities of different user environments in networked classes and the development of a school-based language lesson and self-study system based on this examination, June 2002
[4] SCS, http://www.nime.ac.jp/SCS/index_j.html
[5] Waseda Learning Square, http://www.wls.co.jp/

JUST IN TIME LEARNING FOR SCHOOL SUPERINTENDENTS

Although the role of the superintendent is commonly cited as a keystone in school improvement, it is not the traditional role of times past. This presentation puts forth a more encompassing and collaborative perspective on leadership, suggested by Peter Senge (1999), that it is the ability of a group (not an individual) to sustain the purpose it has begun. This session presents the World Wide Web as a conduit through which superintendents can deliver mo re timely, more extensive, and more contextually appropriate resources to their administrative teams and teaching staffs.

The superintendent is not only the organization's chief executive officer for the learning experiences of children and youth, but the motivating agent and facilitator of adult learning for the administrative team, teaching staff, and community. These multi-dimensional tasks demand attention to the informating role that superintendents play for their varied constituencies. Informating, a term coined by Shoshana Zuboff (1988), is a useful concept for professionals who play such connective roles in the learning success of others. In contrast to the automating technologies that make our work more efficient, informating efforts stretch people to think differently about the work they do and then to use technology in improving that work. How then can the educational CEO keep his or her team connected with each other, and with resources that support the district's mission and that reflect "world class" standards?

The presentation uses a conceptual framework based on Rosabeth Moss Kanter's findings about "world class" organizations. Kanter points to three primary factors accounting for this level of successful group effort. They are: 1) improved thinking and problem-solving, 2) improved performance reflected by results, and 3) improved networking of individuals within the organization. She claims that world class organizations whether they are corporate, medical, or educational all support such an amalgamation of thinkers, makers and traders.

This presentation takes these three categories as organizing units from which to explore available electronic resources through which superintendents can connect the administrative and teaching staffs with information to stretch their thinking, improve their performance, and expand their connections to gurus in their field and to each other.

Integrating the web into a superintendents assistive approach to the learning of others exemplifies to a community a "marketing" as opposed to "sales" approach (Schlechty, 1997) to education. The traditional mindset for most organizations is looking at what exists in our warehouses and designing our offerings to reflect an existing product. Like many products, the shelf life of information in education too exceeds its limits. A major dilemma for veteran educators today is that those practices which accounted for their own professional success and the success of their former students grow increasingly obsolete. In both its informative and communicative capacities, the Web enables superintendents to foster a marketing approach linked to best practices and attention to the development of thinkers, makers, and traders, in any organization.

It creates a leadership arena less shaped by policy and bureaucracy and more connected with others on whose success the ability to sustain positive initiatives depends.

The Cost-Effectiveness of an Online Electric Circuits Course

Edward John Kazlauskas
Rossier School of Education
University of Southern California
United States
kazlausk@usc.edu

Hans H. Kuehl
School of Engineering
University of Southern California
United States
kuehl@usc.edu

Lawrence O. Picus
Rossier School of Education
University of Southern California
United States
lpicus@usc.edu

Abstract: This paper describes an e-project in a college-level introductory electric circuits course. Online materials were developed using the Mallard® course management system. The project is acquiring empirical and other data on two critical issues: 1) Whether the course with its substantial online asynchronous components is as effective as a primarily synchronous course; and 2) The comparative costs of the new mode of online instruction, which replaces pen and paper exercises mediated by graders with self-help online instructional exercises and asynchronous online discussion. The project is comparing the modified online version of the course with a traditional version, and the overall design of the project can be considered a pre-test/post-test, control group design with a follow-up qualitative study. The paper then presents initial results of the project.

Introduction

A semester long university-level course on Introductory Electric Circuits establishes a foundation for the understanding that is required in circuit design and includes: an introduction to primitive circuit elements and basic circuit types derived from them; the application of key physical laws (e.g., Ohm's, Kirchhoff's laws) to circuit analysis; and the application of calculus and differential equation skills in analysis of circuit design. There was the recognition that this traditional synchronous course was to some degree "broken." To fix it, the heart of the course needed to be addressed – the paper and pencil homework problems, which are directly or indirectly related to 80% of the course grade and clearly related to student retention and overall success. As a result, an e-component was developed to address this issue.

The Course Management System

The principal software used in the project- is Mallard®, a course management system (CMS). Mallard® and other central CMS software at the university, such as Blackboard®, reside on a robust server serving some 30,000 users. Mallard® is web-based, allowing easy deployment into residential and non-residential environments. As a CMS, Mallard® is similar to others packages, but is especially useful for various types of math problems because it has the mathematical and computational functionality to evaluate and grade most types of problems in this course

The online course materials, the homework, is written in the extended HTML of Mallard®, are intended to replace the cumbersome and unsatisfactory process of solitary exchanges of paper problems with course graders. Online materials have been created that engage students, prepare them for future courses in circuit design, and provide for the potential of improved retention. While the broad content of the online course materials is adapted from a paper text source, the new materials are pedagogically and methodologically unique. For example, the complex equations and other aspects of the problem solutions submitted online by students are evaluated instantly. Further, the online problems are carefully deconstructed versions of the paper originals, which allow students to work to mastery through each element of the problem and at each point are provided detailed and immediate feedback on their mistakes. Students experiment and discover answers themselves and, when needed, have access to email where they can immediately query other students and the instructor for help. Some of the specific features of the online course materials include the following; Capability to program random values into problems so individual students get different numerical values in their problem statements; Immediate evaluation and grading of students' submitted problem solutions and return; Mallard® graded problem scores are automatically recorded; If solution is incorrect, student can rethink the method and submit another solution (10 times without penalty before the due date); Student can then pinpoint more easily where an error lies, and submit a corrected answer; Other student grades, such as exam scores, paper-and-pencil homework scores, laboratory scores, can be uploaded.

Project Description

A project, using the revised e-version of the Introduction to Electric Circuits course, was secured through funding by the Andrew W. Mellon Foundation Cost-Effective Uses of Technology in Teaching (CEUTT) Initiative that focuses on the cost and effectiveness of technology in higher education and whose goal is to identify and disseminate good practices, regarding methods of instruction, and measures of cost-effectiveness. The project is now acquiring empirical and other data on two issues: 1) Whether the course with its substantial online asynchronous components is as effective as a primarily synchronous course with similar material but delivered entirely by a standard lecture, recitation, homework, exam format; and 2) The comparative costs of the new mode of online instruction, which replaces pen and paper exercises mediated by graders with self-help online instructional exercises and asynchronous discussion mediated by the instructor and the students themselves. The plan is to compare the modified online course with a traditional course on the same material, and to measure cost and learning outcomes. The intent is to conduct this comparison working with current and upcoming enrollees in the course (three semesters of data).

The overall design of the project can be considered a pre-test/post-test, control group design with a follow-up qualitative study. In addition, the approach utilizes an entry-level assessment, non-intrusive data gathering throughout the project, post-course assessment, and a follow-retention test. Students in the course are divided into two groups, randomly assigned: (1) Group A and (2) Group B. During the first half of the semester Group A receives training and access to Mallard®, and is known as the ' Mallard group'; Group B is the traditional 'paper' group. In the second half of the semester, Group A no longer has access to Mallard® and switches to be the 'paper' group; Group B then receives training and access to Mallard®, and is the Mallard group. All students receive the same examinations, including the Final. Procedures are established to minimize any leakage across the groups, such as by controlling students' access to Mallard® for only certain parts of the semester. In addition to these two groups, a paper-only group and a Mallard-only group were established to satisfy requests from students who did not wish to partake of the regular 'experiment.' Although the number of students involved in these additional groups is small, the data do provide additional data analysis opportunities.

Data gathering consists of the following. (1) A pre-course instrument intended to measure the students' existing knowledge; a pre-course survey of attitudes; a pre-test instrument intended to measure the students' knowledge of content prior to receiving the course content; a post-test instrument intended to measure the students' knowledge and skill mastery after the course; a post-course attitudinal survey; and a retention test administered at a scheduled time during the semester after the course. (2) Grades on homework and exam; and numbers of time online homework submitted; number of interactions with teaching assistant; amount of time logged-in; etc. (3) But in addition, other approaches may be employed further along in the project, including the use of performance data, such as grades from course prerequisites, unstructured and structured interviews, observations of learners and instructors, examination of student work, and the administration of other instruments. The summative evaluation will consist of the aggregation of data gathered from the three offerings of the course but also emphasizes evaluation in terms of attaining the objectives of the project and of a more detailed analysis of student learning and outcomes.

Initial Effectiveness Results

Results in the Fall 2001 semester from both groups indicate a majority of students were 20-21 years of age (with a range of 19-38); were mostly male; and with English the primary language but with 7 other languages represented. The groups differed in terms of their majors; and a large majority of students were not freshmen or sophomores, although the course is recommended at this level. For the most part, prerequisite coursework was taken or being taken. The majority of students indicated no experience in analyzing or designing electronic circuits. There was variability between groups in terms of the amount of prior experience. A majority had some or a lot of interest in the topics of the course. For the most part students were positive in their self-assessment of the course-related content questions. Data were collected for Spring 2002 and compared to the earlier group. The Fall 2001 groups were slightly younger in age than the Spring 2002 groups, and, although English was the primary language of the majority of students, the Fall 2001 groups exhibited more language variability. Fall 2001 represented electrical engineering and biomedical engineering, and other majors, while Spring-enrollees were mostly electrical engineering majors. Although Fall 2001 students represented a variety of academic levels most Spring 2002 students were second-semester sophomores. A large percentage of Fall 2001 enrollees had not take CSCI 101L, the majority of Spring 2002 students had taken this course. Fall 2001 students exhibited variability in amounts of experience, while the majority of student in Spring 2002 groups had no experience.

Quantitative results for the Fall 2001 semester indicate that Group A and Group B performed differently on the various mid-term exams, but Group B seemed to perform better that Group A irrespective of their use of Mallard® or paper. The combined Mallard® and 'Mallard only' groups performed better overall on Midterms. The Paper Only Group did not perform well on exams when compared to Groups A, B, or 'Mallard Only.' For the most part, the homework grades of the Mallard group were higher. At this point in time, the means are not significantly different between the groups on the homework. For Spring 2002, there were no differences in the test performance of the groups on the same examinations; there was little difference between groups on homework performance.

Various qualitative and other results indicated that interest in the course was intensified. Student felt that it was "them against computer" instead of against the instructor. Some students couldn't sleep until they got the correct answer. The instructor of the course received more e-mail, office visits, and phone calls about homework than ever before. There were much higher homework grades, many were100%. Students liked the immediate grading and appreciated that they didn't have to wait a week for graded results. If a submitted solution is wrong, students liked being able to resubmit a solution up to 10 times without penalty before the due date. They felt that they learned from their mistakes while reworking problems. The majority of the students think that Mallard® should be continued in the electric circuits course.

Initial Cost Results

This project also has a cost focus. The approach to measuring costs in a project of this nature is to use Levin and McEwan's (2001) ingredients approach. This is accomplished by specifying the "ingredients" of each option considered, and by estimating the costs of each ingredient. Costs measurement is more than simply the expenditures (accounting systems typically report resource flows by object) involved in providing each ingredient, but also includes the concept of economic or opportunity costs (measures of what must be foregone to realize some benefit). For this study, expenditures and costs are being gathered for personnel, and for all other resources. In measuring the cost of personnel, much of the analysis focuses on opportunity costs.

One of the primary costs of development of the Mallard® system was the time of the instructor with an average of 159 hours spent per semester. As anticipated, over time the number of hours spent in development activities has declined. However, it should be noted that much of the development time for the fall 2001 and spring 2002 semesters was due to the study itself. In engineering courses using only the paper and pencil method, students traditionally are given homework solutions after turning in their assignments so they can determine if their methods and resulting solutions are correct or not. On the other hand, in courses using only Mallard® homework, solutions are generally not distributed to students because Mallard® automatically informs them of the correctness of their submitted answers. Assigned Mallard® problems can be used again in subsequent semesters since their solutions are not available from previous semesters. It was decided at the beginning of the study, to furnish homework solutions via the class Web site to both groups, i.e., everyone in the class. -As a result, solutions to all of the Mallard® problems assigned during the semester-are available to everyone in the class and in future classes, requiring the coding of many new problems. The instructor indicated that if all students in the class were using Mallard®, there would be virtually no costs for the development and coding of new problems. An additional development cost is that of teaching assistant time to learn Mallard and to code problems into Mallard. A total of 518 hours of teaching assistant time was spent in development activities. Individual rates of pay ranged from $7 per hour to $16 per hour. None of the teaching assistants appear to have received tuition remission in addition to their hourly pay for these activities. Note that *no* teaching assistant costs for development were incurred in the actual last two semesters (Fall 2001 and Spring 2002

Regarding instructional costs, allocation of instructor's time during the Fall 2001 and Spring 2002 semesters included preparation of lectures and exams, and coding of problems. As discussed previously four groups existed, thus other costs also includes creating and maintaining three Web sites and a paper-only database as well as shifting students from one format to another during the semester. It was therefore necessary to keep track of and administer four groups instead of two. This cost will be eliminated with the move to a Mallard® only format.

It is in the analysis of teaching assistant time that the most substantial differences in the cost of Mallard® and paper homework become apparent. There was no grading of Mallard® homework but, for example, in the spring 2002 semester, one teaching assistant whose time sheet shows a total of 125 hours in grading for the paper homework grading. If paper homework assignments were eliminated in favor of Mallard®, then most of the grading time would no longer be needed (teaching assistants would still have to grade the tests). Thus, the savings in time – and hence costs.

Data on student time on class activities are also available. Our hope was to compare the time students in the Mallard group spent on class activities to the time other students spent. But, student participation in this data collection activity was limited during one of the semesters, and we are continuing to ascertain the quality of the data by attempting to determine how consistent students were in turning in or not turning in the data collection sheets, and in allocating their time correctly to learning activities.

Maintenance and support costs are also being gathered, such as the Mallard® licensing fees (currently $1,000 per year), installation and maintenance costs, and user support costs (for faculty, teaching assistants, and for students). Unfortunately it may not be possible to get detailed breakdowns of the time spent by computer personnel in supporting Mallard and in providing user support. But it appears that as it relates to the entire university computer operation, the costs are relatively small. In particular, Mallard® is today a stable product that is not upgraded regularly, and is not widely used across campus.

Concluding Comments

The project is gathering data from at least one more iteration of the course (fall 2002); and is securing advice from a project Advisory Board that is reviewing the planning and design efforts, and the results.

References

Levin, H, M., McEwan, P. (2001). *Cost Effectiveness Analysis: Methods and Applications.* Thousand Oaks, Sage.

Acknowledgements

The evaluation efforts of the online electric circuits course was funded by the Andrew W. Mellon Foundation Initiative on the Cost Effective Uses of Technology in Teaching (CEUTT)

Blended Learning at a Leading Executive Education Institute: State of the Practice

Alim Khan
Karen Lindquist
IMD – International Institute for Management Development
Lausanne, Switzerland
alim.khan@imd.ch
karen.lindquist@imd.ch

Abstract: A review over five years has shown the emergence of blended programs – combining face-to-face and ICT at a distance – at one of the world's leading executive education institutes. A review of current practice shows a wide variety of ICT employed in programs. We take a deeper look at how and why ICT is used, through a broad analysis of ICT use in programs, complemented by a case study of a design for a specific program. The analysis reveals that a range of ICT tools have been deployed, and further, that their use differs according to type of program. The case study suggests that rather than the proliferation of ICT tools itself, or the improved technology or bandwidth that accompanies this phenomenon, it is close attention to client business and learning objectives in program design that is driving adoption of ICT in programs.

Making use of ICT in Executive Education Programs

IMD (International Institute for Management Development) is an executive education institute that provides management development programs for middle to senior level managers. For its first few decades of existence, all of its programs were run in classrooms and meeting rooms on its campus in Lausanne, Switzerland, or at client locations. This face-to-face model of high-touch program delivery served the needs of its clients well enough for IMD over the years to be ranked among the leading executive education providers worldwide.[1]

In 1997, IMD began to use Internet and communications technologies (ICT), and especially program websites, to enhance its face-to-face delivery of executive education programs. In their earliest form, these program websites were a convenient repository for depositing program materials. However, it was quickly realized that a flexible solution that offered additional capabilities, especially in peer-to-peer communication, would allow these program websites to develop into a broader platform that would more substantially support learning objectives. Having evaluated leading solution providers' products such as Lotus LearningSpace, WebCT, and Blackboard, IMD chose to develop its own proprietary platform. This custom platform allowed some components that are mostly superfluous in an executive education environment to be eliminated entirely (e.g. grading), and afforded enhancement of others (e.g. tools to allow participants to network and collaborate virtually while not co-located).

The evolution in use of ICT at IMD

Five years on, we knew that use of this platform had increased greatly among programs. We wondered to what extent, and further, sought insight into the variety of ICT tools being used in various program components. Finally, we wondered how program directors, who are responsible for overall program design and execution (including the use of ICT in programs), went about the process of incorporating ICT when designing programs. We followed the creation of a program proposal and present this case study, to address the latter question. Our prior questions lend themselves to a more quantitative approach, and we therefore have gathered and analyzed statistics from log files, program archives, and reports, to provide a view of the use of ICT in programs.

Our overall five-year review showed steady and dramatic growth in the number of programs that have made use of ICT (table 1).

---

[1] e.g. Financial Times rankings of international non-degree executive education have ranked IMD among the top ten providers worldwide since the survey's inception in 1999.

*2002 figures Jan-July only	2002*	2001	2000	1999	1998	1997
Programs supported with ICT	36	42	32	16	2	1

Table 1: Programs Using ICT, 1997-2002

As we have noted above, initially programs used websites consisting of static pages, with content in HTML format and links for downloading content in other formats. To see the richer set of ICT currently in use, we gathered information across all programs during the first half of 2002 which were classified as blended programs, those combining face to face with virtual components (since IMD does not run completely virtual programs, while its face-to-face programs make minimal use of ICT). We examined the program websites, discussion logs, and conducted interviews with the program directors involved. These 36 blended programs represented 40% of all programs conducted by IMD during the period studied.

We classified these programs as either single module or multi-module. In this latter case, there is an opportunity for technology-mediated interaction between the face-to-face modules. We found that there was a variety of ICT tools employed directly (e.g. online chat) or embedded in program activities (e.g. online assignments), and that multi-module programs did indeed make greater use of these tools and activities (table 2).

TOOLS AND ACTIVITIES		Total	Single	Multi	Total	Single	Multi
TOTAL PROGRAM POPULATION		36	20	16	100%	56%	44%
TOOLS USED	Content library	28	13	15	78%	65%	94%
	On-line surveys	14	8	6	39%	40%	38%
	Industry Analysis	19	7	12	53%	35%	75%
	Selected research	13	10	3	36%	50%	19%
	Participant-generated content	12	5	7	33%	25%	44%
	Forums	19	5	14	53%	25%	88%
	Chat rooms	4	2	2	11%	10%	13%
	On-line assignments	8	2	6	22%	10%	38%
	Situated project work	14	3	11	39%	15%	69%
	Supplementary CD-Rom	4	0	4	11%	0%	25%
	Community photos	17	5	12	47%	25%	75%
	Electronic follow-up	2	1	1	6%	5%	6%
Average number of tools used		4	3	6			

Table 2: ICT Tools and Activities Using ICT in Programs, January – July 2002

We indeed found a broad portfolio of ICT in use in programs today: **Content library** consists of the schedule and all readings to be covered throughout the program, as well as logistics information and participant profiles. **On-line surveys** are organizational diagnostic or personal psychometric surveys administered on-line, usually in preparation for a face-to-face module that will include a debriefing of the results of the survey. **Industry analysis** is an online, highly collaborative tool that is part of a process for analyzing an industry and a company's competitive position within it. **Selected research** refers to research reports custom-selected from external commercial research providers. **Participant-generated content** refers to captured, recorded and posted participant-generated learning points and conclusions from learning activities, in electronic text, graphic, or digital image form. **Forums** are asynchronous threaded discussion forums for conversation and constructive debate.[2] **Chat rooms** are a synchronous text chat facility that can be used independently by participants (self-organized) or as part of an organized exercise. **On-line assignments** are problem-solving exercises or assignments that require results and feedback to be posted on the platform as a learning activity in the program. **Situated project work** is a current strategic project, chosen by client companies and carried out by that company's program participants to help these participants meet both learning and business objectives. **Supplementary CD-ROMs** are computer-based training programs that ensure all participants have a basic knowledge of topics such as introductory corporate finance, so that discussions can begin at a higher level than would otherwise be possible. **Community photos** are digital photos taken of participants while they are on campus, working or socializing, and posted on the platform as a reminder while participants are working at a distance. **Electronic follow-up** occurs after the program has ended. Participants share how they have applied new learning in work activities. It typically happens through web conferencing.

---

[2] We have excluded forums that were made available but not used.

BEST COPY AVAILABLE

A Spectrum of Blended Learning – From Content to Collaboration

A further exploration of the difference between single and multi-module programs yielded more insights. We found that single-module programs tended to use fewer ICT tools and activities (average 3 per program) and were more focused on content delivery than multi-module programs, which were characterized by project work, an emphasis on collaboration, and used more tools and activities (average 6 per program). Figure 3 below contrasts the emphasis on content and collaboration in both types of programs across selected program components.

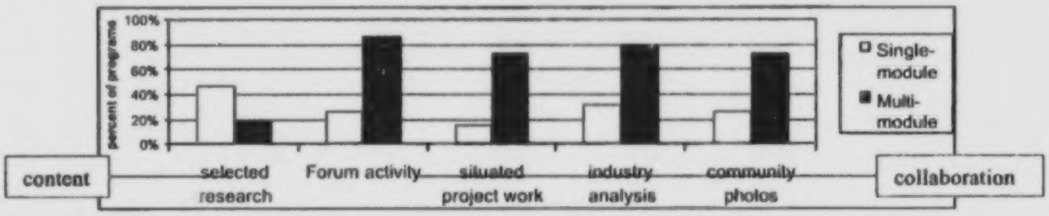


Figure 3: Content and Collaboration in Single and Multi Module Programs

Focusing on forums, we found that the average number of discussion postings in multi-module program forums was higher too, as expected given the greater opportunity to post messages between modules (table 4).

Participants and Discussion forums	Total	Single module	Multi-module
Number of Participants	1691	514	429
Number of Forum messages	2186	169	2016
Postings per participant (average)	1.29	0.33	4.70

Table 4: Average Number of Postings in Discussion Forums

Blended programs at IMD appear to fall across a spectrum. At one end are single module programs in which ICT provides convenient access to content. At the opposite end are multi-module programs in which ICT is also used for collaboration and shared learning. As Figure 5 shows, many programs fall somewhere in between.

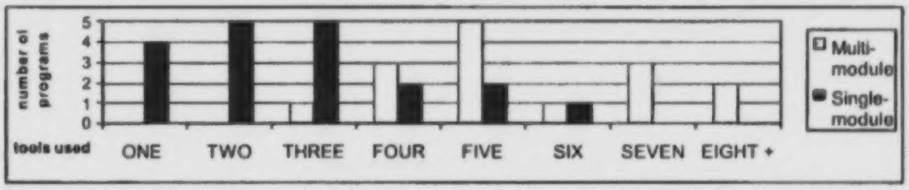


Figure 5: Number of Tools and Activities Used by Program Type

Case study: Program Proposal for a Global Financial Services Organization

With this spectrum in mind, we sought to understand how programs are designed with respect to the use of ICT tools. How does a blended program emerge? To provide some insight, we conducted a case study on a proposed design for a complex multi-modular program.

Background: Client Company's Objectives

The client company is a global financial services company. One of its key objectives is to improve its capability to innovate and implement ideas quickly across organizational boundaries. To achieve this objective, it identified its middle management as needing to develop the following: an awareness of the organization's strategic

BEST COPY AVAILABLE

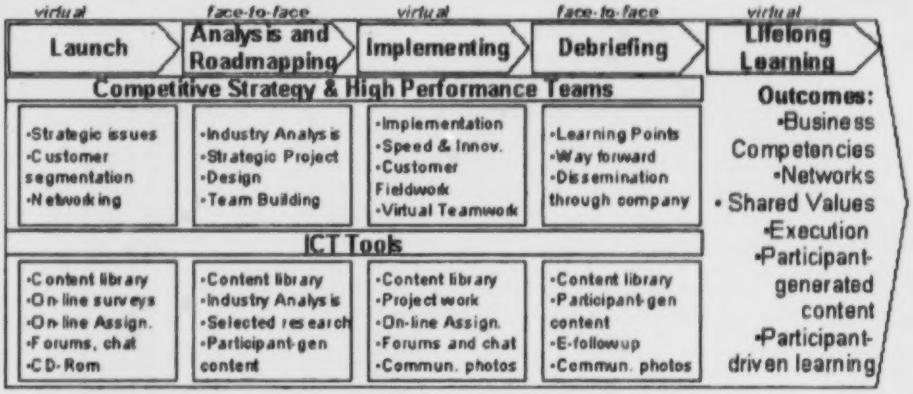
imperatives; customer-driven thinking as opposed to internally generated thinking; innovative ideas and heir implementation to close the gap between the current practice and strategic imperatives; and improved effectiveness in working in global teams.

To develop its middle managers along these lines, the company decided to partner with a top-tier business school. But the traditional "week at business school" program would not be sufficient to induce deep understanding and the required behavioral change among the target group. Neither could the company spare its managers for long periods of time away from work. Tuition, travel and lodging costs would also be an issue. While the company recognized the value of taking managers out of their daily business routines to be exposed to new ways of thinking, this practice alone was seen as too abstract. Also, the difficulty of transferring, translating, and applying these new ways of thinking to business issues back at the office would remain.

Proposed Approach: "Extending the Learning" Philosophy

To address these objectives given the constraints, much of the learning would be built around participants' business projects. This project component would give meaning to the learning, and participants return to work with immediate "take home value" in the form of progress made on their projects. The use of ICT tools to support collaboration in such an approach would therefore be considered a critical part of the program.

This blended design would also afford strategic awareness, because it would allow for the longer timeframes that strategic considerations often require. Rather than instant but intangible insight, participants could develop an appreciation for strategy as grounded in their own specific business situations. Similar arguments apply to the other objectives, such as customer centred thinking, development and implementation of innovation, and global teamwork objectives. In addition, the cost-effectiveness of continuing to work together at a distance via ICT, without the travel, time, or expense required to meet in person, would allow cost and time concems to be addressed. Figure 6 illustrates how all of the components would come together.



virtual
face-to-face
virtual
face-to-face
virtual
Launch
Analysis and Roadmapping
Implementing
Debriefing
Lifelong Learning
Competitive Strategy & High Performance Teams
•Strategic issues
•Customer segmentation
•Networking
•Industry Analysis
•Strategic Project
•Design
•Team Building
•Implementation
•Speed & Innov.
•Customer Fieldwork
•Virtual Teamwork
•Learning Points
•Way forward
•Dissemination through company
ICT Tools
•Content library
•On-line surveys
•On-line Assign.
•Forums, chat
•CD-Rom
•Content library
•Industry Analysis
•Selected research
•Participant-gen content
•Content library
•Project work
•On-line Assign.
•Forums and chat
•Commun. photos
•Content library
•Participant-gen content
•E-followup
•Commun. photos
Outcomes:
•Business Competencies
•Networks
• Shared Values
•Execution
•Participant-generated content
•Participant-driven learning

Figure 6: Program Map

Conclusion: Learning and Business Objectives Drive ICT Usage in Programs

From an ICT point of view, the program described above is a good example of selective use of a variety of tools. The program would also have a deep and transformative impact on the organization's management, through extensive collaboration among participants and coaching by IMD through ICT. In this case, the strategic use of ICT in the program design helped achieve challenging client objectives. The proliferation of ICT tools appears to be a response to such demanding client objectives. In this case, it appears that demanding client objectives, rather than a technological focus, are driving adoption of ICT in this program. Anecdotal evidence from other programs and conversations with program directors reveals similar patterns. Thus, we would expect future technological innovations to be adopted not for their ability to replace or enhance face-to-face experiences – but for their strategic fit in meeting client objectives.

BEST COPY AVAILABLE

Interest Required for Online Courses

Caroline King
School of Computing and Information Technology
UNITEC Institute of Technology,
Auckland, New Zealand
+64 9 415 4321 ex 8659
chking@unitec.ac.nz

Mae McSporran
School of Computing and Information Technology
UNITEC Institute of Technology,
Auckland, New Zealand
+64 9 415 4321 ex 8658
mmcsporran@staffmail.unitec.ac.nz

ABSTRACT

In common with most developed countries, 'New Zealand's learning environment is being transformed by new advances in technology, electronic media and the Internet.' (Beckford and Fitzsimons, 2002) The result is that teachers in this ever-changing environment have to be adaptable. This paper discusses how to keep true to pedagogical strategies whilst managing the technical issues encountered when porting courses to the web.

Our primary aim in education is to facilitate the acquisition of knowledge by our students. Whereas, in the past, lecturers could stand up at the front anddeliver a series of notes with an occasional diversion of a discussion, we teachers (tutors, lecturers) today are compared to the "edutainment" industry, where our students are very likely to switch off if not kept entertained. Our colleagues in learning psychology have long ago proved that concentration spans of today's students are reduced and that we must involve our audience. Just as we continually think of new activities in the classroom, we must think of ways to port these to online teaching. As the growth of this area explodes, we must examine the pedagogical strategies that can be used for online teaching.

INTRODUCTION

Use of the new technologies of e-communication, internet access and online courses, is having a profound affect on how society is learning (Bonk et al, 2000) Peer networks, virtual learning space and collaborative learning circles are some of the new techniques being employed. Once the initial mastery of these is achieved, the transformation to teaching online should make us more creative. It is time to look at who adapts best as an online teacher, and the techniques that will enhance the chances of success. The transition for teachers is not simple. Some tend to concentrate on the technology and forget the pedagogy of learning. Some simply hate change, and claim ideals are rarely achieved. Some teachers put a great deal of time and effort into unsuccessful ventures. 'Initial costs in staff time...high and returns are speculative.'(Swindell, 1999).

The role of the instructor is increasingly changing but the aim is the same – to make the delivery methods work for one hundred per cent of the students in one way or another. In a face-to-face class, a good teacher will watch carefully for the facial expressions of affirmation. Online, the affirmation comes through the written communication channel rather than the visual senses.

THE ROLE OF THE INSTRUCTOR

Many instructors are unsure of the online environment. According to De Fazio et al (2000, p 146), 'Academic support is often a complex role requiring a mixture of knowledge of the subject, language and study skills. In addition, there is a people or strong pastoral element that underlies the very nature of the work'. This is difficult enough in a face-to-face situation, but via a computer, 'however, retaining or attaining a sense of human interface between the teacher and the student... can be rather challenging' (De Fazio et al,2000 p 151). Instructors need to be innovative and proactive in the adoption of online strategies and the evaluation of pedagogical strategies. Their role is not just to employ new technologies, but also to maximise the achievable benefits from them. Their role is to prepare the students for the next stage in their learning.

Successful management of background tasks is important if the instructor wishes to enhance the learning. Administration of a web based course brings with it new challenging decisions about resources, tools, partners and markets. Being in love with new technology does not generate new students or class satisfaction. Good old-fashioned passionate teaching enamours students to rave about the usefulness of your course. Boring, non-passionate reading of notes drives them out of the classroom and the same disinterest to online resources results in non-participation, the silent class. If this is a base level course, the flow on effect could jeopardise the offering of higher level courses. Therefore the instructor has an obligation to tailor the use of technology to the course in question. As O'Keefe and McGrath (2000 p 378) state, 'Lecturers need to be aware of the models of teaching and learning which they implicitly or explicitly adopt, and to critically consider the role of technology both in the development of the curricula and the delivery ofthe material'. Whether online or offline, the interaction between the teacher and learner is a core element of learning. Feedback is required. 'The teacher is an important mediator in the process of constructivist academic learning' (O'Keefe and McGrath , 2000 p 377 citing Laurillard,1993), particularly in e-learning. Discussion boards have been used successfully for many years, but they are not the only tool and tend to be over used. To make this tool viable requires considerable input from the instructor. It is the instructor's role to promote collaboration, a necessary pre-requisite of on-line discussion. If students are not interested in helping others, and cannot see the benefits, the discussions will die. 'This means that a groupware application is not enough for changing the teaching-learning processes.....but simultaneous attempts to change the whole collaboration culture of the classroom are also needed.' (Lehtinen et al ,2000 p 35)

Instructors must take a lead role in the pedagogical strategies attempted in a course, but also need a mentor with whom to discuss new ideas, and preferably one with more experience in online teaching. Continual improvement can only occur if pedagogical and technical strategies that have been successful are repeated or developed further, and those that were less than successful are analysed as to their shortcomings and either discarded or reshaped. For this to happen, course documents providing reflective comments written at the time of delivery or shortly thereafter, must be available. The instructor's role in a course is preparation, delivery and most importantly, reflection, evaluation and improvement, thereby monitoring students' interest and maintaining their own.

STRATEGIES FOR FULFILMENT OF ROLES

Campbell and Hawksworth (1999) point out that the introduction to online learning is important. In our experience a conversational role taken by the instructor allows more participation by the students. Formal or directive statements like an email directing students to discuss their chosen research topic online will result in very few postings other than a declaration of the topic the student is intending to pursue. According to Green and Eves, (2000,p76), 'discussing information that the student is familiar with is essential to the establishment of confidence ... As confidence grows, students become willing to respond to the postings of others ..so the lecturer must bolster confidence during online chats and by the tone of responses to postings' . When online instructors are more interactive and spontaneous and have a genuine concern for the wellbeing of their students, this caring attitude is transferred whether in class or online and results in more interactivity.

Peer assistance should never be underestimated. Instructional conversations can be time consuming but Frequently Asked Questions (FAQs) can be stored and used again and again when appropriate. By actively encouraging the students to participate and by showing a personal interest, the instructor can facilitate the gain of significant advantages for all, by allowing the students not only to post questions, but also to provide answers. However, the postings must be monitored and mediated. The lecturer must not allow incorrect answers to go unquestioned or leave requests for help and challenges to postings to go unanswered. Weekly newsletters can be stored, edited and re-cycled where appropriate. Personalising articles and providing social reporting achieves a familial atmosphere, enhancing learning. (Campbell and Hawksworth, 1999)

One of the easiest ways to avoid overuse of any tool or strategy is to use a graph when formulating lesson plan strategies, drawing attention to usage. Variety is the key as espoused by Bonk et al (2000)

In Class	Online
Ice Breaker 8 noun activity (describe partner)	Ad hoc groups made - same exercise
Peer Feedback Roles Critical Friends	Via email Via discussion "groups"
Reading Reaction Class groups, Case Studies	Discussion Group online
Structured controversy	Whole class discussion (Points)
Brainstorming, Concept Mapping	Use of the Whiteboard (Groups)
Scavenger Hunt (library)	Use the web to get resources
Role Play (paper handouts)	Make script available to certain students. Use "avatar" names
Discussion of sound vision (resources)	Voicemail, video via net (slow) CDs or tapes (digitised)
Guest Experts (in class expensive	Use of new conferencing software

THE PRACTICE OF THE THEORY.

Current tertiary courses use a range of online facilities, with success varying from absolute success to dismal failures. Our study of one successful course with much online content, a second year paper that prepares students for customer support roles in industry, gives an insight into the use of different techniques and strategies. Originally the online resources were used to alleviate the administration load of a Co-operative Education unit, however this course was re-engineered to actively promote online learning within and outside the classroom.

In this course, initial sessions were used to familiarise the students with the tools that are required for online discussions. Blackboard (an online teaching shell) was set up to facilitate class discussions, personal diaries, file management, task completion, course notices and home pages of the students. Tasks involving collaboration with other students were assigned. These required the use of various technical equipment e.g. scanners, digital cameras and various software, the end focus being on the production of a personal home page and familiarity with the Blackboard utilities. Many different (computer) programs have been used to facilitate collaborative learning making it an important pedagogical tool. (Lehtinen et al, 1999 p16). Very early on, the students were required to conduct online discussions, even though they are physically in the same room. Here the instructor's role was critical. Digital Pictures were used so that participants could have an image of the person they were speaking to. Humour was also used, (cartoons) together with motivational snippets. A heavy focus on sharing resources found on the web was encouraged. To enhance problem solving abilities, small working groups were set up on Blackboard and each group given a similar but different brain-teaser problem. The tools within Blackboard (whiteboard and chat) allowed the participants to draw diagrams and discuss whilst being physically separated. This began in the classroom and continued remotely. The purpose of this non-assessable exercise was to encourage the metamorphosis of the student from face-to-face customer support to remote customer support, the most common implementation nowadays. Weekly tasks were set up in order to evaluate the students' ability to delegate, prioritise and organise. The students were able to view the urgency of a task and monitor/flag their own progress in private, whilst still allowing the lecturer to monitor progress. This was a practice advocated by O'Keefe and McGrath , (2000, p 375 citing Burley and McNaught,1997) 'In online courses it was necessary to retain the high degree of interaction and clarification that face-to-face tutorials provide'

The initial weeks were for the building of a learning community, which then flowed on to become online and supportive whilst they participated in their work-based placement. The use of the online support and social interaction was to raise confidence in their ability to become online commuters, giving them the skills to perform, completely online, other tasks, such as the required organisation of a training day, with no input from the lecturer until the actual training day. Monitoring of the students' communications continued, however, with the lecturer ready to step in if necessary.

All class activities and course documents were put online and visible to the students, except the Lecturer Course Portfolio document. This was a document written after (or updated) each session, providing useful information about the course and the educational context in which it was completed. The instructor's honest reflections were critical, since disasters can be as important as "golden moments". Immediately summarising a lesson overcame academic amnesia. Reading the portfolio before a session avoided pitfalls and boring repetitive teaching. Ideas on the use of appropriate online strategies linked to the student learning needs (after Laurillard), modified through experience by Mae McSporran, are as follows:

Level	Student Learning Needs	Online strategy
1	Motivation & Orientation	Clear and current information
	Information Handling Skills	FAQs, Sharing, Online resources
	Individual choices	Negotiation of topics for study
2	Independent learning Skills	Use of Personal diary, quizzes
	Developing Understanding	Collaborative tasks, problem solving exercises
	Linking theory to practice	Embed Multimedia and simulations, Use Students as mentors
3	Practising Discussion of ideas	Online debates, sharing etc.
	Rehearsing Skills	Interactive activities
	Practising Teamwork	Peer work and actual projects

EVALUATION OF THE COURSE COMPONENTS

Useful indicators of the effectiveness of the teaching are 'students' satisfaction about how the course was taught and what they believed they learned from it' and 'how a teacher assessed their own teaching' (Yates et al,1999) As promulgated by Yates et al (1999), a high standard of teaching is expected and the process of online teaching is more public and transparent than many anticipate. 'Expectations about what is quality service in providing education are different in a web environment' (Beckford and Fitzsimons, 2002).

The lecturer course portfolio proved to be a valuable resource in providing reflections on both successful and unsuccessful strategies. Comments from this have confirmed the findings of Lehtinen (1999) that the most successful strategies are those involving student collaboration, with timely and constructive feedback and encouragement from the lecturer. From the evaluation of this course and others, it appears that many of the qualities appreciated in face-to-face teaching are also those appreciated in online teaching. The strategy of varying the techniques in the exercises and tasks was instrumental in the success of this course. 'What has contributed to the success of the venture into online teaching has been the adaptations that teachers have made to their prevailing practice.' (Yates et al,1999) The adaptation of in-class exercises to online exercises in the course studied retained the hands-on approach. This required continual monitoring and the workload was not insignificant. However, care and attention to online questions and requests for help and guidance delivered their own rewards, that of effusive thanks from appreciative students. The porting to online of previously face-to-face class intensive lessons in interpersonal skills, and the total online and remotely controlled exercise of the training day have shown that with good monitoring, interaction and genuine interest in the students' progress, unlikely subjects for online teaching can be adapted successfully.

CONCLUSION

In order to improve delivery, documentation of the social, managerial and technological actions that instructors take are just as important as the pedagogical strategies used by online instructors. For this, the lecturer course portfolio or similar is ideal. Online teaching requires as much commitment to the students as face-to face teaching, albeit via a different medium. Appropriate interactivity is the key to success in online teaching. Students need to be allowed to discuss without intervention, unless help is needed. When help is needed, it should be timely and constructive, and this is why the instructors need to monitor the sites closely. Encouraging messages never go amiss. Lecturers always put their own flavour on any lesson, and experienced ones will devise innovative ways of using technology. But most important is the total commitment and interest of the instructor. The successful online instructors have 'built up a reputation for having staff that are enthusiastic about their teaching' (Yates et al,1999). As such, they will have provided variety in the course material and will have taught a useful variety of techniques. Online teaching requires interesting material and interested staff.

REFERENCES

Beckford, N., Fitzsimons,M. (Eds) (2002) *Highways and Pathways: Exploring New Zealand's E-Learning Opportunities*, The Report of the e-Learning Advisory Group, Wellington, New Zealand, March 2002

Bonk, J., Kirkley, J., Hara, N, Dennen., V.,(2000) *Advances in Pedagogy, Finding the Instructor in Post-Secondary Online Learning*, Learning and Teaching Online, New Pedagogies for New Technologies, Expert Seminar, Middlesex University, England, 7 –8th September, 2000 (no page numbers)

Burley,H., McNaught,C. (1997), *Providing Flexibility and Support to students with electronic lectures and tutorials in economics* In McNaught, C. (1997) Conference Proceedings of Teaching with Technology at LaTrobe, pp 31 – 37, Academic Development Unit, LaTrobe University, Bundoora, Australia

Campbell, N. and Hawksworth, L (1999) *The Nuts and Bolts of Learning with the Internet in Indigenous Contexts*, Computers in New Zealand Schools Journal November, 1999, 11,3: 34-37

De Fazio,T., Gilding,A., Zorenon,G.(2000) *Student Learning Support in an Online Learning Environment,* ASCILITE 2000, Proceedings of the 17th Annual Conference of the Australian Society for Computers in Learning in Tertiary Education, Nov 2000

Green,J., Eves,C. (2000) *Structuring Discussions in an Electronic Forum on a Distance Education Course*Short paper, ASCILITE 2000, Proceedings of the 17th Annual Conference of the Australian Society for Computers in Learning in Tertiary Education, Nov 2000

Laurillard (1993) *Rethinking University Education* In Ryan y. (1998). Time and Tide: Teaching and Learning On-Line. The Australian Universities Review, Vol 41: 14-19

Lehtinen, E, Hakkarainen, K, Lipponen, L, Rahikainen, M., Muukkonen, H, (1999) *Computer Supported Collaborative Learning: A Review*, University of Helsinki, online document accessed January 2002. http://www.kas.utu.fi/papers/clnet/clnetreport.html

O'Keefe,S. McGrath,D. (2000)*On-Line Delivery in Higher Education: What Questions Should We Be Asking?* ASCILITE 2000, Proceedings of the 17th Annual Conference of the Australian Society for Computers in Learning in Tertiary Education, Nov 2000

Swindell, J. (1999) *Developing Open Learning Systems: Moving Painlessly from the Classroom to Distance Teaching*, Alt-C99, Proceedings from the 6th International Conference, University of Bristol, September 1999

Yates, R., Campbell, N., McGee, C (1999) *Its not out with the Old and in with the New: The challenge to adapt to Online Teaching*, School of Education, University of Waikato (Private correspondence)

Creating Dialogic Enquiry in an Online Community

Jayne Klenner-Moore, PhD. (ABD)
King's College
Mass Communications & Media Technologies
Wilkes Barre, PA. USA

Abstract: This paper presents ongoing research into creating dialogic enquiry in an online community. There is evidence that the dialogic approach provides for better understanding of key concepts necessary for complex problem-solving in the traditional classroom (Wertsch, 1997). Does this hold true for online communities? Here the research is limited. Wells (personal correspondence, 2002) says that there is a definite potential for this area of research and that he has found that by providing what he calls "activity objects" into the online discourse students have more interesting debates. The problem of enhancing problem-solving skills, becomes increasingly important as we move more and more courses online, or add an online component to a traditional classroom (A blended environment). This paper will provide a model for implementing activity objects into a blended learning environment, and creating an environment that is conducive to dialogic enquiry, knowledge structure, and enhancing problem-solving skills.

Context

The purpose of this paper is to describe findings and observations from ongoing research done in a small liberal-arts college, criminal justice course, working with a blended learning environment. Dialogic enquiry includes a five-step model based on the work done at the inquiry home page site (http://www.inquiry.uiuc.edu/index.php3) (see fig 1.) and includes a combination of the problem-based learning cycle. Activity objects (Wells, 1995) are used to structure the dialogue and provide a goal-oriented activity to engage and promote the dialogue between students and instructor in an online community. This dialogue will mediate the knowledge structuring, which will then enhance problem-solving.

Jean-Paul Bronchart (in Wertsch, Del Rio, and Alvarez, 1995 p. 82) tells us that one of the meanings of mediation can be explained as "discourses formed have the status of open works – works on whose foundations subjects build their understanding of the world". This project was designed to help novice criminal justice students to understand the world of crime scene investigations. What do practitioners do in the field? The online community and dialogue helped students to develop questioning skills that helped build problem-solving skills germane to this field.

Meaningful action is formed by speech, and can be reflected upon by using textual representations such as those allowed for in message boards and chat rooms – features of an online community. "Discourses shape the educative action that is actually carried out within the framework of didactic systems" (Bronchart, 1995 p. 84). The question still remains how to design the activities in an online community that will be most productive in structuring students' knowledge about a subject so that they may become better at solving ill-structured problems. We based our activity objects around real crime scene photographs and allowed students to investigate on their own and with their peers, what those photographs represented. They then reflected on their discussions and were prompted to formulate analyses of these photographs to determine what had possibly transpired, to "solve" the crime.

A goal of this model is to develop optimal conditions for teaching in blended learning community where discourse is a primary ingredient in the blended environment teaching system. In this paper a model for achieving that goal, through the development of activity objects that can be used to spark the online discussion and aid in pushing the students through the enquiry cycle will be presented.

Sign, Symbol, & Language

Language is the medium through which we communicate ideas and come to know about the world around us. It is culturally mediated throughout the lifetime of the individual and meanings change through social interaction. Although, as Engström admits in his discussion of Russian theorist Bakhtin, and Wittgenstein's ideas of language, Activity Theory has only begun to properly integrate the idea of discourse. This model of dialogic enquiry is hoped to integrate Activity Theory and language as the main cultural tool to help students develop better problem-solving skills. In an online community language takes on the form of artifact, as it is now written and may be saved for later retrieval, as well as becoming a tool for reflection. Therefore, in our model for developing activity objects, there is requisite, a place for dialogue, both written text and oral dialogue which may take place in the traditional class as well as online. The forms of which dialogue help for reflection of the culture (Bruner, 1990), as well as reflection of the course content. It is this dialogue which shapes the learning and the construction of knowledge within the community of learners.

Practice

It is with the inclusion of the activity object, which provides for goal-oriented activity, that a community of practice, in this case an online community will stimulate the dialogue and promote knowledge structure. Engström and Miettinen give us the definition of practice as stated by Dewey:

> *It means that knowing is literally something which we do; that analysis is ultimately physical and active; that meanings in their logical quality are standpoints, attitudes, and methods of behaving toward facts, ant that active experimentation is essential to verifications.* (Deweyin Engström, Miettinen, Punamaki, 1999 p. 6).

Activity theory is concerned with practice as it is the outward exemplification of the outcome of the activity as well as the place where we can study the interaction of culture, division of labor, community, and rules among other things. Practice is one of the biggest areas currently under investigation among Activity Theory researchers.

Developing the Activity Objects

In 1996 King's College began to look more closely at building a "classroom without walls" (Mech conversations, Teagle Grant project). One of the ways that we started this march was through the addition of list serves to the classroom environment. We discovered much to our chagrin that students just didn't talk much online unless the teacher directed them to the discussion. We needed to find a way to "prime the pump, so that students would begin to use the technology to enhance the classroom experience.

What was needed for this course were activity objects that would stimulate the dialogue in the online community and allow for students to follow the inquiry cycle as noted in figure 1, below. The model that we employed brought together the traditional classroom and the online community to facilitate the enquiry cycle.

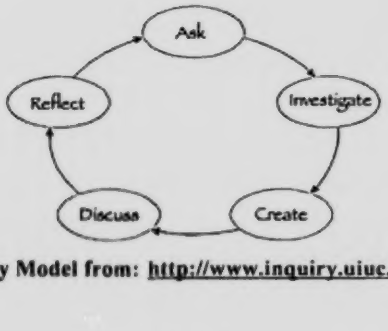


Figure 1 Enquiry Model from: http://www.inquiry.uiuc.edu/index.php3

BEST COPY AVAILABLE

In the classroom environment, students were introduced to course content and concepts for criminal investigations. They discussed various methods for interpreting what they saw in simulated crime scenes. In this course they became what is often referred to as a "community of practice", (Wenger, McDermott, Snyder 2002) also referred to as communities of learners or COLs (Jonassen, 1999). A community that shares a goal oriented environment. The practice that these students were involved in was the practice of crime scene analysis. The goal for students was to develop problem-solving skills related to this practice.

For the online community we used WebCT where students had the use of chat rooms for discussion, a form of instant messenger, as well as links to course content and the activity objects. Our activity objects were taken from real crime scenes and created on a web page. Students viewed the web page and then went into their assigned chat areas to discuss the photos. You may view the exam page, which includes the crime scene photos and the exam questions at http://www.kings.edu/jkmoore/cj/exam/. [1] Each activity object was developed following the same format as the exam questions. This allowed students to solve novel problems (Jonassen, class notes) using the same mental models that were constructed during the dialogic enquiry phase of the learning experience.

Students then followed the stages of the enquiry model. In this course we utilized a teacher-directed (Barell, 1998) discussion form. Other models will include student-directed, and student-teacher-directed (Barell, 1998) forms of dialogue.

In order to "solve" the problem that is presented by the question, students use the activity object as a tool to ask questions of each other. They begin by *asking* questions about the activity object (photo), then using class notes, other web sites, and the library try to *investigate* information that will help to answer the question. It is during this investigation stage that the students begin to take ownership of the learning process and to synthesize information that will carry them to the next stage (Inquiry Home Page, 2001). In the next stage, *create*; students now begin to formulate a solution using prior knowledge and creativity to come up with the new possibilities for a solution. Now that each student has some idea of what a possible solution may be, there ensues another dialogue where each student presents his ideas to the group, at this point the dialogue take the shape of a debate. And it is here that the social co-construction of knowledge begins within the community. Simultaneously, students are able to *reflect* on their own and others solutions. This then brings our cycle back to the "start" and more questions and dialogues begin.

It is important to note that this process will follow the cyclical routine not once but many times until the problem is solved by the students. In addition, each domain will require that the instructor who wishes to employ this system study the community of practice from which this domain springs.

Future Explorations

At King's College we will be continuing the work with two additional courses in the criminal justice department to test the validity of our instruments and the specific form of dialogic enquiry which will work best online. In addition we have enlisted the aid of several different departments to test this theory and model across domains. We will be developing activity objects for courses in accountancy, philosophy, theology, history and mass communications. It is our hope that a model for development can be made available to all departments on campus who utilize an online community in any form.

References:

Barell, J. (1998). PBL: An Inquiry Approach. Arlington Heights, IL. SkyLight Training and Publishing, Inc.

---

[1] Plese be advised that these are very graphic photos and may cause some distress to the viewer. And please only use my office phone if you wish to contact anyone regarding questions on this site.

Bronckart, J-P. (1995).Theories of action, speech, natural language, and discourse. In J.V.Wertsch, P. Del Rio, A. Alvarez (Eds.), *Sociocultural Studies of Mind* (pp. 75 – 91). Cambridge: Cambridge University Press.

Bruner, J. (1990). *Acts of Meaning*. Cambridge, MA: Harvard University Press.

Engeström, Y., Miettinen (1999). Introduction. In Y. Engström, R. Miettinen, R-L, Punamaki (Eds.), Perspectives on Activity Theory (Learning in Doing: Social, cognitive, and computational perspectives) (pp. 1 – 18). Cambridge: Cambridge University Press.

Inquiry Home Page: was retrieved from http://www.inquiry.uiuc.edu/index.php3 on 20 August 2002.

Jonassen, D.H. (1999). Designing Constructivist Learning Environments. In C. M. Reigeluth (Ed.), *Instructional-Design Theories and Models, A New Paradigm of Instructional Theory Vol II.* Mahwah, NJ. Lawrence Erlbaum Associates, Inc.

Wegner, E., McDermott, R., Snyder, W. (2002). *Cultivating Communities of Practice: A Guide to Managing Knowledge.* Boston, MA. Harvard Business School Press.

Wells, G. (1999). *Dialogic Inquiry: towards a sociocultural practice and theory of education.* Cambridge: Cambridge University Press.

Wells, G. (in press) Dialogic inquiry in education: Building on Vygotsky's legacy. Invited presentation at NCTE, Detroit, November 1997. To appear in C.D. Lee and P. Smagorinsky (Eds.) *Vygotskian Perspectives on Literacy Research.* Cambridge University Press.

BUILDING THE LEARNING COMMUNITY THROUGH TEAMING AND TECHNOLOGY

Cheryl S. Knight, PhD., Director
Dianne B. Barber, Ed.S., Coordinator

Adult Basic Skills Professional Development
Appalachian State University
Boone, North Carolina 28608

ABSTRACT

The Adult Basic Skills Professional Development Project (ABSPD) is a collaborative effort between the North Carolina Community College System and Appalachian State University. ABSPD is committed to enhancing the quality of Basic Skills instruction in North Carolina through providing relevant, timely, accessible, and effective professional development for program faculty and volunteers, create a cadre of Certified Resource Specialists, and develop better instructional skills for the classroom in community colleges and community-based literacy organizations. ABSPD accomplishes this mission by using a team approach to produce multi-media train-the-trainer materials and workshops to build a successful learning community. The presentation will model the teaming approach used to produce training materials. Samples of project media will be featured.

INTRODUCTION

The Adult Basic Skills Professional Development Project (ABSPD) began in 1988 as a one-year project funded by the North Carolina Community College System. ABSPD is housed at Appalachian State University in the Department of Curriculum and Instruction. It is now in the 15th year of providing state-of-the-art professional development to enhance the quality of Basic Skills instruction in North Carolina through building the capacity of community colleges and community-based organizations to provide relevant, timely, accessible, and effective professional development.

ABSPD uses the team approach to produce multi-media train-the-trainer materials and workshops to build a successful learning community. This paper presents the teaming approach used to produce multimedia in a train-the-trainer program to enhance a collaborative teaching effort in the learning communities of community colleges, higher education, and literacy-based organizations.

THE TEAM

The ABSPD team consists of four full-time, one part-time and two graduate students team members housed at Appalachian State University. Each member plays an indispensable role in the planning and production of training media and events. The team meets twice a year with an Advisory Board and consults with the State Office Basic Skills staff on a regular basis. The team meets weekly to discuss progress and future goals.

THE TEAM APPROACH

The planning and production of training media and events is a team effort in which each member plays an indispensable role. From the brainstorming of ideas for content and layout to the final evaluation, each team member makes significant contributions. When the Advisory Board request a training product the team begins reading, generating ideas, and taking notes. The team members convene to share thoughts as they piece together the puzzle that will result in a quality media production. Next one team member takes primary responsibility for writing a script, outlining a plan, or putting structure to the project. Rough drafts are distributed to the team for editing, changing or rewriting. The team meets in a seminar to discuss the draft and add ideas for incorporating graphics, sound, video or other media enhancement to the product. The input is then incorporated into the writing of the next draft while team members, among their other responsibilities, video tape scenes, search for graphics, music, etc. After several meetings to present findings and refine the script, it is time to work on the artsy domain, the designing of storyboards and preparing mockups to provide a visualization of the training concepts. Again the team convenes to give feedback, each member contributing questions and answers from his or her own prospective.

Now is the time to begin the media product, but again the team effort is imperative. From experience, we have learned that waiting to view until the product is thought to be complete is a poor procedure. Too many changes must be made and often they seem to constitute a total makeover. The ABSPD team meets at least weekly to view progress, redesign, discuss changes, and reach consensus on acceptability. Often between meetings emails are circulated requesting feedback on a frame, a video clip, selection of graphics, or any other detail that impacts the quality of the media.

At last edits are complete. Time has come for the grand showing. The team gathers to view the culmination of our collaborative efforts, be it a video or the opening of an institute. As the event begins, we witness ideas come to life as the product unfolds on the screen capturing its audience through sight, sound and touch.

THE TRAINING

Multi-media productions include videos and CD ROMs. The training videos are accompanied by a manual and viewing guide. Annual institutes provide training in techniques of professional development, cutting edge research, integration of skills with a contemporary theme, and an infusion of technology. The ABSPD project plans and presents regional, individual community college and literacy organization workshops in which multimedia programs dominate. In addition, the ABSPD team publishes quarterly newsletters, maintains a current web page, presents at professional conferences, and consults with basic skills professionals throughout the United States.

During 2001-2002, training for professional development and other major activities consisted of the following:

- Developing technology support through video productions and web page accessibility;
- Writing Instructor Training Manuals;
- Producing a CD ROM;
- Providing assistance in planning and presenting professional development with community colleges, community-based organizations and Basic Skills programs;
- Designing the 2002 Summer Institute, "Focus on Cultural Awareness Through Writing."

The ABSPD team produced three videos emphasizing GED 2002: Writing and Reading, Social Studies and Science, and Mathematics and the Scientific Calculator, featuring information necessary to properly teach for successful completion of the GED 2002 Test. Each video begins with a history of the GED and information applicable across testing areas. Videos are designed for use both in individualized professional development and formal group training. They present complete information for preparing an instructor for teaching adults in GED programs. Integration of critical thinking in all skills and academic areas is emphasized. A printed viewing guide accompanies the videos to enable interaction and processing of content in both individual and group settings.

The project team published a three volume series, Adult Basic Skills GED Training Manual, coordinated with the video series. The manuals contain a narrative chapter, lesson plans, glossary and resources, all compiled in 3-ring binders for easy use.
Because instructors must apply generic skills and information across the curriculum, chapters entitled "Critical Thinking" and "Adult Characteristics" are included in all three manuals. For each content area the narrative and lesson section can be pulled out and used individually. The lesson sections contain suggested activities that teach content and skills. They are not intended to be inclusive, but do model integrated multi-level instruction, a model that must be implemented in our adult classrooms if students are to learn to think critically and make application both on the test and in life.

The ABSPD team wrote and produced a CD-ROM that focuses on using the scientific calculator. The first section introduces the calculator as a tool. The second section teaches the use of the calculator to perform basic and intermediate functions. The third section teaches the use of the calculator to perform advanced functions. Practice is provided for each key. The CD-ROM is designed to train instructors in using the calculator with Level I Basic Skills through Adult High School math students. Instructors can also adapt the CD-ROM for student use.

The team collaborates with the North Carolina Community College System office to provide assistance in planning and presenting professional development for community colleges. We consult with national projects, state programs, and community-based organizations. The team incorporates technology to provide training through a Certified Resource Specialist Retreat and numerous GED 2002 workshops. This year we presented formally and informally at conferences using multi-media, shared media products with other programs across the United States, and made ABSPD products available for purchase outside North Carolina.

The team collaborated to design the 2002 Summer Institute, "Focus on Cultural Awareness Through Writing" for 120 directors, instructors and literacy volunteers. Due to the North Carolina budget crisis, it was cancelled May 9, two weeks before the Institute was to begin.

The rapid shift of societal expectations for home, school, and community has placed a heavy focus on technological changes that allow faster and more efficient communication. As all of us become more dependent on technology as a communication tool, educators recognize the impact technology has on instructors and their students. Meeting the challenge of technology requires a respect of each team member's expertise.

The ABSPD web page is available on the Internet. It provides immediate information about the ABSPD project and Adult Basic Skills education across the state and country. New and updated information is continuously added to the site. For convenience and efficiency, it is linked with the North Carolina Community College Literacy Resource Center and other literacy locations.

The Impact

Impact on the community college Basic Skills programs and community-based organizations provided by the ABSPD Project as communicated by directors and participants includes the following:

- Provides participants with the competencies for conducting on-site training
- Provides quality training in areas of need
- Enriches instructors' knowledge of instruction
- Provides individualized training
- Mentors colleagues
- Organizes professional development opportunities
- Teaches trainers how to customize training
- Conducts training in new instructor orientation
- Prepares instructors for leadership roles
- Provides specific instruction on teaching the adult learner
- Motivates increased learning, informed teaching and collaboration
- Builds confidence in trainers and instructors

A survey, conducted annually, request respondent to rate the usability of the materials produced by the ABSPD team. The respondents rate the products as meeting their training needs. Several directors left blank the columns for advanced technology related training products indicating a need for greater support, referring to adequate hardware, software, and training, in using the web and CD-ROMs as training devices.

CONCLUSION:

Collaboration between ABSPD and the North Carolina Community College Adult Basic Skills staff provides multiple ideas and approaches that otherwise would have never been voiced. The synergy generated verifies that ideas added to ideas generate a sum greater than the parts.

Morph Chat: A Multimodal Instant Messaging System[1]

Nupura Kolwalkar
Auburn University
Human Centered Computing Lab
Computer Science & Software Engineering
107 Dunstan Hall
Auburn, AL 36849 USA
nupura@eng.auburn.edu

Juan E. Gilbert
Auburn University
Human Centered Computing Lab
Computer Science & Software Engineering
107 Dunstan Hall
Auburn, AL 36849 USA
gilbert@eng.auburn.edu

Abstract: The acceptance of Instant Messaging Systems (IMS) is increasing within the outreach education community with the growing popularity of distance learning. Instant Messaging Systems such as WebCT chat (2002) have become a part of distance learning in many schools in America. Morph Chat, a multimodal IMS, is the next generation of instant messaging. It is multimodal in the sense that it makes use of audio as well as visual communications to convey information to the users. The research described below, talks of a multimodal IMS, which uses animated agents (Johnson 2001) as the virtual representatives of users.

Introduction

Instant Messaging Systems (IMS) are the ideal means of communication for short and focused queries where an answer is needed quickly. With instant messaging the user knows before asking a question that the recipient is available to answer. IMS lead to instant feedback versus the traditional e-mail where, a question is asked and then answered possibly at a later time. The answer may result in another question. Getting to the final answer may take some time. With instant messaging, the user's question is answered in real time so s/he can quickly respond and get the final answer. This platform has proven to be crucial in distance learning environments such as WebCT chat. These IMS give the enrolled students a virtual presence out of the classroom. It is more interactive than video taped classes since it gives the outreach students a chance to interact not only with the professor but also with their classmates. However current IMS are text based and require constant user attention.

Traditional instant messaging has been deployed as a textual dialogue. Then came the computer-to-computer and computer-to-phone vocal conversations, where users were allowed to make calls from the computer to another user's computer/telephone and talk via computers. This system needed extra hardware, i.e. microphone. A close observation of the existing IMS show that none are multimodal interfaces.

Multimodal Interfaces

Traditional Web browsers visually render Web pages written in HTML, and user interaction is primarily done through the keyboard and a pointing device such as a mouse, roller ball, touch pad or stylus. In contrast, voice user interfaces, present information using a combination of synthetic speech and pre-recorded audio, and allow interaction using spoken commands or phrases. The input options are speech, keypads and pointing devices and electronic ink. The output options are speech and audio, plain text and visual displays. By using two or more of these input and output options a multimodal user interface is created.

Multimodal interfaces can be exploited a few different ways. A couple of them are:

- **Usage of more than one output mode to present complementary information**: In many cell phones, voicemail notification is done using a certain pre-set beep as well as a graphic showing an envelope opening or closing. This presents the same information using two different modes.
- **Choice of selection between different modes depending on the context**: Cell phone users are given two options to send a textual page. One is to type in the message using the keypad or call a call center and speak out the message, which will be typed in by a representative as text to be sent to a specific user(s). So users can switch between modes of input depending upon convenience and necessity.

Morph Chat — A multimodal interface

The two output modes used by Morph Chat to communicate information are visual and auditory. The visual output mode uses text messages and facial expressions. The auditory output mode uses synthetic voices through text -to-speech. Upon entry into the Morph Chat system, users will be prompted to select a random name to use as an identity for sending messages. When the user selects the name and enters the system, s/he is prompted to select a persona from a pop-up window. The user will see the controls of the chat outlet in the parent window are disabled. The user has to select a persona from the pop-up window to be able to send instant messages. As soon as the user clicks on an image representing a persona, this pop-up window is closed and the initially disabled controls in the parent window are made active. At this state the user can send and receive messages to/from the other users who are online.

As users log in, the persona representing them will come up to tell all the other users, that this person has logged in. At the same time a green box will be added to a set of similar boxes to announce the arrival of the new user, David (see figure 1). These boxes represent the chat names of the users and default to the color red.

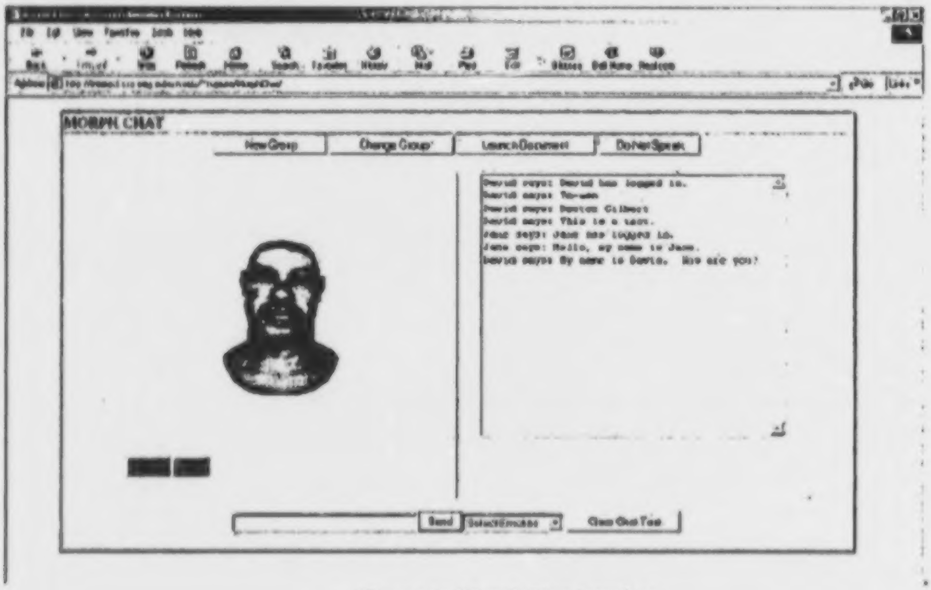
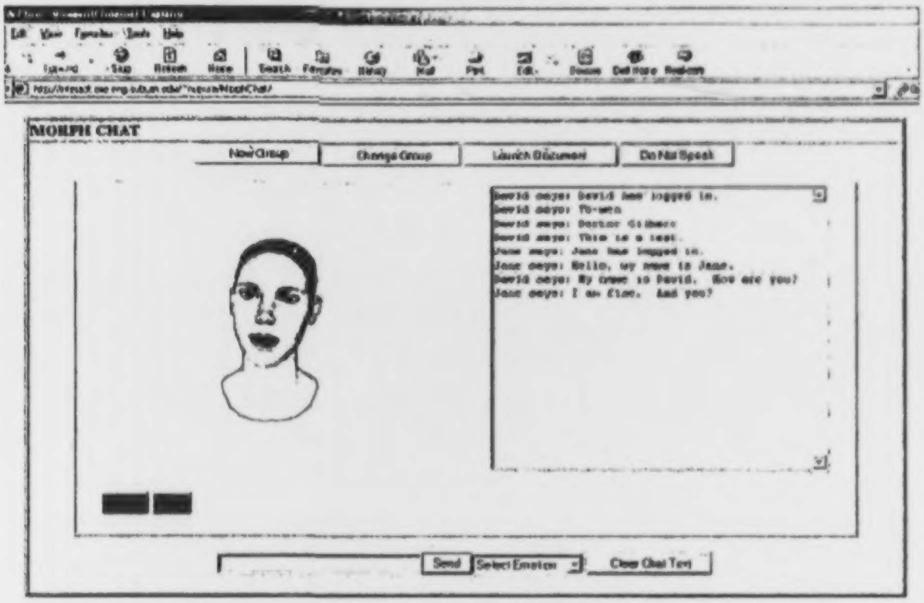


Figure 1: Morph Chat Interface

Users send messages by typing in text and pressing the Send button or the return key. When David sends a message, the persona that represents David appears on every users screen and speaks the typed message on everyone's screen. To use this application, users need not be pre-registered.

BEST COPY AVAILABLE

Figure 1 and Figure 2 show a conversation between two users David and Jane. David logs in first and then Jane. Jane's login is announced. Figure 2 shows Jane represented by the persona she selected. A green box with Jane's name on it indicates that Jane is talking at the moment.



David says: David has logged in.
David says: Yo-wen
David says: [illegible]
David says: This is a test.
Jane says: Jane has logged in.
Jane says: Hello, my name is Jane.
David says: My name is David. How are you?
Jane says: I am fine. And you?

Figure 2: Morph Chat Interface

The Morph Chat system does not require extra hardware for use. The users do need to download Haptek plug-in to be able to send instant messages. Haptek has provided a free version at http://www.haptek.com. If a user does not have this software, Morph Chat offers a download option from within the application window.

Morph Chat – The Architecture

On the server side of the Morph Chat application, a database stores all messages. Though the users are not expected to pre-register and provide personal information, the identity can be proven through the IP address of the workstation used. Hence it is very important that the users know that privacy is restricted. This application is completely time dependent. Each user's action is time stamped. Every message, emotion and/or document sent across from one user to all the other users becomes a row entry in the database. Each entry has a time stamp. The table is sorted in descending order with the latest time to be the last entry. Messages are selected based upon their time stamp every two seconds or when the client side message queue becomes empty.

At the client end, there are two local queues, which get data from the server: the user queue and the message queue. The user queue contains the data of all the user names of the users currently logged in. This queue is locally parsed into each individual name, which is then displayed as a green box on each user's screen. The message queue contains the user name, the persona ID, the message to be sent, emotions and the Web document address of a Web page to be launched on each user's machine. A variety of functions parse this queue in the order of the data received. First the persona representing the sender of the message is displayed, then the green box turns red, the persona speaks the message, expresses the emotion if any and last the message is displayed in the text area of the application. This process is recursive in its functioning until all the messages in the message queue are processed. When all of the messages are processed, the client's machine will go to the server to retrieve more messages. If there are no messages in the database queue, the client will check for messages every two seconds.

BEST COPY AVAILABLE

Conclusion

As Instant Messaging Systems (IMS) increase their presence in distance learning environments, Morph Chat will prove to be a crucial tool as a multimodal IMS application. Morph Chat will give users an opportunity to choose between the modes of communicating and thereby reduce the stress of constant user attention. Users can listen to the messages sent by an instructor in addition to reading the messages. The Morph Chat interface provides users with an interactive, animated instant messaging environment that proves to be entertaining as well as effective.

The important features and usability of the Morph Chat system will be clearly demonstrated during the presentation. The presentation will include a demonstration of the Morph Chat environment with multiple participants. The architecture and implementation will be discussed during the presentation as well.

References

1. Johnson, W.L., Rickel, J.W., and Lester, J.C. Animated Pedagogical Agents: Face-to-Face Interaction in Interactive Learning Environments. *International Journal of Artificial Intelligence in Education 11* (2001), 47-78.
2. WebCT. (2002) WebCT.com. [Online]. Available: http://www.webct.com .

---

[1] This research is supported by the National Science Foundation grant #EIA-0085952.

A Unified Content Strategy for Learning Materials

Pamela Kostur
Senior Consultant
The Rockley Group
Toronto, ON Canada
kostur@rockley.com

Abstract: A unified content strategy is a repeatable method of creating consistently structured content for reuse, managing that content in a definitive source, and assembling it to meet diverse needs. A unified content strategy applied to learning materials means that you can serve the needs of different learners and learning objectives, and potentially, deliver dynamic content adapted to learners' unique styles and objectives. You can also unify learning materials with other information products such as brochures, reference manuals, and user guides, so you write content once and use it wherever it is required.

What is a unified content strategy?

A unified content strategy is a repeatable method of creating consistent content for reuse, managing that content in a definitive source, and assembling it to meet diverse needs. A unified content strategy applied to learning materials means that you can serve the needs of different learners and learning objectives, providing learners with content adapted to their unique style and objectives. A unified content strategy also connects authors throughout the organization, allowing content from one area to be used in materials created in another area and reducing authors isolation, creating content that other authors may also be creating content for.

In a unified content strategy, all information requirements are identified up front (e.g., learning content, objectives, evaluation, instructor's guide, supplementary materials). Content is broken into "elements" or reusable learning objects (RLOs) that are stored in a single source or location, such as a database. Elements are identified by metadata describing such things as what objectives they satisfy, who the intended audience is, the information product in which they belong (e.g., student guide or instructor's guide) and the type of learning they support (e.g., receptive, guided discovery). Once elements are defined and described, they can be used wherever they are required. Elements can also be published dynamically to support learners' individual needs (such as experience, language, learning style) and to respond to how well they are doing as they progress through the materials.

A unified content strategy also means that learning materials can be "unified" with other information products such as brochures, reference manuals, and user guides. Elements that are used in the user and learning materials can be pulled from the database and reorganized into marketing materials such as brochures, press releases, and customer demonstrations. In this way, wherever the same content is used, it is consistent. For example, while analyzing one organization's materials in an attempt to unify content across nine different courses, we found four different definitions of the same term, in all nine courses. In another case, we discovered a course description in a brochure that differed significantly from the course description provided in the actual course. These kinds of inconsistencies can result in confusion (caused by students learning incorrect information), they can damage your organization's reputation, and they can also result in accidents and law suits.

Benefits of a Unified Content Strategy

A unified content strategy is a coherent content strategy. Organizations can rely on content being the same wherever it appears, providing both internal and external customers with a consistent message, brand, and accuracy. No longer do organizations have to worry about contradicting themselves with differing information; where duplication occurs, it is the same content. Additional benefits include faster time to market, better use of resources, reduced costs, and improved quality of content.

Faster time to market is achieved through shorter content creation and maintenance cycles. Authors spend less time repeatedly authoring content because they reuse existing content wherever possible, supplementing it where appropriate. For example, the steps that appear in a product user guide can become the same steps in the training materials, supplemented with objectives, examples, and exercises. Reviewers also spend less time reviewing content because they only have to review the content that is new or changed; content that has already been reviewed

BEST COPY AVAILABLE

and signed off doesn't need to be reviewed again. In the case of reusing steps from user guide to training materials, reviewers would only have to review the steps once instead of in two different places—after all, they're the same steps.

In a unified content strategy, you make better use of your resources because the repetitive processes of creation and maintenance are reduced. Because they are required to do less repetitive work, everyone involved in the content creation process can do more value-added work or respond to new requirements. For example, instead of cutting and pasting materials from one document into another one (e.g., from student workbook to instructor's guide), authors create the reusable element once and use it wherever it is required. When they have to update the reusable element, authors don't have to search for all the places it appears. Instead, the element is updated automatically (or, depending on the technology to support your unified content strategy, authors are notified when an element they have reused is updated). Because the often tedious work of cutting, pasting, and tracking content is reduced, authors can spend their time on what they do best—supporting learners with good learning materials.

Because repetitive tasks are eliminated, the costs of creating and managing content are also reduced. Less work is required to get a product to market, not only decreasing internal costs, but potentially increasing revenue. Content is modified or corrected once instead of multiple times, reducing maintenance costs. Translation costs are also reduced because reusable content is translated only once instead of multiple times.

A unified content strategy even helps to improve the quality of content. Content is clearly modeled for consistent structure; increasing its readability and usability. Most importantly, content is accurate and consistent wherever it appears. Issues of inaccurate content, inconsistent content, or missing content are reduced or eliminated.

A unified content strategy also supports SCORM (Sharable Content Object Reference Model), an initiative of the ADL (Advanced Distributed Learning Network) whose primary goal is to provide high quality instruction anytime, anywhere, tailored to individual learners' needs. SCORM accomplishes this by modeling information for different uses and ensuring individual components comply with certain standards for reuse. The SCORM standard is an XML-based industry formalization of the concept of single sourcing. It is similar to the information modeling approach we follow in our unified content methodology.

Applying a unified content strategy to learning materials

To apply a unified content strategy to learning materials, you need to figure what content your learning materials consist of, determine everywhere that content is used and can potentially be reused (within one course, across courses, as well as across other information products), then build a model that supports sound instructional techniques as well as content reuse.

The pedagogical model

Effective instructional design includes three components: prepare (read/view material), do (perform learning activities), and reflect (consider what was learned; apply skills). To develop a pedagogical model that supports these components, you need to:

- Define information types and the learning architectures appropriate for the materials
- Define and incorporate interactivity
- Design learning activities
- Create a course structure that guides learners through the materials, allowing them to work through the materials in a manner best suited to their needs and the type of information they are learning

The unified content component of the pedagogical model requires that you go beyond building a solid course structure. Added to that structure is metadata, indicating in which course or courses each RLO belongs, as well as what type of learning it supports and which learning activities will be used to support it.

Types of information and learning architectures

Information type refers to the content's purpose. Two primary types of information are:

- Near-transfer – methodical, done the same way each time, such as a calculation
- Far-transfer – analytical, done differently depending on situation; similar concepts applied to different situations

Learning architecture refers to the way in which instruction is designed, at a macro level. The learning architecture describes the overall approach to the materials. The four learning architectures are:

- Receptive

- Behavioral
- Guided discovery
- Exploratory

In a unified content model, you tag elements as receptive, behavioral, guided discovery, or exploratory materials and delivering them to support the types of information and learners they are best suited for. In a receptive architecture, learners absorb knowledge and skills from listening to a lecture, watching a video, or reading text. Learners take information in, but there is no externally prompted interaction. Information is presented in text sequences, examples, analogies, visuals, etc. Receptive learning can cause cognitive overload (especially in learners with poor metacognitive skills) if other learning strategies aren't incorporated with it. It's good for building up a good source of information, but—especially for novice learners—it must be balanced with other approaches to ensure the information is absorbed into LTM (long term memory).

The behavioral architecture assumes that learning occurs by a gradual building of skills and information, strengthened by interactions imbedded into the instruction. Learners are provided with small chunks of instruction (basic to complex), followed by an interactive session after each chunk. This approach is widely used in computer-based learning. It manages cognitive load and encourages encoding of information into LTM through frequent interactions. It works very well for teaching procedural (near-transfer) information. However, it's sometimes tiring for learners with more experience. Also, by providing metacognitive regulation, learners don't get an opportunity to build their own metacognitive skills.

Guided discovery emphasizes the building of unique knowledge through case-based learning. Guided discovery is a more "constructivist" approach to learning; the instructional materials provide learners with the resources and experiences required to construct new knowledge. The emphasis is on construction instead of acquisition (which is the basis of the behavioral architecture). Learners are provided with a realistic problem or scenario, and access an array of resources to solve the problem. Guided discovery works well for far-transfer information, but it demands that learners have good metacognitive skills. However, it also helps learners to develop their metacognitive skills and to transfer their knowledge to the "real world".

Exploratory learning accommodates higher learner control. The assumption is that learners (especially in an internet environment) will access the information that best suits their needs. Depending on the amount of information to explore, overload can result, but keeping topics brief and adding frequent, optional practice, can help to manage the cognitive load. Exploratory architecture works well for both near- and far-transfer information, with other strategies employed within the architecture. However, the danger is that learners get lost while exploring. It also assumes that learners have the metacognitive abilities required to make the right learning choices.

There is rarely pure implementation of a single architecture. A combination of architectures is usually required to accommodate varying abilities, balance cognitive load, encourage learners to develop their own metacognitive skills, and teach different types of information (near- and far-transfer). With a unified content strategy, you can outline a number of different learning activities to support various learning architectures, types of information, as well as learner preference.

The unified content model

A unified content model should indicate how architectures will be combined, using metadata to indicate not only which course a learning object belongs in (as well as which other information products it can be used in, either identically or derivatively), but also, what type of learning (and learners) it supports and what learning activities will be used to support it. For example, in a recent project, we were tasked with building a model to accommodate nine different courses that were being moved online. During our initial analysis of the paper-based materials, we discovered much repeated material within courses and across courses. Sometimes, the repeated versions of content were inconsistent from course to course, and even within a course. In fact, learners often complained about the repetition and the inconsistencies. We determined that by reusing elements, we could reuse approximately 35% of the content and potentially, eliminate unnecessary repetition, making the courses more consistent and easier to work through.

The unified content model we developed for this project tells authors how each course should be constructed (hierarchically, based on the pedagogical model and type of information), what an element is (e.g., topic heading, learning content, learning activity, objective, knowledge check question), all the places where that element belongs, and which supplementary information should accompany it. Accordingly, the model includes metadata that describes in which course an element belongs (output) as well as additional descriptors, such as how well learners must "master" an element. (Metadata is simply information about information; in a unified content strategy, it allows authors to provide additional information about how an element is used and to track it.)

The metadata representing "output" tells authors (and the database in which elements are stored) where to publish a particular element. When developing storyboards for learning materials in which content is reused, we include a field for the metadata; authors simply enter the metatags representing the courses in which an element belongs. Metadata to identify output is critical in unifying content beyond learning materials. The same content can appear in a number of different places (e.g., the instructor's guide, the brochure) with more or less detail. Metadata defines everywhere that content will be used.

Additional metadata may not affect output (i.e., where an element is published), but it can be used to provide further information about each element. For example, some elements have to be learned at a particular "mastery" level. While the mastery level does not affect the output, it's essential to identify so that authors can tie evaluation directly to mastery level. There may be three mastery levels, all of which appear in one course. To pass the course, learners may have to acquire general knowledge of one topic (mastery level 1), but must have more applied knowledge of another topic (mastery level 3). Both topics, however, appear in one course. The element that requires mastery level 1 must be taught and evaluated at level 1; the element that requires mastery level 3 must be taught and evaluated at mastery level 3. By identifying mastery level as metadata, authors can easily identify what type of evaluation and learning activities to provide for each element. Further, if mastery levels must change, authors can quickly find all elements tagged with a particular mastery level and update them accordingly. Additional metadata may include such things as:

- Type of information
- Type of learning activity
- Learning architecture it supports
- Date
- Author
- Status
- Version

The unified content process—a summary

Implementing a unified content strategy involves:

- "deconstructing" all content from all courses into elements or RLOs
- assigning elements into outputs, based on learning objectives
- developing standards for and rewriting elements so they follow a consistent structure (consistency is critical in a unified content strategy) and conform to your instructional model that defines which learning architectures best support your content, objectives, and learners' needs
- compiling courses (and other information products) from their required elements, providing supplemental information as required to accommodate different learners, different mastery levels, and even different information products.

A unified content strategy requires much up front analysis; you need to break content down to determine how and where it can be reused and determine how best to write it to support its various uses and users. However, once the analysis is complete, courses can be easily constructed and kept up to date. Also, wherever an element is used it is consistent, eliminating unnecessary repetition.

References

Choi, Ikseon and David H. Jonassen. "Learning Objectives from the Perspective of the Experienced Cognition Framework." *Educational Technology*, November/December 2000.

Clark, Ruth Colvin. "Four Architectures of Instruction." *Performance Improvement*, Volume 39, No. 10. November/December 2000.

Kostur, Pamela and Jane Aronovitch. "From Information to Instruction: Transforming Textbooks into Online Learning Materials." *IPCC Proceedings*, 2001.

Rockley, Ann with Pamela Kostur and Steve Manning. *Managing Enterprise Content: A Unified Content Strategy.* New Riders, 2002. (due out October 2002, ISBN 0735713065)

Watson John B. and Allison Rossett. "Guiding the Independent Learner in Web-Based Training." *Educational Technology*, May/June 1999.

Issues of Transclusions

Harald Krottmaier
Institute for Information Processing and
Computer Supported new Media (IICM)
Graz University of Technology, Austria
hkrott@iicm.edu

Denis Helic
Institute for Information Processing and
Computer Supported new Media (IICM)
Graz University of Technology, Austria
dhelic@iicm.edu

Abstract: Transclusions were first mentioned in the early 1960 by Ted Nelson. Generally speaking transclusions are a method of reusing parts of a document without duplicating these parts. In the proposed implementation authors of documents will be informed (on request) if parts of these documents are reused elsewhere. Authors using transclusions are informed about changes in the reused document. Reused document fragments are marked in both documents to help readers while exploring documents. The concept is old but implementations are still not available to authors and readers. After a short introduction this paper shows some applications of transclusions. Thereafter ideas on how to implement transclusions using a second generation hypermedia information system are presented.

Introduction and Problems

The idea of transclusions was born in 1960, when Ted Nelson invented Xanadu, a revolutionary information- and document management system. "Reuse without duplicating document fragments with the original context available" ([Nelson, 1995]) is the key issue of the transclusion concept. Newly assembled documents are also called *compound documents*, on the other hand, documents reused in one or more compound documents are called *transcluded documents*.

As there is no duplication of document fragments when reusing content many advantages over ordinary cut-and-pasting of data arise (see e.g. [Krottmaier and Maurer, 2001]). In the following we are going to to numerate some of the advantages.

Intellectual Property: Parts of a document are not 'stolen' but simply 'reused in another context'. It must be visible to the reader of a document that parts of the document are no original contributions, but references or inclusions of some other work. Dependent on the electronic format of the compound document this is easily implemented by adding hyperlinks to the original work before and after the inclusion of the reused material. Please note that in HTML documents it is possible to reuse whole images in any context stored on any server system. The reader of the document will not notice this fact without reading the source-code of the HTML document.

Disk Space: Since parts of a document are not copied into a new document there is no need to save the reused part more than once. Surrogates of the reused parts must be stored in a predefined format. There will be no waste of disk space, if the surrogate definition requires less disk space than the referenced part. It is obvious that transcluded documents must be available to the system when assembling the document. Without coping the reused part and without sophisticated caching mechanisms this fact may limit the applications of transclusions to intranet or even intra-server applications.

Update: There is simply no need of manually updating referenced parts because the content is always requested from the *original source*. Since this is an advantage in many applications (e.g. a collection of different course material which is automatically up-to-date) there are drawbacks in some other applications where many people are responsible for the content and access control is not an issue. Some action must be taken if reused parts are changed. At least the author of the compound document must be informed (e.g. via email) by the system if there are any changes in the reused part. While there is no need to update a document it might be a time-intensive task to assemble a compound document. Therefore reusing a document which reuses parts of another document (which itself reuses parts of other documents etc.) must be limited to a certain level. Nevertheless, improvements in network infrastructure and processing speed will reduce this problem.

Two Way Reading: When displaying the transcluded document the system must add additional navigation facilities around the quotes in the compound document. This action is necessary to indicate the reuse of content (see 'Intellectual Property'). Links to the original source of the transclusion are provided. This makes it possible for the reader of a document to take a look at the original context of a quote. The reader of the transcluded document on the other hand has the ability to explore which parts of a document are no original contributions. If a fragment of a document is reused it is very likely that this fragment is important!

These are some of the most important advantages and drawbacks when using transclusions. Authors of compound documents must be aware of the risks when using this technology. The information system where these documents are stored must support authors in many ways (i.e. creation of transclusions, notification of changes, types of changes [Francisco-Revilla et al., 2001], etc.).

Applications of Transclusions

With the knowledge of the concept many existing applications can be improved. This section lists three possible applications. Please note that many other applications will profit from the idea of transclusions.

Electronic Publishing: Scholar papers often quote paragraphs or sentences of other already published papers. When using transclusions readers of the new paper are able to jump directly to the context of the quote (i.e. to the original paper). It is therefore possible for the reader of the compound document to explore the reused quote in the original context. This issue is especially useful for novices in a topic. The author of the compound document may create a special 'view' of a topic. Readers who are interested in the details may read also the original contributions to the topic. Readers of the transcluded document on the other hand are able to see which parts of a document are reused in other documents. This is a very important information! If a part of a document is reused in some other document, it is very likely that this part is very important. This additional 'meta-data' ("This part is also used in some other document(s)...") is a kind of implicit rating of a fragment of a document. In addition to attributes in link-objects (whether the part is used as a positive or negative example) useful information is added to the transcluded document!

Discussion Forum: In electronic written communication (especially in electronic discussion forums like bulletin boards or news groups etc.) many new postings refer to previous postings. These postings are (usually) immutable. In electronic journals or libraries this kind of communication is also very common (e.g. 'letters to the editor' often refer to parts of previous published articles). Referring to parts of an article should be possible by simply mark the fragment to be included in the new document or posting. Readers of the new article can be sure that the referenced part is not modified by the author of the new article. Also readers of the 'old' (i.e. transcluded) document are able to see which parts are discussed later in some other posting. On the other hand it is very likely, if the system is used in the right way and uses are used to it, that questions will be asked not more than once. A much more efficient communication will be the result when using transclusions in this kind of application. Time will also be saved because of additional structure in discussion threads.

Course Material: Very often existing course material is simply a collection of (unidirectional) links to related material stored on different server systems. Unfortunately it is not possible with current web technology to link to parts of existing material and to create links back to the collection. A very simple example will clarify this situation: imagine a single very important paragraph in an article of 100 pages. The author of the course material may add a link exactly to the paragraph, but can't include a link in the (remote stored) material *back to* the collection! Therefore the author of the collection has to cut-and-paste paragraphs of existing material into new documents. The original contexts of these paragraphs are lost.

BEST COPY AVAILABLE

These three applications showed the need for transclusions. Systems supporting transclusions will have a great impact in may areas. Proper use of transclusions and interoperability between these systems may help authors and readers of content stored on the web.

Requirements and Implementation

In scientific publishing the usage of quotes and references are very common. Readers of those publications have to do a lot of work if they want to explore a reference and want to find the original context of a quote used in another document. Systems like ResearchIndex ([NEC Research Institute, 2002]) are able to answer questions like "Where (i.e. on which page) is this reference used?" but it is not possible to explore the original context of the reused quote! Therefore we are motivated to implement this feature in the Journal of Universal Computer Science ([J.UCS, 2002]). In the publishing system used for serving J.UCS content is offered in several electronic formats to the readers. At the time of writing these formats are HTML, PostScript and also PDF. We consider the implementation of XML formated documents and also eBook-formated content.

In a first implementation we are going to support HTML documents (for both, source and destination document format) with additional hyperlinking information. The source and destination document(s) will be stored in a Hyperwave Information Server (HIS, see e.g. [Hyperwave, 2001] or [Maurer, 1996]), where it is possible to add link objects *without* being the owner of a document. Please note that inserting hyperlinks to HTML documents implies editing of the document itself. Note also that a link in HTML is unidirectional! A successor of the implementation will also consider other document formats (like PDF) and other source systems (like ordinary HTTP-server systems). Let us now sketch ideas related to the involved participants and systems:

Author of the original document: If parts of the document are reused in other documents this participant may want to be notified by the system. If the author wants to change a transcluded part of the document, the related parts should be marked. Note that in the original design of Xanadu (see e.g. [Nelson, 1995]), a "write once – read many" system was considered. Therefore it was prohibited to remove documents. Editing of documents was allowed *only* if the old version was still available and accessible by the system.

Author of a document using transclusions: It must be easy for the author who is using transclusions to determine the fragment of a document to be transcluded. Therefore easy to use tools must be implemented supporting the user in the creation of a new document. In a first implementation a simple JavaScript-based implementation will be used. While there are many drawbacks of this approach the user must not install a separate software and a prototype implementation will be available very soon. The selected part will be represented by links following the XPointer-specification (e.g. [DeRose et al., 2001b], [DeRose et al., 2001a]), therefore the selected fragment may be defined in many ways (e.g. use the 5'th paragraph, or use the first paragraph after the 3rd heading etc.). The links will be stored using objects on the server system.

System, where the transcluded document is stored: The system must be able to serve parts of a document. If documents are mutable, a version control system must be integrated to make old versions of the document accessible. Additionally, the system must provide the reader of the document (depending on personal preferences) with navigation facilities which indicates transcluded parts. If the author of a transcluded document edit some part of the document, the system is responsible for informing other authors using parts of the document about the change. Please note that bidirectional links are an absolutely necessary requirement for the system to perform this task. In the first implementation we consider a HIS as server system because of the many advantages over ordinary web-systems without link management and bidirectional link concept.

System, where compound documents are stored: This system is responsible for assembling the compound document. Navigation facilities must be included by the system to support the reader of the document. If the transcluded part has changed also the reader may be informed about this change. The author of the document has to define whether the user should be informed or not. In our first implementation also this server system will be a HIS.

Reader of assembled documents: It must be easy for the user to notice the reused parts of a document and to jump immediately to the original context of the reused parts.

Since there are many issues to consider, the first implementation will be very limited in terms of supported document formats and server systems. Nevertheless, future extensions are considered in the design of the software.

Conclusion and Future Work

This paper has shown that transclusions have many advantages for the web community and that there is a need for an easy to use system. Readers of a compound document have the possibility to *explore the original context* of the used quote. Authors of compound documents are able to easily *reuse existing material* and do not have to update reused document fragments. Finally, authors of transcluded documents knows *which parts are used* by other authors due to the bidirectional behavior of the used link mechanism. Transclusions have many advantages over conventional cut-and-paste reuse of content.

Future work is addressed to a first implementation in the Journal of Universal Computer Science. Thereafter usability tests and user responses will be evaluated. After successful tests authors of the journal will be able to use transclusions of articles published in J.UCS.

References

[DeRose et al., 2001a] DeRose, S., Maler, E., and Daniel Jr., R. (2001a). XML Pointer Language (XPointer) Version 1.0. available online `http://www.w3.org/TR/2001/CR-xptr-20010911` .

[DeRose et al., 2001b] DeRose, S., Maler, E., and Orchard, D. (2001b). XML Linking Language (xlink) Version 1.0. available online `http://www.w3.org/TR/xlink` .

[Francisco-Revilla et al., 2001] Francisco-Revilla, L., Shipman, F., Furuta, R., Karadkar, U., and Arora, A. (2001). Managing change on the web. In *Proceedings of the first ACM/IEEE-CS joint conference on Digital libraries*, pages 67–76. ACM Press.

[Hyperwave, 2001] Hyperwave (2001). Hyperwave Informatino Server. `http://www.hyperwave.com`.

[J.UCS, 2002] J.UCS (2002). Journal of Universal Computer Science. `http://www.jucs.org` .

[Krottmaier and Maurer, 2001] Krottmaier, H. and Maurer, H. (2001). Transclusions in the 21st Century. *Journal of Universal Computer Science*, 7(12):1125–1136. `http://www.jucs.org/jucs_7_12/transclusions_in_the_21st`.

[Maurer, 1996] Maurer, H. (1996). now Hyperwave — The Next Generation Web Solution.

[NEC Research Institute, 2002] NEC Research Institute (2002). Researchindex. `http://www.researchindex.com` .

[Nelson, 1995] Nelson, T. (1995). The Heart of Connection: Hypermedia Unified Transclusion. *Communications of the ACM*, 38:31–33.

More than Passive Reading: Interactive Features in Digital Libraries

Harald Krottmaier
Institute for Information Processing and
Computer Supported new Media (IICM)
Graz University of Technology, Austria
hkrott@iicm.edu

Denis Helic
Institute for Information Processing and
Computer Supported new Media (IICM)
Graz University of Technology, Austria
dhelic@iicm.edu

Abstract: At the moment it is not very common to actively work with material stored on an Internet server system. Once the right information resource is found, only passive information consumption of documents is provided by a majority of information systems. While this is appropriate for a kind of reading material, this is a limitation for scientific articles. Scientific articles are often read more than once, are usually annotated while they are explored, and are often the root of further investigations. In this paper we explore two features which will be available in the Journal of Universal Computer Science (J.UCS). These features will support the reader in exploring articles and will make it much easier to turn information into knowledge.

Introduction

Digital libraries are often the source of information. Three common steps are necessary to turn information into knowledge:

1. Find the right information.
2. Explore this information.
3. Apply the information.

Several tools are available to support scientists in finding the right information: search engines (such as Google) and directory services (such as Opendirectory) are often used as 'entry to the web'. While search engines are often used by users *who know exactly what they are searching for* and directory services are used by users *who do not know exactly what they are looking for*, there are also some system specific notification mechanisms available, which 'directs' users to sources of information. In the context of digital library systems this kind of service is called 'Alert Service'. These tools are currently well known and heavily used in the Internet community.

A few highly sophisticated features (such as 'find similar information resources') are already integrated in search engines and are inherently available in directory services . Other specialized application specific features are available in the server systems providing the information. In this paper we are going to discuss two features: an annotation feature and a personalization feature. We illustrate implementation details of these features. Annotations are available in J.UCS ([J.UCS, 2002]) since the beginning (1994). The personalization feature is currently under development and will be released in the near future. In J.UCS we use a Hyperwave Information Server (HIS, [Hyperwave, 2001]) to make the implementation of these features as easy as possible. In the following sections we explore some aspects of these features.

Annotations

It is very common to write handwritten annotations on paper or mark some regions of text as important or unimportant for understanding, especially in personally owned material ([Marshall, 1997]). "Dog-eared" books *are highly customized books* and the turned-down corner may be of great value to the "creator" while trying to find an interesting part of the book again! No matter what type of content (text or graphic) on whatever position may be annotated in a traditional library environment. It is obvious that it should be possible to annotate also material stored in a digital library environment.

Unfortunately not all digital library systems support the reader in the creation of electronic annotations although electronic annotations are much more powerful than "analog" annotations in a traditional environment. The following list illustrates features of electronic annotations:

Private Annotations: if the digital library system provides the user with an identification facility, it is very easy to support private annotations. Private annotations must be visible only to the author of the annotation.

Shared Annotations: if annotations are stored in an intermediate- or server system, it is possible that users share annotations. Therefore many users may explore the content by using annotations very quickly. There are many applications of this kind, especially if users are working in groups and/or are exploring online-available literature.

Typed Annotations: types like 'Question', 'Answer', 'Problem', 'Solution', 'Rating' etc. are needful in selecting whether to read or not to read the annotation or even the content. Additional attributes like 'User who wrote the annotation' may be very helpful.

Rated Content: A document may be rated by special annotations. Users may decide to read just articles with top ratings and may not waste their time in reading (obviously) poor written articles. Actual content (i.e. recently published content) must be treated in a special manner.

Nevertheless, some technical problems have to be solved and tools must be created to support users in writing and managing annotations. Let us now discuss some approaches and problems in conjunction with the annotation feature. There are different possibilities of the storage location of the annotations. Annotations may be stored on 1.) client-side systems, 2.) intermediate systems and 3.) server-side systems ([Krottmaier, 2001]).

Annotations in J.UCS are stored on the server-side, therefore they are easily accessible to all users or to a group of users. Annotations in J.UCS are 1.) indexed and therefore search able, 2.) interlinked via special link-types with the content and 3.) physically separated from the content.

We mentioned the term *information source*. This kind of source is a collection of documents which all represents the same content. I.e. if content is available to users in different formats (e.g. in PDF, PostScript and HTML) we talk about *one* information source but different formats of the content.

This fact introduces another problem: Annotations to the HTML-representation of the content should also be presented to users when looking at the PDF-version of the content and vice versa. On the other hand, not every reader of the PDF-version is able to create annotations because the annotation feature is not available in Acrobat Reader. The Adobe Acrobat API-license prohibits development of plug-ins supporting annotations. Therefore another solution without using the PDF-inherent annotation facility must be developed. Currently we explore two approaches to solve this problem: feedback forms for *each page* in the document and hyperlinks from *each section* to an annotation server application.

There are many applications of annotations. One application is the '*active documents*' concept ([Heinrich and Maurer, 2000]). Active documents introduce a system which may automatically answers questions. Users may ask any question at any position in a document stored on the server system. The system either answers the question automatically (by searching for answers to similar questions), or forwards the question to the author or maintainer of the document. If there are many users of the library and if the tools are easy to use, there is an enormous power in using this idea of active documents! But also other applications are possible: e.g. an *intelligent automatic summary* of a document. This summary can be as easy to implement as collecting and displaying all highlighted document fragments which are created by the readers of the document. Again, many users may increase the quality of these summaries.

There are many studies about how annotations are written in an electronic environment (e.g. [Marshall et al., 2001]). Many web based based environments (e.g. [Rosenstock and Gertz, 2001], [Kahan et al., 2001]) are using annotations. Annotations are a necessary feature in every system providing information to a large community.

Rearrange Documents and Document Fragments

Organizing whole content entities or parts of content in a user defined way is essential when improving the usability of digital libraries ([Krottmaier, 2001]). We are currently implementing such a *server side personal data collection* in the environment of the Journal of Universal Computer Science. This makes it easier for readers *to work with the content* of the library. In the upcoming prototype it will be possible to simply select information sources (in our case articles and article collection) stored on the server and link them to a personal collection. As a result of the integrated link database, the collections will remain up-to-date even if objects are moved to some other location on the server. Therefore the infamous `'HTTP-error 404'` ('Page not found') cannot appear when accessing objects stored in the database.

Such a personalized data collection may be static or dynamic. The example above showed a static collection, where each article must be selected and linked to the collection. If there is the request to visualize 'all articles by author XXX' or 'all articles in category YYY', this approach is not very effective. Therefore other possibilities must exist: to answer the first question (articles by author), so called *query objects*, i.e. objects, representing a search query in the database, will be used. When these queries are executed, all matching objects will appear in the listing of the personal collection. The second question (articles by category) can be answered by linking the appropriate category-collection organized by the administrator to the personal collection of the user.

Since we are using an object-oriented database system (Hyperwave Information Server, HIS) which supports inherently users and groups, it is possible to implement *public* and *private* collections of articles simply by assigning the proper 'rights'-attribute. Public collections may be used as a kind of *public bookmarks* already implemented by a lot of services (e.g. [MyBookmarks, 2001]). But there are several other advantages, including accessibility, when saving bookmarks on the server-side rather than on the local file system in some browser-specific format.

Organizing objects stored *on* the server system (*local objects*) is obviously not sufficient in the context of an open digital library system. It must also be possible to organize objects stored on any other system (*remote object*) like HTTP-server systems, other internet based systems, and even files stored on the local file system.

To enable structuring of remote objects a surrogate object must be created in the database. This object (in Hyperwave terminology also known as 'remote object') is then used as handle for further operations. Since the control of the referenced part is completely up to the remote server administrator, tools (such as link checkers and content watchers etc.) must be integrated to support the user while working with remote objects.

Structuring a single document as one unit is easy compared to the task of structuring parts of a document. Resources are usually addressed by URLs (Uniform Resource Locators, [Berners-Lee et al., 1994]). Depending on the document format, more granularity is possible.

We should not limit this discussion of fragments of a text based document (such as HTML, XML and PDF). A user may address the upper left part of an image, or the first 5 seconds of a video, etc. There is much work to do, to implement this feature.

Conclusion and Future Work

In this paper two necessary features were described in the context of the Journal of Universal Computer Science. Problems and issues of the well known annotation feature were presented and ideas on how to personalize documents and document collections were discussed.

In the current implementation it is not possible to add annotations *at any position* in the HTML representation of the information resource. Only whole content objects may be annotated at the time of writing. Although this approach is suitable for small documents, it is inappropriate when working with large documents. Therefore future work is addressed to make it possible to addannotations to parts of documents – simply by selecting a corresponding document fragment. Sharing annotations between different document formats is also an issue in the prototype.

The current working prototype does support rearrangement of locally stored objects, but does not support restructuring of document fragments. The next step is therefore to organize and restructure parts of documents.

References

[Berners-Lee et al., 1994] Berners-Lee, T., Masinter, L., and McCahill, M. (1994). Uniform Resource Locators. available online `http://www.w3.org/Addressing/rfc1738.txt` .

[Heinrich and Maurer, 2000] Heinrich, E. and Maurer, H. (2000). Active Documents: Concept, Implementation and Applications. *Journal of Universal Computer Science*, 6(12):1197–1202. `http://www.jucs.org/jucs_6_12/active_documents_concept_implementation`.

[Hyperwave, 2001] Hyperwave (2001). Hyperwave Informatino Server. `http://www.hyperwave.com`.

[J.UCS, 2002] J.UCS (2002). Journal of Universal Computer Science. `http://www.jucs.org` .

[Kahan et al., 2001] Kahan, J., Koivunen, M.-R., Prud'Hommeaux, E., and Swick, R. R. (2001). Annotea: An open rdf infrastructure for shared web annotations. In *Proc. of the WWW10 International Conference*.

[Krottmaier, 2001] Krottmaier, H. (2001). Improving the Usability of a Digital Library. In Hübler, A., Linde, P., and Smith, J. W., editors, *Electronic Publishing*, pages 178–182, Canterbury, Kent, United Kingdom. International Council for Computer Communication (ICCC) and International Federation for Information Processing (IFIP).

[Marshall, 1997] Marshall, C. C. (1997). Annotation: From paper books to digital library. In *ACM DL*, pages 131–140.

[Marshall et al., 2001] Marshall, C. C., Price, M. N., Golovchinsky, G., and Schilit, B. N. (2001). Designing e-books for legal research. In *Proceedings of the first ACM/IEEE-CS joint conference on Digital libraries*, pages 41 – 48. ACM Press.

[MyBookmarks, 2001] MyBookmarks (2001). `http://www.mybookmarks.com` .

[Rosenstock and Gertz, 2001] Rosenstock, B. and Gertz, M. (2001). Web-based scholarship:annotating the digital library. In *Proceedings of the first ACM/IEEE-CS joint conference on Digital libraries*, pages 104 – 105. ACM Press.

Use of Social Navigation Features in Collaborative E-Learning

Jaakko Kurhila[1], Miikka Miettinen[2], Petri Nokelainen[2] and Henry Tirri[2]

[1]Department of Computer Science
University of Helsinki, Finland
jaakko.kurhila@cs.helsinki.fi

[2]Complex Systems Computation Group
Helsinki Institute for Information Technology, Finland
firstname.lastname@hiit.fi

Abstract: EDUCO is a system for collaborative learning that uses real-time direct social navigation. Social navigation means making the navigation of other users visible to everyone else in the system. The paper discusses the social navigation features of EDUCO and reports empirical results regarding the collaborative behaviour of the students in a university-level Web-course. Contrary to our research hypothesis and the common wisdom in the research area, the data gathered showed that making other users' navigation visible did not have an effect on navigation in this experiment.

Introduction

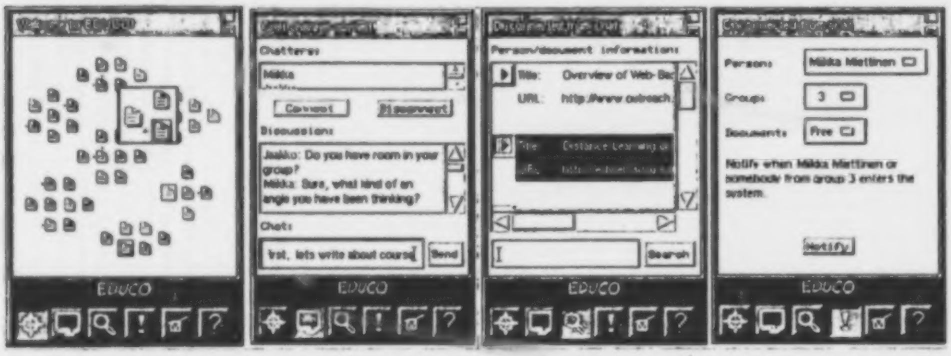
Social navigation (Munro, Höök and Benyon 1999) provides interesting opportunities in collaborative e-learning. When simplified, social navigation means that the users of an environment are dynamically provided with the information of the actions of other users of the same environment. A trivial example is a counter on a Web page, showing how many other people have visited the page. In their seminal book about social navigation, Munro et al. (1999) use an on-line grocery store as an example when classifying different types of social navigation: if people visiting the store are given recommendations what other people have bought, it is a form of *indirect social navigation*. If a shopper in the grocery store has a sense of other people moving about the store and can engage in seeking e.g. assistance, it is a case of *direct social navigation*.

Experiments with social navigation in educational setting have mostly fallen into the category of indirect social navigation (see e.g. Dieberger 1999). However, EDUCO is a system for collaborative learning to employ real-time direct social navigation. Real-time aspects of EDUCO create the feeling of live companions in the system (Kurhila et al. 2002). Other important facilities include tools for synchronous and asynchronous communication, and support for forming study groups and publishing their work. The purpose of the paper is to demonstrate how the tool was applied to a real-life situation, and describe how the features of social navigation are empirically evaluated from a data gathered from a university-level course of 46 students.

System Description of EDUCO

EDUCO is a system for both the learners and the teachers, to be used with standard web-browsers. From a technological point-of-view, EDUCO consists of a socket server along with cgi-scripts, and a Java applet for every user. From the user point-of-view, the key issues are navigation towards useful information, synchronous and asynchronous communication, group forming and publishing group works.

There is no direct metaphor for the use of EDUCO in traditional classrooms. A learning area in EDUCO consists of the EDUCO tool itself, a view to a document, and comments for the document. The user interface of EDUCO tool consists of different views of which only one is visible at a time. The most important views are map, chat, search and alarm (Fig. 1).



Miikka

Jaakko: Do you have room in your group?
Miikka: Sure, what kind of an angle you have been thinking?

first, lets write about course

Title: Overview of Web-Ba
URL: http://www.outreach.

Person: Miikka Miettinen
Group: 3
Documents: Free

Notify when Miikka Miettinen or somebody from group 3 enters the system.

Figure 1: From left to right, four different views of EDUCO: Map, Chat, Search and Alarm.

Map view presents documents currently available in the learning environment and provides a way to navigate to them directly. By double clicking a document a user can open it in the rightmost frame in the browser window. A user is represented as a coloured dot around the document he or she is currently viewing (Fig. 1). Other users are visible to every user in real-time, so that their navigation is visible to everyone present.

The documents change their brightness level and colour on the map depending on how much they have been viewed relative to the other documents, as seen in Fig. 1. The total time all users have spent viewing each document is recorded every hour. The change in the brightness and in the colour of an individual document are determined by the distance of its moving average for the last 24 hours from the same average for all documents.

In other words, map view provides the users of EDUCO two social navigation features. Colouring the documents according to how much they have been viewed is a form of indirect social navigation. Presenting users as moving dots next to the documents they are currently viewing is a form of direct social navigation. Both of these features can help the users to follow the footsteps of the others. The direct social navigation also adds to the sense of not being alone in a web-course (Kurhila et al. 2002).

EDUCO has a built-in *chat* functionality integrated to be map view to enable synchronous communication between peers and other users of the environment. The chatters can be picked up from the map view by clicking the dots representing users. The number of participants in the discussion is unlimited, but one person may use only one chat channel simultaneously. Figure 1 shows an example of the use of chat. In addition to synchronous discussions, EDUCO uses two types of document-specific *asynchronous communications*: areas for general comments and hierarchical newsgroup-type discussions for meaningful knowledge building.

The *search* function of EDUCO can be used in finding persons or documents. The search is targeted to the titles of documents and names of users, both online and offline. The search results are shown in the search view (Fig. 1), but also in map view by highlighting the document with a blue rectangle, as it can be seen in Fig. 1.

The *alarm* offers each user a possibility to set "triggers" into the documents, groups and the overall system. In other words, a user can set EDUCO to alarm when certain conditions occur. This feature is useful in a case where a user searches for a companion showing interest to a certain document or topic, or wants to contact a particular person when he or she enters the system. The alarm function also enables making combinations of triggering events. Figure 1 shows an example of a combination of triggers: the alarm will beep if "Miikka Miettinen" or somebody from group 3 enters the system".

An important feature in EDUCO is the *support for forming groups*. Alarms, chat and navigational patterns can be used when screening for potential partners for group work. Another feature is a list of available (not yet in any group) participants in a Web-course. Every user can form a group by dicking a button "Add a new group". Other people can join an already existing group, or they can start a new group. After producing a joint work, it can be published in EDUCO for comments.

The group-forming feature of EDUCO is designed for Web-courses where the learning process involves writing reports in groups. Document icons in the "map view" of EDUCO can each represent a collection of student reports.

BEST COPY AVAILABLE

Empirical evaluation

Study setting

A valuable feature in systems like EDUCO is that they make it possible to accumulate large amounts of interesting information through completely unobtrusive observation of the users' activities. Whenever someone moves to another page, starts a chat discussion, joins a group, or uses any other of the available functions, the details of the event are registered in the log. This allows extensive re-construction of the conditions under which the action took place, and facilitates the analysis of the users' behavioural patterns as they occur in real-life e-learning situations.

The data set was collected during the Spring 2002 semester from a course entitled "Computer Uses in Education" with a subtitle of "Web-based learning"'. The course was given at the Department of Computer Science, University of Helsinki, Finland. The course was a web-based course without face-to-face meetings and the use of EDUCO was mandatory. Forty-six students were active in the course. Some of the students were adult learners with varying backgrounds and degrees but most of them were Computer Science majors.

The format of the course was unique compared to the other courses at the Department. The students had nine weekly reports to produce from nine different topics. It was not allowed to produce the report alone. At least a working pair was required, and a group of three was also recommended. Moreover, the groups were not allowed to stay the same during the course. A student had to be involved with at least three different groups.

Apart from the documents containing the reports of the student groups, the documents in EDUCO map discussed the issues covered during the first eight weeks. The documents were organized to eight different clusters under a common theme. The themes were close to the weekly topics but not completely the same. The document cluster sizes varied from two to ten, giving a total of ca. 40 documents. The exact amount of documents varied during the course, since new resources were added occasionally.

Results

In this paper, our empirical analysis focuses on social navigation and the formation of groups. We first attempt to examine if the presence of one or more users around a certain document attracts others to navigate to that document as well. This is the real-time aspect of social navigation as implemented in EDUCO. As stated earlier, the document icons also change their brightness/colour based on their popularity. In order to evaluate the role of the colouring mechanism, we compare overall navigation patterns to periods when a new weekly assignment was published so that the colours had not yet changed to influence the users by guiding them to the most relevant documents.

The idea of our analysis of real-time social navigation was to compare the frequencies and lengths of visits to documents that were already being read by at least one person ("occupied documents"), and visits that started without there being others present at the particular document ("unoccupied documents"). Only a rough indication of the tendency of people to move together could be obtained this way, since there were other factors with obvious effects on the results. In particular, the assignments given during the course directed most of the activity to a small number of documents, making social navigation almost unavoidable during the busiest periods. The validity of data gathered from a real course more than compensates for the lack of control, however, when it comes to evaluating the usefulness of a real system.

In order to calculate the relevant statistics, we re-constructed the navigation activity that took place during course from the log file. This involved stepping through the log one row at a time and moving users from one visitor list to another the way they moved when they were actually using the system. The number of visits to occupied and unoccupied documents as well as the lengths of the visits were computed along the way. Our hypothesis was that occupied documents would be somewhat more popular than unoccupied ones. Another intuitive guess was that visits to occupied documents would be shorter, because people would go and take a quick look at things that others seem to find interesting.

Table 1 shows the main results of the re-construction. The 48 students are sorted into 5 groups according to the distribution of their visits to occupied and unoccupied documents (group 5 has 8 students and the other groups 10). The last row of the table contains the overall figures for all students.

	Occupied % of visits	Occupied Average length	Unoccupied % of visits	Unoccupied Average length
Group 1	60%	11	40%	8
Group 2	53%	11	47%	7
Group 3	49%	10	51%	5
Group 4	43%	9	57%	5
Group 5	32%	10	68%	5
All	48%	10	52%	6

Table 1: The number and average length of visits to occupied and unoccupied documents.

The numbers in Table 1 do not indicate a preference to occupied documents over unoccupied ones, since the proportions are practically equal in all groups. The minor differences in the average lengths of the visits do no justify any conclusions either. Therefore, the log data did not provide support for our idea of the usefulness of real-time social navigation.

Another essential mechanism for social navigation is the colouring of the document icons according to their popularity. During the course, there were almost always some documents shining brighter than the others. Since they were generally the most relevant documents for the weekly assignment, the amount of guidance provided by the colouring could not be assessed in isolation under normal conditions. However, after a new assignment was published, there was a period of a few hours, during which the documents that had just become important did not stand out yet. Our analysis is based on comparing the navigation patterns observed during the first six hours following the publication of an assignment to the average patterns of the entire course.

According to our hypothesis, visits should be shorter on average when the colouring does not guide the users directly to the most useful documents. Unfortunately, it turned out that this is not the case. The average length of a visit was 7.5 minutes for periods following the publication of an assignment, and 7.2 minutes in the whole data set. From an intuitive point of view, colouring should help finding relevant documents, but as in the case of real-time social navigation, the log data did not provide support for our intuitive views.

Conclusions

The paper presented a system for collaborative Web-based learning that supports social navigation and described a real-life situation where it was used. Common wisdom has been that allowing a user to see the navigation steps of other users has an effect to the navigation of the user, although valid empirical evaluations are somewhat lacking. However, the effects of synchronous and asynchronous features of social navigation in EDUCO appeared to be non-existent in this study. The result was surprising, especially when a previous study with the same system (with less functionality) showed slightly opposite results (Kurhila et al. 2002). Further studies are necessary toseparate the effective factors.

References

Dieberger, A. (1999). Social Navigation in Populated Information Spaces. In A. Munro, K. Höök & D. Benyon (Eds.), *Social Navigation of Information Space*, 35-54. London: Springer.

Kurhila, J., Miettinen, M., Nokelainen, P., & Tirri, H. (2002). EDUCO - A Collaborative Learning Environment using Social Navigation. In P. de Bra et al. (Eds.) *Proc. Adaptive Hypermedia and Adaptive Web-Based Systems (AH 2002)*, 242-252, Berlin Heidelberg: Springer.

Munro, A., Höök, K. & Benyon, D. (1999). Footprints in the Snow. In A. Munro, K. Höök & D. Benyon (Eds.), *Social Navigation of Information Space*, 1-14. London: Springer.

Obtaining Realistic Information on the Context of Use of E-learning System

Masaaki KUROSU*[1] and Hideaki TAKAHASHI*[2]
National Institute of Multimedia Education
Japan
PFD00343@nifty.com *[1] hide@nime.ac.jp *[2]

Abstract: By applying the fieldwork methods such as the interview and the observation, we started our study for obtaining more realistic information about the context of use of e-learning system for the purpose of establishing the full list of system requirements. The information derived from the fieldwork will surely provide us more realistic requirement of the future e-learning system.

Introduction

Besides the university students, there are many people who would like to learn something more than they have learnt at the university or at the high school. Different from the university students, people working in the office, people working at home or people who have retired spend their lives in a variety of situations. In order for the e-learning system to be more usable, effective and satisfactory to these people, it has to be flexible and adaptive for their context. In other words, we have to obtain the contextual information on how they are spending their life in order to clarify the requirements for the e-learning systems in terms of the time course, the contents and the use of media. Although we have many research results on the requirements for the e-learning system quantitatively, most of them are based on the questionnaire. It is frequently pointed out that the questionnaire and the statistical analysis based on the quantitative data such as the questionnaire reveal just a part of the whole requirements. This is the reason why we conceived of applying the fieldwork techniques to specify the context of use information of people who have the need for e-learning.

Importance of Context of Use Information

In ISO standard numbered 13407 (ISO 1999), i.e. "Human-centered design processes for interactive systems", it is clearly stated that the interactive systems should follow the design process as follows (Figure 1).

a) to understand and specify the context of use
b) to specify the user and organization requirements
c) to produce design solutions
d) to evaluate designs against requirements

In the standard, the context of use is defined as "user, tasks, equipment (hardware, software and materials), and the physical and social environments in which a product is used". It is undoubtedly necessary and important "to understand and specify the context of use", because this process is positioned at the top of all processes. Because the system design should put an emphasis on the traceability, the information specified at the first process should be kept and followed by subsequent processes. This is the prerequisite for an interactive system to be usable, i.e. effective, efficient and satisfactory.

Of course, the e-learning system is no exception. If we don't have the adequate information about the context of use of the e-learning system, the system might not fit to the user's needs and situational requirements.

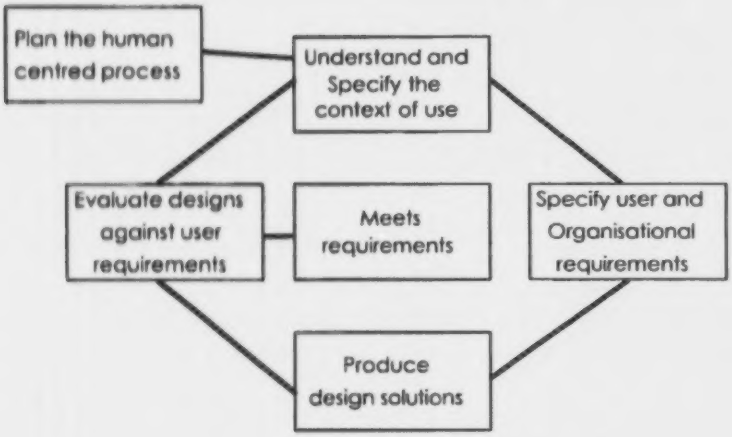

Plan the human centred process
Understand and Specify the context of use
Evaluate designs against user requirements
Meets requirements
Specify user and Organisational requirements
Produce design solutions

Figure 1: Human centered design processes for interactive systems in ISO 13407

Field Work Methods

Based on ISO13407, a Technical Report ISO TR16982 (ISO 2000) "Ergonomics of human-system interaction — Usability methods supporting human centered design" was issued in order to recommend adequate usability methods for each of the design process. This TR includes such methods as the observation, the performance-related measures, the critical incidents, the questionnaires, the interviews, the thinking aloud method, the collaborative design and evaluation, and the creativity methods for supporting the design processes proposed by ISO13407.

Among them, the interview and the observation are especially recommended for the first process for obtaining the contextual information. Although these methods was developed and have been mainly used by the ethnographers in their fieldwork, their importance and effectiveness are now recognized in the field of HCI (Human Computer Interaction) as two of the main methods for designing interactive systems. Thus it is expected that the use of such methods will fulfill the list of requirements for the e-learning system that is now insufficiently and poorly filled with because of the previous use of the quantitative methods such as a questionnaire.

Focus of Interview and Observation

Before starting to obtain the information on e-learning system by the use of interview and observation, we considered about the focal points as follows.

(a) Demographic characteristics – age, gender, occupation, academic background, etc. as the basic general information.

(b) Current situation – activity in terms of the temporal and spatial dimensions, i.e. how the user is spending his/her time of the day, and the days of the week in which location (home / office / public places, etc).

(c) Expected carrier path – if the user have a clear image of his/her life in the future, e.g. to get a job, to become a social worker, etc.

(d) Obstacles – what kind of barriers there are

(e) Other – any additional information

Obtaining Realistic Information

For the purpose of obtaining realistic information, we thought that the interview and the observation should be conducted in the real field of the user as far as possible. This is similar to the concept of the contextual inquiry method proposed by Beyer and Holtzblatt (1998). Natural artifacts around the user will ease the user and will give us more realistic information, thus it was decided that the interview and the observation will basically not be held in the experimental settings but in the real life situation.

Trial Research

We started our study by applying the fieldwork methods to a housewife who has just started attending some e-learning courses. As far as we knew from our earlier study: she has graduated the doctoral course but not yet obtained the Ph.D. She is busy now for taking care of her children of 3 years and 8 months. Hence,

7:00	Wakes up in the morning	19:00	Comes back home
7:15	Child care	19:15	Child care
7:30	House work	19:30	Dinner
7:45		19:45	
8:00		20:00	Child care
8:15	Child care	20:15	
8:30		20:30	
8:45	Takes the child to nursery school	20:45	
9:00		21:00	
9:15		21:15	
9:30		21:30	House work
9:45		21:45	
10:00	Comes back home	22:00	
10:15	Child care	22:15	
10:30		22:30	Accesses the mail software
10:45		22:45	
11:00	House work	23:00	
11:15		23:15	
11:30	Puts on the PC	23:30	
11:45	Accesses the mail software	23:45	
12:00		0:00	Accesses UCLA e-learning site
12:15		0:15	Starts e-learning
12:30	Lunch	0:30	
12:45	Accesses UCLA e-learning site	0:45	Submits an assignment
13:00	Starts e-learning	1:00	
13:15	Visits the discussion board	1:15	Visits the discussion board
13:30		1:30	
13:45	Child care	1:45	
14:00		2:00	
14:15		2:15	
14:30		2:30	
14:45		2:45	
15:00	Access UCLA e-learning site	3:00	Goes to bed
15:15	Starts e-learning	3:15	
15:30		3:30	
15:45	Reads the course documents	3:45	
16:00	Homework	4:00	
16:15		4:15	
16:30		4:30	
16:45		4:45	
17:00		5:00	
17:15		5:15	
17:30		5:30	Child care
17:45	Goes to the nursery school	5:45	
18:00		6:00	
18:15		6:15	Goes to bed
18:30		6:30	
18:45		6:45	

BEST COPY AVAILABLE

Table 1: Timetable of a housewife who is learning by UCLA web site

her studying time is separated during the day and she sometimes accesses the course during midnight (e.g. 2-3 AM) as can be seen in Table 1 and Figure 2. She frequently studies the course material on the bed or on the dining table as well as in front of the PC. But she has a strong motivation to get a position at the university in the near future and this motivation lets her cope with the difficult situation for learning.

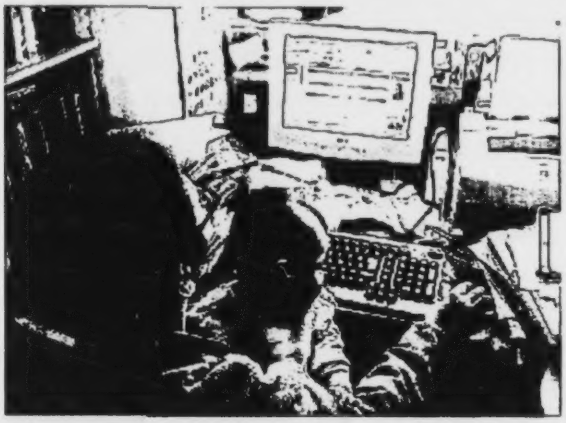


Figure 2: The situation of the housewife using her PC

Future Direction

We are planning to start some other researches for students of broadcasting university courses and the e-learning courses as well as to continue the study with this woman. It is expected that we will be able to summarize the information to propose a sufficient list of requirements for the future e-learning system.

References

Beyer, H. and Holtzblatt, K. (1998) *Contextual Design*. Morgan Kaufmann

ISO13407 (1999) *Human-centred design processes for interactive systems*. International Organization for Standardization

ISO/TR16982 (2000) *Ergonomics of human-system interaction — Usability methods supporting human centred design*. International Organization for Standardization

BEST COPY AVAILABLE

Managing Time Thresholds in Mixed-Initiative Learning Environments

Dimitris Lamboudis, Anastasios Economides
University of Macedonia
Thessaloniki, Greece
dimlamb@uom.gr, economid@uom.gr

Abstract, The effectiveness of pedagogical agents, in terms of their believability and adaptivity, in mixed-initiative learning environments can be considerably affected by the "timing" of agents' actions. This paper describes an approach to manage time thresholds, which takes into account the response "style" of each individual learner. The proposed approach has provided very positive results in the context of an agent-based, mixed-initiative learning environment, which we are currently developing.

Introduction

Mixed-initiative problem solving lies at the heart of knowledge-based learning environments, aiming to provide an individualised learning experience. Learning environments, which are inhabited by animated pedagogical agents, constitute one of the most prominent paradigms of mixed-initiative systems (Johnson, 2000), (Johnson et al, 2000), (Andre et al, 1999). While learners are actively engaged in problem solving activities, agents monitor their progress and provide to them feedback which is according to their individual profile, aiming to increase learning effectiveness and efficiency. Typical scenarios include an introduction to the subject by the agent, followed by a test, or a task to be accomplished, to evaluate the learner's level of knowledge acquisition (Lester et al, 1999). While the learner tries to perform the task in hand, the agent monitors his/her actions, and continuously evaluates various factors in order to engage and assist. The pedagogical agents' potential to couple feedback functionalities with a strong visual presence, makes them an ideal examp le for studying mixed-initiative interactions (Shaw et al, 1999).

Mixed-initiative systems must consider a set of key decisions in their effort to support joint activity, including: *when* to engage learners with a service, *how* to best contribute to solving a problem, *when* to pass control back to users, and *when* to query users for additional information (Horvitz, 1999). In order to reach to *situated* decisions, agents make "guesses" about learners' needs. These "guesses" usually depend on the evidence obtained through the "keyhole" of the user interface, collaborative statistical data about the learner (Zuckerman and Albreciit, 2001) and explicitly asked information, most commonly in the form of a query the user has to go through in the beginning of a session.

Moreover, in the context of such systems, there are many additional parameters and principles that should be taken into account by the agent in order to reach a turn taking decision (Horvitz, 1999), (Lester et al, 1999), (Bates, 1994). For example, the personality and the emotional state of the agent, the advisory history, the idle time elapsed etc.

This paper focuses on a specific aspect of agent behaviour in this context, namely *timing,* which is directly connected (among others), to *time thresholds.* Time thresholds are defined as the amount of time the learner is allowed to spend in order to successfully complete a task without the agent's help.

Idle time is one of the main variables used by the agents to infer that the learner has difficulties in understanding, solving and, in general, successfully proceeding in the learning procedure. Idle time is usually defined over a predefined time threshold, i.e. agents compare the time elapsed until the learner response, with a predefined time threshold. The actual value of this threshold is most of the times derived from statistical data and corresponds to the "mean time" that learners spend for the completion of the particular task (Lester et al, 1999).

It can be argued, however, that this approach has two main limitations:

- The pattern of the agent's behaviour is soon revealed to the student; this fact may considerably compromise agent's believability, and therefore, agent's effectiveness (Lester et al, 1997a).
- It does not take into account the individual learner's characteristics (it is rather targeted to the "average learner"), which is the main objective in personalized learning environments (Sampson, Karagiannidis, Kinshuk, 2002)

This paper proposes an alternative approach for managing time thresholds in agent-based, mixed initiative learning systems. The proposed algorithm takes into account the response of each individual learner, and has provided very positive results in the context of an agent-based, mixed-initiative learning environment, which we are currently developing.

The Proposed Algorithm

Our approach attempts to overcome the limitations identified in the previous section. The algorithm, instead of spontaneously engaging the agent when idle time exceeds a predefined time threshold, allows the learner to have "a second chance" by extending the threshold. This second chance (the extension of the predefined time threshold) is not provided unconditionally, since this would be equivalent to just set another rigid threshold, although greater than the initial one. Instead, when the threshold is reached, the agent decides to extend it by some probability P_e and not to extend it by some probability $P_a = 1-P_e$. Thus, in the "worst case", the agent will behave conventionally, i.e. like in the existing systems. However, there is a possibility, which is partially defined by the designer, at least as far as the initial value of P_e is concerned, that the agent will give the learner a second chance. Yet, if this possibility is heavily depending on the initial value of P_e, it would be just another ad hoc intervention of the designer, lacking any adaptive characteristics.

Instead, the probability of extending the time threshold (i.e. the definition of P_e), is determined by the agent, through the algorithm which checks if this extension of time has any affects on the learning procedure, that is, if it helps the learner to achieve his/her goals. In case it does, it reinforces the value of P_e. In the long run, this means that independently of the initial values of P_e and P_a the system will favour the option that actually helps the learner.

In more detail, the algorithm is shown in (Fig. 1). The corresponding notation and assumptions are as follows:

- A learning procedure that can be represented by a set of n hierarchically ordered Tasks, $T=\{T_i, i=1... n\}$;
- A set of corresponding time thresholds, $t=\{t_i, i=1... n\}$;
- An initial value of P_e^0 (the corresponding $P_a^0 = 1- P_e^0$);
  Where $P_e^0= P$ *(extend time threshold in* $T_1 \mid t> t_1$*)*, i.e. the conditional probability of extending the time in the first task, given that the time threshold has been reached;
- A constant ?p to represent the reinforcement of P_e^{i-1};
  Where $P_e^{i-1}= P$ *(extend time threshold in* $T_i \mid t> t_i$*)*, i.e. the conditional probability of extending the time in the i_{th} task, given that the time threshold has been reached;
- A constant ?t to represent the extension amount of the time threshold; (Both ?p and ?t can be either constant values or percentages);
- A Boolean *e*, to serve as a flag to declare if there has been a time extension $e=1$ or not $e=0$;

Given these assumptions the algorithm receives t_i and P_e^{i-1} as input and process them as follows:

```
While (there is no positive response) Do
    if (e=1) then
        act and proceed to Task ($t_i$-?t, $P_e^{i-1}$)
    else
        If ($t> t_i$) then
            $t_i= t_i$+?t by $P_e^{i-1}$ and e=1;
            act by $P_a^{i-1}$ and proceed to Task ($t_i$-?t, $P_e^{i-1}$)
end while
if (e=1) then
    $P_e^i = P_e^{i-1}$ + ?p
    $P_a^i = 1- P_e^i$
Next Task ($t_{i+1}$, $P_e^i$)
```

Note that in case of action-taking by the agent, the algorithm remains to the same task but with a decreased threshold. Since the learner has received help he/she should be able to complete the task in less time. The agent is assumed to provide exhaustive help if needed; thus the algorithm ends with a positive response and avoids stack overflow.

The proposed algorithm can overcome the shortcomings of existing approaches:

1. The use of probabilities, instead of a predefined time threshold, increases the possibility that the agent behaviour will not be revealed to the learner, thus the believability of our agents can be enhanced.
2. Moreover, the time thresholds are dynamically adapted to the individual learner response, thus contributing to a learning experience which is driven by the learner characteristics

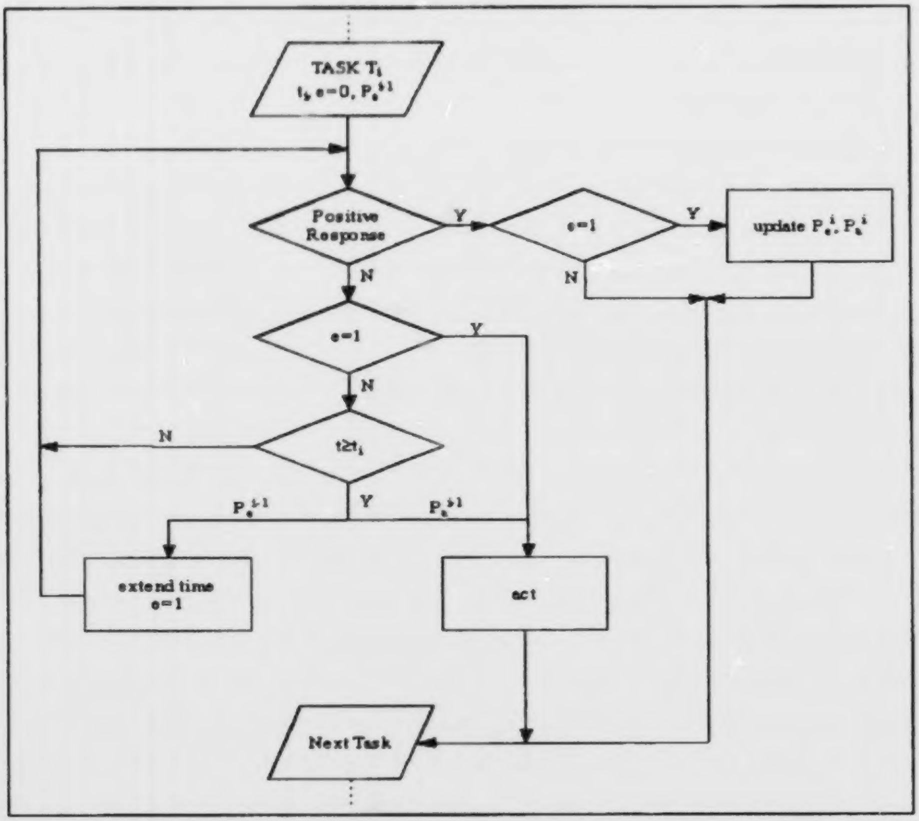


Figure 1: The proposed algorithm for managing time thresholds in agent-based, mixed-initiative learning systems

It is important to note that:

- The algorithm controls *when* an intervention will occur and not if the intervention will take place or not. The agent *will*, after all, engage if needed. Thus the algorithm maintains the pedagogical mainstream of decisions but introduces small variations to adapt to the particular user's style.
- The case of decreasing the value of P_e is not concerned. It seems rational to do so if the agent receives positive feedback before the threshold is reached but this would have the affect of balancing the value of P_e close to the initial value thus cancelling the adaptivity of the algorithm. After all, in the worse case, the agent will wait a bit longer before acting.
- Keeping the sequence of P_e ascending may lead to a value close or even equal to the unit ($P_e = 1$). This should not be avoided in general, since it actually means that the need of the user for extra time is very strong. However, in order to maintain the second characteristic of the algorithm (hiding the behaviour pattern), the designer could incorporate a control for the upper limit of the value of P_e.

Discussion

This paper has proposed an algorithm for managing the "timing" of agents actions in the context of mixed-initiative learning systems. The idea of the algorithm is to modify the timing of agents interventions, based on a probabilistic model, which takes into account the responses of each individual learner.

The proposed algorithm is being implemented in the context of an agent-based, mixed-initiative learning environment that we are currently developing. We have conducted some preliminary experiments with students of our department to evaluate the algorithm. In particular, we interviewed students using the system with pre-defined time thresholds, against students using the system where thresholds follow the proposed approach. This informal evaluation provided very positive feedback: the fact that agent's behaviour cannot be easily determined by the students, makes the agent believable, and enhance their learning effectiveness.

References

Andre E., Rist T., and Moeller J. (1999). Employing AI Methods to Control the Behaviour of Animated Interface Agents. *Applied Artificial Intelligence Journal*, *13 4-5*.

Bates, J. (1994). The Role of Emotion in Believable Agents. *Communications of the ACM*, 37 (7), 122-125.

Horvitz, E. (1999). Principles of Mixed-Initiative User Interfaces. *Proceedings of CHI '99, ACM SIGCHI Conference on Human Factors in Computing Systems, Pittsburgh, PA, May 1999*.

Johnson W. L. (2000), *Pedagogical Agents. MIT Press.*

Johnson W. L., Rickel J. W., Lester J. C. (2000). Animated Pedagogical Agents: Face-to-Face Interaction in Interactive Learning Environments. *International Journal of Artificial Intelligence in Education 2000*, 11, 47-78.

Lester, J. C., Converse, S. A. Kahler, S. E. Barlow, S. T., Stone, B. A. and Bhogal, R. (1997a). The Persona Effect: Affective Impact of Animated Pedagogical Agents. *Proceedings of CHI '97 (Human Factors in Computing Systems*, pp. 359-366.

Lester J.C., Stone B.A., and Stelling G.D. (1999). Lifelike Pedagogical Agents for Mixed-Initiative Problem Solving in Constructivist Learning Environments. *User Modelling and User-Adapted Interaction*, 9, (1-2), pp. 1-44, 1999.

Sampson D., Karagiannidis, C., Kinshuk, (2002). Personalised Learning: Educational, Technological and Standardisation Perspective. *Interactive Educational Multimedia*, number 4 (April 2002), pp. 24-39

Shaw E., Ganeshan R., Johnson W. L., and Millar D. (1999). Building a Case for Agent-Assisted Learning as a Catalyst for Curriculum Reform in Medical Education. *International Conference on Artificial Intelligence in Education*.

Zuckerman I., and Albreciit D. W. (2001). Predictive Statistical Models for User Modeling. *User Modeling and User Adapted Interaction*, 11.

Acknowledgements

Part of the R&D work reported in this paper is carried out in the context of the "EP.E.N.D.Y.SH" project, partially funded by the Greek Ministry of Education.

Hard Choices: Selecting a Course Management System

by Bruce Landon, Ph.D.

Choices are difficult because there are *too many products*

The situation is reminiscent of the early automobile industry when there were over a hundred automakers. Like the early auto industry many other competitors will not survive in the long run. The current front-runners: WebCT and BlackBoard started out as small almost personal projects a few years ago and are now multi-million dollar enterprises that span the global education marketplace. There may well be others out the current products that will evolve into the major brands of tomorrow as the market matures. The point of this analogy is that selecting a learning management system is much more complicated than selecting a new car, in part, because there are so many competing models. There are over 100 products in this marketplace that range from relatively simple limited function applications like WebBoard which just provides threaded discussions and chat to complex enterprise wide learning systems that link to backend databases and administrative data systems used by colleges and universities. Previously in 1997, I had attempted to characterize these products as components or suites by this categorization turned out not to be useful because there were so many variations from product to product he became difficult to classify new products. Also, the products in this marketplace evolve quite rapidly with a new model or version almost every year, like automobiles. So to deal with this rapidly changing market it seems better to characterize products in terms of the features that they provide.

Too little working memory in decision-makers

Nobel laureate, Herbert Simon (1979) characterized the human decision making capacity as having "Bounded Rationality" (also see Gigerenzer & Selten, 2001). When people face decisions they operate within the bounds or capacities of the human mind. They are limited by fallible perceptions, wandering attention, faulty memories, and fluctuating information-processing abilities. People don't optimize, but instead resort to simplifying rules of thumb in order to proceed with their decision-making. These limitations have been investigated for decades with the repeated finding that working memory limitations play a major role in limiting the ability to make rational decisions.

When facing difficult decisions, people encounter overload and then they resort to ways of coping that involve cognitive shortcuts. When overloaded, they are more susceptible to cognitive illusions (Kahneman and Tversky, 1996). Cognitive illusions are similar to perceptual illusions in that they stem from the fact that in both types of illusions the person can focus only on a small part of the situation at one time. In the case of perceptual illusions this is because the fovea of the eye that sees fine detail encodes only a small segment of the spatial panorama at each fixation. In the case of cognitive illusions this is largely because the conscious working memory can hold only a few "things" and the rest must be inferred or extrapolated in ways that are sometimes biased. In both types of illusions the person is not necessarily aware of any "illusion" at all and may believe that they are "seeing everything correctly."

Too many Cognitive Illusions in Decision-Making

The discrepancies associated with cognitive illusions may be seen a little more clearly in contrast to an idealized rational decision process. In the idealized process, one starts by selecting relevant features/criteria and then assigning an importance weighting to each of those features. Next one evaluates each choice option on each of those important features and assigns a suitability score. Finally one makes the rational decision to choose the option with the highest weighted average suitability score (the average of the weights for a feature multiplied by the feature's suitability score). Choosing the option with the best score is the rational decision (Keeney and Raiffa, 1976 as cited in Roe, Busemeyer and Townsend, 2001). With only a couple of optional choices and a few important features it is likely the limitations of working memory would be overwhelmed even if one were able to do the mental multiplication part. When one is overwhelmed by the size and complexity of the decision situation then one is susceptible to a host of cognitive illusions. A few of the major ones are: Availability Heuristic, Representativeness Heuristic, Hindsight Bias, Gambler's Fallacy, the Framing Effect, Similarity Effect, Decoy Effects, and Overconfidence Effect. When the decision situation is simple and small, on the other hand, most people can and do make good judgments unaffected by these cognitive illusions.

Making the decision situation smaller and simpler can circumvent these obstacles. Dividing up a complex decision into several small and simpler decisions keeps the load on working memory within normal capacity and then decision makers can be quite rational in making good decisions. Donald Norman (1999) has made the case that human-computer interactions can and should be designed to take account of normal human fallible perceptions, wandering attention, faulty memories, and fluctuating information-processing abilities. With good design of decision-making processes that keep the in-the-head part small and simple, a system can be optimized to enable quality decision-making. The normative weighted averaging strategy can be easily divided up into small and simple component parts and then later recombined (outside-of-the-head) into a rational decision process that leads to the "best option." There is a powerful decision-making synergy in combining the focused judgmental prowess of people with the memory and computational prowess of computers.

How people normally Make Decisions: The 5 Basic Strategies

There are five basic decisions strategies (Payne & Bettman, 2001) for choosing among options (products, services etc.) based on features or aspects of the options. All of these five strategies are compromised by the reality that the set of options is limited to those known to the decision-maker and the "best" option may be simply missed in the whole process. While the names of these strategies on may be unfamiliar is quite likely that everyone has used all of the following strategies at one time or another:

One Reason strategy (aka lexicographic, pick the best)
Elimination by Aspect strategy (aka pick the last)
Satisficing strategy (aka Bounded Rationality Model)
Equal Weight strategy (aka scoring strategy)
Weighted Averaging strategy (aka weighted adding strategy, grading model)

The One Reason strategy involves two steps: selecting the most important feature and then picking the product from all of the options that is best on that one feature. There is no requirement for the features to be expressed as numbers. If there is a tie then the decision maker simply repeats the process on the second most important feature. This non-compensatory strategy does not allow for some features of an option to make up for other less adequate features. The only involvement of a second feature is in the case of a tie that is broken by considering the next most important feature and selecting the option that is best on that feature.

The Elimination by Aspect strategy is a simple screening strategy involving two steps: setting the requirements for each of the features and then eliminating options one at a time which do not meet any one of the requirements. The decision maker examines the features of each option one by one and the option is eliminated as soon as a feature is found that does not meet the requirements. This popular strategy does not need for the features requirements be expressed as numbers and is easy-to-use. The elimination by aspect is a non-compensatory strategy so that once an option is rejected on any feature that option is eliminated from further consideration. This strategy does not necessarily result in a single best option since more than one option may pass on all of the requirements. Including any features that are irrelevant or biased in favor of one of the options compromises this process.

The Satisficing strategy (Simon, 1955 cited in Gigerenzer and Selten, 2001) is more psychologically developed model of sequential decision-making that includes setting requirement cutoff levels for each feature. An option is examined until it fails to meet one of the cutoff levels then it is rejected and the next option is considered. The first option that passes on all of the features is selected. If none of the options pass all of the cutoff requirements, then the requirements are reduced to new lower cutoff levels and the process is repeated. The satisficing strategy is non-compensatory and effected by the order in which the options are presented as well as the aspiration level of the initial cutoff requirements.

The Equal Weight strategy is comprehensive and considers all of the features on all of the options. The suitability values of one (passed) or zero (failed) are assigned to each to each feature on each option. The total suitability score for each option is the simple sum of the feature suitability values for that option (all features are weighted equally). The option with the highest sum of the values is selected. This strategy is directly analogous to multiple choice test scoring where correct answers are awarded one, wrong answers are awarded zero, and the highest sum score identifies (selects) the best student on the test. This compensatory numeric strategy enables some features assigned one's to compensate for other features that were assigned zero's. This strategy is more useful when there are many features because there is less risk of a tie for best score.

The Weighted Averaging strategy is a more complex version of the simple sum score model where each feature is also assigned an importance weighing. This idea implies that the decision maker is willing to make trade-offs to arrive at the selected option. The process involves five steps: (1) setting the importance weights for each of the features, (2) for each option then determining the numerical suitability value for every feature, (3) multiplying the feature suitability value times the feature weight, (4) then summing these weighted features subscores into an option total score, and (5) finally selecting the option with the highest average score. The averaging of the weighted option total scores simply returns the scores to the scaling metric of the feature suitability value units (which are often on a rating scale such as 1=poor to 9=excellent). This strategy is directly analogous to the grading model where different parts of the grade are weighted differentially (or subsections of an exam are weighted differentially) to arrive at the final mark. The weighted averaging strategy is compensatory in two ways: high scores on one feature compensate for low scores on another feature and a lower importance weight on one feature is compensated for by a higher importance weight on another feature. This strategy is less likely to result in ties between options than is the equal weight strategy when using a relatively small number of features. Furthermore, the weighted averaging strategy is considered the normatively rational decision process because it uses all of the information available in a consistent manner to arrive at a selection. This model is similar to the multiple linear regression model used in statistical analyses and suffers from some of the same shortcomings, most notably it is compromised when irrelevant features are used and when unreliable suitability values are used.

Decision makers often make use of combinations of the above strategies. In combined strategies the decision is made in phases. The initial phase is often to screen out some of the potential options in order to reduce the complexity of the situation to as short list of options. This phase is followed by a more thorough consideration phase to select the best option from a short-list of candidate options. The primary reason that everyone does not use the weighted averaging strategy all the time for all decisions is because it would be too mentally difficult and too time consuming. Other strategies are heuristic attempts to make good decisions with less effort and in less time and sometimes they seem to work well enough.

Thinking in terms of product features

Within each of the three audiences the features of the products can be further grouped into clusters of features and this can reduce the complexity further. On the Online Educational Delivery Applications site (http://www.edutools.info/landonline/) the following conceptual groupings have been used to provide targeted views for the learners, learner support, and technical administrator audiences respectively:

Learner Tools (for learner audience)
    Communication Tools
    Real-time Tools
    Productivity Tools
    Student Involvement Tools

Support Tools (for learner support audience)
    Administration
    Curriculum
    Instructor

Technical Specifications (for technical administrator audience)
    Pricing/Licensing
    Standardization
    Technical Administration
    Hardware/Software

Within each of these conceptual categories there would be a small number of specific application tools or features. Altogether there were 52 such specific features that could be a part of an individual application. The complete listing of application features inside of the above conceptual structure attempts to organize the otherwise overwhelming list of features: (adapted from http://www.edutools.info)

No product had all of the possible features and no institutional situation needed all of the features either. The Online Educational Delivery Applications site was intended to help institutions find products with the features that they need and for vendors of products to be discoverable on the basis of the product functionality in the context of a rapidly developing marketplace. The list of product features also turns out to be a moving target over time as new technologies are incorporated into the evolving applications.

Screening phase of decision-making based on requirements of Individual Situations

The elimination by aspect strategy is a screening strategy involving two steps: setting the requirements for each of the features and then eliminating options one at a time which do not meet any of the requirements. To be able to decide which features are important the conventional approach is to conduct some sort of needs analysis of what is required in the institutional setting. This analysis often reveals the uniqueness of the needs of the future users of the online system. At this stage it can be beneficial to involve the stakeholders: students, faculty, student support personnel, and the technical administrators to gain later acceptance of the eventual decision as well as to become aware of needed features that might have been otherwise overlooked. Politically it can be beneficial to even involve representatives from the governing board of the institution when this decision will represent a new pedagogical direction or is expected to involve significant long-term resource commitment.

Making a Short List of Application Options

Using the web tool described above greatly speeds up this elimination by aspect process for those applications that are reviewed on the site. The elimination by aspect is a non-compensatory strategy so that once an option is rejected on any feature that option is eliminated from further consideration. This strategy does not necessarily result in a single best option since more than one option may pass on all of the requirements. The usual outcome of the elimination by aspect strategy is to result in a short list of possibly acceptable options that become the narrowed focus for a more discriminating decision strategy. It may be prudent for comparison purposes to include in the short list any applications that are used by consortia where the local institution is a member or in the case of community colleges the application that is used by local universities where the college has special relationships.

Evaluating product suitability as part of the weighted averaging strategy

Evaluating products (or externally hosted product options) can be a very large task. The greater the number of products and the greater the number of important features multiplies quickly into a potentially overwhelming product research task. This task can be partially shifted to the vendors by structuring a competition among the likely candidates where they are invited to bring the information to the decision makers rather than the decision makers seeking out the vendors and trying to find out the most current product information. The market has matured enough so that most vendors are capable of responding to a request for proposal (RFP) to supply the desired product functionality. Many institutions already have RFP procedures but may never have used them for a situation as complex as selecting an online educational delivery application.

Inviting the shortlist of vendors to competitive presentations/proposals (RFP model)

The RFP model has been described for web software acquisition recently (http://www.technologynews.net/rfp/infotech_rfp.doc) as a necessary part of the decision process. The RFP model offers several advantages over less formal product selection processes including: all vendors get the same information and have a fair opportunity to compete while the decision makers get a proposal document that can be used to assess both the vendor interest and competence. The RFP would be sent to the short list of possible vendors. The vendors will likely have questions as they prepare their proposals so it is useful to have a designated contact person who can supply consistent clarifying information to all of the vendors' requests for information. When the proposals are received there is often another round of elimination by aspect strategy to determine which proposals are in the competitive range. The US Department of Defense (http://web.deskbook.osd.mil/reflib/mfarsups/072ua/009/072ua009doc.htm) further advises that a proposal may be considered outside of the competitive range if (1) it does not address the essential requirements, (2) has a substantial technical drawback the would essentially require a new proposal to fix, or (3) the proposal contains major deficiencies, omissions, or out-of-line costs. They also advise that these proposals are part of a negotiation process and at the end of negotiations, the competitive vendors should be provided with one additional final opportunity to submit a revision known as the "best and final offer."

The RFP method is a time-consuming and involving process both for the institution and for the potential vendors that can be used to produce a fair vendor competition where the best candidate is selected and the social goals of rational decision-making are accomplished. The Online Educational Delivery Application site provides web tool support for the Weighted Averaging Strategy calculation part of the of decision-making. This decision engine tool is little more than an automated score sheet that combines the feature importance and the feature suitability scores into an appropriate total product score. The tool does however enable the decision-makers to use the most rational strategy of decision-making, which would be impossible to do in one's head. The following example illustrates the decision engine web tool using two vendors (WebCT and BlackBoard) with three features (accessibility for persons with disabilities, student help, and instructor help).

References

Gigerenzer, G. & Selten, R. (2001). Rethinking Rationality. In Gigerenzer, G. (Ed.) & Selten, R. (Ed.), (2001) Bounded rationality: The adaptive toolbox. (pp1-12) MIT Press, Cambridge.

Kahneman, D. & Tversky, A. (1996). On the reality of cognitive illusions. Psychological Review, 103(2), 583-591.

Norman, D.A. (1999). The invisible computer: why good products fail, the personal computer is so complex, and information appliances are the solution. MIT Press, Cambridge.

Payne, W.J. & Bettman, J.R. (2001). Preferential Choice and Adaptive Strategy Use. In Gigerenzer, G. (Ed.) & Selten, R. (Ed.), (2001) Bounded rationality: The adaptive toolbox. (pp. 123-146). MIT Press, Cambridge.

Roe, R.M., Busemyer, J.R. & Townsend, J.T. (2001). Multialternative Decision Field Theory: A Dynamic Connectionist Model of Decision Making. Psychological Review, 108(2), 370-392.

Simon, Herbert, (1979). Models of Thought. Yale University Press, New Haven.

Developing, Delivering, and Managing Legal Compliance eLearning Courseware in a Corporate Environment

Teresa Lau
Sun Microsystems Inc.
Menlo Park, CA
USA
teresa.lau@sun.com

Abstract: The paper describes Sun Microsystems' implementation and management of a mandatory online legal course, Business Conduct Overview, for a global, corporate wide audience beginning in July 2002. Sun created an eLearning environment to help employees access customized content, track their progress, report course completion, assess content comprehension, and send e-mail reminders to employees who haven't completed the mandatory training. The various components of the eLearning environment, implementation of the online course, and future plans for delivery and management of online legal compliance training at Sun are discussed.

1. Introduction

Throughout its 20-year history, Sun Microsystems has committed itself to the highest standards of business integrity. Because of increasingly complex legal and regulatory environments in the many countries in which Sun does business, Sun must make every effort to promote its employees' compliance with standards of business conduct. To raise employees' legal and ethical awareness and provide them with resources they need to make the right decisions and take effective actions, Sun's Business Conduct Office has developed an online learning course that is mandatory for all salaried employees to complete. To provide an easily accessible and effective eLearning environment, Sun Microsystems developed a suite of tools to deliver and manage online learning. The eLearning environment includes several unique features, such as the following:

- Automatic e-mail notifications to employees and their managers regarding scheduling and completion of mandatory training; e-mail reminders to those who haven't completed mandatory training
- Automatic launch of personalized content by job type, geographical location, and language preference
- Tracking and reporting
- Online quizzes to test and enhance retention and comprehension

The training is being rolled out in phases. Employees and their managers are notified when to begin the training. At present, nearly one-third of the targeted employee audience has completed the online training.

2. eLearning System Features

2.1. Automatic E-mail Notification

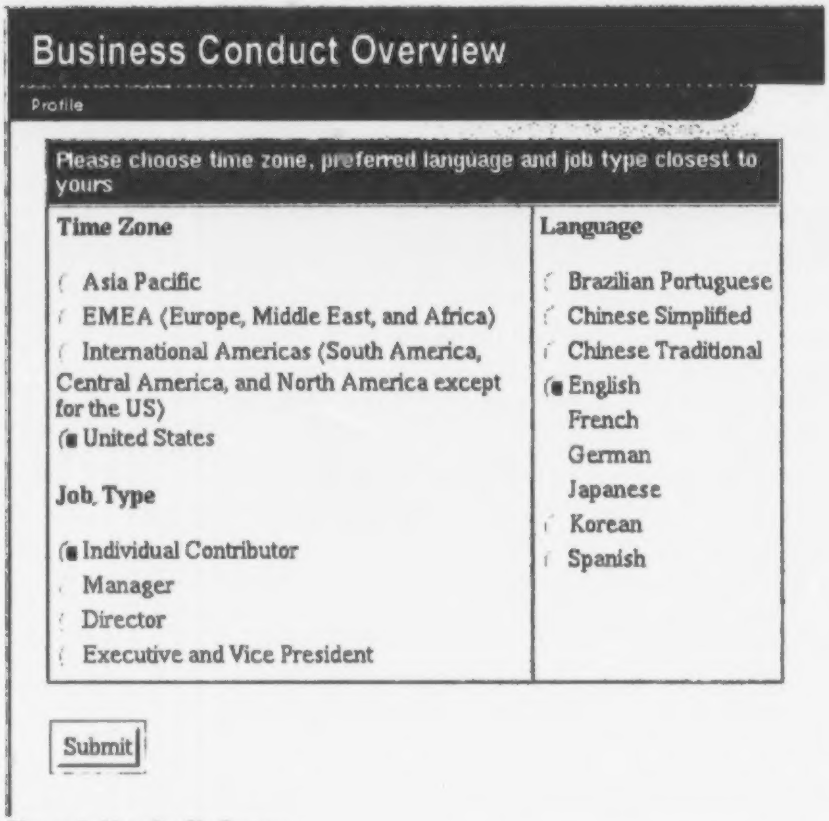
To accommodate the 40,000 Sun employees required to complete the legal training, the Business Conduct Overview course is being rolled out in phases that cut across organizational lines. The integration of the training system and Sun's human resources and e-mail systems allow customized e-mail notifications and reminders to be generated and sent automatically to employees and their managers when various events occur:

- An employee is scheduled to begin the mandatory training.
- An employee has completed the training.
- An employee has not completed the training although the deadline for completion has passed.

The customized e-mail messages serve as a means of communication between the Business Conduct Office and the global Sun community. This helps employees and managers take responsibility for managing their own training.

2.2. Personalized and Localized eLearning Content

To deliver customized content to employees that is tailored to individual responsibilities and needs, the system uses an up-front user profile survey to gather user information (Figure 1). The system can then dynamically generate personalized content based on an employee's job type, geographical location, and language preference.



Business Conduct Overview

Profile

Please choose time zone, preferred language and job type closest to yours

Time Zone

○ Asia Pacific
○ EMEA (Europe, Middle East, and Africa)
○ International Americas (South America, Central America, and North America except for the US)
● United States

Job Type

● Individual Contributor
○ Manager
○ Director
○ Executive and Vice President

Language

○ Brazilian Portuguese
○ Chinese Simplified
○ Chinese Traditional
● English
○ French
○ German
○ Japanese
○ Korean
○ Spanish

Figure 1: User Profile Survey

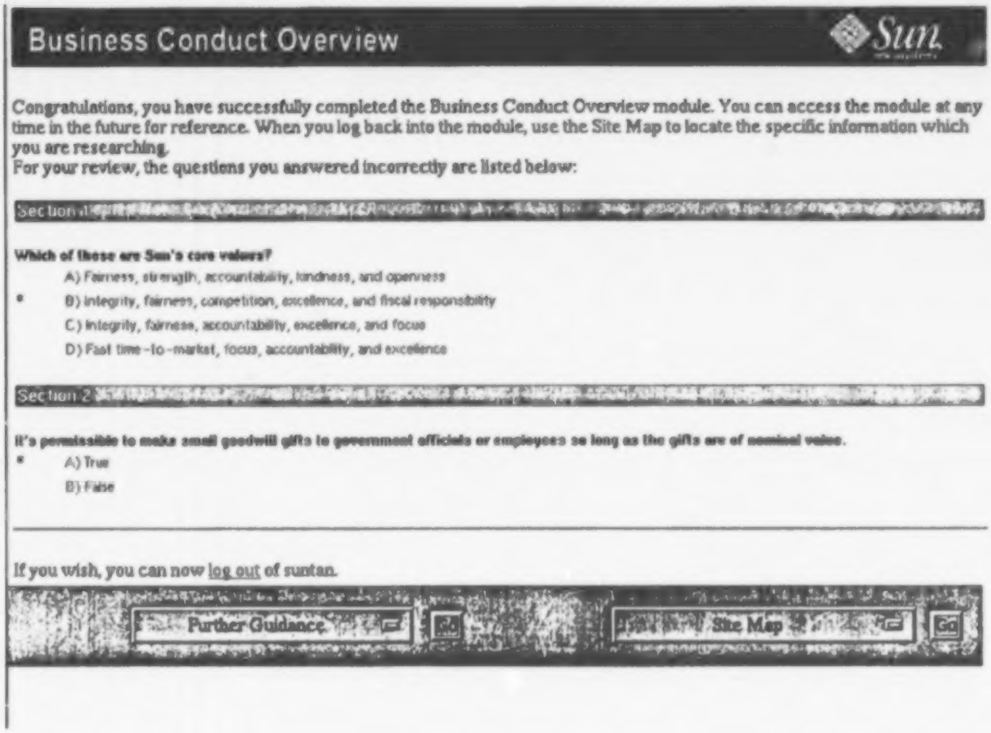
2.3. Tracking and Reporting

User progress tracking and management reporting are two important components of the eLearning environment for legal compliance training. To enable tracking, it is necessary to authenticate the user by his or her employee login and password against the human resources database connected through the eLearning system. Once an employee has logged into the system, all activities at the course level are tracked, and completion data is automatically collected and stored. The tracking data is assembled in real time into reports organized at the employee, manager, and organizational level. Real-time user tracking and reporting has proven valuable in managing Sun's mandatory legal training.

BEST COPY AVAILABLE

2.4. Online Testing and Assessment

To test employees' comprehension and retention of key concepts, short quizzes with feedback are embedded in each section of the course. At the end of the course, employees take a final test. After they have completed the final test, employees receive their test results with incorrect answers highlighted (Figure 2). They are also given additional references that correspond to the questions missed. The final test demonstrates the employee's mastery of content and is required for the employee to receive a completion status. The testing tool also includes comprehensive reporting features: for example, the summary scores can be used to analyze the effectiveness of the online instructional content.



Congratulations, you have successfully completed the Business Conduct Overview module. You can access the module at any time in the future for reference. When you log back into the module, use the Site Map to locate the specific information which you are researching.
For your review, the questions you answered incorrectly are listed below:

Section 1

Which of these are Sun's core values?

A) Fairness, strength, accountability, kindness, and openness
* B) Integrity, fairness, competition, excellence, and fiscal responsibility
C) Integrity, fairness, accountability, excellence, and focus
D) Fast time-to-market, focus, accountability, and excellence

Section 2

It's permissible to make small goodwill gifts to government officials or employees so long as the gifts are of nominal value.

* A) True
B) False

If you wish, you can now log out of suntan.

Figure 2: Test Feedback

3. Conclusion

Sun Microsystems has designed, developed, delivered, and managed an online legal compliance course for its worldwide workforce. Since the initial rollout in July 2002, more than one-third of eligible employees have successfully completed the mandatory training. The eLearning environment created for the delivery, administration, and management of the online course has proven an efficient, robust, cost-effective, and reliable way to deliver and manage online legal compliance training for a large enterprise. The success of online training for an internal audience will pave the way for Sun to launch the same legal training for our partners next year.

4. References

BEST COPY AVAILABLE

General Counsel Roundtable (2000). *Affirmative Defense: Innovative Approaches to Practicing Preventive Law*. Washington: Corporate Executive Board, 2000.

General Counsel Roundtable (2000). *On-Line Compliance Training Systems*. Washington: Corporate Executive Board, 2000.

Streaming, Plug-in Free PowerPoint™ Playback over the Web

Introduction

Microsoft PowerPoint is the most popular authoring tool for creating business presentations and training content. And for good reason – it's easy to learn and to use. It supports narration, animation, transitions, embedded video, as well as the ability to hyperlink or to navigate to specific slides within a single presentation, to other PowerPoint presentations, to Web pages (URLs) and to other content.

The only problem with PowerPoint is that the output files are too large for delivery over the Internet or through e-mail, and too numerous to manage easily.

That's where ***impatica*** comes in. Simply put, ***impatica* for PowerPoint** extends the reach of PowerPoint by providing an easy to use tool for delivering PowerPoint presentations over the Internet or through e-mail. And unlike PowerPoint's "Save as HTML", "Save as Web Page" or other options for Internet delivery, ***impatica* for PowerPoint** retains the rich media functionality of your presentation

This document describes how ***impatica* for PowerPoint** works, explains how the "*impaticized*" content is efficiently delivered and highlights the resultant benefits.

Conversion for Streaming Delivery

***impatica* for PowerPoint** is a desktop software application that reads Microsoft PowerPoint files and transforms the file into an efficient streaming format that can subsequently be read and "played" by a small Java applet on the viewer's Internet device.

***impatica* for PowerPoint** dissects the PowerPoint file and identifies each audio, text, shape, and picture. Each media object is compressed or otherwise optimized for Internet delivery.

- Audio is converted to Sun AU format and then compressed using ***impatica***'s proprietary compression algorithm. (Sun AU audio is the only audio format currently supported by Java.)
- Pictures and other images are converted to GIF format (if 8-bit or less) or to JPEG format (if greater than 8-bit). JPEGs are compressed according to a Translation Option set by the content developer in the Graphical User Interface for ***impatica* for PowerPoint**.
- Pictures are further optimized by discarding any picture elements that have been removed through cropping. (Even if cropped, PowerPoint retains the entire original picture.)
- Text objects are rendered as images during the translation process. While this transformation is not necessarily optimal in terms of file size, it is a crucial step to ensure that all text will be displayed identically on all viewers' devices, regardless of hardware, OS, or browser platform.
- Wherever possible, autoshapes are retained as dimensioned objects; however, some compound autoshapes are rendered as images at translation time.

impatica* for PowerPoint** files typically achieve 90 to 95% compression of narrated, animated PowerPoint presentations, meaning that the resultant ***impatica file will be only 5 to 10% of the size of the original PowerPoint file. Note, however, that the actual compression achieved on a particular PowerPoint file will be dependent on the relative proportion of audio, text, autoshapes and image objects.

The optimized media objects are then organized into the ***impatica*** streaming file format, in the order of appearance in which the objects are required. That is, the objects required for the first slide are placed in front of the objects required for the second slide, and so on. Note that, in presentations that include hyperlinks between slides, since it is not possible to anticipate the order in which the viewer will choose to view the slides, the streaming ***impatica*** file is always organized in the physical slide order.

Wherever possible, ***impatica* for PowerPoint** will reuse objects that appear multiple times throughout the presentation. This pertains to all object types, including audio, text, autoshapes and images.

Playback in a Browser

Once translated, the ***impatica*** file must be uploaded to a Web server from which it can be played by ***impatica***'s Java applet. Specifically, playback is initiated by opening a Web page that contains HTML code pointing to ***impatica***'s applet and ***impatica*** file.

```
<APPLET CODEBASE = "appletlocation.com" CODE = "com.impatica.ImPlayer.class"
ARCHIVE = "ImPlayer.jar" WIDTH =504 HEIGHT =288>

<PARAM NAME = "FILE" VALUE="Intro">

</APPLET>
```

(Note that, if the ***impatica*** content and applet code are located in the same folder as the HTML page that invokes playback, the "CODEBASE" attribute is not required.)

When the Browser opens the Web page, it launches the applet which, in turn, opens and begins to stream the ***impatica*** content file. As soon as the first ***impatica*** objects have been received, the applet begins to display and play the ***impatica*** presentation while the remaining content objects are being streamed in the background.

Provided that the Internet connection is fast enough to stream the remaining content faster than it is required for playback, the ***impatica*** presentation will play without pause or hesitation. Normally, continuous playback can be achieved within a 2K stream, i.e., over a 28.8 kbps connection.

Note that when playing presentations that contain hyperlinks to specific slides within the presentation, pauses may occur if the viewer clicks on a hyperlink that jumps ahead several slides. The likelihood and extent of the pause will depend on the speed of the Internet connection, the "richness" of the PowerPoint content, and the number of slides jumped over by the hyperlink. However, these delays can be essentially eliminated through effective content design, using "tips and tricks" explained in the ***impatica*** for PowerPoint Users Manual.

Unlike other streaming technologies that require special server-side software to "push" the content to the browser, ***impatica*** content is read by the applet (within the browser) from any standard HTTP server. This approach has the additional advantage that ***impatica*** content will be automatically cached by proxy servers and caching network strategies thereby reducing the load on the main server. Because there is no server side software, the only playback bottleneck at the server end is the raw throughput of the server cluster and the corresponding connection to the Internet backbone.

Delivery through E-mail

Delivery of ***impatica*** content through e-mail is essentially the same as viewing ***impatica*** content from a Web page. The actual e-mail message is a small, simple HTML document that contains the <applet> tag and related information required to launch the applet and stream the ***impatica*** content from the server over the Internet.

The fundamental advantage of this approach is that the actual e-mail delivered to the recipients' inbox is tiny – generally only 2 to 3K, including all headers and addressing information. There are no bulky attachments that must be downloaded and that would typically clog up the recipients' in-box.

Only when the e-mail is opened, and as long as the user is then connected to the Internet, is the ***impatica*** content accessed and displayed as it is being streamed in from the server.

Scalability and bandwidth requirements

With reasonable content design, most narrated, animated ***impatica*** content will play within a 2Kbps stream. That bandwidth requirement is approximately the same as a well designed web page that contains a reasonable mix of text and graphics. One thousand concurrent hits to a web page that contains ***impatica*** content would require an aggregate throughput capacity of 20 Mbps, disregarding for the moment any savings that result from proxy servers or other caching schemes. That load would be well within the capability of a competent Web server. On the client side, the other important benefit of the high compression ratio is that the quality of the streaming presentation is acceptable at the very least, and high at best, over a standard modem connection (33-56Kbps).

These features represent major bandwidth advantages over other multimedia content delivery streams, such as Macromedia Flash and QuickTime or other video streaming technologies. In a large educational or corporate environment, the reduction in bandwidth can easily translate into thousands of dollars of savings on a monthly basis.

Storage requirements

Another benefit of ***impatica***'s aggressive approach to compression is a significant reduction in the amount of disk space required to host PowerPoint content on the server. On average, *impaticized* PowerPoint files require only 10% of the storage capacity for PowerPoint files, whether they are stored as .ppt files or saved as HTML or as Web pages. Because *impaticized* PowerPoint presentations are stored as simple content files on an HTTP server, without any special server-side software, there is no additional overhead beyond the actual small ***impatica*** file.

The bottom line

impatica's unique and powerful technology combined with its intuitively simple user interface delivers important benefits to anyone wishing to publish their PowerPoint presentation over the Internet:

- **PowerPoint users become empowered as online publishers;**
- **The time, cost and complexity of producing online training and other content is substantially reduced;**
- **Presentations can be delivered to the widest possible audience, without regard for hardware, OS, browser or Internet connection speed;**
- **Plug-in free delivery ensures hassle-free, spontaneous delivery.**
- **Narrated, animated, interactive rich media content provides an engaging message – people remember more when they SEE, HEAR and INTERACT with the content;**

Diabetes and Your Eyes: A Pilot Study on Multimedia Education for Underserved Populations

Kimberly Lawless, Ph.D.[1]; Ben Gerber, M.D.[2]; Louanne Smolin, Ed.D.[1]; Irwin Brodsky, M.D., M.P.H.[2]; Mariela Girotti, R.N.[2]; Lourdes Pelaez, M.D.[2]; Arnold Eiser, M.D.[2]

[1] College of Education, University of Illinois at Chicago, Chicago, IL
[2] Department of Medicine, University of Illinois at Chicago, Chicago, IL

INTRODUCTION

The development and implementation of technology as a vehicle for instructional delivery to health care patients is on the rise (Health on the Net Foundation, 2002). More than ever, individuals are searching for more health knowledge and questioning their medical management through Internet derived mechanisms (Pew Foundation, 2002). Providers sensitive to these changes may suspect that acquired information is more valuable to patients when complimented or endorsed by their own health providers (Clement, 1995). In fact, both parties may potentially benefit, with providers saving time for education.

More recently, touch screen 'kiosks' are being investigated in clinical environments. Kiosks have been described as an easy, convenient, and preferable medium for learning (Glasgow, McKay, Boles et al., 1999). Example applications have included cancer therapy, support for individuals with brain injuries, and chronic disease management such as diabetes (Lewis, 1999). However, there are significant barriers to widespread use among vulnerable populations.

A digital divide persists in the United States, where specific low-income urban as well as rural geographic areas have less access despite overall growth in the US (National Telecommunications and Information Association, 2002). Besides having access to technology, computer skills make current applications more difficult to use (Eng, Maxfield, Patrick, et al., 1998). Few interfaces have been able to accommodate the diverse levels of capability among patients. Also, health literacy remains a barrier. In a study of 25 common health web sites, all of the English and 86% of the Spanish web sites required a high school level or greater reading ability (Berland, Elliott, Morales, et al., 2001). Health information that requires a higher level of literacy will exclude the 40 or more million Americans who are functionally illiterate. In response, recent computer applications have begun to address literacy, and subsequently received favorable responses in pilot testing (Castaldini, Saltmarch, Luck, et al., 1998).

One of the potential benefits of multimedia learning environments on patient education is the ability to target individual needs and preferences. Unfortunately, there are few quality resources available that target African-American, Latino, and other ethnic minority groups. According to Rosenthal and Bandura (1978) "attribute similarity generally increases the power of modeling influences even when the personal characteristics may be spurious indicants of performance capabilities" (p. 656). As such attending to salient characteristics of the population such as age, gender, education level, socioeconomic status, race and ethnicity can increase the impact of the learning materials (Bandura, 1997). Because multimedia environment invite the inclusion of video, users are able to see "themselves" in the educational materials, and can more easily provides appropriate modeling opportunities to minority populations where they might not otherwise be accessible.

This proposal details the development and implementation of a new multimedia application for an underserved patient population with diabetes. A pilot study was conducted to evaluate program use by participants, as well as patient attitudes regarding diabetic eye disease. The main outcome sought from using the program was to increase compliance with annual dlated eye examinations (the standard of medical care).

METHODS

Software Application Development

Prior to developing the application a needs analysis was undertaken. Research examining African-American and Latino diabetic patients was reviewed, especially regarding barriers to obtaining yearly eye examinations (e.g., Walker, Basch, Howard, et al., 1997). In addition, currently available information regarding diabetic eye disease was obtained through the National Eye Institute and National Eye Health Education Program and the Core Curriculum for Diabetes Education.

A lesson plan was created based on the ultimate objective of patients obtaining eye examinations. The lesson plan included 5 segments: (1) An introduction to diabetic eye disease (via patient testimonial), (2) A tutorial on how diabetes affects the eye, (3) A series of patient testimonials relating the barriers to obtaining eye examinations, (4) An interactive portion where the user is tested regarding the needs for an eye exam based on patient testimonials, and (5) A tour of the ophthalmology clinic where eye examinations are performed. The lesson plan was translated into Spanish by two bilingual researchers.

To complete the multimedia, digital images from the National Eye Institute were obtained. In addition, patients were recruited to provide videotaped testimonials. Consented individuals discussed their experiences with diabetic eye disease, or with eye examinations. A total of 16 African-American and 16 Latino diabetic patients were recorded in English and Spanish respectively, answering open ended questions freely without scripting. Example barriers discussed by patients included: fear, denial, religion/faith, pain, and insurance.

Clinical Pilot Testing

Patients arriving for their scheduled medicine or diabetes clinic appointments were recruited. Inclusion criteria include history of type 1 or type 2 diabetes, English or Spanish speaking, and responsibility for diabetes self-care. Consented patients were taken to the computer in the clinic and were instructed regarding the use of the touch screen. They were allowed to view the program at that time, or after their visits with their providers if more convenient. Participants were able to complete the program in approximately 15-20 minutes.

After viewing the multimedia program, a brief 20-question survey was completed regarding attitudes toward computerized patient education as well as diabetic eye disease. In addition, follow-up surveys were conducted 3 months and 6 months later by telephone.

RESULTS

A sample of 56 patients viewed the multimedia application and completed the initial survey (Table 1 includes demographic and descriptive information). Twenty-seven patients, primarily African-American (18/27), completed the English lesson, while 29 Latino patients completed the Spanish version. Overall, a majority of these subjects had no more than some high school education (70% of the English group, 83% of the Spanish group); and many had never had taken any diabetes education classes before. With respect to standard of care, only 15 (56%) of the English group and 15 (52%) of the Spanish group have undergone dilated eye examinations. Finally, many have reported limited or no computer usage previously (48% of the English group, 14% of the Spanish group).

Of the initial 56 patients, 34 responded to the 3-month survey, and 30 responded to the 6-month survey. A repeated measures ANOVA with language (English/Spanish) as a between-subjects factor was employed. When necessary the Huynh-Feldt correction for degrees of freedom was used.

In the first of these analyses, difficulty of using the computer program (1 = Very Easy; 5 = Very Hard) was used as the dependant measure. Results of the analysis indicated a significant Time X Language interaction ($F_{(2,52)} = 8.73$; $p < .01$). Examining a v-plot of this interaction, a quadratic effect for difficulty of use over time between languages was identified. Those participants who viewed the English version of the program rated computer usage significantly more difficult at the time of the three month follow-up, while the Spanish version participants maintained a consistent rating over time. Main effects for Time and Language were also significant ($F_{(1,26)} = 7.71$, $p < .01$); $F_{(1,26)} = 12.51$, $p < .01$, respectively), but interpretation was set aside in favor of the interaction.

For most of the attitude questions regarding diabetic eye disease, responses did not show a trend over time. However, significant main effects for time were observed with 'diabetes can result in blindness' ($F_{(2,52)} = 3.48$; $p = .038$) and 'you can have eye damage with no symptoms' ($F_{(2,52)} = 3.94$; $p = .025$); both with agreement lessening over time.

There was a small but significant difference between language groups with respect to attitude towards seeing the eye doctor every year ($F_{(1,26)} = 5.04$; $p = .034$). The group viewing the Spanish program were more likely to strongly agree with this item.

Finally, a significant interaction between Language and Time toward being 'afraid to see the eye doctor', ($F_{(2,52)} = 4.734$; $p < .05$). Main effects for Time and Language were not found to be significant. Examining a plot of the interaction we saw that the English group had an increase in reported fear to see the eye doctor at three months, but returned to baseline after an additional three months. However, the Spanish group remain consistent immediately following and at the three month follow-up, with a sharp increase in fear at the six month survey.

DISCUSSION

Despite common barriers to accessing health information, there was clear interest and use by the underserved patient groups represented in our sample. Most individuals felt the multimedia was 'easy' or 'very easy' to use; yet there was still a small minority who had difficulty with the English version. Some individuals expected the kiosk to act like a television, running continuously without user input. The reduced level of computer skills may increase the difficulty in actively engaging users. Unfortunately, activities that may better translate a message and provide education require more interaction than simple directions (such as touching the screen). Given the potential benefit of behavioral change, we need further research to improve the user interface.

There was a significant trend toward having greater difficulty using the program reported by subjects at 3 and 6 months. Some individuals may be more likely to report interest and enthusiasm immediately after experiencing a novel intervention. This may be an important concept to consider in additional evaluations where attitudes may change over time.

Attitudes towards diabetic eye disease and eye examinations were positive; though the study did not capture behavioral change from the intervention (the study did not include pre-testing). Differences between English and Spanish groups may represent inequalities in the program, particularly with patient testimonials. For example, some of the Spanish video sequences may stress specific ideas more strongly; or the English video clips may be less clear or influential. In either situation, the cultural differences in the program may contribute to expressing different messages resulting in different outcomes.

The data collected on attitudes post-intervention will be applied towards further development of the lesson. For example, the idea that faith alone may prevent eye disease was common in both English and Spanish groups; despite the majority disagreeing with it. Addressing faith is very important in education on prevention.

The greatest advantages cited by patients include: ease of use of the computer program, the educational nature of the audio narration, and the video testimonials of patients. Some of the users wished to unplug the headphones to so friends or family members can simultaneously view the multimedia. Having more headphones available at a kiosk may be worthwhile.

Implementation in the clinical environment is a significant challenge for interactive kiosks. Since the study has been completed, the computer has continued to collect data regarding patient usage. Further data analysis may offer solutions on how to integrate education into clinical flow. For example, prior to visiting a health provider, there is often an undesirable waiting period possibly serving as an opportune time for self-education. However, after an encounter with a provider, interest in personal health is piqued, and additional reinforcement via the computer may be a powerful component to the office visit (Gerber and Eiser, 2001).

Limitations to the study include small sample size, and large number of individuals unable to complete the telephone call survey. High levels of drop out in follow up surveys may result in overestimating the ease of computer use, if these individuals were less likely to provide positive attitudes about the program in follow up.

Increased resources are necessary to provide tailored information to people of different ethnicity, educational background or gender. Besides the creation of a second version of educational materials in Spanish for the Latino population, further work may still be considered to distinguish between people from Mexico, Puerto Rico, South America, or other Latin American regions. Further research is needed to better understand the cost/benefit ratio between cost of production and implementation and benefit of tailoring material to a target audience.

REFERENCES

Anderson, R. M. , Barr, P. A. , Edwards, G. J. , et al. (1996). Using focus groups to identify psychosocial issues of urban black individuals with diabetes. Diabetes Educ, 22, 28-33.

Bandura, A. (1997). *Self-efficacy: The exercise of control.* New York, NY: W.H. Freeman and Company.

Berland, G. K., Elliott, M. N., Morales, L. S., et al. (2001). Health information on the Internet: Accessibility, quality, and readability in English and Spanish. JAMA, 285 (20), 2612-2621.

Castaldini, M, Saltmarch, M, Luck, S et al (1998). The development and pilot testing of a multimedia CD-ROM for diabetes education. Diabetes Educ 24(4), 285-296.

Clement, S. (1995). Diabetes self-management education. Diabetes Care, 18, 1204-14.

Eng, T. R., Maxfield, A., Patrick, K. et al. (1998). Access to health information and support: A public highway or a private road? JAMA 280(15), 1371-1375.

Gerber, B. S., Eiser, A. R. (2001). The patient physician relationship in the Internet age: future prospects and the research agenda. J Med Internet Res 3(2), E15.

Glasgow, R. E., McKay, H. G., Boles, S. M. et al. (1999). Interactive computer technology, behavioral science, and family practice. J Fam Pract 48(6), 464-470.

Health On the Net Foundation. HON's Fifth Survey on the Use of the Internet for Medical & Health Purposes. URL: http://www.hon.ch [accessed Feb. 20, 2002].

Lewis, D. (1999). Computer-based approaches to patient education: a review of the literature. J Am Med Inform Assoc 6(4), 272-82.

National Telecommunications and Information Administration. *A Nation Online: How Americans Are Expanding Their Use Of The Internet*. URL: http://www.ntia.doc.gov/ntiahome/dn/index.html. [accessed Mar. 2, 2002].

Rosenthal, T. L., & Bandura, A. (1978). Psychological modeling: Theory and practice. In S. L. Garfield & A. E. Bergin (Eds.), *Handbook of Psychotherapy and Behavior change: An empirical Analysis* (pp. 621-658). New York: Wiley.

The Pew Internet and American Life Project. The Online Health Care Revolution: *How the Web helps Americans take better care of themselves*. URL: http://www.pewinternet.org/ [accessed Feb. 1, 2002].

Walker, E. A., Basch, C. E., Howard, C. J., et al. (1997). Incentives and barriers to retinopathy screening among African-Americans with diabetes. Journal of Diabetes and Its Complications 11, 298-306.

ACKNOWLDGEMENTS

Support from this project came through a grant from the Agency for Healthcare Research and Quality (U18-11092).

A New Baseline for Faculty Knowledge of Educational Technologies

Tracey Leacock, PhD
Simon Fraser University, Canada
leacock@techbc.ca

Abstract: As the pressure to use new technologies in the delivery of education increases, institutions should strive towards agreement on a new baseline level of faculty knowledge of learning technologies and an understanding of the impacts of technology on education. At TechBC, we developed a process that included an up-front investment in bringing current faculty up to the new level as well as the development of a culture that will help incoming faculty achieve the new level quickly. The key aspects of the approach include fostering a culture that encourages innovation in the use of educational technologies -- when and where they are appropriate -- and the formation of faculty into clusters for development and delivery of courseware.

In the past, there have been two extremes that described many potential users of educational technology: the technophobes and the technophiles. As the pressure to use new technologies in the delivery of education becomes ubiquitous, institutions should strive to move adherents at both extremes towards agreement on a new baseline level of knowledge for faculty and an understanding of the impacts of technology on education. At The Technical University of British Columbia (TechBC), we developed a process to do just that.

The TechBC Story

TechBC (now SFU-Surrey) uses a hybrid system (Nesbit 2002), in which face-to-face classes are mixed with online activities, to deliver degree programs in Information Technology and Interactive Arts to undergraduate and graduate learners. All courses have a significant online component delivered through our course management system (CMS), a proprietary system designed for content delivery, conferencing, etc. CMS content typically includes a combination of text, animations, links to external resources, video, interactive activities, etc. (Humphrey 2001). In the face-to-face sessions, faculty lead small group activities that enable learners to interact with and deepen their understanding of the content they are working with.

We are fortunate to have been in the position of having new programs and being able to hire faculty who have self-selected themselves as having an interest in the use of technology to improve the quality of education. However, behind the statement of interest, we have found that our faculty bring a variety of levels of technical expertise. In many cases, there has been more interest than first-hand experience.

Once we realized that not all of our faculty were comfortable with the whys (pedagogical considerations) or hows (technical considerations) of using the new technologies available to educators, we initiated an intensive and multi-faceted approach to increasing the baseline level of knowledge in these areas for all current faculty. We designed the process to become largely self-sustaining, with minimal institutional investment in across-the-board training after the initial start-up phase.

TechBC's unique situation made it easier to bring about such an approach, but the same ideas would be of great value to any institutions dealing with resistance or uncertainty around the increasingly prevalent role of technology in education.

Why Change the Baseline?

At one time, faculty could happily get by with just a pen and paper. In recent years, typing – or more appropriately, keyboarding – and even general computer literacy have become accepted basic skills.

Institutions expect that faulty will know how to send an email and how to find information on the web. The next logical step is to expect faculty to have some basic knowledge of how principles of instructional design can be applied to create solid courseware using new technologies. This knowledge must also be tied in with a good understanding of when the use of the technologies is appropriate and why.

The approach we took was designed to make this expectation explicit. By investing in "educational programs to foster these skills" (Advisory Committee for Online Learning 2001), we have changed what constitutes basic knowledge at our campus. Our goals were to improve the overall quality of courseware, increase the confidence of the faculty in working with new technologies, and establish strong working relationships between faculty and various areas of specialized support (e.g. media developers) who would be available to assist when faculty wanted to try projects that required a high level of technical expertise.

Our Approach

We used a multi-faceted approach to the initial development of the knowledge needed for this new baseline. The four main categories of effort included: faculty orientations; a mandatory course on educational technology and learning; ongoing workshops; and a formalized cluster structure for development and delivery of course materials.

Orientation. All new faculty attend an orientation session that provides an overview of what we do, how we do it, and whom to talk to about specific questions. This sets the stage in a number of ways. It clearly establishes our philosophy of teamwork – we're not sending anyone out on their own into uncharted waters. It also makes clear that we expect everyone to look for new and innovative ways that technology can *improve* learning – we aren't looking for bells and whistles, but we're not looking for the *status quo* for its own sake either. Finally, faculty have an opportunity to meet the people who can provide more advanced support, so they know what help is available. Typically, these orientations are held as group sessions just prior to the start of each term. This provides all new academic staff with a solid grounding, and allows continuing staff an opportunity to drop in to remind themselves of any services that they may not have used recently.

METL. All faculty are required to take a one-semester course called Mastering Educational Technology and Learning (METL). METL covers topics ranging from the design of measurable learning objectives, to the effective use of asynchronous conferencing, to how to integrate learning objects into online content to improve learning. This course uses the same delivery methods that faculty will use in their own classes – a combination of online resources and activities and face-to-face sessions where they can apply their new knowledge. Learners (faculty) work together in small groups, using courseware that they are currently developing or delivering as examples for discussion and activities. (See Stacey 2001 for a review.)

Ongoing workshops. TechBC also offers optional workshops on topics such as designing concept maps for content; matching learning objectives, content, and assessments; and moderating online conferences. The topics are flexible and depend on the needs of participants. These workshops may be offered by members of our Educational Technology & Learning unit or by faculty who have gained experience in particular technologies or delivery methods. The workshops are typically informal and may be as short as a brown-bag lunch or as long as a full day, depending on the needs of the topic.

Clusters. The most innovative aspect of our attempts to raise the baseline on knowledge of new technologies in education has been our use of clusters (Leacock 2001). This is also the aspect that will have the biggest impact on the self-sustainability of the process. We use clusters both for development of courseware and for delivery of courses that have many sections. Both types of clusters are formed on a term-to-term basis.

Development clusters typically consist of 4-10 developers (faculty), an instructional designer, and a project manager. Other specialists are also available as resources to the cluster on an as-needed basis (Fig. 1). The cluster is responsible for the development of a set of courses (up to 6-credits per cluster member), and the group has to follow a general pattern and timeline for development. Within these constraints, there is flexibility for different approaches. The cluster members provide ongoing feedback and insights that are directly related to each other's current development assignments.

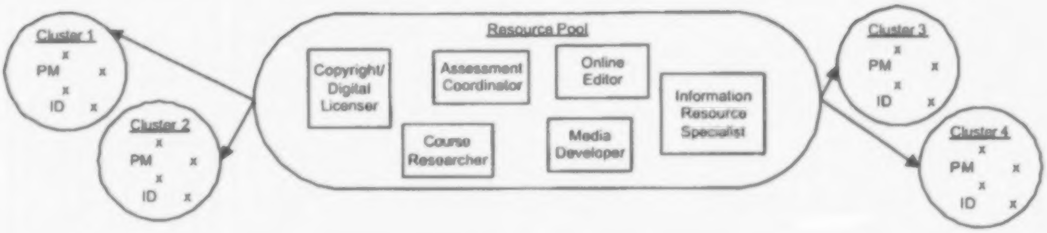


Figure 1: Structure of Development Clusters at TechBC.

Members of a cluster generally meet synchronously on a weekly basis, using a combination of face-to-face meetings and teleconferencing. They also communicate through email and informal meetings regularly. The cluster members share their experiences with using the TechBC delivery models (Course Delivery Models 2001) and available technologies in different teaching contexts. This feedback helps developers to learn from and build on what their peers have already tried, and it fosters a culture of open communication and knowledge-sharing.

Developers have a single four-month cycle in which to complete an assignment. There are three supra-cluster checkpoints: specifications review, quality circles, and the final show & tell. Each cluster may decide to implement additional internal checkpoints. At the specifications review, a university planning committee reviews the detailed plans for the courseware to ensure that they fit with the intentions of the overall programs and institutional needs. (See Module Specification System 2001.) At the quality circles checkpoint, an interdisciplinary team that includes a content expert, an instructional designer, an assessment specialist, and others reviews a sample unit of each course and provides feedback that the developer can use to improve that unit and inform the development of the remaining units (Belfer & Leacock 2002 unpublished raw data). Finally, the clusters present the completed courseware in a show & tell session that is open to all members of the university community.

The results of this cluster development process have been exciting. When we introduced this approach, many developers were new to the online environment and were not familiar with the concepts of instructional design. The feedback from within the clusters tended to be at a low level. However, after completing the METL course and going through the cluster development process once, most developers showed a marked improvement in their choice of technologies, activities, and assessments. This also meant that they were able to provide one another with better feedback as well.

We recently extended the cluster concept to the delivery of our high-enrollment courses by formally grouping all instructors of each course into clusters and encouraging them to communicate regularly on what they were doing in their sections. This helps newer instructors to learn from their more experienced peers, and it increases consistency across sections.

Outcomes

Now that we have a large percentage of experienced faculty who have achieved a new baseline level of knowledge, they automatically use that knowledge when interacting with new faculty, thus, increasing the baseline knowledge of their peers. The result is a self-sustaining culture that understands the benefits and limitations of current technologies in educational delivery and that is prepared to look for and evaluate new and innovative ways to improve education through technology and better instructional design. The tangible results include increased productivity, reduction in the overassessment of learners, strong peer-peer support networks, and more effective use of specialized support services for technically challenging projects.

BEST COPY AVAILABLE

Productivity. Prior to introducing this approach, course development tended to stretch over multiple terms, and was more likely to trickle over into delivery. Only a few courses would be developed by a few faculty in any given term. In the first semester of using this approach, we increased productivity to approximately 90 credit hours worth of courseware, developed by 19 faculty in six clusters. (Most of these faculty also held teaching responsibilities during this term.)

Assessment. At TechBC, we had identified a problem with overassessment, due to the modular nature of content delivery (courses are delivered in 5-week, 1-credit chunks, each with a transcripted grade). The quality circles and peer feedback have led to more effective ways to assess learner progress that reduce learner and faculty time commitments, while improving the validity of the assessments (Belfer 2001). The material that is developed is also more integrated across the curriculum, has better agreement between objectives, content, and assessments, and has lead to improved ratings by learners during and after delivery.

Peer Support. By changing clusters each term to meet operational needs, faculty get an opportunity to work and develop relationships with many others with similar or related interests. Faculty who studied together during METL or worked together to create courseware also tend to continue to collaborate during later development cycles and to openly discuss issues that arise during delivery.

Specialized Support. Our Educational Technology & Learning unit provides specialized support for development and delivery needs. This unit is now able to allocate its resources to new and innovative projects, as most faculty are able to take care of more basic tasks themselves.

Conclusion

At TechBC, we consciously chose to make an up-front investment in increasing faculty knowledge of the new technologies available to educators. We implemented an approach that had some mandatory components, covering basic information that applied to everyone's teaching, and some optional components that allowed those who were interested to work with certain technologies or activities more closely. The result has been as much a cultural change as a technical change. We have created an environment that encourages innovation in the search for better ways of fostering effective learning. We have created informal peer support structures that promote collaboration, rather than lone ranger or competitive approaches. Finally, we have succeeded in raising the bar on what constitutes basic knowledge of educational technologies.

References

Advisory Committee for Online Learning, The (2001). *The e-learning evolution in colleges and universities*. Ottawa, ON Canada: Industry Canada.

Belfer, K. (2001). *Evaluation Practice Guidelines*. Retrieved July 2, 2002 from http://www.etl.techbc.ca/data/0079EvaluationMethodsDraft/EvaluationModelsMay-02.pdf

Belfer, K. & Leacock, T. (2002) [The effect of quality circles on the courseware development process at TechBC]. Unpublished raw data.

Course Delivery Models at TechBC (2001). Retrieved July 2, 2002 from http://www.etl.techbc.ca/data/0005DeliveryModelsSummary/DMSummaries.pdf

Humphrey, D. (2001) *CMS Orientation*. Retrieved July 2, 2002 from http://www.etl.techbc.ca/data/0001CMSOrientation/index.html

Leacock, T., Farhangi, H. Mansell, A., & Belfer, K. (2001). Infinite possibilities, finite resources: The TechBC course development process. *Computers & Advanced Technology in Education*, 2001, International Association of Science and Technology for Development, Banff, AB. 245-250

Module Specification System (2001). Retrieved July 2, 2002 from http://www.hub.techbc.ca/mss

Nesbit, J. (2000). *Innovation @ TechBC*. Retrieved July 2, 2002 from http://www.etl.techbc.ca/data/0032InnovationAtTechBC/index.html

Stacey, P. (2001, May 25). E-learning – Authoring, instructional design and teaching. *T-net British Columbia*. Retrieved July 2, 2002 from http://www.bctechnology.com/statics/pstacey-may2501.html

Peer and Self Evaluation for Improving Student Collaboration in Online Courses

Lars Leader

Lorraine Schmertzing

Department of Curriculum & Instructional Technology
Valdosta State University
U.S.A.
lfleader@valdosta.edu

Abstract: Although student collaboration for projects offers advantages, especially in the online environment, too often student contributions to a team effort are not equitable or effective. This study addressed that problem by incorporating both peer and self-evaluation into collaborative projects undertaken by graduate students in an online course on evaluation and research methods. In one experimental group, students anonymously evaluated themselves and other team members on their collaborative efforts. Differences between this group and a control group on subsequent project grades and perceived collaboration within project teams suggested that self/peer evaluation could promote group collaboration. Survey responses indicated that after completing self/peer evaluations, students increased the frequency of communication within teams. Implications for promoting online group collaboration and further research are discussed.

Introduction

Project-based learning and the use of project work for students in general have been implemented in recent years in many schools and training organizations. Learner collaboration on the frequently complex tasks in projects is at the heart of this instructional technique. Studies provide considerable evidence that the joint problem solving in these situations is associated with better use of higher-level thinking skills, such as planning, reflection, and metacognition (O'Malley, 1995). Computer-mediated communication in distance learning has also been shown to promote critical thinking by incorporating technologies such as asynchronous discussion boards, which foster revision and reflection in the learning process (Barab, Tomas, & Merril, 2001). With the increase in instructional use of the World Wide Web, learners now often collaborate online for projects. This provides the opportunity to involve students in higher-order learning tasks while taking advantage of the practical benefits of distance education.

However, there is also a downside to student collaboration in project work. Students in collaborative groups frequently complain about some members of the group not "pulling their weight." This decrease in individual effort when performing in a group compared with working alone was termed "social loafing" by Falchikov and Goldfinch (2000). Social psychologists suggest that slacking by members of collaborative groups can be discouraged through individual accountability in the group environment (Myers, 1990). Various ways to identify the contribution of individual group members can be incorporated into assessment of project work. Yet, this is often difficult to administer, especially in an online course where it is often impossible to observe the work of the groups. Trying to identify each group member's contribution may lead to negative attitudes among students if they are asked to judge each other's contribution and make that evaluation available to the group. Or students may collude to provide inflated evaluations of each other to the instructor. The present study considers an alternative approach intended to promote better collaborative effort within project groups. The main research question in this ongoing study is, "When online project team members each anonymously evaluate the collaborative effort made by themselves and other members of their team, what are the effects of these evaluations on project quality and team member attitudes?"

Method

The students in this study took a graduate course in evaluation and research methods at a regional southeastern university. This is a required course within a totally online Instructional Technology program. Participants were graduate education students at the Masters and Educational Specialist levels. The 5 males and 23 females were nearly all of the students in two sections of the course during the years 2001 and 2002.

Among the course requirements were three major projects in which the students worked collaboratively and were assessed by a group grade on each project. The first project involved each team observing an activity, writing descriptive notes on it, and interviewing one of the participants. The team report of this qualitative fieldwork included coded excerpts, data display, and interpretation of the meaning of behaviors in the observed activity. The second project was a team evaluation of an educational or training program. This mixed-method evaluation included testing, observation, and survey. The third project was a proposal for an instructional intervention to address a concern within the evaluated program. The product for this project was a PowerPoint presentation developed by the team. The students self-selected the members of their two- or three-person teams.

For the study design, the teams were randomly assigned to two groups. During each course the primary investigator was not informed as to the assignment of particular students to the groups. Students in the intervention group ($n = 14$) anonymously evaluated themselves and their other team members after the first course project; those in the control group ($n = 14$) did not. The online evaluation form consisted of 12 statements with Likert-style responses. These statements described characteristics of a team member that would facilitate effective collaboration within the project team. One statement asked if "This teammate shared fairly in the production effort." Another statement was "This teammate communicated effectively." Another was "This teammate helped the team to effectively use the strengths of each team member." Each participant completed a separate form on each member of the team. For the self-evaluation, each participant completed a form with the same statements reworded as in this example: "I provided accurate information for the report of this project." Options for responding to each statement were: strongly agree, agree, disagree, and strongly disagree.

The dependent measures were (1) the group grades on the three projects and (2) the individual student responses to a survey completed after the first project and again after the third project. Each project was graded on points for content, format, and clarity by the primary investigator. Students worked on the second and third projects after the intervention group performed the self/peer evaluation. Therefore, the grades on these two projects were combined for analysis. The student survey consisted of 20 Likert-style questions. Some questions asked about skill in using online communication tools. An example is "What is your present level of skill using chat room discussion?" Other questions asked about the frequency of interaction using these tools, for example: "While working with your teammate(s), how often did you communicate by WebCT personal mail?" Another type of question asked about teamwork. For example, one question was "How often did problems concerning the responsibilities that members of your team were to assume affect the quality of your project?" An open-ended question at the end of each survey asked the students to comment on team project work in the course.

Both grade and survey data were analyzed using t-tests. An alpha of .05 established significance. Descriptive statistics were obtained for the survey and self/peer evaluation responses. The open-ended question responses were analyzed qualitatively for trends and themes.

Results

On the first project, the grades for the intervention group ($M = 18.29$) did not differ significantly from the grades of the control group ($M = 18.14$), indicating pre-intervention equivalence of groups. On the second and third projects, which followed the peer/self evaluation of collaboration, the grades for intervention group ($M = 41.64$) were higher than the grades of the control group ($M = 40.00$). However, this difference only approached significance, $t(1,26)$, $SE = .84$, $p = .06$.

On the first student survey no significant difference was found between the groups on their responses to any of the items, again indicating pre-intervention equivalence of groups. Responses to the second student survey, which was administered after completion of the third project, indicated significant differences on three of the 20 items. All three items asked student how often they had communicated with their teammate(s) while working on the second and third projects. Response options (and values) were: never (1), less than once per week (2), 1-2 time per week (3), 3-6 times per week (4), and daily or more frequently (5). On the item that asked about team communication by telephone, the means were 2.92 for the intervention group and 2.15 for the control group, $t(1,24)$, $SE = .36$, $p = .04$. For the item that asked about team use of a chat room, the means were 1.92 and 1.38 respectively, $t(1,26)$, $SE = .23$, $p = .03$. The third item asked about team communication by WebCT personal mail. The means were 3.61 for the intervention group and 2.69 for the control group, $t(1,26)$, $SE = .42$, $p = .04$.

Description of student survey responses for the groups combined was also obtained. When they started the course, almost half of the students were looking forward to being on a team, with the rest about equally divided between a dislike based on bad previous experiences and ambivalence over the prospect of group work. On a Likert-response scale that ranged from 1 = very uncomfortable to 4 = very comfortable, the students were, on the average, comfortable with group work in the course after the first project ($M = 3.44$) as well as after the third project ($M = 3.26$). When asked about grouping for project work, 78% on the first survey wanted to work in a group rather than individually and 72% on the second survey preferred group work. The students responded that for their own learning the team project work was effective ($M = 3.27$ on the first survey and 3.42 on the second one), with a four-point scale from very ineffective to very effective.

A general analysis of the qualitative data from the open-ended survey questions revealed several major themes. One of the prominent ones focused on the benefit of having someone to use as a "sounding board". It is interesting to note that this theme appeared much more regularly in the comments block of the early survey than the later survey. Students identified a variety of ways that having the "sounding board" was beneficial, such as: "I like having someone I can bounce my ideas off of," "Working in my team has been conducive to brainstorming, has provided different viewpoints leading to better ideas, and it has helped us to begin to grasp complex concepts by talking them out," and "Getting another person's input has helped me to see some other dimensions that I would not have picked up on alone."

Another recurring theme was related to individuals and how their own traits either helped or hindered the team experiences. Routine comments regarding team members like, "when all members pull their weight, group work could be effective," "[often] you end up with one or two people doing most of the work (if not all)," and "If all partners contribute to the work load, the learning experience can be invaluable" were present. However, there were also a number of students who chose to emphasize the importance of each person's involvement in a more positive manner: "I work well with a team when I have the freedom to work with whomever I choose [which was the case in this project]," "both of us seem to compliment each other," "the grouping was great," and "grouping should be done carefully." Students chose to make the point somewhat differently, but either in the early survey or the late survey most students either blatantly stated or eluded to the idea that the success of teamwork lies in the natural ability of the team to "fit" together. We chose to include the word, "natural" ability because there was only one comment that indicated a process of working to create a team fit. Other than the admission that, "at times coordination was a bit confusing (due to my work schedule) though successful due to my partner's coordinating and communication skills," no other student indicated a shift from a difficult working relationship to a beneficial team relationship.

Based on a curiosity about how the intervention might change the descriptive language students used in their comments on teamwork, a simple analysis was done to compare the responses from the intervention and control groups. Each comment was examined for words or phrases that may demonstrate strong emotion and/or a more personal tone in the context of the sentence. Some of the key words were friend, feel, personally, excuses, unhappy, stressful, joy, nice, and fear. It did not appear that the intervention changed the descriptive language. Rather it was fairly consistent that students who used emotional language on the early survey were the same students who used it on the later survey and it did not matter whether they were in the control group or the intervention group.

Discussion

The focus of this study was on how peer and self-evaluation for collaborative effort in online project teams might affect project quality and team member attitudes. For project quality, the results indicate that the effect was borderline. Grades for the intervention group on the projects which they undertook and completed after their peer and self-evaluation only approached being significantly higher than the grades of the students in the control group. On the evaluation forms the students responded to statements that were meant to serve as criteria for effective collaboration. Responding to these rating criteria was anticipated to have beneficial effects on team members. The self-evaluation was expected to promote personal development and improve interaction among team members. It was also meant to compel team members to direct their individual efforts in ways they otherwise might have ignored or omitted. Similarly, the peer evaluation was expected to provide direction for improving group collaboration. As explained by Haas and Hass (1998), reflecting on the various criteria that make for an effective collaborative effort and evaluating how other members of the team measure up may suggest to the student evaluator opportunities for improving the group effort.

However, the only measures that did differ significantly between the intervention and control groups were student responses on three of the student survey items. Each of the three items concerned the frequency of interaction between students when using communication tools. Students in the intervention group reported that they communicated with others on their teams significantly more frequently by telephone, chat room, and e-mail than did the students in the control group. This finding appears to indicate that the self/peer evaluation promoted more communication within teams. It may be that students' awareness of the importance of communicating frequently with others on the team was positively influenced by the rating criteria on the evaluation forms. Two of the evaluation items focusing specifically on communication within the team were "This teammate met (in-person or online) when needed" and "This teammate communicated effectively." The thought occurs to us that this increase in frequency is one of the easier changes to realize for improving collaboration. As our analysis of the open-ended comments suggested, students in neither the intervention group nor the control group indicated that the quality of their collaboration improved in such areas as fair distribution of effort, suggesting ideas and accepting others' ideas, and effectively using the strengths of each team member. Inculcation of these characteristics of superior collaboration may require more direct methods, such as training focused on effective collaboration.

This research is an on-going effort. We plan to continue the study with additional participants in the current and future sections of the evaluation and research methods course. With data obtained from more participants, the effectiveness of using peer and self-evaluation to promote online collaboration in student teams should become clearer.

References

Barab, S., Thomas, M. & Merril, H. (2001). Online learning: From information dissemination to fostering collaboration. *Journal of Interactive Learning Research, 12*(1), 105-143.

Falchikov, N., & Goldfinch, J. (2000). Student peer assessment in higher education: A meta-analysis comparing peer and teacher marks. *Review of Educational Research, 70,* 287-322.

Haas, A. L., & Haas, R. W. (1998). The use of self-rating and peer-ratings to evaluate performances of student group members. *Journal of Marketing Education, 20,* 200-210.

Myers, D. G. (1990). *Social psychology* (3rd ed.). New York: McGraw-Hill.

O'Malley, C. (1995). *Computer supported collaborative learning.* Berlin: Springer.

Academic Administration and Organization Model of Digital Distance Universities

In-Sook Lee, Sejong University, 98 Gunja-dong, Gwangjin-gu
Seoul, Korea, inlee@sejong.ac.kr
Seyoung Chun, Chungnam University, Korea, sychun@cnu.ac.kr
Yeonwook Im, Hanyang Cyber University, Korea, yeonwook@empal.com
Heok Heo, Sunchon University, Korea, hoheo@sunchon.sunchon.ac.kr

Abstract: Digital distance education system has become a growing form at the higher education sector. This study suggests a model of academic administration and organization for digital distance universities, which would serve as a corner stone for early successful establishment and enhancement of educational quality. This model shows that distance universities should be equipped with services in both the faculty and staff sides of academic administration, instruction-learning support, student support and welfare, and educational evaluation and these services also need support in the form of organization. The model also emphasizes flexibility and dynamism that connects services and organizations and enables timely provision of services and top-level receptiveness.

Introduction

Digital distance education system has become a growing form at the higher education sector. In Korea, the Ministry of Education and Human Resources permits the establishment of digital distance universities, as part of lifelong education initiatives, and further tries to extend the scope of those universities. The governmental supports have accelerated distance education systems in terms of quantity: Now it is a high time for more attention to be paid to 'quality'. It definitely needs to study a framework of academic and organizational systems that can embrace the diverse needs of learners, the pedagogical considerations of various technologies, and the various instructional services.

The purpose of this study is to suggest a model of academic administration and organization for digital distance universities, which would serve as a corner stone for early successful establishment and enhancement of educational quality. This study was accomplished through the following methods: Content analysis of related documents through which a theoretical framework for the model has been derived. Surveys on three different types of research subjects, which include 15 national and 4 international digital distance universities, 2 national distance education companies, and 18 experts.

Results and Suggestions

Eight Propositions

Based on the reflections on all results of literature review, surveys, and benchmarking, the following eight propositions were suggested that the academic and organizational model of digital distance universities has meant to satisfy:
1) Strategic goals driving digital distance education can vary and organizational structures, governance, programmatic emphases, and financial models should be compatible with the strategic goals. 2) To be successful and competitive, digital distance education will require a governance model with a level of dynamism and flexibility dramatically different from the traditional faculty governance model. 3) Organizational governance should create right mixes about the responsibilities and agreeing on who make what decisions. 4) Governance and organizational structures for attracting and retaining qualified teaching faculty and instructional support personnel are emphasized. 5) Providing appropriate academic and student services to learners is a critical quality issue. 6) With distance education, partnerships are essential. 7) A multitude of policy issues associated with digital distance education exists - ownership of intellectual

property, workload, accessibility, appropriate use, conflict of interest, to name a few. 8) Digital distance education can be an expensive proposition so that only institutions with significant investment capacity should establish distance education.

Suggested Academic Administration and Organization Model

On the basis of above eight propositions, we propose an academic administration and organization model for successful educational service (Figure 1).

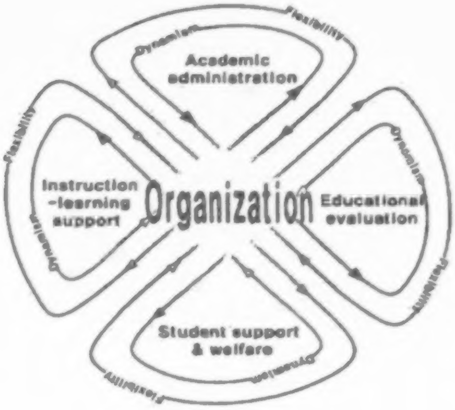


Figure 1. Academic administration and organization model

This model shows that distance universities should be equipped with services in both the faculty and staff sides of academic administration, instruction-learning support, student support and welfare, and educational evaluation and these services also need support in the form of organization. The model also emphasizes flexibility and dynamism that connects services and organizations and enables timely provision of services and top-level receptiveness.

Academic administration covers the ideas of academic term system, curriculum operation model, academic organization, tuition and fee, admission and registration, learning quality control, and enrollment size. Instruction-learning support deals with the issues of curriculum quality control, content quality control, instruction-learning process quality control, appropriate technology infrastructure, and faculty support system. Student support and welfare deals with the issues of academic information, learning support service, requests and complaints handling, and technology infrastructure. Educational evaluation introduces various key ideas for quality control in distance education. Teaching and administration support organization suggests that instructional support, system management, marketing and public relations are given more emphasis in distance universities than in traditional offline universities. Organizational structure exhibits more diversity in institutions that provide services in partnerships than in institutions that provide all services by themselves.

A variety of support organizations are needed in distance universities for quality control of various aspects of the institutions including the following (Figure 2): (1) curriculum development and assessment (curriculum development, quality control in curriculum, assessment of education effectiveness); (2) contents development (instructional design, graphic design, web programming, multimedia development); (3) student support (academic information, learning evaluation system, evaluation system for learning process, learning progress checking, etc.); (4) faculty support for instructional development (instructor training, consulting, instructional resource development); (5) marketing and promotion (student recruiting,

BEST COPY AVAILABLE

promotion and sales of educational services, faculty recruiting); and (6) system management (system development and operation, technical support services).

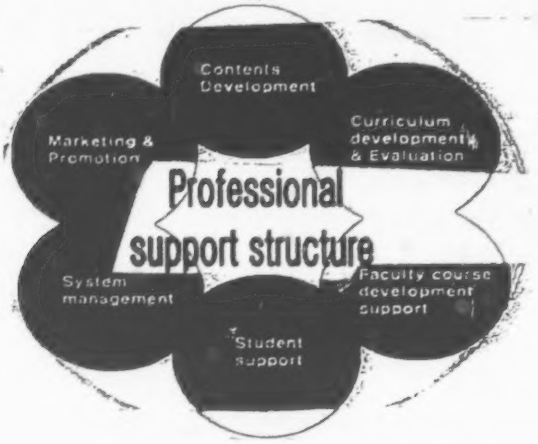

Contents Development
Curriculum development & Evaluation
Marketing & Promotion
Professional support structure
System management
Faculty course development support
Student support

Figure 2. Professional Support

References

AAUP (1997, November). Report on distance learning. Presented by the subcommittee on distance learning. http://www.aaup.org/govrel/distlern/dlrpttxt.htm. Accessed 02/26/2002.

AFT (2000. September). Guidelines for the evaluation of electronically offered degree and certificate programs. Washington, D.C.: AFT.

Berg. G. A. (2001). Distance learning best practices debate. WebNet Journal. 3(2). 5-6, 17.

Council for Higher Education Accreditation (2002). Accreditation and assuring quality in distance learning. CHEA monograph series 2002, number 1. Washington, D. C.: CHEA

Eaton, J. S. (2001. 10). Core academic values, quality, and regional accreditation: The challenge of distance learning. Washington, D. C.: CHEA. http://www.chea.org/Research/core-values.cfm.

Gellman-Danley, B. & Fetzner, M.J. (1998). Asking the Really Tough Questions: Policy Issues for Distance Learning. Journal of Distance Learning Administration. 1(1). [Online] http://www.westga.edu/~distance/danley11.html

James C. Taylor, J.C. & Swannell, P. (2001). An Euniversity for an E-world. International Review of Research in Open and Distance Learning.htttp://www.irrodl.org/content/v2.1/usq.html

Kidwell, J., Mattie, J., & Sousa, M. (2000). Preparing your campus for E-business. In the E is for everything, R. Katz and D. Oblingor (Eds.). San Francisco: Jossey-Bass.

McLendon, E. and Cronk, P. 1999. Rethinking Academic Management Practices: A case of meeting new challenges in online delivery. Online Journal of Distance Learning Administration. 2(1). http://www.westga.edu/~distance/mclendon21.html) (5/25/99)

BEST COPY AVAILABLE

Moore, M.G. (1994). Administrative Barriers to Adoption of Distance Education. The American Journal of Distance Education. 8(3).

NCES (1999). Distance Education at Postsecondary Education Institutions: 1997-98 [PDF file] http://www.ed.gov/Technology/reports.html. Accessed 07/30/2001.

Oblinger, D. G., Barone, C. A., & Hawkins, B. L. (2001). Distributed education and its challenges: An overview. Washington, D.C.: American Council on Education.

ODLQC. Standards in open and distance learning. http://www.odlqc.org.uk/odlqc/standard.htm. Updated May 2001.

Delphi Study on Competency Model of Online Instructor

Online instruction has greatly changed the learning environment and learning process in comparison with traditional instruction. It requires a new kind of roles and competencies in instructors (Oh, 1998; Berge, 1996; Kearsley et al., 1995; Kearsley, 200; Reeve & Reeve, 1997). Nonetheless, many studies have been made on technology related to online education and its potential, whereas few studies have been conducted to identify what instructors actually do online (Salmon, 2000). Therefore, there is a need for a systematic and comprehensive study of online instructer's roles and competencies.

This study attempted to provide one indicator for training, selection and placement of future online instructors by identifying online instructor's roles and competencies in a more systematic and comprehensive way. To attain this goal, the following research questions were set:

First, what major roles and competences are required of online instructors?

Second, what role cluster by each role is required of online instructors?

Third, what is the descriptive competency model synthesizing online instructors' roles and competencies?

To fulfill these study questions, the current study conducted the questionnaire research three times with the use of the Delphi technique, especially the Modified Delphi technique which is a research method of finding out the consensus by extracting and synthesizing an expert group's opinions and judgement.

Based on the study results, the following conclusion was drawn:

First, the major role and competency required of online instructors were as follows: 6 major roles required of online instructors include 'interaction facilitator and manager', 'information manager and user', 'classroom evaluator', 'collaborator', 'subject matter expert', and 'planner'. The items rated as the core competency of online instructors totalled 15 items, of which 5 items were found to be 'subject matter expertise', 'interaction facilitation and management', 'instructional design', 'online communication', and 'learning activity evaluation'.

Second, 18 competencies were adopted as the competency cluster of the 'interaction facilitator/manager'. 21 competencies were adopted as the competency cluster of the 'information manager/user'. 14 competencies were adopted as the competency cluster of 'classroom evaluator'. 19 competencies were adopted as the competency cluster of 'collaborator'. 16 competencies were adopted as the competency cluster of 'subject matter expert'. And 16 competencies were adopted as 'planner'.

Third, 5 finally identified core competencies included 'subject matter expert', 'interaction facilitation and management', 'instructional design', 'online communication', and 'learning activity evaluation'. Basic common competency is what becomes commonly fundamental in performing every role adopted in this research. It was found that 7 finally identified basic common competencies. And 'role-related competency' is the competency necessary in carrying out a particular role and refers to the competency partially applied according to 6 roles. It was found that the 'role-related competency' of the online instructor accounted for 14 competencies.

Time and Resource Issues Pertaining to the Design and the Management of Course Materials for a WebCT-Based Project with Engineering Students

Geneviève Légaré
Concordia University, Montréal, Canada
legare@vax2.concordia.ca

Abstract

This paper describes a project using WebCT with engineering students registered in the course "Impacts of Technology on Society" at Concordia University, Montréal. Students carried out five individual assignments that were posted and returned using WebCT. The assignments were used to provide practice in writing as well as to develop critical thinking skills. More specifically, WebCT was used primarily as a mode of delivery to post and to receive student assignments. While a content analysis study was subsequently conducted to analyze the incidence of critical thinking skills in student assignments, the purpose here is to address some of the practical aspects of using WebCT. Thus, the focus of the paper is on the issues of time and resources required to carry out instructional activities using WebCT.

Introduction

Background

The course "Impacts of Technology on Society" is a required course for all fourth year engineering students registered at Concordia University. The course is specifically designed to address social, environmental, ethical, and political issues pertaining to the role of technology in society. Typically, the assignments consist of two short papers (5-7 pages), one major report carried out in teams and a class presentation. Instructional approaches include class discussions, lectures and case presentations. Eighty-five students registered in two sections of the course participated in this project.

One of the challenge with teaching the course is that the students come in with very little experience in writing and expressing ideas. To address this issue, the instructors decided to use WebCT primarily as a mode of communication, which allowed for more writing practices. In the revised version of the course, the short papers were replaced with five written assignments, that is, two essays and three case studies of increasing difficulty. The WebCT assignments were designed and managed by the teaching assistant/researcher, while all other activities were handled by the course instructor.

WebCT Features

From an instructional point of view, WebCT offers a number of interesting features. One can present on-line course materials (documents, lectures notes, course outlines, exercises etc.); provide glossaries for specific terms and concepts; develop quizzes and surveys; communicate by e-mail and create discussion groups; manage student files (for example, to post grades or to track their on-line visits). Course materials can be created as a multimedia package which may include, in addition to the usual text, images such as photographs or graphics, sound and video excerpts, and links to external websites. In addition, design features such as limiting access, determining availibility date and other control features are also available. One of the main advantage of WebCT is that the course content is restricted to the students registered in the course and available at the user's convenience. In short, WebCT presents a series of

BEST COPY AVAILABLE

advantages for the instructor who wishes to go beyond the traditional lecture approach and develop richer and more complex course materials.

Given our needs and our means, we used WebCT primarily as a communication device rather than as a fully developed interactive tool. Consequently, we used the interface mainly to introduce course materials, to communicate to students by e-mail and to post grades. We also used the quizz feature to collect student's feedback about the instructional approaches. For the purpose of this presentation however, only the issues pertaining to the posting of course materials will be addressed.

Characteristics of the Course Materials

The assignments were two essays and three case studies pertaining to the issue of food production technologies. The case studies were specifically designed for the course, using Leenders and Erskine's model of case writing (1989). The documents were quite complex and voluminous, ranging from seven to 20 pages. We designed the case studies in the typical constructivist fashion (see, for example, Cognition and Technology Group at Vanderbilt, 1990; Lave & Wenger, 1991). Multiple perspectives were provided to the students using different visual media. Thus, all information necessary to identify problems and to make recommendations was provided either as articles, links to relevant websites, graphics, images and statistics. Students had to sift through the information, identify the problem (s) and offer possible solution (s). All course materials were created using Claris HomePage and then were saved as a "zip" file.

Time and Resources Issues

While the integration of communication and information technologies such as WebCT in a course offers a great instructional potential, one should not neglect the time involved in creating and managing the materials and additional resources required to use such means in an efficient and effective manner. These issues are discussed below.

Time Issues

While designing materials for instructional technologies may require more time than regular print-based material, using WebCT entails that more "person-time" will be required to deal with logistics issues such as uploading and testing the materials and managing students' files. Thus, four general steps may be considered: 1) Designing the materials; 2) Preparing the material for the WebCT environment; 3) Organizing the logistics involved in using WebCT and 4) Conducting the instructional activities per se.

1) Designing the Materials for a WebCT Environment

The time spent on this step depends more on the type of document to be prepared for the course than the use of a communication technology such as WebCT. Traditional print-based materials such as lecture notes for example, will require less designing time than a case study or a Web page that introduces images, graphics and links. In WebCT, the usual steps involved in the design of interactive materials have to be covered: searching for content, organizing the information in a meaningful way for the learners, validating the content with subject-matter experts and conducting a formative evaluation. In other words, creating an interactive document that includes several media involves more design time than print-based materials. However, the instructor who wants to use WebCT in an interactive fashion will have to learn how to use a web page design software.

2) Preparing for the WebCT Environment

After the material has been created, one has to upload the course materials in WebCT. First, the instructor needs to become familiar with the designer's view options of the shell. In other words, the instructor has to understand the logic behind the design of the WebCT shell. This logic is not totally intuitive. For example, the zipped materials first have to be uploaded in the management tree, then unzipped in the desired folder. All images and links have to be verified to make sure that they have been uploaded and then successfully unzipped. Then one has to verify that all the links work. The next step is to give the students access to the document. This means that while the material may have been uploaded in WebCT, the document is still not accessible by the students. Toggling from the designer's view to the student view is probably the most time-consuming step since one has to go out entirely from the browser and then enter as a student to verify that all the links and the images really appear.

In short, the steps involved in uploading the materials include zipping and unzipping the file, verifying that all the images have been uploaded, organizing the files in the management tree, verifying that the file does appear in the student mode, setting up the access for students and finally, testing the document in student mode. In our project, uploading the course materials and testing the set up required an average of three hours for each assignment. Finally, in the 3.11 version, it was not possible to upload the same material for two sections at once. In other words, when one teaches two sections of the same course, the uploading procedures have to be repeated twice. It is not possible to "duplicate" or to dispatch the materials and the set up to a running course.

3) Organizing the Logistics

Organizing the logistics surrounding the use of WebCT is another issue worth considering before using WebCT. One has to ensure that everybody has access to a computer either from home or from a lab and that all students create their account by a given date. One also has to do some trouble shooting and updating with the students who are experiencing difficulties. Yet, the most time-consuming task in terms of using WebCT in the classoorm is the management of students's assignments. In this project, the teaching assistant/researcher had to : 1) open up the e-mail messages and the attachments; 2) verify the format and the filename; 3) return a reception notice; 4) file the assignment in the proper folder and; 5) assign a participation grade to the student. Although the WebCT part of the course was also designed for research purposes (i.-e. an increased number of assignments) creating and receiving even a lesser number of assignments in WebCT would still require quite some time. To illustrate the point, the task of managing student assignments, despite the application of systematic procedures, required 1.5 days of work per assignment for 85 students.

4) Conducting the Instructional Activities

The use of WebCT does not directly affect the amount of time dedicated to the instructional task per se. In other words, the grading and the provision of feedback is as time-consuming in a WebCT environment as it is in traditional approaches. However, one observation about our experience is that we had the feeling of spending too much time on the logistics and the management of the student files and not enough on the instructional tasks themselves.

Resource Issues

Technical Support for Students

In order to facilitate the students' use of WebCT it is essential to offer proper technical support, especially if it is their first experience with such an environment. In our case, a handout outlining the steps about how to log on to the system was distributed in class. A help line was also made available for the students, as well as a drop-in session for trouble-shooting. In addition, a class presentation of the environment was presented at the beginning of the term.

Clear instructions are essential for submitting electronic files. Such instructions should contain information as to how to give a filename (using the student's last name of the student and their first initials as well as the assignment number); what type of document is accepted (e.g. Word, Word Perfect, PDF, etc.); an explanation about the meaning of the extension (e.g. ".doc", ".pdf"). At first, we perceived this information as being trivial, but we were surprised to find out that quite a few students had little knowledge about the type or the version of word processing software.

Technical Support for Instructors

Learning to navigate in WebCT is not as intuitive as it could be. Some time and energy have to be invested prior to designing the course materials or the course interface. Instructors, teaching assistant and facilitators have to be supported in order to develop the course. In our experience, we were a team of five people. The head instructor with the help of the Information and Instructional Technology Service staff, created the interface for the course and chose the icons and the features to be used; the teaching-assistant/researcher created the materials to be uploaded, debugged and organized the set-up, as well as managed the students' assignments; and finally, two instructors managed the mail and the student grades to be posted. In essence, the instructors, in order to be successful and efficient with WebCT, need some form of technical support from the university, as well as some teaching assistance resources dedicated to the magement of the course in WebCT.

Conclusion

In conclusion, the use of complex and voluminous case studies containing graphics, images, texts, references, and links to relevant websites was facilitated by the WebCT environment. However, as our experience demonstrated, more person-time was dedicated to the design, the logistics, and the management of student assignments than on the instructional activities per se. This implies that whenever planning to use WebCT, one has to expect that more time will be spent on non-instructional task. Consequently, when planning to use an interface such as WebCT, careful planning of physical and human resources has to be considered in order to ensure a successful and relevant integration of WebCT in a course.

References

Cognition and Technology group at Vanderbilt. (1990). Anchored instruction and its relationship to situated cognition. Educational Researcher, August-September, 2-10.

Jones, K. (1985). *Designing your own simulations*, London: Methuen.

Lave, J., & Wenger, E. (1991). *Situated Learning: legitimate peripheral participation*. Cambridge: Cambridge University Press.

Leenders, M. R., & Erskine, J., A. (1989). *Case research: The case writing process* (third ed.). London, Ontario: School of Business Administration, University of Western Ontario.

Thiagarajan, S., & Stolovitch, H. D. (1978). Instructional Simulation Games (Vol. 12). Englewood Cliffs, NJ: Educational Technology Publications.

Teaching about Mythic Kings: How Integrating Multi-Media Presentation Technology with Traditional Essay Writing Has Helped Students Learn More History

Abstract of Brief Paper Proposal for the Association for the Advancement of Computing in Education, World Conference, October 15-19, 2002, Montreal, Canada

By David Walter Leinweber, Ph.D.
Associate Professor of History
Oxford College of Emory University

OVERVIEW OF THE PROPOSAL

This brief paper highlights experiences and issues related to incorporating multi—media technology into a special topics course I am teaching this Spring Semester at Oxford College of Emory University – *HST 385: Mythic Kings*. A major feature of the course is the preparation of a multi-media presentation prepared by students, based on a significant historical essay they have written. I have found this fusion of traditional essay writing with modern multi-media technological capacities to add an exciting and enriching dimension to students' learning about history.

In a brief presentation to the World Association for the Advancement of Computing in Education, I would like to share some of my experiences using multi-media technology with *HST 385:Mythic Kings*, including some illustrations/examples taken from students' work. I would also like to share some of the practical and philosophical issues I addressed as I configured technology into this course in a very central way.

Having each student convert major written essays into major multi-media presentations has helped them integrate art, music, architecture, and literature into a larger historical framework. The result is a much deeper level of learning that shows students how disparate peoples, places, and periods relate to each other. In addition, technology has helped students directly see how such considerations as music and art are important parts of history, not discrete entities to be considered only by artists, musicians, or art and music historians.

BACKGROUND REGARDING THE COURSE

HST 385: Mythic Kings is a special topics class designed for a rather small group of students who have completed the pre-requisite of *HST 101: Western Civilization Through the Reformation*. There are seven students in this course, all very well-prepared for the discussion, special projects, and research that the course requires. This is important, as it allows us to assume some general familiarity with the various periods discussed, as well as a certain seriousness one brings to the topic.

Also, *HST 385: Mythic Kings* was designed and supported based upon work done by the instructor while a 2001 participant in The Teaching, Learning, and Technology Institute (TLTI), sponsored by Oxford College of Emory University. TLTI expert instruction was directly designed around the proposed course syllabus. The expert support of Oxford's technological staff was a critical element of this course, both as I developed it, and as students proceeded towards completing it.

Other key elements of the *HST 385: Mythic Kings* syllabus are itemized below.

INDIVIDUALIZED SYLLABI

In addition to mundane matters of course administration, the syllabus for HST 385 provided a list of particular "mythic kings." Among these were included Osiris, David, Priam, Theseus, Alexander the Great, Arthur, Charlemagne, and Napoleon. Each student selected his or her own Mythic King from this list, and was provided with an extensive list of references for that particular figure. These references included major primary sources on the historical figure in question, as well as literary, artistic, and musical works that reflected the monarch's enduring legacy in culture and myth. Below you will find a sample of the syllabus references given for one of the student's projects, Theseus as a Mythic King.

A. Theseus

Literature: Boccaccio, Giovanni, *Teseida;* Chaucer, Geoffrey, "The Knight's Tale" in *Canterbury Tales;* Dante, *The Inferno*, Canto XII; Euripides, *Hippolytus;* Hawthorne, Nathaniel, "The Minotaur," in *Tanglewood Tales;* Ovid, *Metamorphoses Book VIII;* Plutarch, *Theseus;* Seneca, *Phaedra;* Shakespeare, William, *A Midsummer Night's Dream; – Two Noble Kinsmen*

Music: Richard Strauss, *Ariadne on Naxos* (1912); Milhaud, Darius, *L'Abandon d'Ariane* (1928); *--La Déliverance de Thésée* (1928); Britten, Benjamin, *A Midsummer Night's Dream* (1960); Mendelssohn, Felix, *A Midsummer Night's Dream* (1876); Roussel, Albert, *Bacchus et Ariane* (1930).

Note that an important component of the course was the inclusion of much classical music – operas, oratorios, piano concertos, symphonies, and ballets. Several students chafed some at this. But they are learning to see music (and art) as not just something for people in music departments, but as an important part of the historical record. I viewed the inclusion of music in the syllabus as essential, and have remained firm that students consult the various works related to their particular topics. Music was an important part of the course in the basic sense; but it also presents one of the most exciting potentials for the multi-media component of the course.

TRADITIONAL RESEARCH AND ESSAY WRITING

The central feature of the syllabus was that each student would prepare a major and quite traditional research essay of 15-20 pages in length. Due on the last day of class, the essay focuses on the historical and cultural legacy of a particular mythic king. These are footnoted papers, with bibliographies.

Before completing this major essay, students would write a series of short papers in preparation. Assigned topics for these shorter papers were: The Historical King (e.g. Arthur); Sources of Knowledge about the Historical King; The Image of the King in the Arts; The Kingly Ideal.

Having completed these very serious and meticulous papers, students can generally speak with true authority on their particular king. They are therefore grounded in a serious body of content knowledge that they can then import into their Multi-Media presentations. This grounding in a rather traditional approach to history is very important, and adds enormously to the exciting and creative work they can then incorporate into the technology component of the course.

MULTI-MEDIA PRESENTATION

The essay completed by students is converted into a major multi-media presentation that summarizes its major points, and illustrates them with a wide variety of materials, including maps, music, art, and key passages from literature. This conversion of the written essay into a very carefully structured and thoughtfully conceived multi-media presentation is a critical component of the *HST 385:Mythic Kings* course. The presentations are scheduled for 45 minutes each, so they constitute a major segment of the student's work for the semester.

As a critical sub-component of the Mythic Kings multi-media presentations, students select appropriate and relevant music clips from a variety of musical sources. They integrate the music into the larger framework of important themes and images drawn from the life and times of their particular king. Slides featuring art, architecture, portraits, and other relevant images are organized thematically into sub-presentations that highlight the relationship between history and the Fine Arts

This key musical aspect of the Mythic Kings course has helped students relate such "musical" figures as Palestrina, Purcell, Handel, Berlioz, or Britten, to the larger historical context of their times. It has highlighted for them, and me, how a Handel Oratorio from the eighteenth century can relate to Renaissance Art, which can also relate to famous literary passages from Ovid, or Vergil, or the Bible, or great buildings of the world. The use of PowerPoint technology has illustrated this for them in powerful ways that I could not have imagined even seven or eight years ago.

CONCLUSION

As a rather traditional history teacher, I am very pleased that technology has provided an enormously enriching dimension to my special topics course. Technology has not conflicted with the content of the course. It has not replaced solid learning with bells and whistles. Multi-media technology, coupled with the completion of a serious traditional essay, has enabled my students to gain a much broader sense of how common figures, stories, images, and themes can connect disparate peoples, places, and periods. This has made a very significance difference in my class.

In my presentation to the World Conference for the Association for the Advancement of Computing in Education, I would like to share some of my experiences with using multimedia technology in *HST 385: Mythic Kings* at Oxford College of Emory University.

Reusable Learning Objects: Hazards, Hi-Performance, and a New Convergence

Juan Leon, Ph.D.
Vice-President, Learning and Knowledge Management Strategies
Intelli-media
U.S.A.
juanleon@comcast.net

Abstract: This paper addresses the growing gap between the promise of Reusable Learning Object (RLO) based content development and the sometimes disappointing reality of RLO performance in deployment. After reviewing the principal causes of these disappointments, the discussion outlines strategies for maximizing the benefits of RLO approaches. The first strategy applies most to Instructional Design processes. It demands special attention to curriculum driven training development. The second strategy applies most to Knowledge Management techniques. It demands a sophisticated understanding of metadata schemes and rule-based automation. The discussion concludes by reviewing the social forces and industry trends that are driving the evolution of RLO based systems. Of these, the increasing use of competency-based models of organizational development is seen as the trend most likely to complement RLO based approaches to content creation and management.

The past year was in some ways a good one for realizing return on investment (ROI) with e-Learning. e-Learning delivered new product information to sales forces in the field, reducing their time out of action. For other geographically dispersed employees, classes and discussions normally held at a central site were held over the Web. Collapsing distance in these ways, e-Learning's web-based mode of delivery trimmed training travel budgets across numerous industries.

Not uncommonly, the e-Learning windfall is being reinvested by training departments through the purchase of Learning Management Systems (LMSs) or Learning and Content Management Systems (LCMSs). Will these major investments produce comparably outstanding results by way of the course and content management they offer? The answer may depend in part on how successfully these systems can be stocked with high-quality, standards based course materials. Without the content, the systems will be no more than administrative tools, a great convenience at course registration time, but of no direct consequence to training itself. Without the standardization, these systems will deliver little by way of useful content capture and reuse.

With regard to both these issues, the most promising and problematic feature of the new LMSs and, especially, the LCMSs, is the "Reusable Learning Object" (RLO). "Create once, use many" has been an--admittedly awkward--RLO tagline throughout their evolution. The tagline expresses the idea that instruction can be systematically decomposed into small units and then stored in accordance with internationally agreed upon standards for "packaging". Appropriately labeled, this unit of instruction can function as a piece of "LEGO" in an open and growing world of such LEGO pieces. Each piece is ready to be combined and recombined with others to suit multiple training and information exchange purposes.

Thus, the RLO approach to content creation and management can promise several things, among them:

- Personalized learning
- Collaborative authoring
- Easily modified content libraries
- Efficient management of instructional assets (typically achieved by housing them in a database of RLOs)

Designed to be modular, sharable, and reusable, RLOs are conceived as the basic units of a component based learning (and knowledge management) strategy that can produce remarkably high returns on investment.

Inherent Difficulties

However, RLO based training development systems have often proven difficult to implement. "A great idea, but it doesn't work in reality", has too often become the RLO adopter's refrain. What tends to give rise to this kind of disappointment? The following are frequently unanticipated yet all-too-common difficulties:

- RLO based development brings with it technical challenges that are not only more daunting than those posed by e-Learning or other forms of technology based training but are *different in kind*.
- RLO based development requires more planning up front than training departments are accustomed to or may have the time for.
- Instructional designers don't like RLO based approaches, or remain dubious of their benefits.

There are also larger organizational hurdles. In many organizations content functions and training functions are widely fragmented across business units; and there is not enough understanding of what standards based development involves. These organizational issues must be addressed before real economies of scale can be seen in RLO based content development and content management.

Where to Begin for Training Departments

Responding to these new technical and organizational challenges will require greater levels of cooperation among training departments and IT or IS groups. Training departments will increasingly need to think of the IT or IS group not as a source of "support" alone, but as a partner in enterprise-wide communications, education, and knowledge management efforts. While developing these enhanced intra-organizational relationships, the training department will have to contend with challenges proper to training development itself. The greatest of these is the challenge of achieving coherence in RLO based course construction.

Coherence is that subjective experience that is created by a course composed of well-integrated parts. This sense of coherence is fundamental to understanding and learning. We experience coherence when a course maintains:

- subject matter consistency and natural progression
- logical consistency and natural progression
- thematic consistency and natural progression
- aesthetic wholeness (including consistency of style)

Because RLOs are designed to function as stand-alone units independent of any context, when linked together into courses they tend to produce discontinuities in subject matter, in logic, in theme, and in the "look and feel" of course components. Consequently, course coherence is not likely to be the result of a hastily conceived RLO based development strategy.

An Effective Approach

The answer to this particular challenge is not to create RLOs according to a pre-defined formula—that would defeat their special purpose—but to design them within the framework of a well-planned curriculum, one that incorporates standards compliant classification schemes allowing for consistent labeling of RLOs and efficient retrieval of the RLOs from databases. The curriculum must also be specified in detail sufficient to allow each RLO to target its own clearly focused learning objective.

Wyeth Pharmaceutical's successful implementation of an enterprise learning and content management system last year took a still more radical approach that is instructive. Before building a new curriculum they stepped back and built up a competency model. Their motto: "Design your curriculum in light of your competency model." Doing so helped turn training development into an efficient, enterprise-wide process, moving it away from the purely project driven model of production that had resulted in a "jigsaw puzzle" of training materials created ad hoc. (See Dr. Roshan's paper on e-Learning at Wyeth for more on that organization's integrated approach to training, knowledge management, and organizational development.)

Working toward related goals, Pfizer's training groups have championed efforts to collaborate with Human Resources in developing an enterprise-wide capabilities model. The model supports curricula that are both more comprehensive than in the past and more attuned to the needs of the individual learner. Particularly noteworthy, Pfizer's capabilities model and new curricula support training follow-up and career-long professional development.

Another Effective Approach

The challenge of RLO based course coherence can be further addressed through the use of RLO authoring and management tools that aid in the creation and maintenance of coherence. These tools do so, in part, by enforcing classification schemes, conducting intelligent searches against RLO databases, guiding course designers in the final selection of course components, and helping in the real-time authoring of transitional material unique to a particular course under construction. They help turn instructional design expertise into useful "rules" that can be applied semi-automatically.

Finally, instructional designers may need to learn to think and work in new ways, producing more compact and carefully structured units of instruction while keeping a close eye on curricular objectives.

Consequential Convergences

Producing high-quality RLO based content may be difficult, but the challenge is not likely to be withdrawn anytime soon. Today's explorations of training development based on RLO models comes as a natural consequence of five on-going social and industry trends:

- E-Learning is becoming a commonly used tool, one essential to the smooth operations of critical business processes. Findings from a recent survey of training professionals indicate that over 45% of the organizations polled now use e-Learning as an essential part of their business operations (SRI, 2002).
- "Blended" learning is being increasingly favored. (Driscoll, 2002)
- Both training content and performance support resources are being integrated with organizational IS and Knowledge Management efforts.
- Standards for content packaging and uniform labeling conventions are being widely adopted. It is now difficult to find a serious developer of e-Learning related tools or content that does not comply (to some degree) with AICC, SCORM and / or IMS standards and specifications for interoperability.
- Intranets and the Internet are increasingly taken for granted as communications channels, as are the consistency in technical formats and standards they provide.

When it comes to the growth of RLO based training development, these five trends will continue to provide the push, the pull, or both. Some of the reasons for this include the following:

- Materials digitized for e-Learning are ready to be placed into Learning Objects, and e-Learning now housed in databases—instead of books and binders—is only a small conceptual distance away from RLO course components housed in databases.
- Blended approaches require training materials that can be rapidly used in smaller chunks and quickly customized, while corporate CIOs are more alert than ever to the possibility of capturing and exploiting the knowledge produced by training departments.
- As the corporate world moves toward standards-based content development and exchange, no one will want to be left out or stigmatized as "incompatible".
- The continued evolution of ubiquitous computing will only increase demand for the kind of just-in-time training and information that are the forte of RLO based systems.

Despite the challenges inherent to RLO based content development, then, it is very likely that the training industry will continue to move in the RLO direction. While caution and even skepticism are warranted, we may expect that RLOs, in some form, are soon likely to begin populating efficient learning and content management systems. Experience with RLO implementations may lead to greater successes as we increasingly fulfill the promises of well-made, well-managed and well-used digital content libraries. In particular, the on-going development of competency and capabilities training models will better support the design of the comprehensive curricula essential to practical success with large-scale RLO implementations.

Looking to the horizon, how might the convergence of RLOs and competency model trends further evolve?

Standards and specifications bodies such as the IEEE Learning Technology Standards Committee (LTSC), the IMS Global Learning Consortium (IMS), and others will need to develop the taxonomies through which competencies will be defined and mapped in and across competency management systems. This will be a far more difficult task than that of specifying an RLO package's structure or the metadata to be used in RLO tagging.

Note, for instance, the complexity—and breadth—of any reasonable working definition of "competency", this one crafted by the HR-XML Competency Workgroup last year:

> A specific, identifiable, definable, and measurable knowledge, skill, ability and/or other deployment-related characteristic (e.g. attitude, behavior, physical ability) which a human resource may possess and which is necessary for, or material to, the performance of an activity within a specific business context. (Bork & Kiel, 2001)

Rather than agreeing upon packaging conventions and the kind of classification information that is important to know about a Learning Object, creating complete taxonomies of workplace competencies would involve defining and mapping *all relevant human actions and attitudes as they pertain to carrying out a given task in a given sphere of business activity*. Little wonder, then, that competency specifications and standards groups are having trouble pursuing their goals and that the HR-XML Competency Workgroup makes a point of rejecting taxonomy building altogether.

Instead, it takes on the more manageable burden of creating an XML Schema that provides practical means to exchange information about competencies in a variety of business contexts. The Schema allows competencies to be defined one at a time, a step-by-step approach thay may allow for the piece-by-piece creation of comprehensive, coherent RLO libraries available in the future workplace.

References

Barron, Tom. (May, 2002). SRI Consulting Business Intelligence, "Learning Object Approach is Making Inroads". http://www.sric-bi.com

Bork, D., & Kiel, P. (December, 2001). "HR-XML Consortium: December 7, 2001, Interoperability Summit" [presentation] Contact: dan@ixmatch.com paul@hr-xml.org

Driscoll, M. (March, 2002) "Blended Learning". *e-learning magazine*, p. 54.

Roshan, V. (February, 2002). "How One Corporation Got a Charge out of e-Learning." http://www.cpsnet.com/reprints/2002/02/elearning.pdf

An Empirical Investigation of Student Satisfaction with Web-based Courses

Peter Leong
Department of Educational Technology
University of Hawaii at Manoa
United States
peterleo@hawaii.edu

Curtis P. Ho
Department of Educational Technology
University of Hawaii at Manoa
United States
curtis@hawaii.edu

Barbara Saromines-Ganne
Leeward Community College
United States
bsg@hawaii.edu

Abstract: Electronic communication has become an integral part of higher education. Along with the growth of electronic communication is the rise of Web-based courses. This empirical study surveyed 128 students enrolled in 29 courses offered entirely over the Internet to determine the dimensions which underlie student satisfaction with Web-based courses and examined how these dimensions can be used to predict student satisfaction levels. This study also examined the relationship between demographic variables, such as gender, year in school, students' prior computer, email, and Internet proficiency, as well as, Web-based course experience and their satisfaction levels with Web-based courses. The implication of this study is that instructors of Web-based courses may be able to increase their online students' satisfaction by addressing the appropriate factors underlying student satisfaction.

Introduction

The Internet has impacted the way we learn. More and more courses offered by institutions of higher education are delivered via the Internet. A recent survey by the U.S. Department of Education's National Center for Education Statistics (NCES) found Web-based distance education to be the most widespread mode of delivery (Lewis, et. al, 1999). At least 58 percent of institutions which offered distance education used Web-based courses, compared to 54 percent that used two-way interactive video and 47 percent which used one-way pre-recorded video. Because Web-based distance education is a fast-growing area, it is imperative that we gain a better understanding of this mode of distance education delivery. Most of the current literature about Web-based learning is based upon anecdotal experience or qualitative study (Kearsley, 1998). Many researchers agree that one of the greatest problems with online learning is the lack of empirical research and quantitative studies (McIssac & Gunawardena, 1996; Schlosser & Anderson, 1994; Sherritt & Basom, 1997). Numerous studies in the field of distance education have focused on the comparisons of student performance in distance-education courses versus traditional face-to-face courses (DeLoughry, 1988; Souder, 1993). The general conclusion reached by these investigators is that there is "no significant difference" between the performances of students in distance-education courses compared to traditional face-to-face courses (Russell, 1999; Schlosser &

Anderson, 1994). More recent research efforts have focused on student attitudes rather than the previous emphasis on student performance (Biner, et al. 1994). Biner, Dean and Mellinger (1994) contend that student satisfaction play an important role in determining the success of distance-education courses. The authors argue that sustaining positive student attitudes can result in a number of student benefits such as lower student attrition rates, and higher levels of student motivation.

The Study

This empirical study surveyed 128 students enrolled in 29 courses offered entirely over the Internet to determine the dimensions which underlie student satisfaction with Web-based courses and examined how these dimensions can be used to predict student satisfaction levels. This study also examined the relationship between demographic variables, such as gender, year in school, students' prior computer, e-mail and Internet proficiency, as well as, Web-based course experience and their satisfaction levels with Web-based courses. This research attempted to provide valuable information on the factors that influence the satisfaction of students participating in Web-based courses. The intent of the researcher was to obtain results from a quantitative study that would guide in the design and development of Web-based courses that would fulfill the needs of distance learners, thus ultimately leading to their success in distance-education courses.

The participants consisted of students who were enrolled in 29 Web-based courses in the University of Hawaii system, Hawaii Pacific University, Baker College, Michigan and Nova Southeastern University, Florida for the Fall 2000 semester. The 29 courses spanned a wide range of content areas: two Anthropology courses, one Astronomy course, one Biology course, four Business Management courses, six Computer courses, three English courses, two Educational Technology courses, one History course, one Japanese course, one Journalism course, three Mathematics courses, two Medical courses, and two Political Science courses.

Survey Design

A review of the existing literature on student satisfaction with Web-based instruction, distance education courses and general student course evaluations yielded eight dimensions and 47 question items for the survey questionnaire to ascertain the factors that underlie student satisfaction with Web-based courses. The eight original dimensions were instruction, instructor's aspects, management/coordination, technological characteristics, interaction, experience with system, workload/difficulty and expected/fairness of grading.

The survey questionnaire was divided into two sections. In Section A, students were given a list of 47 statements that addressed the eight dimensions that could potentially affect their satisfaction with Web-based courses. For each statement, students were asked to evaluate the extent of their agreement with each statement. Throughout the survey instrument, a five-point, Likert-type scale ranging from "Strongly disagree" to "Strongly agree" was used. In Section B, students' satisfaction, demographic and individual information was collected. Student satisfaction was measured based on students' responses to two survey questions: overall satisfaction with the Web-based course, and comparison of the course with traditional face-to-face classroom courses (DeBourgh, 1999). Information about students' prior experience with computers, the Internet, e-mail and Web-based courses was gathered. Demographic data collected included gender and year in school.

Procedure

A letter to solicit for survey participants was sent via e-mail to 29 professors who taught Web-based courses, who then forwarded it to their online students. Recruitment of participants was on a voluntary basis, although some instructors provided additional incentive for students to participate in this study by offering extra course credits for completing the survey. The primary method to obtain data was through an online survey questionnaire that was made available to the students from December 11 to 23, 2000. Overall, there were 508 students in the 29 Web-based courses surveyed. A total of 128 usable survey submissions were received, giving a response rate of 25.2 percent.

Data Analysis

All data was analyzed with the use of the SPSS® Version 10.0 for Windows statistical software package. Prior to any data analysis, negatively phrased items were first transformed to ensure comparability of data. Descriptive statistics such as means and standard deviations were calculated for the student satisfaction variables, levels of satisfactions, and the demographic data collected.

Factor analysis was performed on the 47 variables that were expected to underlie student satisfaction with Web-based courses to establish the major dimensions of online student satisfaction. Varimax orthogonal rotation was used. After applying factor analysis, the study examined the relationship between the dimensions of student satisfaction and the overall student satisfaction. Stepwise multiple regression was used to identify dimensions that significantly predict overall student satisfaction with Web-based courses. The dependent variable was a summated scale that consisted of two items: overall satisfaction with the Web-based course, and comparison of the course with traditional face-to-face classroom courses (DeBourgh, 1999). Independent variables were the five dimensions extracted by factor analysis. In addition, t-test and univariate analysis of variance (ANOVA) were used to answer the other research questions in this study.

Results & Implications

Of the initial 47 items in the original survey, only 26 items emerged after factor analysis was performed and they loaded on five factors that were named – interaction, instructor, system-wide technology, workload/difficulty, and function-specific technology, see [Table 1]. The interaction factor was comprised of seven questions measuring respondents' satisfaction with the interaction they experienced throughout the duration of the Web-based course. The instructor dimension was comprised of six questions that measured respondents' satisfaction with the instructor of the online course that they took. The three items that comprised the workload/difficulty dimension measured students' satisfaction with the workload and the level of difficulty of online courses. The system-wide technology dimension included six questions that addressed the general technological aspects of Web-based course systems, such as ease of access and navigation, "user friendliness", online enrollment/registration, and assignment submission. The function-specific technology dimension consisted of four items that dealt with specific technological functions or features that are common to most Web-based course management tools, such as online grade book, assessment, audio/video components, and online lecture presentations.

Dimensions of Online Student Satisfaction

Dimensions	Number of Questions
Interaction	7
Instructor	6
System-wide technology	6
Workload/Difficulty	3
Function-specific technology	4

Table 1: Five dimensions of online student satisfaction involving 26 question items

Regressional analysis performed revealed that the five proposed dimensions of online student satisfaction were related to overall student satisfaction. Overall student satisfaction is apparently influenced primarily by four dimensions: instructor, system-wide technology, workload/difficulty and interaction. None of the demographic factors examined, such as gender and year in school, had any significant impact on overall student satisfaction with Web-based courses. Similarly, students' prior experience with computers, e-mail, Internet, and Web-based courses did not have any significant impact on overall student satisfaction.

The implication from the results of this study is that instructors of Web-based courses may be able to increase their online students' satisfaction by addressing the appropriate factors underlying student satisfaction. For example, it may be possible for online instructors to alter how satisfied their students are with this aspect of their online course by providing more timely feedback, and making themselves more accessible to their students. Additionally, student satisfaction with Web-based courses could be improved by ensuring that general technological aspects of Web-based course systems, such as ease of access and navigation, are improved. Biner, Dean and Mellinger (1994) argue that student satisfaction plays an important role in determining the success of distance-education courses. Therefore, understanding these factors that underlie online students' satisfaction can lead to increased success of online courses.

References

Biner, P. M., Dean, R. S., and Mellinger, A. E. (1994). Factors underlying distance learner satisfaction with televised college-level courses. *The American Journal of Distance Education*, 8(1), 60-71.

DeBourgh, G. A. (1999). Technology is the tool, teaching is the task: Student satisfaction in distance learning. (Report No. IR019596). (ERIC document No. ED 432 226)

DeLoughry, T. J. (1988). Remote instruction using computers found as effective as classroom sessions. *Chronicle of Higher Education*, 34(2), 15-21.

Kearsley, G. (1998). A Guide to Online Education. Retrieved August 13, 2000 from the World Wide Web: http://home.sprynet.com/~gkearsley/online.htm

Lewis, L., Kyle, S., and Farris, E. (1999). Distance Education at Postsecondary Education Institutions: 1997-98. National Center for Education Statistics (NCES), U.S. Department of Education, NCES #2000-013. Washington, DC: U.S. Government Printing Office.

McIssac, M. S. and Gunawardena, C. N. (1996). Distance Education. In D. Johassen (Ed.), *Handbook of research for educational communication*. (pp. 403-437). New York: Macmillan.

Rainie, L. and Packel, D. (2001). More online, doing more. The Internet & American Life Project. Retrieved March 1, 2001 from the World Wide Web: http://www.pewinternet.org

Russell, T. L. (1999). *The no significant difference phenomenon: as reported in 355 research reports, summaries, and papers*. Raleigh: North Carolina State University.

Schlosser, C. A. and Anderson, M. L. (1994). *Distance Education: Review of the Literature*. Washington, DC: A.E.C.T

Sherritt and Basom, (1997). Using the Internet for Higher Education. (ERIC Document Reproduction Service No. ED 407 546)

Souder, W. E. (1993). The effectiveness of traditional vs. satellite delivery in three management of technology master's degree programs. *The American Journal of Distance Education*, 7(1), 37-53.

The Global and the Local:
policy and policy processes for education

Brian Lewis, Simon Fraser University
Jennifer Jenson, York University
Richard Smith, Simon Fraser University

> *"It's like riding the front car on the roller coaster. . . It may look like you're steering the cars, but in fact you're just holding on."*

A New Policy Context

This is how the head of the US House Telecommunications and Finance Subcommittee, Rep. Edward Markey, described his role as a key policy maker in 1994. . It is an cautionary statement, reflecting graphically the type of shell shock we have witnessed among teachers, principles, boards, and bureaucrats involved in education policy-making across Canada, even today.

An information revolution has shaken the world. The effects of this revolution are visible on micro and macro levels-- from the details of the way people live their lives every day, to the highest decisions of government. The *Economist* (1996) put it this way: "by reducing the cost of communication, IT (information technology) has helped to globalise production and financial markets. In turn, globalisation spurs technology by intensifying competition and by speeding up the diffusion of technology through direct investment. Together, globalisation and IT crush time and space.

Most countries are greeting the emerging communication technologies with new sets of globally harmonised regulatory and economic policies. In the formulation of these policies, they are facing the simultaneous turmoil induced by a series of related fundamental global trends: world-wide policy deregulation in telecommunications, the collapse of traditional national market barriers, economic concentration in truly transnational companies, and breathtaking technological innovation, as communication technologies converge into a digital sea.

This has led to profound questions about the role and nature of policy itself. Are the old values attainable -- or even desirable-- anymore? Policy makers everywhere have begun to find their traditional policy contexts inadequate, indeed irrelevant, to their work.

Policy decisions are crucial here. But never have policy makers seemed so overcome with events, so dazed, in such disarray. The information revolution has challenged the functions and capabilities of policy itself.

Policy is that set of written and unwritten rules and guidelines which institutionalise and put into operational forms the social contracts which define our institutions and organisations. Policy is at work at both macro and micro levels of governance and control: in government at all levels, and in virtually all other public and private institutions, including our universities and our school systems. Policy addresses both institutional procedures and institutional goals. It provides a framework for the structure of decision making within an organisation, and it rationalises the decision-making process in the context of substantive and idealized value sets which represent the goals of the organisation.

Policy can take progressive or conservative forms. In its progressive aspects, policy will be flexible and it will map and steer the development of the organisation in light of evolving

Implementing Library Instruction for Freshman Composition on WebCT: The Oakland University Experience, 2001/2002

Frank J. Lepkowski
Kresge Library
Oakland University
United States
lepkowsk@oakland.edu

Abstract: In 2001 the library at Oakland University decided to supplement classroom instruction for freshman composition classes with WebCT modules. This web-based instruction included library basics, using the Voyager catalog system and an introduction to the FirstSearch databases. Using this new instructional modality caused striking changes in the relationship between the library faculty and the Rhetoric program, in the librarians' practice of classroom instruction, and in students' perception of the learning outcomes. Librarians were extremely ambivalent about the WebCT instruction and came close to canceling it for the next academic year; Rhetoric faculty consistently evaluated the WebCT module more favorably than the librarians' classroom performance; students frequently approached their library instruction after WebCT with an assumption that they had already learned whatever was needed through online instruction. The most successful outcomes came when a.) librarians and Rhetoric faculty collaborated closely; b.) Rhetoric faculty ensured that their students completed WebCT before arriving in the library; c.) librarians forged ahead with new content in the classroom instead of reviewing what had been covered in WebCT; d.) the students arrived in the library ready to do research with a topic area for investigation already identified.

Introduction

Oakland University is a growing suburban commuter university located in Rochester, Michigan, some 25 miles north of Detroit. Historically the library has been quite pedagogically active, teaming with other teaching faculty to deliver course-related instruction that in recent years has reached more than a quarter of Oakland's 16,000 students annually. In 2001/2002 the library joined in the University's campaign to use WebCT to deliver online instruction. What follows herein is an admitted unscientific yet, it is to be hoped, objective and analytical report on the program's effects on students, writing faculty, and the librarians.

Organizational Context

At Oakland University, all students are required to take a sequence including Rhetoric 160, or Composition II, the crowning focus of which is the consummation of writing a research paper. For many years, the library has provided a full week (roughly 3.5 hours of class time) of instruction in research techniques for this course. In 2000/01, due to the increasing number of sections and a static number of librarians, the library was forced to reduce its contact hours per section from 3.5 to 2. After teaching for one semester with greatly curtailed content, the library attempted to replace some of the lost instructional time with a library instruction course using WebCT.

The University had committed itself to WebCT some time previously, and was sponsoring a big push to have instructors create content for online courses. Over the course of summer 2001, a WebCT module was created covering the basics of library layout and procedures, basic searching in the online catalog Voyager, and introduction to the use of FirstSearch full-text article databases. In order to deliver this to all Rhetoric students, the decision was made to create a WebCT course for each Rhetoric section, into which the library module was then inserted. Previously an online course would only have been created on a individual basis for those sections of Rhetoric where the instructor wanted to develop online material.

Thus the adoption of this module of online library instruction resulted in the web-enhancement of the whole Rhetoric program, including the classes of many instructors who were not otherwise interested in web development.

In particular the Rhetoric faculty had the essential role of ensuring that the students in each section had absorbed all of the online content before arriving at the library for 2 contact hours of classroom instruction by a librarian. Many of the rhetoricians were first-time users of WebCT and were it not for us would not have been placed in the position of having to be familiar with it. The library held training sessions for them and distributed assistive documentation both for the instructors and their students. As can readily be imagined, we found widely varying degrees of commitment to or even understanding of this task among the 30 or so Rhetoric instructors. Similarly the library faculty also needed training in the use of WebCT. Everyone involved was forced to come to terms with this new manner of delivering instruction.

Consequences of Implementation

For the librarians, the creation of this WebCT component altered fundamentally aspects of the pedagogical situation. For the first time, we had to assume prior knowledge on the part of our students, the absence of which had been axiomatic to (and a realistic basis for) our previous manner of instruction. In fact we were forced to make a great leap of faith that in fact the students would actually *learn* from the WebCT module and would bring to the library with them a base level of knowledge upon which we would build. This assumption led us into two principal and somewhat paradoxical areas of difficulty.

The first difficulty was with ensuring the students' completion of the WebCT portion of the class before arriving in our classrooms. Some of our colleagues in Rhetoric were most wondrously effective in extracting compliance from their students, and in sections like that we had 80-100% completion rates. In other sections the instructors showed minimal commitment to this goal, with the result being that some sections would arrive with only 5-20% having done the assignments. Occasionally we found a section where nary a blessed soul had done so, and not infrequently we considered a success a class with a 50-60% completion rates.

The conundrum for the librarians given this wide variance in the amount of preparation by our students was that of choosing a level to pitch the class to in our instruction. We librarians are a service-minded crew and we hate to have any lambs stray from the flock as we guide them through the steep paths and perilous desfiles of the research process; there is also the matter of confronting slack-jawed incomprehension as we try to forge onward. We had been used to trying to sense the level of our audience and calibrating our approach to what we found there; now we had an expectation which we were powerless to enforce upon which the level of instruction was predicated. The more hard-nosed librarians proceeded with planned instruction assuming the students had done the required preparation, and those more sensitive to the gulf of understanding tried to compromise by reviewing content from WebCT to a greater or lesser extent related directly to the incomprehension level in the class. This created not infrequently a profound resentment among those students who had done the work, and the faculty who had made some efforts to ensure their having done so.

The second difficulty was paradoxical in relation to the first. For a certain category of students it seemed that completion of the WebCT module conveyed not the gratifying sense of having learned the bare minimum necessary to begin library research, but rather an illusion of mastery of the topic which made further instruction otiose. Thus it was that some of these students became resistant to further instruction and did not seemingly understand how rudimentary their searching skills still were. A question for further inquiry is whether completion of online instruction leaves the student feeling he or she has learned more than the old, in-person mode of conveying knowledge—a prospect which cannot help but cause an tremor of uncertainty in even an experienced teacher's breast. In our experience it seemed to create resistance to further learning in some cases. It is perhaps not surprising that given the difficulties of implementing the new program and the uncertain position occupied by the librarian with respect to the material that a certain amount of resentment and negativity towards WebCT began to occur.

As the academic year ended, the library faculty considered the future of WebCT instruction and the Rhetoric faculty were asked to contribute to a frank assessment of the effectiveness of the library instruction program. Evaluation of the WebCT library module was consistently positive and its continued use strongly backed, which rather surprised us considering how negative our own view of it was. In fact, the rhetoricians were overall less positive about the classroom performance of librarians. This was especially true when librarians had been seen to cover material in class which had already been done on WebCT. Both the students who had done the work and their instructors who had worked energetically to ensure that they had felt betrayed by librarians' concession to the ignorance of the irresponsible students. Clearly librarians need to make adjustments to their instructional practice to capitalize on the opportunities offered by online instruction, by accepting the accountability of students for their work, and proceeding from the WebCT content as a starting point.

Practices Conducive to Success

Through discussion among the librarians, and also with the Rhetoric faculty at their retreat, elements were identified which seem to be essential to successful library instruction in the current environment. *First,* a close working relationship between the librarian and the rhetorician is extremely important. They need to be communicating well before the class comes to the library, working on the goals for the classroom instruction, sharing information about the topics of student research. *Second,* it is essential that the Rhetoric instructor require the students to work the WebCT module, preferably with a grade attached to it; students seem to take more seriously schoolwork that is in some direct way involved with their GPAs. The librarian should assist in this process by monitoring the progress of students in a section and informing the Rhetoric Instructor when there are laggards as the date for classroom instruction approaches.

Third, students must have a sense of their research topic before receiving the classroom instruction in the library. To see that what they have to learn is meaningful to them, even after having completed the wonderful WebCT module, there needs to exist a clear and ineluctable link between what they need to do for the instructor who will be giving them their grades, and what they have to learn in the library. The most reliable predictor of a successful, productive library session is when students have an impetus and specificity to their research needs. *Fourth,* librarians need to accept students' accountability for their actions and resist the temptation to cover basics that should have been learned through WebCT. The best means of doing this seems to be minimizing the amount of exposition at the outset of the library classroom teaching, and instead involving them in practical searching exercises involving their own research topics.

Thus, in order to be successful, course-related library instruction through WebCT needs to rely upon a close and committed collegial relationship between the librarian and the instructor of record, potent incentives for students to actually do the work, and classroom followup which is directly related to their research projects. In this blended mode of instruction, as rhetoricians are obliged to ensure students undertake the basic level of library instruction, so librarians are obliged to adapt their classroom practice in the light of a presumption of student accountability. Both sides of the instructional team benefit from this, as do, most importantly, our students.

social perspectives and goals. In its more conservative aspect, policy tends to entrench established institutional practices and power relationships in favour of stability.

Conservative policy becomes dysfunctional when it works against the recognition of the underlying changing realities of an organisation, and in favour of protecting the status quo. Dysfunctional policy assumes that the agreed-upon procedures and goals are fixed and natural—it denies the reality of the institution or organisation as an historical reality, and denies its own role as the operational form of evolving social and institutional relations. A conservative policy is dysfunctional when it is used to defend bad decisions on procedural grounds, when it is used to bolster an institution and its powers against beneficial change and evolution, when it becomes exclusionary and non-inclusive.

But policy breakdowns can occur at the progressive end of the spectrum as well. A progressive policy becomes dysfunctional if it is too far out front, if it is uninformed, short-sighted, pressure-group driven and non-inclusive.

Policies addressing the information revolution are largely meant to be progressive policies by their implementers—that is, they are intended to map, steer and facilitate institutional change in light of the promise of a technological and economic revolution. They are often "out-front" policies, leading social change.

Education Policy: The Global meets the Local

The "education revolution" must be understood as a critically important part of a more general information revolution—one front in a larger campaign. In this micro realm we find the same transformation of policy and the same transformation of values which we which find in the larger macro-economic and information policy spheres.

Policies addressing the implementation and use of new technologies within education find themselves firmly entangled within overall information and economic strategies. Increasingly, education policies find themselves straddling boundaries between educational and economic objectives, even subordinate to them. The "ivory tower," if it ever existed, exists no longer. (See also *The Tower Under Siege*, Brian Lewis, Richard Smith, Christine Massey, McGill-Queen's University Press, 2002)

In our work we have identified and clarified some of the most pressing issues arising from the implementation of computer-based technologies in schools. These questions include: technological, infrastructure, human resource and learning policy issues; questions of sustainability; questions of gender; and questions of public policy in an increasingly technocentric and commercial education environment.

Each of these issues speaks to the need for strategies designed to address how and why choices are made, who makes them, and to what effect, both intended and unintended. Too often the reverse happens: technology changes rapidly and decisions are made in a more or less ad hoc fashion, as administrators scramble in response to the initial promises of technology. And then these same administrators, as well as teachers, students and parents, must face unforeseen problems and demands triggered by its implementation. The cart drives the horse.

There is a critical need for an approach to the implementation of technology in our schools that pays attention to questions of policy, organizational culture, politics, and decision-making practices. That is the approach we have taken in our work. Technology for whom, why, when, where? What value does technology add to the educational experience? How are the decisions made? By whom?

These can all be understood as "local" questions, grounded in the needs of real people, in real circumstances and real contexts. Yet these local questions-- answers to which we believe are key to the successful implementation of any plan for education, technology or otherwise-- are too often subsumed by the global issues, objectives, and assumptions of plans to develop "knowledge workers for the knowledge economy."

In fact, it is as if a major social fault line has shifted: there has been a shift in our relationship to almost all social activity—which seems increasingly judged and evaluated against a touchstone of macro-economic objectives and priorities. Education has not escaped this shift. If education had once been an objective, a goal, a final cause, for many of its leaders, movers and funders, it has now become much more purely a means to the end of a more efficient and competitive economy and workforce, captured within the notion of the "knowledge economy."

Is policy important?

Our fundamental notions of the purpose and value of education have been drifting, migrating from a primary interest in civic, moral and individual development, from service to families and communities, to the interests of a developing economic and technological infrastructure. Education as a goal in itself, and as a vehicle for the development of the individuals and citizens has been largely devalued in the context of these global changes. Technology policies tend to reflect this shift in basic assumptions: technology policies for schools have been developed, implicitly or explicitly, in alignment with a larger, fundamental shift in values which tends to privilege economic activity and technology as ends, and which tends to favour one-size-fits-all solutions to diverse problems.

But while policy drift reflects social drift, it is not a one-way process, nor is it a simple, one-on-one relation. The global never entirely subsumes the local and the particular. The local is always grounded in the reality of peoples' lives, and it is always potentially a site of resistance and creativity. Policy decisions made at the lower levels—the classroom, the school, the district, the region-- feed back in to the system, and ultimately help determine the direction of change and the velocity of change. And the way in which policy decisions are developed encourages or discourages the buy-in of its participants and stakeholders. Ultimately, local policies assure or discourage the sustainability of change.

Policy-makers and administrators at the school, school district and governmental levels have a decisive impact on the direction of any school reform (Glennan, 1998). Parents are also important: often the key driver for technology in the classrooms, parents need information to judge the educational "value" of different types of learning resources. They would ideally be part of the policy-making process. And in the classroom, teachers must be given the ultimate responsibility for determining the appropriate application of these tools. It is where we find this type of process that we find successful technological implementation and practice.

Technology Policy for Canadian Schools

The overall picture we would paint of a progressive, healthy policy-making process for education is one in which an enabling, supportive context for experimentation comes from the top, while specific applications and innovations coming from the bottom, fully grounded in an understanding of local learner needs.

Policy makers must first ask WHY? What is the vision, the reason for change? What are our goals? Where do we want to go? These are the fundamental questions which should be driving technology policy for our schools. Defining and co-ordinating this vision is the first task of policy leadership. Provinces should have technology plans, with clear goals. Boards should have plans. Schools should have plans. And good planning should be rewarded with resources, up and down the chain. These plans have to be grounded in local and regional concerns: what do what do we want our children to learn? What works best as a learning strategy, a learning technology — why and for whom?

Policy makers must see technology as a means, not as an end. They must adapt a VALUE-ADDED approach to technology. There is no single solution because there is no single problem. Technology-enhanced learning must not be understood as a alternative to the traditional and legitimate teaching, training, service and community functions of a school, but as a way to add value to each of these functions in specific cases. How can the introduction of technology enhance learning, help build community and citizenship, expand the horizons of our learners, add value to the education experience and help us achieve our traditional educational goals, as well as new objectives?

Policy makers must ask HOW? A transparent and inclusive policy process is essential. At each level, managers needs to think carefully and consciously about the appropriate process for the development of policy. These processes need to be seen to be, and in fact must be, transparent and inclusive. They must locally appropriate—fit the institution and its history and culture. They must embody local/regional knowledge. They must include an implementation strategy. We are no longer entirely pioneers—we have a considerable body of successful and unsuccessful practice in front of us and we can learn from those examples. A first step should always be to attempt to foresee the problems, generate possible best practices, critique these practices in light of the local circumstances, and attempt to generate local solutions.

And finally, policy makers must be prepared to ask WHAT IF? We must reward experimentation, make room to play and grow, make room to fail. We need to increase the critical mass of examples of successful practice, at the local level. Good teachers teaching great courses, made better through new tools. Schools should encourage and legitimize innovation, create an environment which encourages risk-taking, and publicize it. The end result should be a critical mass of good examples, well publicized—as well as mistakes made and lessons learned (equally valuable). Policies have to be formulated which support innovation and make it sustainable, once achieved— incentives for innovation, professional development policies and policies designed to sustain both the technical and human resource infrastructures which are required.

A transparent and responsive policy practice combined with a value-added approach to technology will enable teachers to feel in control of these technologies, and encourage them to become innovators themselves, in their own attempts to fulfil the goals of their professional practice.

References:

Economist, (1996, September 28) "The Hitchhiker's Guide to Cybernomics," p. 1.

Glennan, T.K. (1998). "New American schools after six years." MR-945-NAS [WWW document]. URL: http://www.rand.org/publications/MR/MR945/MR945.pdf

Lewis, B., Massey, C. and Smith, R. (2001). *The Tower Under Siege: Technology, Power and Education*. Montreal & Kingston: McGill-Queen's University Press.

Enabling open network access during exams

Michael Chiles, Luby Liao, John Paul, Jeff Wright
University of San Diego
San Diego, CA 92110
mchiles,liao,jpl,jhwright@sandiego.edu

Abstract This paper presents our experiences of giving students open network access during exams while guarding against cheating. The practical information presented should be of interest to would-be practitioners and technological conservatives who can test their pedagogies with an aim to give their students the best education while ensuring academic integrity.

1. Introduction

A question frequently asked by instructors in an increasing number of disciplines is how to give an exam that allows students limited and controlled access to the Internet from classroom computers. The following question posted on the ACM SIGCSE Forum mailing list on May 5, 2002 is typical:

'Has anyone tried giving a programming exam for some of your intro-level courses in a lab? I always get complaints from students that it is not fair to write code on a piece of paper without using the tools they normally use (and they are right about that). So, I want to block a lab for 2 hours, and assign a few programming problems to work out, and let them do it. However, I want to somehow avoid them sharing efforts, so that might means having every machine disconnected from the network. What other issues are there? Has anyone tried this? Has it worked? Do students do better than in paper exams? ...'

This paper details one possible solution to this problem in the context of an Engineering Math course. Our approach addresses the poster's problem without disconnecting machines from the Internet.

In the Spring semester of 2002, Jeff Wright taught two sections of Math 110A: Engineering Math using Maple 6, a well-known computer algebra system in a lab equipped with Apple Macintosh computers. To run Maple, each computer must obtain a license from a remote license server which limits the total number of Maple users on the USD network at any given time. While students use Maple in class and during exams, they are encouraged to access the class web site where Jeff maintains copies of relevant Maple worksheets and other items of interest. To summarize, Jeff's problem is to allow students access to the remote license server and the class web site, but disallow other uses such as chat, email, instant messaging, and other unauthorized Net access.

On the flip side, the ideas presented here may be useful to people who for one reason or another believe that giving students any network access during an exam is a bad idea for pedagogical reasons other than the possibility of cheating. Our approach allows these hypotheses to be tested in a more direct way.

2. A conceptually very simple solution

Our solution is outlined in the following steps:

Publicize network access policy to students. Students are told that that they can use Maple and access the class web site during exams. Other intentional outbound traffic such as emailing is considered a violation. We further tell students that during an exam the inbound and outbound traffic of their machines will be captured and later analyzed for evidence of violation.

Exam time reconnaissance. During an exam, we record students' communication in the form of IP packets with other computers. The result is stored in a file that typically amounts to megabytes in size.

Post-exam analysis of the captured network traffic. Using the multi-megabyte file obtained in step two, together with the web access log of the USD web site, we generate various reports to identify possible network access violations.

3. Miscellaneous considerations

The campus network at USD is based on secure switched Ethernet, effectively transforming traditional Ethernet from a broadcast technology to a point-to-point technology. In this case the only packets a machine can normally see are its own and those broadcast packets sent by other computers in the same local area network. Hence, the arbitrary sniffing of all IP traffic on the network described above cannot be implemented until the campus network administrator performs a configuration procedure known as port mirroring [2]. Port mirroring involves copying all packets in and out of all the monitored machines to a specific monitoring machine, known as the 'sniffer'.

A separate issue at USD is a strong privacy policy that prohibits unauthorized sniffing of IP packets. We address this by performing the following steps before giving an exam we wish to monitor:

- request that the network administrator performs port mirroring to enable exam time reconnaissance.
- notify Academic Computing that we will be sniffing packets during exams.
- let the students know that we will be sniffing their packets during exams.

4. Technical details

1. First, we obtain a list of the Media Access Control (MAC) addresses of the classroom computers from the campus network administrator. Every campus computer connects with the campus network using an Ethernet card. Every Ethernet card has a permanent and unique MAC address of the form `hh:hh:hh:hh:hh:hh`, where `h` is a hexadecimal digit. Note that 'MAC' should not be confused with the Apple Macintosh computer. The relevance of MAC addresses lies with the fact that our lab computers obtain their IP addresses from a DHCP server when they are powered on. These IP addresses are dynamic as opposed to static because they can potentially change from time to time rather than staying fixed. MAC addresses, on the other hand, remain fixed and serve to identify the computers and the students using them.

2. Immediately before the exam, we run the following command on the designated 'sniffer' computer on the same local area network running Redhat Linux 7.2:

```
tcpdump ether host 00:05:20:C5:67:40  or 00:05:20:96:3F:2E or ...
```

Note the use of MAC addresses to specify the monitored machines in this command, rather than the potentially transient dynamic IPs. Here '...' stands for the remaining long list of other MAC addresses. What follows the `tcpdump` command is an example of a filter expression. In practice, since the filter expression is very long, we use a more convenient form:

```
tcpdump -F tcpdump_exp
```

where `tcpdump_exp` is a file that contains the filter expression and `-F` instructs `tcpdump` to read the filter expression from the file. This command will capture all inbound and outbound packets from all the machines listed in `tcpdump_exp`.

Tcpdump is a freeware packet-sniffing program available for Unix and Windows machines. Tcpdump can be installed with the following simple rpm command on computers running Redhat Linux:

```
rpm -Uvh tcpdump-3.6.2-12.i386.rpm
```

A fragment of the output from the `tcpdump` command follows:

```
07:29:09.967237  xyz203.sandiego.edu.1612  >  www.sandiego.edu.http:  P
607407960:607408445(485) ack 2259258923 win 32768 (DF)
07:29:09.973142  xyz203.sandiego.edu.1611  >  www.sandiego.edu.http:  P
607340903:607341388(485) ack 2259236870 win 32768 (DF)
```

The first line says that at 7:29 AM, the machine `xyz203.sandiego.edu` sent a packet from its port `1612` to the USD web server machine `www.sandiego.edu` which listens on the well-known port `80`, symbolically named `http`. '>' visually indicates the direction of the communication. For details of the meaning of the output line components, we refer the readers to the documentation for `tcpdump`, and [1].

Even though we specify MAC addresses in the `tcpdump` command, the `tcpdump` output identifies machines using their DNS names and not MAC numbers. At USD the DNS names of the monitored machines are programmatically mapped to their dynamic IPs in an intuitive way. For example, `xyz203.sandiego.edu` has IP address `192.215.84.203`. Thus, we need a table that maps the MAC address of each machine to its dynamic IP during the exam. We use another freeware packet sniffing program called `ettercap` to produce this table. The command is

```
ettercap -Nl
```

The output columns, aside from the first, are IP address, MAC address, and fully qualified domain name of each lab computer:

```
14) 192.215.84.172        00:05:02:37:24:9F      xyz172.sandiego.edu
15) 192.215.84.190        00:05:02:F5:2B:04      xyz190.sandiego.edu
16) 192.215.84.205        00:50:E4:05:DA:55      xyz205.sandiego.edu
17) 192.215.84.207        00:05:02:1E:D0:6F      xyz207.sandiego.edu
```

3. The final step is to analyze the `tcpdump` output. Visually scanning it is instructive, but since the readable output file is megabytes in size, it is useful to write scripts to generate reports from the `tcpdump` output file. We used the Python programming language to develop these scripts, but any language with strong text processing support, such as Awk or Perl, could be used. As an illustration, we show fragments of two HTML reports we generated. The next two tables in the first HTML file report on two machines, `xyz157` and `xyz159`. These tables show outbound traffic of each machine. The three columns of the tables are the source port used, the destination machine and the destination port.

Outbound traffic from xyz157.sandiego.edu

src port	destination	dst port
netbios-ssn	lsanca1-ar22-4-33-006-054.lsanca1.dsl-verizon.net	2463
1857	http://www.sandiego.edu/	http
netbios-ssn	adsl-66-125-108-220.dsl.scrm01.pacbell.net	2487
netbios-ssn	66-105-104-140.customer.algx.net	2843
1861	http://www.sandiego.edu/	http
Bootpc	dhcp1.sandiego.edu	bootps
1865	http://www.sandiego.edu/	http

Outbound traffic from xyz159.sandiego.edu

src port	destination	dst port
netbios-ssn	lsanca1-ar22-4-33-006-054.lsanca1.dsl-verizon.net	2459
netbios-ssn	adsl-66-125-108-220.dsl.scrm01.pacbell.net	2483
netbios-ssn	66-105-104-140.customer.algx.net	2839
http	211.219.112.180	3267
Bootpc	dhcp1.sandiego.edu	bootps
netbios-ssn	HSE-Ottawa-ppp240974.sympatico.ca	1798
netbios-ssn	64.128.149.45	1875
http	218.11.130.38	4820

Immediately we notice that the student machines contacted various *targets* that appear suspicious or require further investigation. To wit,

1. on line 1, `xyz159` talked to the server running on port `2459` of `sancal-ar22-4-33-006-054.lsancal.dsl-verizon.net`. Is this a violation?

2. on line 2, `xyz157` talked to the USD web server listening on port `80` (symbolically named `http`) of `www.sandiego.edu`. In this case, further investigation is needed to decide whether xyz157 was accessing Jeff's home page at `http://www.sandiego.edu/~jesper` legally, or someone else's web site such as `http://www.sandiego.edu/~cheater` illegally.

Note that in the first case, `xyz159` talked to its target using a privileged port `139`, symbolically named `netbios-ssn`. This contact was not initiated by the student and therefore does not represent a violation. In the second HTML report we generated, such irrelevant records are filtered out.

To answer the second question, a simple programmed scan of the USD web site access log will suffice. To emphasize the importance of this simple but essential procedure, imagine the following scenario. Student A prepared his cheating group by training the members to use Netscape editor to publish to a common web site http://www.sandiego.edu/~cheater. During an exam, all the group members open Netscape editor to constantly publish their solutions to the site for their members to see. A simple Unix command `grep` applied to the web access log will catch this.

As promised, the next HTML report excludes irrelevant information from the report.

Outbound traffic from xyz157.sandiego.edu

src port	destination	dst port
1857	http://www.sandiego.edu/	http
1861	http://www.sandiego.edu/	http
1865	http://www.sandiego.edu/	http
1865	http://www.sandiego.edu/	http
1870	http://www.sandiego.edu/	http
1882	http://www.sandiego.edu/	http

Outbound traffic from xyz159.sandiego.edu

src port	destination	dst port
49152	dns.sandiego.edu	domain
49158	ftp08.apple.com	ntp
1367	http://www.sandiego.edu/	http
1363	http://www.sandiego.edu/	http

Line 1 of xyz159's table is the result of a contact to the Domain Name Server of USD, typically triggered by a web page request. Line 2 is a request from xyz159 to ftp08.apple.com, a time server, to synchronize the computer's system clock. Neither of these packets could be used by students to carry out clandestine communications.

5. Conclusion

After the post-exam analysis, we found no evidence of cheating. We feel that our method is effective for empowering students while preventing them from abusing their power. This practice enriches Jeff's teaching method and benefits his students. Our successes have encouraged us to continue to work to improve and streamline our approach and to experiment with new ones. The Python programs we have written to generate the reports are not refined enough to be published, but they can be useful to some people as examples. Feel free to email `liao@sandiego.edu` to request copies.

6. References

[1] S Northcutt & J Novak, Network intrusion detection, New Riders, 2001

[2] R Seifert, The switch book, Wiley computer publishing, 2000

Development of Web Server Surveillance Software

Introduction:

In early 1970s, David Bell and Leonard La Paula developed a model for secure computer operations. This model was based on the concept of various levels of classified information (Unclassified, confidential, secret and top secret) and various levels of clearance. If a person had a clearance level that dominated the classification level of a file, that person could access the file. If the persons clearance level was lower than the file's classification, access would be denied. This was used in the defense. The Trusted Computing System Evaluation Criteria (TCSEC) also known as Orange Book in 1983 defines Computer System accord in the following scale:

D-the minimal protection or not rated
C1-Discretionary Security Protection
C2-Controlled Access Protection
B1-Labeled Security Protection
B2- Structured Protection
B3- Security Domains
A1- Verified Design.

The other attempts are the German green Book in 1989, the Canadian Criteria in 1990, the information Technology Security Evaluation Criteria (ITSEC) in 1991 and the Federal Criteria in 1992. The concept was that common application environments could develop their own profiles for security functionality and assurance levels. The profile would then be used by some authority to certify the compliance of computer systems.

When Computers are networked together, new security issues arise and old issues arise in different ways. The Orange Book did not address the issue of networked computers. The Trusted Network Interpretation of TCSEC (TNI) took all the requirements of the Orange Book and attempted to address a networked environment of computers. Few systems were evaluated under TNI and it did not achieve commercial success. Hence it appears that none of the solutions by themselves solved all of the security problems. A good security system proposed is a mix of all of these solutions and many more. The intent is to prevent legitimate users from using the server for sending and spreading information harmful for the human society.

Security Essentials:

Computer security (COMPUSEC) is necessary to control access on our computer systems and Network Security (NETSEC) is needed to control the security of LAN. Together all of these concepts provide information Security (INFOSEC). Technology has progressed too fast for most of the proposed process. The anti virus software, Access controls like user ID, smart cards, biometric and Firewall are some preventive methods. A firewall cannot prevent an attacker from using an allowed connection to attack a system. If a webserver is allowed to be accessed it is vulnerable to an attack, since the user is already in the internal network.

Security Threats from legitimate users:

Intrusion Detection Systems (IDS) were once treated as the solution to the entire security problems. Intrusion Detection Systems (IDS) have existed for a long time. No longer it is needed to protect our files and systems, but just identify when someone was doing wrong and stop them. Some IDS have the ability to stop attacks before they were successful. No IDS is foolproof. They cannot detect legitimate users having incorrect access to informations. There are 2 types of IDS.

1.Host based H-IDS

2.Network-based (–IDS)

These have well defined criteria for what constitutes a penetration attempt and what constitutes the security perimeter. This perimeter can be defined by fire walls, telecom demarcation points,

The Defining Goals are :

- Detection of attacks
- Prevention of attacks
- Detection of policy violations
- Enforcement of use policies
- Enforcement of connection Policies
- Collection of Evidence

Proposed Web Server Surveillance:

The proposed Web server Surveillance System is shown in Figure.

Monitoring mechanism ensures that the users are constantly checked for the content of the traffic without violating the privacy policy. Policy Management schemes choose on what to monitor. IDS schemes are used to detect any malicious intent. Pattern Recognition schemes can be used for comparing with harmful patterns. Natural language Processing is also used.

When suspicious activity occurs, there are five steps that can be taken to determine the nature of the activity. These are:

1.Identify the systems using IP addresses.

2.Log additional traffic between Source to Destination.

3.Log all traffic from the Source S.

4.Log the contents of packets from the Source

5.Calculate the vulnerability and threat level.

Following each of the steps, a determination should be made as to whether sufficient evidence has been found to identify the activity as an attack.Choosing how to respond is critical. Setting Thresholds are necessary to compute Vulnerability and threat The response can be Passive response or Active response If the event occurs once and does not repeat, it is very difficult to confirm. Some anomalies are almost impossible to completely investigate.

GUI tools are used to prepare daily/weekly/monthly reports.

Conclusion:

This Web Server Surveillance Software will prevent users from wrong use of the powerful tool of Communication, the Internet. Also it will prevent Web Server hosts to monitor legitimate users indulging in spread of violence using the server facility.

The Effect of E-mail Project on Enhancing EFL Learners' Academic Writing Skills

Huifen Lin
Department of Adult Education, Instructional Systems, Workforce Education and Development
Penn State University
United States
huifen5612@yahoo.com.tw

Abstract: This paper aims to report the findings of a study conducted to examine if E-mail is an effective tool in enhancing EFL students' academic writing skills. The participants in this study consisted of 8 college students majoring in English as a foreign language in a senior college in Taiwan. Each student was assigned one or two key-pals from eight countries. The findings suggested that although e-mail was proved to be an "authentic communicative writing activity" (Weasenforth &Biesenbach-Lucas 1998), it provided little or no benefits in improving students' overall academic writing skills. However, Email exchange provides an authentic audience that promotes two-way communication and its spontaneous nature and "informal conversational texts"(Marcus 1995) responds to most EFL professionals' belief that language acquisition is more likely to take place when there is a purpose to communicate and there exists an anxiety-free circumstance to do so.

Literature review

With the advent of the era of information, new technologies have been explored extensively in the business, commerce and educational field regarding the effectiveness, potential applications and implications they can bring to benefit the life, work and learning of human beings. The impact of technologies on education has, in particular, received increasing research interest when gathering amounts of findings suggested that if appropriately employed, technology can enhance learner involvement (Warschauer,1996;Kelm,1992), promote collaboration among learners and provide learning environments or tasks that traditional classrooms cannot offer. Computer-mediated Communication (CMC), among other technologies, provides tools that vastly transform means and nature of communication which EFL instructors can take advantage of and integrate into a communication-oriented, learner-centered language classroom. The most appealing feature of CMC is its creation of learning environments in which communication can be engaged beyond geographical boundaries and time constraints. Asynchronous type of CMC, for example, e-mail and BB, involves interactions to occur at different times; on the other hand, synchronous mode, including chat, IRC, and MOOs, enables communication to take place at the same time (Sussex & White 1996).According to Murray (2000),CMC, as "a salient mode of communication" has taken on a new role as a facilitator in the English language learning and instruction. Overall, the realities and potential of electronic communication for reducing learner frustration, easing learning process and creating self-paced learning environment have been recognized through the 1990s by proponents for Communicative Language Teaching (CLT), a method that emphasizes the acquisition of communicative competence being the goal of language instruction. Many ESL/EFL professionals have conducted in-depth research on the effect of e-mail on language teaching, hoping to take advantage of the unique features of the electronic text that this medium generates to assist students' learning of the target language. Research findings do suggest the implementation of e-mail projects in L2 classroom improve students' participation (Kamhi-Stein & Browne-del Mar 1997) and furthermore, foster a "student-student interaction"(Ady 1999;Kern 1996).Sakar (2001) on his research on the cross-cultural effects of e-mail on EFL students also suggested that e-mail exchange provided foreign language learners opportunities to be exposed to both reading and writing practice of the target language and also had great influence on learners' perception and attitudes toward the target language culture and people. Task-based or content-based approaches have been a center of discussion among ESL/EFL professionals and instructors, who believe that by dealing with real-life activities or projects, students gain access to "authenticity"-authentic materials and interactions and become highly motivated, as opposed to the artificial or pseudo interactions created from traditional language classrooms (Wolff, Universitat &Wuppertal 1998). Compared to traditional snail mail, e-mail has become more and more popular with its obvious advantages such as the high speed, low cost and ease of editing and revising. Numerous websites nowadays provide service for people or institutions looking for key pals to conduct projects or collaborative works. These e-mail exchange projects or tasks create a process-oriented, learner-centered language learning environments in which students can practice their reading and writing and oral skills indirectly if the task is appropriately designed.

The Study

The setting for this study was a course titled "Project-based Language Learning" in a five-year senior college English department in Taiwan. A successful complement of the course will lead to partial fulfillment for a Bachelor's degree in language and arts. The course objectives include (a) to provide opportunities for meaningful use of the target language on a task or project basis (b) to integrate previously learnt knowledge in different disciplines such as international business, English teaching methodologies, survival English,etc into the project or task design (c) to recognize the value of collaborative work on the process of language learning and (d) to demonstrate to the department faculty that students have achieved a more-than-satisfactory level of English by successfully turning in the final product of the project and orally present and defense it in front of faculty members and their fellow students. After a preliminary research and productive brainstorming process, the class decided the topic of the project," You've got mail-multicultural exchange" and specified the objectives of the project as "to further improve our English ability, especially writing and reading skills. To be exposed to different cultures, accept them and then develop open-mindedness toward cultural diversity; to reduce conflicts resulting from misunderstandings and to try an alternative way to learn a language". (cited from the project preface written by students). This project included three major stages. First, the preparatory stage, the author guided students to log on the net and browsed websites for interested e-pals. Students were advised to look for at leas 3 e-pals from the target culture he/she was interested in and were practicing sending practice e-mail to each other and to the author before starting the e-mail exchange with international e-pals from U.S. Britain, Austria, Korea, Japan, Germany, Argentina and Sweden. The duration for this project was 3 months, covering 8 topics specifically related to culture. Each participant in the project was required to write and reply to each e-mail message at least one time per week. Second, students turned in off-line essays featuring the cultural topics of the e-mail exchange by making reference to the information given by their e-pals, materials collected from school library or searched from the Internet. At the end of the project, the author expected to receive 8 essays from each of the participants, which were then used to compared with the transcripts of the e-mail messages to examine any significant difference in speech registers employed in both types of writings and in particular, to identify the linguistic features employed in academic writings. Finally, questionnaire and interviews were conducted to draw students' feedback on this e-mail exchange project and the aspects of language learning students especially benefited from this activity.

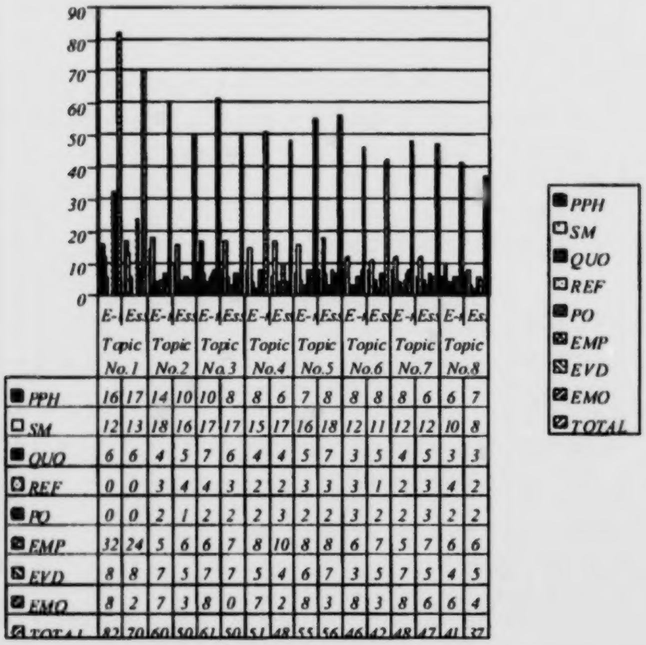
Findings

64 essays and 64 e-mail messages from participants were analyzed according to the linguistic features or speech registers associated with academic writings specified in Table 1. Several insightful findings can be drawn here.

- Paraphrasing, summarizing and giving examples were composing techniques that were used more frequently in both writings.
- Quotation and supporting claims with evidence were two skills that were the least employed in both writings, compared to the other six techniques.
- In e-mail messages, it's easier to appeal to the emotions of the writers/readers as opposed to the paper-and-pencil essay writings.
- There was no significant difference in terms of the frequency of the speech registers associated with academic

writing used in both types of writings.

•The scripts of e-mail messages revealed more carelessly-made errors such as subject-verb agreement, spelling and run-on sentences that mostly would not take place in traditional essay writings.



	Topic No.1		Topic No.2		Topic No.3		Topic No.4		Topic No.5		Topic No.6		Topic No.7		Topic No.8	
	E-	Es	E-	Es	E-	Es	E-	Es	E-	Es	E-	Es	E-	Es	E-	Es
■ PPH	16	17	14	10	10	8	8	6	7	8	8	8	8	6	6	7
□ SM	12	13	18	16	17	17	15	17	16	18	12	11	12	12	10	8
■ QUO	6	6	4	5	7	6	4	4	5	7	3	5	4	5	3	3
▣ REF	0	0	3	4	4	3	2	2	3	3	3	1	2	3	4	2
■ PO	0	0	2	1	2	2	2	3	2	2	3	2	2	3	2	2
▩ EMP	32	24	5	6	6	7	8	10	8	8	6	7	5	7	6	6
▧ EVD	8	8	7	5	7	7	5	4	6	7	3	5	7	5	4	5
▨ EMO	8	2	7	3	8	0	7	2	8	3	8	3	8	6	6	4
▨ TOTAL	82	70	60	50	61	50	51	48	55	56	46	42	48	47	41	37

Table 1: Number of occurrence of academic writing features

Note: PPH-:paraphrase; SM-summarize;QUO-quote;REF-making reference; PO-taking positions; EMP-giving examples; EVD-supporting claims with evidence; EMO-appealing to the emotions

Questionnaires and interviews conducted shortly after the project indicated that participants, in general, believed that e-mail as a writing tool (a) introduced them to a world that they can engage in real, authentic interactions, (b) motivated them to write more and regularly and overcome the language difficulties to get meanings crossed, (c) provided permanent records or resources that they can retrieve or make use of for later work, (d) allowed them to write for real readers/audience instead of writing for the sole reader- the instructor and (e) gave them opportunities to be in contact with more colloquial, informal or dialectal use of the target language, which would be otherwise impossible under the circumstance of traditional language instruction.

Conclusions

This study has shown valuable insights into how EFL students responded to the use of e-mail as a writing tool and the results appeared to suggest that although no significant evidence could be identified to prove that EFL learners improved their skills for writing for academic purposes via involving in the e-mail exchange project, it's still widely recognized that "e-mail provides a context-rich, meaning focused, authentic communicative writing activity" (Weasenforth & Biesenbach-Lucas 1998). Students demonstrated an unexpected level of involvement and enthusiasm towards communicating via e-mail to increase their cultural awareness and language practice opportunities. Cummins (2000) has provided a framework for academic language learning which suggests that focusing on meaning, language and use is essential in language instruction "in order to develop students' access to and mastery of academic registers". Email exchange provides an authentic audience that promote two-way communication and is spontaneous, natural and informal conversational texts responded to most EFL professionals' belief that language acquisition is more likely to take place when there is a purpose to communicate and there exists an anxiety-free circumstance to do so. To conclude, e-mail exchange activity could be appropriately integrated into language instruction given the features and advantages derived from this study; nevertheless, further research on its potentials in promoting language learning compared to other CMC tools can be conducted to provide instructional suggestions for EFL instructors..

References

Ady, J. (1999).Computer-mediated communication in a high school global education curriculum: A brochure project. Social Studies, 90,159-164.

Cummins, J. (2000). Academic language learning, transformative pedagogy and information technology: Towards a critical balance. TESOL Quarterly, 34, (3), 537-547.

Hartfiel, V.F., Hughey, J.B., Wormuth, D.R. &Jacobs, H.L.(1985).Learning ESL composition. Rowley,MA: Newbury House.

Horowitz, D.M. (1986d). What professors actually require: Academic tasks for the ESL classroom.TESOL Quarterly, 20,445-462.

Kamhi-Stein, L.D., & Browne-del Mar, C.(1997).EFL teachers and e-mail instruction: Perceived language and professional benefits. CAELL Journal, 7(4).14-19.

Kelm, O. (1992). The use of synchronous computer networks in second language instruction: A preliminary report. Foreign Language Annals, 25,441-454.

Kern, R. (1996). Computer-mediated communication: Using e-mail to explore personal histories in two cultures. In M.Warschauer (Ed.), Telecollaboration in foreign language learning (pp.105-119). Honolulu: University of Hawaii Press.

Macus, S. (1995).E-mailiorating student writing. Electronic Learning, January 1995,18-19.

Murray, D.E. (2000).Protean communication: The language of computer-mediated communication. TESOL Quarterly, 34(3), 397-421.

Sakar, A. (2001). The cross-cultural effects of electronic mail exchange on the Turkish University students of English as a foreign language. CALL-EJ Online,3(1),Retrieved from http://www.lerc.ritsumei.c.jp/callej/6-1/sakar.html

Spack, Ruth. (1988).Initiating ESL students into the academic discourse community: How far should we go? In T.Silva & P.Matsuda (Ed.),Landmark Essays on ESL Writing (pp.91-108). NJ: Hermagoras Press.

Sussex. & White. (1996). Electronic networking. Annual Review of Applied Linguistics 16, 200-225.

Warschauer, M. (in press-a). Millennialism and media: Language, literacy, and technology in the 21st century. In Proceedings of the 1999 World Congress of Applied Linguistics. Tokyo:Waseda University.

Warschauer, M. (1996). Comparing face-to-face and electronic discussion in the second language classroom. CALICO Journal, 12,7-26.

Weasenfoth, D., Biesenbach-Lucas, S.(1998)The appropriateness of E-mail in composition instruction- linguistic and rhetorical analysis.Retrived July 30,2002 from INSA-Lyon scientific and technological university website: http://www.insa-lyon.fr/Departments/CDRL/use.l[illegible].html

Wolff, D., Universitat, B. &Wuppertal, G.(1998)The use of e-mail in foreign language teaching. Retrieved July 30, 2002, from INSA-Lyon scientific and technological university website: http://www.insa-lyon.fr/Departments/CDRL/use.l[illegible].html

A STRUCTURED APPROACH TO PROGRAM EXPANSION FROM ON-CAMPUS TO DISTANCE DELIVERY

Marilyn Lockhart, Richard Howard, Larry Baker
Montana State University
Bozeman, MT USA

Introduction

The decision at higher education institutions to expand programs and classes from on-campus to distance delivery often has not been made using a systematic, structured approach. Instead, the change at most institutions, particularly those with limited resources, has been driven by political forces, with state legislators, governing boards, and administrators issuing directives to implement the delivery of courses and programs through computer media. These mandates are passed on to deans and department heads, who in turn, look to faculty members to make distance delivery a reality. Arguments of resource savings and enrollment increases seem to be the primary motivation for these mandates. The directives have been presented with minimal consideration or understanding of the impact on faculty. Often, faculty are expected to design and deliver the courses under assumptions and resources similar to those of delivering on-campus classes. A recent review of selected institutions in a state university system revealed that over the past three years, the progress of transitioning from on-campus course delivery to on-line class delivery has been slow, often resulting in faculty and administrator frustration. Gaps between what administrators have promised external constituents and what faculty have delivered have been significant. As external expectations of distance delivery increase, institutional administrators are experiencing increasing pressure with limited ideas about how to enhance the delivery of on-line courses and programs at their institutions.

The purpose of this paper is to present a model of a structured approach to designing and delivering distance education. Adopting a structured approach to identify issues and solutions associated with the development and implementation of distance delivered courses and programs will result in enhancing the campus's ability to meet external expectations, while providing administrators and faculty with a mechanism to identify and recommend needed processes and required resources to deliver quality distance education.

Overview of Structured Decision Making

Structured decision support offers an avenue for the creation of sustainable and positive innovation, in this case, the expansion from only on-campus course delivery to on-line delivery. This structured approach enables college and university administrators to produce a link to faculty and students, increase performance, improve quality, and streamline processes that are easier to manage. Rational or structured decision support typically reflects analytical processes in which models are built that reflect various alternatives that a decision maker can make and assess potential outcomes. In general, these analyses are quantitative in nature and revolve around the relationships of factors/outcomes and related resources. While these models provide important information, their usefulness in the decision making process should be viewed as a starting point. A process of structured or rational decision making reflects the creation of information (quantitative and/or qualitative) that is integrated into the knowledge base of the decision makers and other constituencies across the campus. The results of this integration are the creation of intelligence, which is then brought to bear on the decision that needs to be made. In this process, the empirical information is analyzed, interpreted, and integrated into the knowledge base of the decision makers. The resulting intelligence is the integration of both the results of the data analysis and the decision maker's existing knowledge about the context in which the decision is to be made. Once a decision is made, assessment of the impact of the decision provides the campus with increased organizational intelligence. Critical in this process is the ability to access valid and reliable resource and productivity/outcomes data, and through appropriate analyses, create quality information that is communicated effectively to decision makers.

Using The Structured Approach to Distance Delivery Decision Making

Since the motivation for distance delivery often comes from forces external to the institution, mentioned earlier, often there is a resulting disconnect between administrators and faculty. This structured approach provides a method of eliminating this disconnect or gap between administrators and faculty, as well as providing an avenue for creating the knowledge and information needed for making decisions about distance education. The specific model presented below modifies and simplifies a business redesign process developed by the National Association of College and University Business Officers (NACUBO) and has been used by the authors for examining and improving other academic and administrative processes. The approach should function well in expanding higher education offerings from on-campus to on-line delivery.

The structured approach to making decisions about distance education should begin with several underlying mission values formulated and articulated by senior management. These would include the formation of partnerships between administrators and faculty, the delivery of quality programs and classes, and the use of technological and financial resources to their fullest advantage; all in support of the mission of the institution. The approach includes a three-tiered hierarchy, with continual communication among individuals in the different levels of the hierarchy.

The first tier consists of a "Steering Committee", composed of senior level administrators, charged with providing guidance and oversight to the institution-wide endeavor. Their role is to assess institutional readiness/administration, develop a long-range distance delivery plan, and approve policies, procedures, resources, and other support needed to move efforts forward.

The second tier is a "Process Owners Group" which consists of members from areas of the institution that are directly involved in the processes that "own" implementing distance delivery. Administrators and faculty from the colleges/departments and individuals from information technology center, faculty development, student services, and other key areas should be represented in this group. The "Process Owners Group" forms the work teams, writes project charges, and reviews and approves team recommendations.

The teams are composed of a mixture of faculty and administrators who are actually involved in carrying out the distance education initiatives. Some topics that teams might address include: faculty services, instructional design/course usability, student readiness and support, and student learning outcomes and retention. The teams could answer questions such as:

- How does the institution prepare the faculty pedagogically and technologically to teach on-line course? What improvements are needed in this area?
- What incentives are and should be provided to faculty?
- How do faculty need to be supported during instruction?
- How do we prepare students to take distance classes?
- How user friendly is the technology to students?
- What services, such as library, registration, and ongoing help is available to students? How effective are these services? What are the additional student support needs?
- How should we measure learning outcomes?
- What are the outcomes of distance classes?
- What are the retention rates of on-line students?

The groups operate as teams, rather than as committees, receiving training in team work and structured decision making. Potential team members are interviewed in advance of appointment to assess available time, commitment to the project, and the ability to be a "team player." Team leaders receive in-depth training on the structured approach to decision making and group dynamics. Characteristics of good teams, such as having clear and identified team roles and responsibilities, conducting open discussions, possessing high levels of trust, displaying cooperation and collaboration, exploring and confronting differences, sharing of decision making, and participating equally, are described and developed among group members by the team leader. Collaboration among teams and between teams and the rest of the campus is encouraged and fostered by scheduling communication/progress reports.

Teams may redesign current activities or create new ones. Practices at other institutions are researched and compared to the context of the home institution. Some teams may distribute surveys to key groups (internal and external) in order to obtain data related to distance delivery. Some may conduct interviews with key stakeholders to gather in-depth, detailed data. Following the structured decision making process, recommendations based upon these data are created. Each team is expected to design a business plan that includes personnel and resource implementation requirements, benefits, potential barriers, and an assessment strategy for each set of recommendations.

Plans are presented to the "Process Owners Group" and "Steering Committee" for final approval.

Conclusion

A structured approach to the development and implementation of distance delivery on a campus can eliminate the gap between external expectations and campus realities. Some institutions may discover they should move more cautiously towards distance delivery than others. A structured approach is more likely to be received favorably by faculty because realistic support requirements have been identified and recognized by administers and faculty. The result will be realistic expectations of a distance education program that is consistent with the campus's resources to support it. In addition, through this structured process, identification of the campus's capacities to deliver distance education provides substantive information for discussions with external constituencies about needed resources.

A Feedback Model and Successful E-Learning

Yiping Lou
Department of Educational Leadership, Research and Counseling
Louisiana State University
United States
ylou@lsu.edu

Helena Dedic & Steven Rosenfield
Vanier College & Concordia University
Montreal, Canada
dedich@vaniercollege.qc.ca & rosenfis@vaniercollege.qc.ca

Abstract: Based on the literature concerning feedback, self-regulated learning and cooperative learning, this paper discusses a model of effective feedback that can be used to support student learning in computer-mediated environments. The model portrays the learner and teacher/peers as actors who both provide and receive feedback in interlocking loops during learning activities. Findings from two illustrative examples in science and social science classes indicate that while e-learning settings offer the opportunity to enhance feedback during the learning process, effective feedback structures are not automatically a part of interactive simulations, computer-mediated communication or other e-learning settings. Effective feedback in e-learning requires careful design and experimentation.

Introduction

This paper discusses a model of effective feedback useful in supporting student learning in computer-mediated environments. The word feedback is often used loosely. In this paper we define feedback as an informational message sent by one element of a system to another element, with the expectation that the receiving element will use this message to modulate its performance. For example, a home heating system consists of thermostats, a control switch and a heat source. The thermostats compare room temperature to a predetermined desired temperature, and then send messages to the switch telling it to either turn the heat source on or off (Doig, 2000). Such a system is only functional if: appropriate messages are sent to the switch; the switch correctly interprets messages; the heat source responds effectively to the situation. Thus, feedback is a message sent with the intent of moving the recipient from a current state to a goal state. We will refer to effective feedback as feedback that meets four conditions: 1) feedback recipients have a clear understanding of the gap between their current state and their goal state; 2) appropriate corrective messages (feedback) are sent and received; 3) feedback is interpretable by its recipients; and, 4) recipients possess prerequisite prior knowledge, motivation, and strategies to respond effectively to the feedback. We will first describe our model of effective feedback that is rooted in research on: feedback, self-regulated learning, and cooperative learning. We will then describe two situations drawn from science and social science classes that will illustrate the differences inherent in computer-mediated learning environments and standard face-to-face settings, when viewed through the lens of our model.

A Model of Effective Feedback

From a constructivist perspective, learners build knowledge by cognitively elaborating new information, by reconciling with previously held views both the data gained through their own observation and experimentation, and through external feedback. Similarly, teachers as course designers function as self-regulating systems when they construct new task and feedback structures in a process involving elaboration and experimentation, as well as reconciliation of previously held views with feedback information provided by actions and performance of learners.

Research on feedback has accumulated a wealth of information concerning the impact of feedback on student learning. Several meta-analyses (*e.g.*, Bagert_Drowns et al., 1991; Azevedo & Bernard, 1995) synthesizing this research found that providing feedback versus not providing feedback has a significant positive effect on student achievement, however, the effects of elaborate feedback with explanation were generally found to be significantly larger than simple feedback without explanation. This research has primarily focused on external feedback, as provided by a teacher either directly or via a computer, after student performance.

Research on self-regulated learning (*e.g.*, Butler & Winne, 1995) suggests that learners generate internal feedback during the cognitive process of monitoring. Self-regulated learners monitor their own academic performance, affect and learning strategies. They rely on internal feedback to guide the selection of appropriate strategies and corrective action if their goals are not being met. They seek external feedback when they cannot resolve problems on their own.

Research on small group cooperative learning indicates significant positive effects of small group learning over whole class or individual learning if appropriately structured (Abrami et al., 1995; Lou et al., 2001) and that those who gave or received peer explanations tended to achieve higher than others (Webb, 1989). This research suggests that peers can be another source of external feedback.

Based on the above three areas of research as well as constructivist theories of learning, we have created a model of effective feedback that incorporates all three sources: self, teacher and peers (see Figure 1). In the model, learning/teaching involves simultaneous feedback loops, one centered on the learner and another (completed by the dashed line) centered on the teacher/peer. Solid arrows indicate feedback, while hollow arrows represent corrective actions in response to feedback. Note that a teacher's/peer's corrective action is simultaneously external feedback for the learner. To portray this duality we use both solid and hollow arrows flowing from the teacher/peer to the learner.

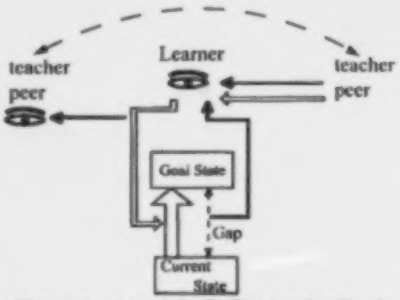


Figure 1. A model of effective feedback

In this model learners are viewed as active self-regulators, who seek feedback and then respond to it. Learners depend on the instructional setting to provide both the tasks from which they can draw data, and the feedback structures that allow them to gauge their performance (Pintrich, Marx & Boyle, 1993). In turn, teachers who create these same task and feedback structures need feedback from learners regarding the effectiveness of the structures. Thus, effective teaching depends on teachers being sent appropriate messages by the students; the ability of teachers to interpret those messages; and, teachers having appropriate skills to respond effectively to messages. That is, teachers, as course designers, form another self-regulating system that initiates changes based on feedback gathered from the actions and performance of learners. Alternatively, peers who offer constructive criticism, form another self-regulating system that interacts with that of learners.

While this model applies both to face-to-face and computer-mediated learning environments, there are vital differences in the type, timing, and sources of feedback used in these different learning settings. For example, in face-to-face classrooms, feedback to individual learners during the learning process tends to be short and simple due to time constraints. More elaborate feedback may be provided to the whole class, but targeting a mythical "average student". Public feedback aimed at an "average student" discourages and bores high-ability students while confusing less apt ones. However, when elaborate feedback is one-on-one, between teacher and an individual student, no student other than the individual involved in the interaction benefits. In the computer-mediated environment individual feedback need no longer be private, nor must public feedback be targeted at the "average student". For example, with discussion boards, public feedback provided by the teacher to an individual student can benefit other students with similar misconceptions. This knowledge motivates teachers to provide more elaborate feedback, which leads to higher performance standards in the class. On the other hand, teachers and learners in face-to-face settings have the advantage of synchronous verbal and non-verbal communication. In face-to-face settings, a good instructor constantly "reads" the class and modifies instruction to maintain student involvement. In computer-mediated settings this type of information is absent and new ways of "reading" involvement must be used.

With two very different e-learning settings, one in science classes using Web-based computer simulations,

BEST COPY AVAILABLE

and one in social science classes using Web-based discussion boards, we will illustrate and draw lessons concerning the interlocked loops of learner and teacher; and then the interlocked loops of learner and peer.

Feedback and Web-Based Simulations

Interactive simulations are frequently used in computer-mediated instruction with the intention of allowing learners to rapidly generate many "instances" of a particular phenomenon. Learners are expected to discover a pattern or rule that explains the phenomenon (hypothesize), and then to verify their hypothesis by interpreting visual (graphical) feedback. For example, in our Calculus course students were asked to observe an animated tangent line moving along a graph of a given function, and then to predict the shape of the graph of the derivative of the given function. Then, a simple modification caused the animation to rerun with the addition of a plot of a graph of the derivative function, thus providing immediate feedback for the student's prediction. After a few tries some students discovered the true nature of the relationship between a function and its derivative, in fact gaining a more general mathematical thought process as well.

In face-to-face classrooms the teacher explains such a relationship, but students rarely discover it in this deeper manner. However, teachers obtain feedback from classroom discussion and non-verbal messages students send, aiding teacher assessment of the depth of conceptual understanding the students have attained. In response to such feedback the teacher can modify instruction immediately. In a computer-mediated environment, where students interact with a computer simulation, the teacher does not get this same feedback.

On the surface it appears that the use of simulations, with visual feedback, enhances student understanding at the expense of feedback for the teacher. However, the situation is more complex. The use of simulations to facilitate learning complex concepts imposes demands on learners not encountered previously in face-to-face settings. First, some students may lack even basic computer skills necessary for learning in a computer-mediated environment. While the number of such students is rapidly decreasing, any such students may actually find that this context hinders rather than facilitates learning. Second, many students may have developed a rigid method of monitoring their own understanding in a subject, and thus may not value feedback that is delivered through the computer interface (Dedic, Rosenfield, Cooper, & Fuchs, 2001). Finally, the ability of students to interpret complex visual messages is often limited. Our work highlighted two ways of helping students to understand such feedback: deliver visual messages in stages, with initial messages being visually simple, and layers of complexity gradually added; and, augment visual feedback with elaborative textual feedback (Alalouf, Klasa, Dedic, & Rosenfield, 2002).

Providing feedback to teachers is a problem in computer-mediated environments for two reasons: the teacher does not obtain such information directly from students, and modifications to the environment require preparation time, therefore resulting in a delay in teachers' responses to any feedback that is obtained. We found that both students' answers to pop-up quizzes, and perusal of student activity log files can generate the requisite teacher feedback. Our research demonstrates that students' answers on pop-up quizzes correlate with achievement after the activity, thus feedback in the form of answers to pop-up quizzes allow us to predict how students are developing conceptual understanding. Further, access to log files allows teachers to trace students' activities during the use of simulations. However, both of these mediums for obtaining feedback must be built into the environment (e.g., Winne, 1989).

Feedback and Web-Based Discussion Boards

CMC tools, such as web-based discussion boards, are increasingly being used in distance education courses or as a supplement to traditional face-to-face classroom teaching and learning, especially in social science courses. One common usage of discussion boards is to enable group/class discussions on topics and issues related to the course. This asynchronous communication provides students with opportunities to reflect and respond to each other thoughtfully. Another effective use of discussion boards is for teachers to provide public and elaborate feedback to either an individual student, or the whole class, so as to benefit more students. For example, in group/class discussions, the instructor can monitor discussions and provide feedback when misconceptions arise. In our social science classes we also used discussion boards to provide detailed feedback on each individual or group project, and to encourage all students to read and comment on the work of others, as well as reading the instructor's feedback. Thus, students not only learned from each other, but also developed a better perception of their learning gap, and consequently helped make feedback effective.

Few studies have been conducted to document how, using CMC, peer feedback between and among students working on different projects can be structured successfully. The primary concern has been that learners are unable to provide each other with quality feedback (Latham, 1997). Our work in a graduate course in instructional design and an undergraduate course in educational technology integration, however, indicates that if appropriate structures and guidance are provided, peer feedback during project-based learning can be beneficial to both the provider and the receiver of the feedback. The strategies used to provide guidance, modeling, and scaffolding in the two courses using class discussion board and group spaces on Blackboard (2000) included: instructor modeling during the early part of the course; the provision of evaluation rubrics; and, the development of common criteria for best projects. In the midterm and end of course evaluations students responded very positively to the structured peer feedback approaches used in the class. Peer feedback placed students in the position of providing feedback, not just receiving it. This promoted student meta-cognitive and critical thinking skills and helped students develop multiple perspectives, thereby increasing achievement motivation and improving self-regulation in learning.

Conclusion

At the core of this paper lies our model of effective feedback involving interlocked feedback loops, portraying learners and teachers/peers as actors who both provide and receive feedback. The model, based on constructivist learning theory and self-regulated learning, emphasizes the importance of gathering learners' process and performance data, and providing feedback during the learning activities so that learners will be effectively guided toward achieving their desired learning goals.

Our findings concerning feedback in science and social science classes indicate that e-learning settings offer the opportunity to enhance feedback during the learning process so that student learning outcomes and affect are improved. However, it is important to note that effective feedback structures are not automatically a part of interactive simulations, CMC or other e-learning settings, and that teachers must actively design them in, and recursively continue to refine them through experimentation.

References

Abrami, P.C., Chambers, B., Poulsen, C., De Simone, C., d'Apollonia, S., & Howden, J. (1995). *Classroom connections: Understanding and using cooperative learning.* Toronto, ONT.: Harcourt -Brace.

Alalouf, E., Klasa, J., Dedic H. & Rosenfield, S (2002). *Conceptual understanding versus algorithmic computation in Calculus: Strawman or real conflict.* Paper presented at the annual meeting of the Association de la Recherche Collegial, Quebec, PQ, Canada.

Azevedo, R. & Bernard, R. M. (1995). A meta-analysis of the effects of feedback in computer-based instruction, *Journal of Educational Computing Research, 13*, (2), 111-27.

Bangert-Drowns, R. L. Kulik, J. A., & Morgan, M. T. (1991). The instructional effect of feedback in test-like events, *Review of Educational Research, 61*, 213-38.

Blackboard, Inc. (2000). *Blackboard, version 5* [Computer software]. Washington, DC: Blackboard.

Butler, D. L, & Winne, P. H. (1995). Feedback and self-regulated learning: A theoretical synthesis, *Review of Educational Research, 65*, 245-81.

Dedic, H., Rosenfield, S., Cooper, M., & Fuchs, M. (2001). "Do I really hafta? WebCAL, A look at the use of livemath software in web-based materials that provide interactive engagement in a collaborative learning environment for differential calculus." *Educational Research and Evaluation, 7*(2-3), 285-312.

Doig, S. M. (2000). *Developing an understanding of the role of feedback in education.* http://www.tedi.uq.edu.au/conferences/A_conf/titles.html, accessed Feb 28, 2002.

Latham, A. S. (1997). Learning through feedback. *Educational Leadership, 54*, p. 86-7.

Lou, Y., Abrami, P. C., & d'Apollonia, S. (2001). Small group and individual learning with technology: A meta-analysis. *Review of Educational Research, 71*, 449-521.

Pintrich, P. R., Marx, R. W., & Boyle, R. A. (1993). Beyond cold conceptual change: The role of motivational beliefs and classroom conceptual factors in the process of conceptual change. *Review of Educational Research, 63*, 167-199.

Webb, N. M. (1989). Peer interaction and learning in small groups. International Journal of Educational Research, 13, 21-39.

Winne, P.H. (1989). Theories of instruction and of intelligence for designing artificially intelligent tutoring systems. *Educational Psychologist, 24*, 229-259.

The Development of a Web-Based Continuing Education Course for Camp Nurses

Jo Lynne Lundy, RN, M.S. Ed.
Doctoral Candidate
Nova Southeastern University
USA
lundyjo@nova.edu

Abstract: Camp nursing is a growing area of specialized nursing practice and there are very few continuing education courses available to the nurse preparing to assume the camp nurse role. Approximately 10,000 camps are currently in operation in the United States and nurses are the most common healthcare providers for those camps. Camp nurses cannot rely on traditional medical equipment and supplies; they must use their own skills, clinical knowledge, critical thinking and problem-solving abilities to make independent decisions and nursing interventions. This research study focused on the collection of data in order to design, implement, and evaluate a Web-based continuing education course for camp nurses. The goals of this study were to determine if camp nurses are receiving specific educational interventions and role orientation prior to assuming camp nursing duties, and to use that information to develop a Web-based course that would enable nurses to bridge the gap between what they know and what they need to know in order to function effectively in the camp nursing role.

Introduction

Nursing is a dynamic process with the opportunity to practice in a variety of clinical settings. The traditional hospital-based practice is the most common, but there are many areas of practice that require specialized education. Camp nursing is one nursing specialty that is experiencing rapid growth. The American Camping Association (ACA) estimates that approximately 10,000 camps are currently in operation in the United States, and an estimated 9 million youth attend camps annually (ACA, 2001). Each accredited camp is required to have a healthcare provider on the property when campers are present, and this provider is most often a registered nurse.

Most nurses are unfamiliar with the outdoor milieu and must learn to adapt clinical skills and patient care to the camp setting. Camp nurses cannot rely on traditional medical equipment and supplies; they must use their own skills, clinical knowledge, critical thinking and problem-solving abilities to make independent decisions and nursing interventions. Due to varying geographical locations, local cultures and customs, and differences in communities, each camp presents unique nursing challenges (Erceg & Pravda, 2001). The nurse working in a camping environment must be prepared to deal with illnesses and injuries in the prehospital setting, and must be adequately trained to handle emergencies of all types.

Two key elements of camp nursing practice are a specialized educational program and a role orientation that will prepare the nurse to practice independently and competently in that specific nursing role. Without a standardized approach to camp nurse education, there can be no consistent standard of outcomes in clinical decision-making, and ultimately in the quality of patient care (Goodman, 1997). The Association of Camp Nurses (ACN) has published *The Scope and Standards of Camp Nursing Practice* (ACN, 2002), but there are presently no national educational standards or standardized courses to prepare nurses to function in this clinical environment.

Nurses enter the camp healthcare environment with a wide variety of backgrounds and experiences. Most nurses practice alone at camp, and without specialized education and role orientation, nurses assuming the role of the primary health care provider in a camp setting do not possess the knowledge base to be successful in that role. An educational course for entry-level camp nurses should include these essential elements: specifying the role and work setting, identifying competencies required to care for specific illnesses and injuries, writing performance criteria, implementing educational programs, and developing evaluation methods to determine when the performance criteria have been met (Alspach, 1990). Two other factors important to the success of a camp nursing course are planning and implementing the program effectively, and selecting an appropriate instructional delivery method (Phelps, 1996).

Goals and Research Questions

Very little has been written in professional nursing literature regarding educational courses for camp nurses. The few references to this topic tend to be standard-setting statements by camping organizations or "how-to" reports from camp nurses themselves. Camp nurses are usually hired for the position without ever having seen the camp and with just a phone interview with a camp administrator. It would seem appropriate for camp administrators to hire only the most experienced nursing candidates, but this may not be a viable option. Employment of experienced nurses in the camp setting may be difficult due to nursing salary expectations that camps are unable to meet, expanded autonomous role challenges that may be beyond the nurse's scope of practice, and the anxiety associated with increased patient acuity in a nontraditional nursing environment (Author).

Nurses seeking to practice in the camp environment should have access to a course designed specifically for the camp nurse, and an orientation to camp nursing practice prior to assuming that role, that is sufficient to enable them to practice safely (Maheady, 1991). This may be difficult because traditional nursing courses and orientation programs are usually not available in the camp clinical setting. Most camp nurses have to accept on-the-job training and orientation to the new role. Nurses in this situation must be accountable for self-assessment of their knowledge and skills deficits and for using self-study mechanisms in order to meet established practice standards. Before any deficit of knowledge, skills, and attitudes can be identified, it is essential to know which of these are necessary in order to deliver a high quality of care (Lindner, 1998).

The goals of this study were to determine if camp nurses are receiving specific educational interventions and role orientation prior to assuming camp nursing duties, and to use that information to develop a Web-based course that will enable nurses to bridge the gap between what they know and what they need to know in order to function effectively in the camp nursing role. This study attempted to answer the following research questions:

1. Are entry-level camp nurses being prepared for the camp nursing role?
2. How are camp nurses preparing for the role of camp nurse?
3. What is the essential course content for a Web-based course for the entry-level camp nurse?
4. How can the effectiveness of a Web-based course for the entry-level camp nurse be evaluated?

Methodology

A descriptive survey design was utilized for this study. The executive committee of the Association of Camp Nurses reviewed and approved this project, and the roster of membership of the ACN was provided as the study sample (n=346). The sample possessed the characteristics and qualifications from which the required data could be obtained, and was representative of the target population. Due to a lack of literature and research on camp nursing, no previously existing instrument was available, and no existing nursing instrument was suitable for adaptation. The survey questionnaire *Camp Nursing: A National Survey* was developed using currently available nursing literature and professional standards for camp nurses published by the ACN. In order to answer the research questions proposed in this study, the survey topics included camp nurse demographics, characteristics of camp health centers, camp nurse job descriptions, the process for and content of camp nurse orientation, and the evaluation of camp nurse orientation outcomes.

Prototype Web-Based Course

The inflexible nature of nursing practice and rapidly changing healthcare reform present challenges to camp nurse education; traditional classroom options do not usually meet the needs of camp nurses. The World Wide Web (the Web) offers many opportunities to deliver quality basic and continuing education; however, barriers to Web-based delivery of an educational course for camp nurses include access to the course from a remote camp setting (not all camps have computers or Internet access available), financial resources of the camp and the camp nurse, obtaining the resources and expertise to build and implement the course, maintaining technical support, and Web hosting issues such as security, sufficient storage space, and knowledgeable system administration (Horton, 2000).

A prototype course was designed using the data collected from the review of literature and the content portion of the survey. The course was delivered via the *Blackboard* course creation Web site (www.blackboard.com). The data obtained from the content section of the survey was used to determine the content that was included in the camp nurse course. A pilot course was developed offering three *modules of instruction*; the three content topics receiving the highest percentage of response in the survey were included in the prototype course: role of the camp nurse (94.8%), asthma management (93.6%), and management of routine illnesses and injuries (91.8%). Evaluation of the prototype course was performed by six camp nurse evaluators from various disciplines; they were given user names, passwords, and the instructions required to access the course.

Findings

The data analysis revealed that full time camp nurses and seasonal camp nurses did not have statistically significant differences in their responses to the content portion of the survey; both groups of nurses generally agreed that the topics queried were important, although the full-time nurses appear to agree more strongly. Both groups felt camp issues were more important than medical knowledge, although nurses who were not full-time camp nurses appear to feel more strongly about this. The mean number of years of nursing experience of the respondents was 21.3. The mean number of years of camp nursing experience of the respondents was 8.5. Only 22.7% of those responding had taken an online course prior to completing the survey, but 98% of those who had taken an online course indicated that they would take another online course in the future. 56.8% of camp nurses reported that they did receive some type of orientation; however, this orientation was described as including as little as a camp tour, to a one-week comprehensive orientation. Methods utilized by nurses in preparing for the camp nurse role include reading the camp policy and procedure manual (78%,)reviewing nursing and medical textbooks (48%), reading journal articles (49.1%), and taking a tour of the camp (49.0%). 82.8% of camp nurses received only on-the-job training for the camp nurse role.

Conclusions

The findings suggest that camp nurses are utilizing self-directed learning methods in order to prepare themselves for the camp nursing role. The survey results indicated that camp nurses prefer for initial and annual updates to be accomplished via face-to-face workshops/seminars, Association of Camp Nurses conference presentations/standards, and reviewing textbook information. Online courses were identified as being important for annual continuing education updates, but most of the respondents preferred face-to-face continuing education offerings for initial preparation.

Until there are educational courses specifically designed for camp nurses, this population should continue to use self-directed study methods to prepare for the camp nurse role. Each camp has unique medical, geographical, and cultural concerns, and the camp nurse must be prepared to care for that specific camper population. The nursing profession is based on human contact and many of the respondents indicated that the preferred delivery method for continuing education offerings is in the traditional face-to-face setting. However, those respondents who were more comfortable with computer skills indicated a preference for online continuing education.

References

Alspach, J. (1990). Critical care orientation: A discussion of survey results. *Critical Care Nurse*, 10(6), 10-16.

American Camping Association (2001). *American Camping Association*. Retrieved September 15, 2000 from the World Wide Web: http://www.acacamps.org/.

Anderson, D. (2000). *Internet and Web Design for Teachers: A Step-by-Step Guide to Creating a Virtual Classroom*. New York: Longman Publishing Group.

Association of Camp Nurses. (2000). Scope of Practice Statement. *Compass Point*, 10(4), 12-13

Bitter, G., & Pierson, M. (1999). *Using Technology in the Classroom*. Boston: Allyn and Bacon.

Blakeley, J, & Curran-Smith, J. (1998). Teaching community health nursing by distance methods: Development, process, and evaluation. *The Journal of Continuing Education in Nursing*, 29(4), 148-153.

Erceg, L., & Pravda, M. (2001). *The Basics of Camp Nursing*. Martinsville, IN: American Camping Association.

Goodman, D. (1997). Application of the critical pathway and integrated case teaching methods to nursing orientation. *Journal of Continuing Education in Nursing*, *28*(5), 205-210.

Horton, W. (2000). *Designing Web-Based Training: How to Teach Anyone Anything, Anywhere, Anytime*. New York: Wiley.

Lindner, R. (1998). A framework to identify learning needs for continuing nurse education using information technology. *Journal of Advanced Nursing*, *27*(5), 1017-1020.

Maheady, D. (1991). Camp nursing practice in review. *Pediatric Nursing*, *17*(3), 247-250.

Phelps, S. (1996). Off to a successful start! The use of self-study for hospital-wide nursing orientation. *Journal of Continuing Education in Nursing*, *12*(1), 7-12.

Vaughn, T. (1998). *Multimedia: Making It Work* (4th ed.). New York: Osborne McGraw-Hill.

Acknowledgements: This project could not have been accomplished without the advice and encouragement of Dr. Gertrude Abramson, my mentor and dissertation advisor at Nova Southeastern University, the Association of Camp Nurses (with special thanks to Linda Erceg), and Darek Nalle, PhD (University of Nevada-Reno) who provided invaluable statistical advice.

E-learning pedagogy: The reveal of value adding learning processes. Definitions and Implications for dynamic learning content delivery

Miltiadis D. Lytras
Athens University of Economics and Business, Greece
Department of Management Science and Technology
Email: mdl@aueb.gr

Abstract

E-learning seems to suffer from the heritage of many "e" things that in the last decade formulate the new business environment. The overestimation of the role of technology causes a misunderstanding concerning the key issues in e learning (Lytras and Pouloudi 2001). Our approach for e-learning recognizes three dimensions as the critical pillars that have a direct impact in e-learning performance: E-learning pedagogy (Lytras and Doukidis 2001), (Lytras and Doukidis 2000) , knowledge management (Lytras and Doukidis 2000), (Lytras, Pouloudi et al. 2002), (Lytras, Pouloudi et al. 2002) and Application Integration. This paper focuses on E-learning pedagogy. Our intention is to provide a thoroughly analysis of parameters that justify a pedagogical strategy for e-leanring exploitation. The ultimate objective is to investigate the role of specific learning process in the exploitation of learning content and in the support of dynamic unique learning experiences.

1. Introduction

The case of human resources management in business environments is of vital importance for the establishment of business strategy (Carter and Scarbrough 2001). Knowledge exploitation and learning capability (Ryan 1995), seem to be two integrated aspects of the same phenomenon: The establishment of continuous improvement flexible mechanisms for the exploitation of the intellectual capital in business and academics environments (Coulson 2000). In this context where the investigation of the performance of the undertaken effort is of critical importance for the justification of investments, the detailed analysis of success factors in e-learning is of critical importance.The Multidimensional Dynamic E-learning Model (MDL model) (Lytras and Doukidis 2000), (Lytras and Odman 2001), summarizes a hypothesis, that in e-learning the overall performance can be overviewed in the mass of a cube which boundaries are determined by three parameters. The e-learning pedagogy dimension, the Knowledge Management sophistication and the application integration dimension.

The Multidimensional Dynamic e-Learning (MDL) Model is based on three complementary dimensions:⊡ The Knowledge Management dimension ⊡ The e-Learning dimension ⊡ The application integration dimension. Each of these describe in synopsis detailed considerations that confront the ecooperation platforms such as knowledge management systems with embedded e-learning pedagogy and capacity of dynamic integration with other crucial business applications. To be more specific we will use three explanations for the three dimensions of MDL model. The **Knowledge Management Sophistication** summarizes the ability of the e-learning platform to manage learning content in various formats, to re-use learning modules and to support knowledge management processes such as knowledge creation, knowledge codification, knowledge transformation and knowledge diffusion. The **E-Learning Dimension** stands for the ability of an e-learning system to construct effective learning mechanisms and learning processes that support the achievement of different educational goals. With no doubt this dimension incorporates issues like learning styles, learning needs, learning templates as well as learning specification settings. The **Application Integration Dimension** summarizes for the e-learning platforms the capacity of collaboration with other business applications in order to obtain learning content from real business operations. This dimension seems to be the less detected on the common platforms and this causes a number of gaps for the effective implementation of cooperation systems. The critical issue of insufficient content in many situations is due to the inability of the organizations to establish a knowledge generation mechanism through the operation of information systems that support the most important business processes. Our paper is trying to explain further the e-learning pedagogy dimension. The detailed analysis of each dimension formulates an analytical tool where the delivered value in an e-learning collaboration can be represented in the surface of the cube.

2. Describing methods for Learning Value classification

One of the major obstacles in e-learning is the static approaches to the delivery of learning content. If we assume that in an e-learning system we can obtain sufficient content then the key question is how do you diffuse it to learners and how can we establish effective motivation mechanisms?

For this purpose we decided to analyze the propositions of well-known researchers such as (Bloom and Krathwohl 1984), (Shuell 1992). The key idea of their work seems to has a direct impact in every implementation that refers to learning. But let start our syllogism concerning their relevance of their propositions in learning. The traditional approach in e-learning is mainly focused on the development of session and their delivery through internet usually through a Learning Management System. Unfortunately these platforms do not prove their learning capability. A hypothesis whenever we refer to information systems is that the users of systems require the fulfillment of several needs and potentially this fulfillment is based on a value realization. In other words transforming this general statement in e-learning context we can claim that an e-learner demands the reveal of value components when he/she interacts with the e-learning system. This value realization can be investigated in different level: Technology, content, functionalities, processes, communication etc. But irrelevant of the level, the key

BEST COPY AVAILABLE

understanding is that e-learning is mainly a learning phenomenon. From this perspective the value that the engagement of information and communication technologies promote in e-learning has primarily to be realized through the learning sophistication of the whole system. The cataloguing of learning objects in a database (which is several packages such as WebCT is not as simple) does not mean that learning is guaranteed.

The main this of the e-learning is the specification of engagement mechanisms with the learning content. If we establish capabilities that will set an environment where learners feel motivated and are engaged in learning content exploration then their perception of value is increased. In this direction three concepts are core [illegible] detail analysis: Namely educational objectives, learning processes and learning functions.

2.1 Bloom's & Shuell' s Approaches

The limited space of this paper do not give as the opportunity to discuss in detail two approaches that have for many supported the educational design. The development of a classification framework for writing educational objectives was the main contribution of Bllom in three domains Cognitive, Affective and Psychomotor. Especially in the cognitive domain the hierarchy opf educational goals incorporates: **Knowledge, Comprehension , Application , Analysis , Synthesis.** The taxonomy is hierarchical in the meaning that levels increase in difficulty and sophistication as well as cumulative since each level is based on previous levels or it assumes them as cornerstones in a step b step process that promotes the achievement of well defined objectives. Additionally the 6 levels can be used as an investigation basis, which promotes the learning performance and the highest possible degree of learning content exploitation. Especially in an e-learning environment a such starting point is very crucial. The dispersed learning objects can be packaged using a value adding proposition through learning processes with specific life cycles overstepping the uncertain learning outcomes in the traditional approach where a hierarchical structure of linked modules sets a static learning scenario. The combination of different learning processes and the justified enrichment with metadat a of the various learning objects in order to support different learning processes seems to be an effective knowledge and learning management mechanism. . More over if we accept this scalable qualitative distinction of learning processes then we can un derstand why the attachment of metadata admit personalized learning since each learner could exploit learning objects in the basis of the selection of specific learning processes. The cognitive level of learners in this way, becomes the value driver for increased learning performance. Shuell identified a set of psychological processes, such as raising attention, expectations and motivation, activating prior knowledge and perform monitoring, that foster effective learning in the student. The perception of the learning function as "*an attribute of the learning material in a specific context*" is highlighting the purpose of our research in e-learning. If we can justify several learning processes that are based on the research findings of Bloom and Shuell then t he context for the exploitation of the learning content is secured. In this case for each piece of learning material the author or the knowledge provider has to state the learning processes it serves for the various learners. The list of the 12 learning fnctions determined by Shuell is: Expectations, Motivation, Prior knowledge activation, Attention, Encoding, Comparison, Hypothesis Generation, Repetition, Feedback, Evaluation, Monitoring, Combination, Integration, Synthesis

2.2 The MDL value proposition for e-learning pedagogy

The contributions of Shuell & Bloom propositions facilitate our research. The integration of their approaches can provide a value-oriented approach concerning the delivery of learning content. The distinction of different educational goals and learning functions that promote a goal-oriented delivery of content promotes a dynamic parameterization in an e-learning environment. The dual concern of Shuell model, the fact that the specified learning functions can be utilized both by learners or educators influences and our approach: In an e-learning environment the content is provided by authors and is exploited by learners. But the packaging mechanism of content has to based in metadata that promote the dynamic nature of learning content exploitation. If we try to integrate the main ideas that underlie in the two approaches (Bloom, Shuell) , then we have to admit that there is a qualitative distinction of learning performance which is promoted through specific functions or processes that prerequisite different cognitive skills and promote different value to learners. From this perspective the key issue of how to organize and package the learning content and how to engage learners in an e-learning environment can be derive sophistication through the establishment of dynamic learning processes. The combination of learning processes that have specific life cycle set the context for learning scenarios. The advantages of this approach is that if we specify metadata that support more than one learning process then this increases the exploitation capabilities of a learning object and promote a personalized learning environment. In our model can be added more learning processes if we model them. The underlying logic is that the learning object is packaged through its adaptability to the context of specific learning processes. In our research approach we have investigate 9 learning processes (Lytras, Pouloudi et al. 2002) , and we propose them as the basic value carrier in e-learning environments. These learning processes do not demand a magisterial role but set a base for further exploitation. Namely these learning processes are: **Presentation, Analysis, Synthesis, Evaluation, Reasoning, Explanation, Relation, Problem Solving, Cdlaboration.**

3. Detailed presentation of the proposed e-learning Pedagogy scaling

Our basic syllogism is that e-learning performance is directly related to learning processes, which are value carriers for the learners. The first implication is the requirement to model each learningprocess and consequently to specify metadata for each process in order the linguistic concept of learning process to get empower from descriptive information that can be promoted to learners using ICTs. The ultimate objective is the understanding that reusability of learning resources is not panacea not even a promise for higher learning value except a number of metadata justifies the reusability in terms of diffused value.

An initial statement is that the value in each process is not objective but subjective since each learner pays different importance to processes according to his cognitive level and previous experiences. More over the life cycle of each process has to be analyzed from the perspective of learners and authors. The distinction of several phases does not assume a sequential flow of tasks but rather an indissoluble whole of engaged parts. In the next pages are presented through tabular synopsis the life cycles and the implications of Shuell and Bloom's work in our research.

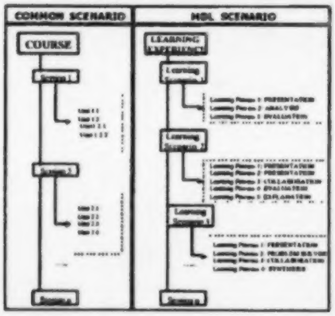


Figure 1. The proposed revision in e -learning content delivery method through value adding learning processes

4. Conclusions

Our approach is setting a context for further exploitation. With no doubt the current situation in e-learning market does not represent the fascinating issue of the incorporation of information and communication technologies in education. Many people use the e-learning term and presuppose the presence of a PowerPoint presentation accompanied with audio as the technological infrastructure for e-learning realization. The MDL framework is being evaluated for more than two year and the findings are very promising. The achievement of higher student satisfaction is only one of the key findings. Finally we have to say that this model is also very demanding. It's realization requires a lot more efforts from both academics and knowledge providers that seem to forget the nature of learning when they prepare learning material. For more information about our research unit you can visit our web site (www.eltrun.aueb.gr) . For comments concerning this paper please send an e-mail to the following address (mdl@aueb.gr).

BEST COPY AVAILABLE

		MDL Learning Processes								
		Presentation	Synthesis	Analysis	Evaluation	Reasoning	Problem Solving	Collaboration	Explanation	Relatio
T. Shuell Learning Functions	Expectations	?	?	?	?	?	?	?	?	?
	Motivation	?	?	?	?	?	?	?	?	?
	Prior knowledge activation	?	?	?	?	?	?	?	?	?
	Attention	?	?	?	?	?	?	?	?	?
	Encoding	?	?	?	?	?	?	?	?	?
	Comparison		?	?	?	?	?		?	?
	Hypothesis Generation		?	?	?	?	?	?	?	?
	Repetition	?	?	?	?	?	?	?	?	?
	Feedback	?	?	?	?	?	?	?	?	?
	Evaluation	?	?	?	?	?	?	?	?	?
	Monitoring	?	? ?	? ?	? ?	? ?	? ?	? ?	? ?	? ?
	Combination, Integration, Synthesis		?	?	?	?	?		?	?
Bloom's Taxonomy	Knowledge	?	?	?	?	?	?	?	?	?
	Comprehension	?	? ?	? ?	? ?	? ?	? ?	?	? ?	? ?
	Application			?	?	?	?		?	?
	Analysis			? ?	? ?	? ?	? ?	?	? ?	?
	Synthesis		? ?	? ?	? ?	? ?	? ?	?	? ?	?
	Evaluation		? ?	? ?	? ?	? ?	? ?		? ?	? ?

?

? : Learning Process is influenced by / can support	? : Metadata Specific in Each Process
? : Metadata of General Purpose	: Learning Scenario

References

[illegible] New York, [illegible] and Co.

Carter, C. and H. Scarbrough (2001). "Towards a second generation of KM? The people management challenge." Education + Training 43(4,5): pp: 215-224.

Coulson, C. (2000). "Developing a corporate learning strategy." Industrial & Commercial Training **Vol. 32**(No. 3): 84-88.

Lytras, M. D. and G. I. Doukidis (2000). Applied Knowledge Management in Education: E-school Architecture. In Dan Remenyi (Eds) proceedings of the 1st European Conference on Knowledge Management (ECKM 2000) , October 26-27, 2000, Bled, Slovenia, pp. 115-122.

Lytras, M. D. and G. I. Doukidis (2000). 'E-learning evaluation criticism. The Multidimensional Dynamic e-Learning Model'. The Fourth IASTED International Conference on Internet and Multimedia Systems and Applications (IMSA 2000) [CD Proceedings], ,November , 20-23, 2000, Las Vegas, Nevada, USA, pp. 368-373.

Lytras, M. D. and G. I. Doukidis (2001). 'E-Learning Pedagogy: Define the Value'. Technology in Education International Conference & Exposition (TechEd 2001), March 26-29, 2001 Southern California ,USA .

Lytras, M. D. and H. Odman (2001). Fulfilling organizational learning on concurrent enterprises: The Multidimensional Dynamic Learning model for knowledge management exploitation. 7th International Conference on Concurrent Enterprising (ICE 2001), June 26-27, 2001, Bremen, Germany.

Lytras, M. D. and A. Pouloudi (2001). E-learning: Just a Waste of Time. In Strong, D., Straub, D. & DeGross, J.I. (Eds) Proceedings of the Seventh Americas Conference on Informaton Systems (AMCIS), Boston, Massachusetts, pp. 216-222.

Lytras, M. D., N. Pouloudi, et al. (2002). "Implementing knowledge management in learning: an advanced framework for technology and learning convergence in work environments." Journal of International Forum of Educational Technology & Society and IEEE Learning Technology Task Force, (accepted for publication in the special issue of April 2002).

Lytras, M. D., N. Pouloudi, et al. (2002). "Knowledge Management Convergence: Expanding Learning Frontiers. Journal of Knowledge Management,." Journal of Knowledge Management **Vol. 6**(1): 40-51.

Ryan, M. (1995). "Human resource management and the politics of knowledge:linking the essential knowledge base of the organization to strategic decision making." Leadership and Organizational Development Journal **Vol. 16**(No. 5).

Shuell, T. J. (1992). Designing instructional computing systems for meaningful learning In M. Jones & P. H. Winne (Eds.), Adaptive learning environments: Foundations and frontiers, New York: Springer-Verlag, pp.19-54.

BEST COPY AVAILABLE

Community Action/interaction Management System

(A Course/Group Management System that Fosters Community)

By Brian G. Mackie
OMIS Department
Northern Illinois University
USA

Norbert Ziemer
OMIS Department
Northern Illinois University
USA

Abstract: Most course/group management systems are designed from the perspective of the facilitator or the administrator. Since these systems have been developed with an emphasis on administration, student ease of use and student-to-student interaction is frequently an afterthought instead of a design requirement. A student-centric course/group management system (CAMS) has been developed, in order to improve learning outcomes. This system allows participants to interact with one another, and makes the interaction process user-friendly. It is intended to help participants become acquainted with their cohorts quickly, whether the course is on-line or web-enhanced. The core of the system is a fully developed database. The software is open-source, requires minimal configuration and is currently being beta-tested with web-enhanced courses, fully online courses and online community groups.

Background Info/Impetus

Many Northern Illinois University faculty had previously used other commercially available class management systems such as WebCT and Blackboard. Observations by faculty members and student feedback from those learning experiences were used as a basis for the CAMS project. Certain learning challenges were found to be more prominent within an online or web-enhanced learning experience. One problem was the fact that the human elements and visual cues from a face-to-face experience were all but eliminated. Another problem encountered was the ease of navigation and use for both the participants and the facilitators. It was noted that there were times when a user was required to make seven or more mouse clicks to navigate to the desired feature or link. Faculty also experienced system drawbacks, such as the inability to efficiently transfer files from other applications and the limited level of customization allowed.

Deficiencies found with Current Systems

Human elements

The human element deficiencies are crucial to the success of an online learning platform, since the first impression when a participant enters the system can be a lasting one. The online learning environment, by definition, utilizes a different learning environment. This interface can offer advantages over a more traditional face-to-face format, but also has drawbacks including the lack of visual cues (Salmon 2000). The environment may feel less "warm" and welcoming to the participant, since frequently he or she cannot see or hear the facilitator and/or other participants. The inability to associate a name including phonetic pronunciation with a face has been a disadvantage of online Course Management Systems (CMS) compared to face-to-face learning environments. Another deficiency is that participants feel isolated or disconnected within the online learning environment. These deficiencies must be addressed by any viable CMS as they strongly influence student retention and learning outcomes.

Navigation, Learning Curve, Ease of Use

Many of the systems evaluated have lacked easy and consistent navigation and interaction. Systems can become so complex that a participant may be required to navigate through seven or more screens to locate/access a desired feature. Navigation deficiencies can slow down the learning curve and possibly become a deterent to the participant.

Flexibility/Customization

A drawback to many other CMS applications is the restricted movement of data. Either the inability to incorporate data from other sources into the system or export data to other sources are limitations caused by not being able to easily access and reuse information within the system. These limitations are major deficiencies of many CMS applications.

CAMS System Components Addressing These Deficiencies

When participants log onto the system, they are presented with a course/group selection page. Beginning with this page the individual's picture is displayed and they are immediately drawn into the community. Upon course/group selection, the participant is transferred to the main course page. Salmon notes that it is important for participants to contribute. The main course page (see figure 3) contains the following information and links to information that the student can **update**:

- Picture of each student in the class
- Phonetic spelling of student's name
- e-Mail address
- Personal website link
- Bookmarks link
- Book exchange Link

The system includes additional components, accessible from the main course page:

- Faculty picture and Faculty comments
- Most recent Class Announcement and a link to all announcements
- Class Information including Office Hours, Book information and Syllabus
- Class Notes link
- Class Assignments link
- Discussion board link (with pictures displayed on discussion board)
- Chat link (the chat program attaches the participant' picture to his or her message as it is sent) see Figure 1
- Display grades link (complete grading program/grade book) with input/export capability see figure 2

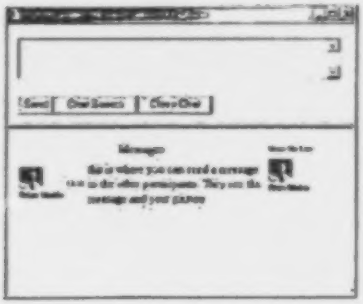
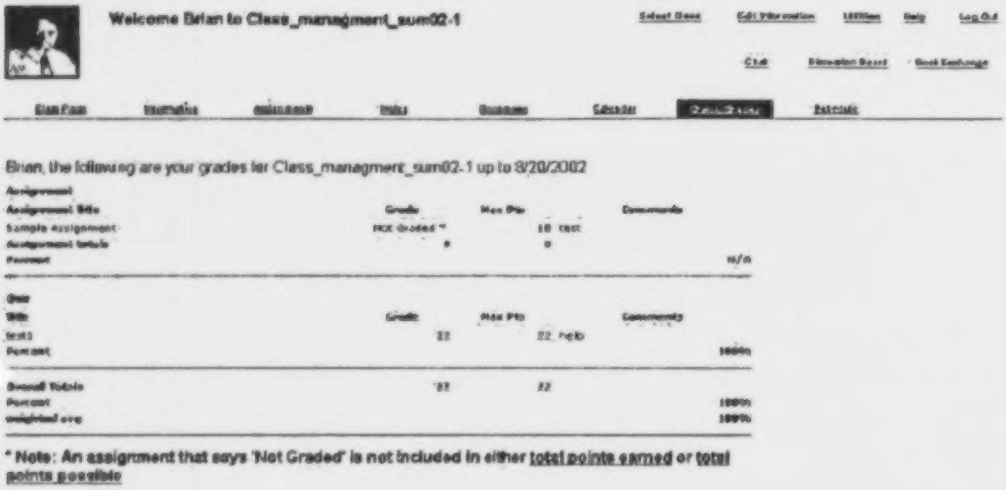


Figure 1

BEST COPY AVAILABLE



Welcome Brian to Class_managment_sum02-1

Brian, the following are your grades for Class_managment_sum02-1 up to 8/20/2002

Assignment

Assignment title	Grade	Max Pts	Comments	
Sample assignment	Not Graded *	10	test	
Assignment totals	0	0		
Percent				n/a

Quiz

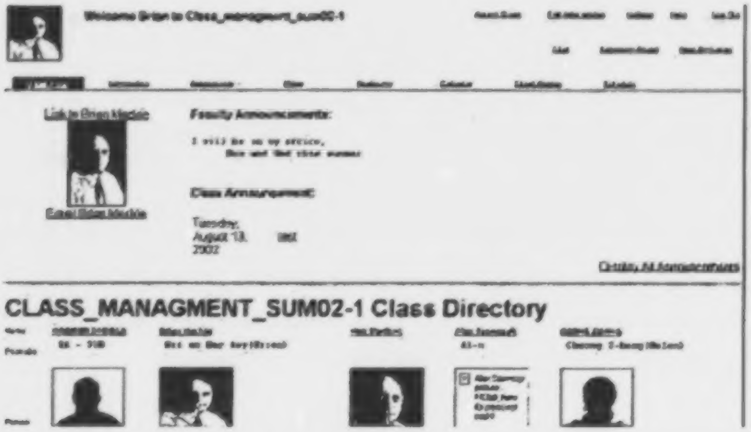
title	Grade	Max Pts	Comments	
test1	22	22	help	
Percent				100%

Overall Totals	22	22	
Percent			100%
weighted avg			100%

* Note: An assignment that says 'Not Graded' is not included in either total points earned or total points possible

Figure 2

The grading program allows the faculty to enter grade types such as quiz, test and project scores. The system is designed to allow weighted grades, so each area can be given a different weight. The faculty creates an assignment and posts a complete assignment description for student viewing. There is also a provision for the facilitator to enter comments for any student grade. There are two comments for each grade; one is available the student, the other is not. When working with student grades the students' pictures are visible. In addition, from the Class main page the students are able to view their scores to date for the class.



Welcome Brian to Class_managment_sum02-1

Faculty Announcements:

Class Announcement:

Tuesday,
August 13,
2002

CLASS_MANAGMENT_SUM02-1 Class Directory

Figure 3

It was decided that the course/group management program would minimize the number of page visits required to reach a desired feature. It was also decided that users should not need a large amount of training to access and use CAMS. Where possible, all selections, modifications and/or additions would use the same techniques. Therefore, all information is updatable whether by participant or facilitator through simple web page forms. The participant or facilitator can update the information using html tags to

BEST COPY AVAILABLE

produce exact formatting; or they may opt to enter the data as text with carriage returns and spaces. If entered in the latter format the system will automatically maintain the format. Participants are allowed to add and update both their personal information and bookmark categories of interest. Additionally, they are allowed to create bookmarks for the class including comments for each bookmark. This is another way of keeping the participant engaged.

Current Status

The CAMS application has been through two levels of beta testing, in both web-enhanced and fully online courses. A community group of approximately 130 OMIS department graduate students is currently being tested. It is anticipated that the CAMS application will be used by many courses in at least two colleges at Northern Illinois University and several other locations.

We are currently monitoring system performance and researching facilitator/participant satisfaction with the system. The system is very robust and ready for expansion to other institutions.

Future Research

It is hoped that other institutions will recognize the potential of the community based and participant-centric system (CAMS) and will contact us to become part of this ongoing research.

Literature References

McVay, Marguerita (2002). *The Online Educator: A Guide to Creating the Virtual Classroom*. New York, NY: RoutledgeFalmer.

Salmon, Gilly (2000). *E-Moderating; The Key to Teaching and Learning Online*. London, UK: Kogan Page Limited.

Stephenson, John. (2001). *Teaching and Learning Online: New Pedagogies for New Technologies*. Sterling, VA: Stylus Publishing, LLC.

A perception of Next Generation E-learning in Australia

Venkatesh Mahadevan
Information and Communication Technology Group
Faculty of Engineering
University of Technology Sydney
Australia
mahadevn@eng.uts.edu.au

Professor Dr Robin Braun
Information and Communication Technology Group
Faculty of Engineering
University of Technology Sydney
Australia
Robin.Braun@uts.edu.au

Anthony Kadi
Information and Communication Technology Group
Faculty of Engineering
University of Technology Sydney
Australia
Anthony.Kadi@uts.edu.au

Abstract: E-Learning has been viewed as technology enhanced and delivered learning in Australia for many years. By extracting the best of the traditional classroom experience and technological infrastructure we could lead to an integrated learning called Blended Learning. Education have became globally accessible; the Blended Learning now needs number of enhanced collaboration features in terms of pedagogical instructions that sets it apart from those existing e-Learning opportunities. This paper explores some of the educational issues underpinning the possible uses of CeNTIE's high broadband network and Telecollaboration software being under development at UTS on an exploratory basis. This paper argues that the e-Learning in the Australian higher education sector is best conceptualized as a collaborative process with educational outcome measurement and the technology (media) does influence the learning provided the participants create their confidence in the use of underlying technology.

Introduction

" E-Learning describes the way new information and communication technologies (ICT) are set to re-invent education and learning in a digital world. In short, it means Internet enabled learning: an exciting range of opportunities for educators and learners alike to use new skills and tools to prosper in an information society" (Arthur Anderson, 2000). Australian universities have undergone profound changes over many years in terms of their commitments to provide quality e-Learning opportunities to their students. In recent years e-Learning has been an integral part of wider use of University's teaching and learning practices and policies. For instance, although most Tele-teaching lectures in the past proceeded smoothly, there were issues like connection problems, time delays in transmission of material and interaction among the participants in the lecture. When it comes to e-Learning, the **REAL** learning is in **LEARNING** *not* in "e" (Russell Thea, 2001). The research at Monash University, Melbourne reveals that apart from the disadvantages such as reduction in learning time, increased potential for disruptive student behavior and reduction in access to lectures, students at remote sites did not feel part of the lecture and have experienced a reduced concentration span. The investigators also found that there appeared to be always weakest interaction between learners compared to content-learner interaction and instructor-learner interaction. They also pinpointed the areas that needed particular attentions are improvement of staff tele-teaching skills and technology (Abdel Halabi, Juhani Tuovinen & Jodie Maxfield, 2000). The advances in digital networks have now leaded us to the creation of new and innovative telecollaboration environments worldwide. Today there are numerous telecollaboration software tools that have helped the educators to broadened their base and allowed them as facilitators, to innovate and customize new education models to implement their new ways of teaching and learning activities. CSIRO's Centre for Networking Technologies for the Information Economy (CeNTIE) and recently received funding from the Australian government and industry collaborators to build a next generation research network linking the key research institutions in Australia is in progress. It recently completed the first metropolitan trial of 10 Gb/s Ethernet network in the Asia pacific region demonstrating shared virtual environments running a surgical training system. The CSIRO is working with the psychologists and educators from three Australian Universities including University of Technology, Sydney (UTS) to identify the appropriate uses in higher education for this high-capacity broadband network system. By embracing a new telecollaboration environment in Australia's higher education sector, UTS is hoping to challenge both the educators and technologists to adapt themselves in a situation to oversee this unpredictable surge of constantly challenging innovation.

Why Collaboration beyond Lecturing?

A common base of all collaboration is Learning. Task oriented collaboration involves the ***back grounded learning*** and the collaborative (peer) learning involves both the tasks as well as the ***fore grounded learning.*** Recalling Vygotsky's theory of social constructivism, where students construct knowledge based on interactions with others, it is evident that telecollaboration helps the participants to work together (interact) on a common, shared goal despite of their physical separation. There are five structures for learning that may or may not occur in a traditional classroom scenario. For instance, use of facilities such as information banks, construction kits and the task managers. (Salomon, G., Perkins, D., & Globerson, T, 1991). Collaboration beyond "lecturing" means designing interactive collaborative learning experiences for all the participants involved and facilitating them throughout their learning processes through those experiences (engagement theory). In which case students would be expected to play their role not just as passive observer but an active constructor of knowledge by taking responsibility of their own learning (out-of-box thinking). "Rich environments for active learning" or REALs are constructivist based and designed to encourage student responsibility and motivation (Dunlap & Grabinger, 1996). Now we have reached into a stage of collaborators sharing the application or white boarding apart from involving synchronous and/or asynchronous communication through audio, video, and/or text and reviewing their course material both synchronously as well as asynchronously. Our research on reviewing numerous collaborative models and theoretical frameworks, shows that currently, there is no one system that plugs the user into the remote site where an individual can perform complex group tasks and feel the sense of presence and contribution with the help of set of collaboration tools and utilities that they may choose to use according to their personal preferences and work patterns (student centred learning). Some of the important collaboration service elements been described in our mock up, helped us to visualize our ideas like joining and leaving a session, pointing to shared objects and communication between many-to-many users (reflective conversations).

According to the Workshop on New Visions for Large-Scale Networks: Research and Applications held in Vienna, Virginia, 2001, collaborative environments need to support transparent, intuitive human interactions with services such as automatic configuration, ubiquitous access, security, multimedia capabilities, immersive environments, expert consultation, and side conversations by providing proactive, intelligent, dynamic and "natural" interactions among the participants. It also says the future collaboration environments will need to deal with unpredictable and emergent changes, meet hard real-time constraints, and handle asynchronous events as they occur. This involves a clear understanding of all the participants involved in the collaboration processes to know the need for collaboration (Dale Spender & Fiona Stewart, 2002). Identification of telecollaborative strategies by the facilitator of future telecollaboration session would maximize the learning opportunities of all the participants involved. This is well matched with the vision of our telecollaboration project at UTS.

Does technology (media) influence the learning?

Technology always has been a strategic investment in the higher education sector to validate its missions. Though the technology plays a major role in driving the revolutionary changes, the challenge for the educators to keep pace with those changes still remains the same. To challenge the traditional teaching paradigms, the technology (media) needs to play a major role. These are the two areas of "islands of innovation" due to many different constraints. The development of digital networks now justifies the need for further emergence of development, maintenance and calibration of those options been identified by those areas as pathfinders of our future telecollaboration session. Online education makes it very rich information medium, not simply because of the multimedia capacity, but it is interactive. Online learning is not so much about taking in existing information, but connecting and creating new resources, actively assembling information and engaging in problem solving. This information in turn can be "checked out" by others. Technologies are not to be treated just to read or receive the information, but needs to be used and "repurposed". As all digitally connected individuals can make information, there are multiple voices, rather than one voice, so there is no one right answer but many possibilities (Dale Spender & Fiona Stewart, 2002). For example technology would enable us in rapidly describing or instantiating new shapes, performing simulation and animations of processes and illustrating the transitions. Encouraging the use of multiple modes of representation (different mediums) is one among the "seven pedagogical goals" of constructivist, learner-centered environments (Honebein, 1996). The technology has been always more powerful in terms of providing transmission and sharing of the content and encouraging more out-of-class student reflection. Our main aim is that the proposed technology would help our educators to make further focus shift from content to the contemporary approach (from surface level learning to deep level learning and from independence to interdependence). Some educationalists strongly believe that learning outcomes in the main are not affected by the technology. Some even view technology as a tool for decontextualized drill. But to others like researchers at UTS, technology is an opening door for creative expression and higher-order thinking skills. In all our debate, we rarely take the time to explore whether there are several ways that may effectively contribute to a good education (David D. Thornburg, 2002). It is sad that many educators until today have little understanding of the limitations and constraints of the technology they use. They need to realize the fact that with the proper understanding of use of technology the participants can perform well in a more easier and productive way. One of the critical concepts of Salomon's theory is that the effectiveness of a medium depends upon its match with the learner, the context and the task (Salomon, 1977).

There are just two remaining hurdles that have thus far prevented the widespread adoption of such a practice. The first hurdle is the multimedia interaction requires broadband networking that is economically accessible. Moreover, the resources of the network must be either in abundance or carefully controlled and used in real-time to ensure that the multimedia interaction is of sufficient quality to prevent the technology from becoming a hindrance to the collaboration. According to the e-Learning user survey been conducted in April 2001 at e-Learning conference & expo held at USA, 53% of the respondents said that the lack of bandwidth is the major challenge to the current eLearning techniques (For example, the problem of having unintelligible audio and jerky-motion video etc). Even with the supply of enormous bandwidth that CeNTIE would offer, we as both educators as well as technologists should know the accountability of its uses. One of the most important technical issues here is just by increasing the bandwidth we will not solve the multimedia burstiness problem. In increasing the bandwidth in distributed multimedia computing, the user acceptance of high degree of perceptible quality of multimedia data is always significant factor. The notion of quality of service (QOS) is central and still receives significant attention among the multimedia network researchers. This includes maximal or minimal resolution, the average throughput, allowed error rates and timing requirements etc. For instance research on real-time text editing and the task of distributed synchronization between multi media data could solve some of the problems of QoS requirements in a telecollaboration scenario.

The second major hurdle is the unavailability of set of software tools and utilities to support and enable our future collaborative interactions. The available ones found to be designed for specific contexts and thus, do not adapt well to other situations. Furthermore, many are constrained by capabilities that were available at the time of their design and implementation, but the rapidly changing ICT field has quickly rendered these obsolete. And finally, and probably most importantly, our collective understanding of collaborative processes and the interactions necessary to make them effective is in its infancy – so the design of software tools to enable, support and perhaps even enhance collaborative outcomes is ignorant of the basic requirements for such tools. The platform-independent software under development for the above purposes would allow integration of transmission and sharing of contents along with pedagogical instructions. By being very easy to use, proactive, and engaging it would provide some intelligence. For instance, the development of special tools such as color deficiency tool, sign language modeling etc would be very helpful for the disadvantaged students.

Today's e-Learning infrastructure is still immature in the tools to analyze and measure results to correlate them into your organization metrics (Bersin Josh, 2002). The purposes of intended outcomes in a telecollaboration scenario are never unchanged. The technology would force us to do certain new things or perhaps do things that we would otherwise not be able to do. Outcome based measurement is critical and time consuming. This is because of the reason that the range of possible outcomes that people in different context might want to achieve is very large. This arises the need of a highly adaptable, large spectrum of outcome measurement techniques that could be available to the range of possible outcomes.

Conclusion

Many factors such as difference in motivational factors, skills, pacing and concentration shifts of the participants that affect the e-Learning are areas of further study. The researchers at UTS are expected to deliver a product (technology), which involves numerous collaborative processes that would solve some of the existing educational problems. This project mainly aims at developing a set of high- engagement, high-performance and high- impact remote access tools, utilities and the appropriate technologies that would be capable of providing a flexible framework for active pedagogical teaching and learning approaches. There is a shared understanding among the researchers at UTS of how to build and use telecollaboration software that would encourage the educators to try new forms of teaching and learning and help them to learn how to utilize the latest technical possibilities. This includes identifying the factors to succeed in spite of the barriers created by this new exciting technology.

References

Abdel Halabi, Juhani Tuovinen and Jodie Maxfield (2000). Evaluation of Educational Interactions in Accounting Tele-Teaching. Monash University, Melbourne, Australia.

Arthur Anderson (2000). The e-Learning Funding Guide: a guide to planning and funding e-Learning in schools, Microsoft.

Bersin Josh (2002). How can you justify your investment. E-Learning Magazine.

David D. Thornburg (2002). A Focus for Educational Reform, http://www.pbs.org/teachersource/thornburg/thornburg0301.shtm.

Dr Dale Spender and Dr Fiona Stewart (2002). Embracing e-Learning in Australian Schools. Report sponsored by Common Wealth Bank of Australia.

Dunlap, J. C. and Grabinger, S. (1996). Rich environments for active learning in the higher education classroom. University of Colorado, Denver, CO, USA.

http://www.ngi-supernet.org/conferences.html, (2001). Workshop on New Visions for Large-Scale Networks: Research and Applications. Vienna, Virginia, USA.

Honebein, P. (1996). Seven goals for the design of constructivist learning environments. In B. Wilson (Ed.), Constructivist learning environments: Case studies in instructional design, New Jersey: Educational Technology Publications. USA.

Russell Thea (2001). E-Learning: The opportunity to challenge the paradigm of traditional methods of education by putting the learner in control. 15th Australian International education Conference, Sydney, Australia.

Salomon, G., Perkins, D. and Globerson, T. (1991). Partners in cognition: Extending human intelligence with intelligent technologies. Educational Researcher, 20(4), 2-9.

Talk and Chalk digital

Carmem Maia
Núcleo of Colective Inteligence applied to Education
Departament of Interactive Higher Education
University Anhembi Morumbi
Sao Paulo, Brasil
Carmem@anhembi.br

Abstract: Is e-learning a modern or, better, a digital version of the already traditional "talking...talking... and chalk" which we witness in the model classroom?

Are we not merely reproducing in a digital way the same traditional education models which are known to us, ignoring the means and possibilities of methodological and curricular innovation which interactive technologies allow?

Are we not repeating the same phenomenon which occurred during the early 80s with the emerging of Informatics laboratories - hermetically closed classrooms with a large number of aligned computers -, which in practice did nothing but copy the same model of lessons given in the classroom with traditional desks?

Introduction

Presently, Higher Education Institutions (IES) are being pressed to develop and use new communication and information technologies for Brazil's students as a way to improve or develop traditional higher teaching through quality. The fever of "e-learning", is now a "hype" that is invading the Brazilian higher education market, has compelled many "IES – Instituições de Ensino Superior" (Higher Education Institutions) to try and modernize their technical staff, ignoring their prime human resources (professors) and the main purpose of their business (teaching-training).

With the increasing technological progress of the tools for delivery of courses and disciplines, are we not running the risk of moving towards the mere digitalization and storing of information and contents, without, necessarily, in the majority of cases, preoccupying ourselves with, and taking major care of, those actors which are on both sides of this screen, that is, professors and pupils?

The question is: how must Higher Education Institutions prepare themselves; how must they focus the development of distant higher education interfaced by the interactive web communications, how can they win the challenges of an ever growing production of topics for an ever increasing number of students and yet have their mind focused on ROI in a way to preserve and maintain all efforts focused on the teaching-training process of the student and all the possibilities referring to innovation, curricular integration and cooperative working formation which available technologies and tools can offer.

How can we develop and implement courses and higher education projects at a distance with the proper tools but with distinct adequate characteristics, adapted to the methodologies and cultural features of each region, and allow professors to maintain their pedagogical and methodological identity even if focused on "mass" education, using one proper tool for the implementation of courses and disciplines?

The challenge is to keep e-learning focused on teaching-training, based on the development of truly cooperative and collaborative methods for an ever increasing number of students, including an integrated management of the topics involved, working efficiently and producing satisfactory proven results, from a pedagogical point of view as well as an institutional point of view.

What is going on

Recent decree 2253, institutionalized by the Ministry of Education and Culture, on 18th of October 2001, literally emphasizes the preoccupation of governmental organs with regard to increasing technological progress, of which higher education cannot be kept afar.

On the one hand, we have statistics about the number of outgoing pupils of higher education wanting to enter university and we know that something has to be done to facilitate the access to these universities.

On the other, we know that the traditional educational model of teaching leaves much to be desired from a qualitative point of view, mainly, in "mass" institutions, where very often more than 100 pupils are gathered in one classroom. What type of interactivity or relationship can exist between pupils and teachers in such a space and during the short time of a traditional lesson ? (50 minutes lesson means basically 30 minutes of real lesson, subtracting all delays by the teacher and pupils, starting the lesson, ending it, etc...). Besides, the model of curricular development of a graduation course, for example, also requires reformulation. To merely create a curriculum, disciplines and classes and wait for integration is not sufficient. The model for higher teaching we know of does not attend any more the pupil's formation requirements and professional performance, and should be reformulated, re-invented.

On the other hand, we have an avalanche of technologies and tools being developed and offered by the teaching institutions. Very often the IES are quite satisfied with the technological resources and automation of contents and do not dwell on the needs and necessities of teaching-training. Technologies should be a means of improving the training process, they should be considered as powerful tools for the necessity to re-invent higher education; however, technological resources are not enough, there should be an educational intelligence behind any system, a powerful brain knowing how to use technologies intelligently with a view to meeting training requirements; otherwise, we are just, and once more, repeating the old and antiquated model of the traditional "talk, talk...chalk" in the classroom, and what is worse, running the serious risk of potentializing - once we are on web and the web is a potentializer - a model which we already know is obsolete and does not meet any longer the requirements of pupils, teachers and the institutions themselves.

By means of decree 2253, legislation clearly shows that the path to follow revolves around a mix of what is being called Click and Brick, that is a mix of the factual presence and the virtual; however, to this end, the academic spheres of the IES (higher education institutions) should re-organize and orient themselves towards this new paradigm. This decree stimulates the use and implanting of technologies for improving this process, thus allowing institutions to provide 20% of the course or discipline duration, by way of distant education, through interactive communication technologies, which in practice means re-orienting educational course projects and teaching plans towards a new format satisfying the requisites of this mix.

The tools and technologies being developed strive to show that in the quest for productivity and attendance to an increasing number of beneficiaries, the relation between the cost of this benefit and the ROI must be taken into account when choosing a technological tool and to this intent, the institutions themselves should be aware of what their business and intelligence point at in relation to the development of the disciplines contents, thus leading to the improvement of training and knowledge and not merely to the development of a technology.

University Anhembi Morumbi e-learning Case

University Anhembi Morumbi is a private university located in the Southeast of Brazil, in Sao Paulo city. It has been founded 35 years ago, implementing the first Tourism Bachelor course in Brasil, and during all this decades, the University have been pioneers and innovative in the Higher Education System in Brasil, which is a very traditional academic system, very resistant to changes.

In the beginning of the 80's, the university begins the implementation of the Department of New Technologies in Education, created to think and implement new strategies and new methodologies, using or not technologies in education. This means the training of all the faculty staff in new technologies and researching during all this years the use of new possibilities to optimize the traditional methodology of the face to face classrooms.

In the 90's, with the advent of Internet, the University creates the Dept of Interactive Learning, to research the net interactive possibilities to Higher Education. During this last decade, many courses , short courses and pos graduation courses have been created and developed by this department, and the University have been recognized as one of the pioneers in the implementation of a successful "mix" between online learning and face to face classes. During the framing and implanting of on-line and interactive processes at Universidade Anhembi Morumbi, we opted to develop first of all favorable conditions for the improvement of teaching nearly 10 years ago, at a time when there were no virtual training environments or the present educational tools for the development of courses.

For about 5 or 6 years we worked on the research and development of this tool, the result being that we acquired the know-how and expertise in efficient methodologies related to distant training, which in turn led us towards the development of new courses and disciplinary contents not to be given by way of the traditional "talk..talk..chalk".

During the last two years, with the configuration of this new motion opening for the Institutions many other possibilities to improve our classes, we realize the necessity of a system that could manage more than 3000 sincroniusly, and we had to face a serious problem regarding management of the contents and small bugs in the system which cannot occur in large scale teaching.

The challenge now is and will be in the use of a teaching automated authoring tool, like Blackboard, highly efficient and with high quality distant education methodologies so as not to reproduce the traditional educational model requiring the student's presence. Once solved the problem of technological bugs, we shall have to pay attention to the development and training of human resources, integrated contents, know-how and virtual "animators" so that, although at a distance, students and teachers should feel motivated and stimulated to pursue their training and that we do not make poor use of the potentiality of human and technological resources.

Authoring Tools – A knife of two edges?

During this last two years we have been looking and researching for authoring tools which could help us to be more efficient and productive in the delivering and in the content production of the courses. We realized that our logistic system of production the e-learning courses were not efficient and It demands a tool which the teacher could manage the course content the way he wants to, with no technical assistance.

However, our concern was in do not create the same traditional model of the information delivery, now digitally, and one of the purpose for this is work with the teachers in a way that he or she could be a content manager, orienting the students to build their own knowledge and not just replyng the old paradigm of the traditional classroom.

The authoring tool, Blackboard, WebCT, Docent or any other, have two faces: Could be very useful and a helpful hand to be more productive and automatized, because they are very user-friendly and easy to learn, but in other way, this tools could be also a knife of two edges, which must be used very carefully, not only focusing the scalability and the managing of the students, but mainly in the process of learning that the student will be involved during the course.

Unfortunately, what we have been realizing during this research is that it is not easy changing cultures and changing minds, mainly the academic areas. Teachers are used with the face to face methodology and sometimes are not so receptive to chaging paradigms. The use of this authoring tools will create new roles for faculty, we believe that it will be very profitable for all: Institution, Faculty and students.

do not want to improve or There lies the big challenge of the new educational technologies and paradigms.

E-Learning for Distance Learners – Does it work?

John Chi-sang MAK
School of Business & Administration
The Open University of Hong Kong
Hong Kong (SAR), CHINA

email: jmak@ouhk.edu.hk

Abstract: This paper reports the use of Information Technology (IT) for enhancing distance learning in Hong Kong. The challenge of Lifelong Learning and the knowledge-based economy require us constantly upgrading and expanding our skills to meet the future, professional and workplace needs. A survey was conducted to investigate the impact of e-learning from distance learners' perspective, that aims at studying how distance learners might view their (1) course performance, (2) IT fear and anxiety, (3) feedbacks on e-tutoring, and (4) comments on course administration during the e-Learning process. Through a case study in the Open University of Hong Kong, this paper describes in details how an online course is designed, delivered and evaluated. The results indicate that with the opportunity for e-Learning distance learners can enjoy the online teaching and learning process. Although fear and anxiety are initially reported, they could be resolved and manageable during the course. Both tutoring and course administration could be improved through online technology.

Introduction

The Open University of Hong Kong (http://www.ouhk.edu.hk), formerly the Open Learning Institute of Hong Kong (OLI), was established by Government in June 1989, aiming to provide higher education opportunities for adults by open and distance education. OUHK offers more than 100 post-graduate, degree and sub-degree programmes in April 2002. The University recruited about 4500 new students in October 2001 and currently has about 26,800 students (OUHK, 2001a). The majority of them are aged between 22 and 35. On average, they take about nine credits per semester, equivalent to about half of the workload of a full-time student. The University uses a flexible credit system under which students earn credits for each course and accumulate credits towards a degree. Currently, most OUHK courses are print-based. There are also trained tutors who hold tutorial sessions, comment on and mark assignments, and answer students' queries by telephone and correspondence.

There is a vast amount of e-Learning initiatives currently taking place in Hong Kong, including PolyU's CyberU, HKU's SOUL, and CityU's iMBA. Many of the continuing education institutions are also claiming to offer e-learning programmes. However, the aims and objectives of 'e-learning' vary among the institutions. For simplicity, terms such as 'e-Learning' and 'online learning', 'e-course' and 'online course' are used interchangeably throughout this research. E-Learning can be viewed as a virtual classroom, incorporating a set of modern training tools, such as a study guide, notice board, student forum, online mentoring, and an interactive, multimedia courseware, e-library, which are aimed not only at the individual learners, but also at training institution. The virtual classroom provides many of the benefits of the traditional classroom while enjoying the major advantages of training delivered over the Internet that can be accessed at any time from any place. At many institutions, the effectiveness of e-Learning has not been well researched prior to its adoption. Daley et al. (2001) indicate that students' attitudes and perceptions of technology influence their ability to acquire and integrate knowledge, extend and refine knowledge, and use knowledge meaningfully. Understanding the factors affecting students' adoption of e-Learning should be a fertile area for research. Learners' willingness to adopt technology is of vital importance to the design and delivery of e-courses by distance education providers.

Research Questions

This study tries to better understand distance learners' attitude toward online teaching and learning. Also, the effectiveness of e-tutoring and course administration are being evaluated. It aims at studying (1) how distance learners might view their performance, (2) what fear and anxiety they may feel, (3) how they evaluate e-tutoring, and (4) how they evaluate online course administration.

Research Design

An IT-based e-courses with Web-based instruction design beginning in April 2002 was selected for evaluation. During the course, students received printed materials by ordinary mail and supplement online course activity and materials through a Web-based course server. An evaluation is then conducted to measure both the learners' perceptions and the effectiveness of course administration:

Subjects

An electronic version of the questionnaire contains 40 questions asking for quantitative information. The evaluation was conducted in July 2002. Seven hundreds and three adult distance learners enrol B121 course, which is running on-line throughout the semester. A total of 238 replies (33.86%) are collected and all of these responses were considered usable for this study after data validation and checking for excessive missing values. The average daily OLE user logins is 94.57 (11.63%) with average daily hits of 4823.23. The total user logins in June 2002 is 622 users (76.51%). Students connected to the OLE server in different ways: OUHK student dial-up kits (2.17%), OUHK Sub-nets (45.67%), and external Internet Service Providers (52.17%).

Method

A set of questionnaires on a study of how the online technology affects on students and tutors has been designed. The questionnaire is broken down into four brief sections, in which raw items have been developed reflective of (1) course performance, (2) computer fear and anxiety, (3) e-tutoring, and (4) online course coordination. The questionnaire used a 5-point Likert-type scale for each item (1=Strongly agree, 2=Agree, 3=Neutral, 4=Disagree, and 5=Strongly Disagree) to solicit students' feedback. The evaluation was conducted in mid-semesters of the course. Some of questions in the evaluations are based on the work of Zane Berg (1996) and Diehl (1989), whereas others are developed to meet the aims of the research. Details of the questionnaires are available upon request.

Course server

The online courses selected for the research include is B121 Business Computing with Internet Applications. It is a semester, 5-credit, and foundation-level course that comprise the Bachelor of Business Administration (BBA) degree programme. B121 aims to introduce learners to microcomputers and their applications in business; and enable them to develop, through hands-on experience, the knowledge and skills necessary to use common microcomputer software applications in business. Learners are required to make regular access to the Web-based course server via a dial-up modem or an Internet connection during their study. OUHK has developed a Web-based online delivery system, called the Online Learning Environment (OLE), to enhance e-learning experience. Based on WebCT 3.1.3, the OLE provides an interactive learning environment for communication among students, tutors and the Course Coordinator. The OLE is locating at URL: http://www.ouhk.edu.hk/ole, which consists of eight major students' components, including News, Administrative Information, Course Materials, Assignments, Interactive Tools, Personal Folder, Evaluation, and Help.

Major Findings

How students might view their performance in online courses (see Table 1.1)

Table 1.1 Issues	Frequent (%) (1=strongly agree, 5=strongly disagree)					Mean	Mode
	1	2	3	4	5		
Q1. Felt motivated to use IT in the learning process	18.5	55.5	23.1	2.9	0.0	2.11	2
Q2. Enjoy online learning via the OLE	12.7	38.8	40.9	7.2	0.4	2.44	3
Q3. Always read Course News	12.3	29.2	35.2	20.3	3.0	2.72	3
Q4. Like to work with classmates via online interaction	8.0	24.9	43.0	22.4	1.7	2.85	3
Q5. Read messages more than post messages	19.4	54.4	19.4	6.3	0.4	2.14	2
Q6. Perform better with group members online	6.7	26.1	53.4	12.6	1.3	2.76	3
Q7. Can better understand how the course was organised	22.9	46.6	22.5	7.6	0.4	2.16	2
Q8. Invest time to learn how to use IT	14.8	59.1	24.1	1.7	0.4	2.14	2
Q9. Perform well with the aid of IT	11.8	50.8	34.0	2.1	1.3	2.30	2
Q10. Felt much better prepared for the workforce	13.9	57.4	25.3	3.0	0.4	2.19	2

BEST COPY AVAILABLE

A great majority (74%) of respondents felt motivated to use IT in the learning process. They also agreed that the Internet could assist them in learning more about the subjects that interest them. As a result of learning how to use technology in the course(s), 71% of respondents were much better prepared for the workforce. With the course materials placed on line, 70% of respondents were able to more effectively understand how the course was organised. Reflecting on the experience, students (74%) thought the course(s) challenged them to invest time learning how to use technology benefited their study. It has been time well spent to learn how technology could be applied to their specific learning demands. All respondents were asked if their expectations of performing well with the aid of technology in the course(s) have been met. Here 63% of respondents indicated that it was, while less than 3.4% of respondents replied that it was not. One of the interesting findings is that 74% of respondents spelt more time to read messages from than post messages onto the Discussion Forum. They tend to receive than contribute to the e-Learning process.

What fear and anxiety students may feel in the online courses (see Table 1.2)

Table 1.2 Issues	Frequency % (1=strongly agree, 5=strongly disagree)					Mean	Mode
	1	2	3	4	5		
Q11. The biggest anxiety is not communicating well	3.8	29.4	45.8	18.9	2.1	2.86	3
Q12. The fear is not being effective in using emails	4.6	13.4	32.4	36.1	13.4	3.40	4
Q13. Don't like to be responsible for learning IT	0.0	7.6	49.6	36.1	6.7	3.42	3
Q14. Create more problem than it solves	1.7	12.0	35.0	39.7	11.5	3.47	4
Q15. Had some serious doubts to perform well initially	1.7	17.4	25.5	41.7	13.6	3.48	4
Q16. Not easy use the OLE system	1.3	13.6	30.9	46.6	7.6	3.46	4
Q17. Felt troubled to learn both IT and subject matters	1.7	13.1	42.4	34.7	8.1	3.34	3
Q18. E-communication skills prevent me from sharing	1.7	13.1	42.4	34.7	8.1	3.34	3
Q19. E-learning is suitable for my learning style	11.5	41.3	31.5	13.6	2.1	2.54	2
Q20. Could not overcome the anxiety and fear	0.9	9.8	32.9	46.2	10.3	3.55	4

A question asked if students were anxious about communicating on line in an open discussion forum. Overall, 21% of respondents indicated that they were, 44% of them expressed their disagreement, and 46% were neutral. All respondents were asked to give their view on the statement "My biggest fear in using a computer is not being effective in using emails". Eighteen percent of respondents indicated their agreement, 32% of them were neutral, and 50% of them disagreed. Responding to the statement "Using the OLE for study created more problems for me than it solved", 51% of respondents indicated disagreement and only 14% agreed. Another question asked of all respondents was about the anxiety of using OLE. The statement "when I found out that this course was heavy on technology use I had some serious doubts about my ability to perform well" received a positive response, with 55% of respondents indicating disagreement and 19% saying that they agreed. In response to the statement "I am troubled by the idea of having to learn how to use technology while at the same time learning my subject matter", 43% of respondents disagreed and 15% expressed their agreement. Overall, students felt not too afraid or anxious in online courses. Instead, the statement "The idea of learning on line is suitable to my style of learning" drew agreement from 53% of respondents, while almost all the rest express a neutral opinion (32%) rather than outright disagreement of 16%.

How students evaluate the effectiveness in the tutoring process (see Table 1.3)

Table 1.3 Issues	Frequency % (1=strongly agree, 5=strongly disagree)					Mean	Mode
	1	2	3	4	5		
Q21. Tutors are knowledgeable about e-learning	18.5	55.5	23.1	2.9	0.0	2.11	2
Q22. Tutors give detailed explanations through e-tutorials	12.7	38.8	40.9	7.2	0.4	2.44	3
Q23. The interest in IT for learning has grown	20.1	51.3	23.9	3.4	1.3	2.15	2
Q24. Hands-on tutorials in using IT are appropriate	14.5	54.0	29.8	1.3	0.0	2.17	2
Q25. Tutors email to clarify queries and course requirements	11.1	36.3	44.0	7.3	1.3	2.51	3
Q26. Tutors always reply emails promptly	9.0	27.4	60.3	2.1	1.3	2.59	3
Q27. Tutors are patient with learners	12.0	41.9	44.0	1.3	0.9	2.37	3
Q28. Tutors make use of 'Discussion' for e-tutoring	5.6	28.3	55.8	8.6	1.7	2.73	3
Q29. Tutors are effective at e-tutoring	8.2	39.2	47.8	3.4	1.3	2.50	3
Q30. E-tutoring increases more interactions	8.2	45.9	40.3	3.9	1.7	2.45	2

BEST COPY AVAILABLE

A great majority of respondents (74%) agreed that their tutors were knowledgeable about OLE. Tutors were found helpful in providing detailed explanations in tutorials. During the course(s), 71% of respondents agreed that their interest in use of computers and the Internet technology is growing. All of the respondents were asked if their tutors replied to email promptly. Thirty-six percent of respondents agreed while 60% of them were neutral. The statement "My tutor was effective at e-tutoring". Forty-seven percent of respondents agreed while 49% of them were neutral. Finally, 54% of respondents agreed that "e-tutoring increases interaction between tutors and students when compared with other print-based courses". Only 6% of them expressed their disagreement.

How students evaluate the effectiveness of course co-ordination (see Table 1.4)

See Table 1.4 Issues	Frequency % (1=strongly agree, 5=strongly disagree)					Mean	Mode
	1	2	3	4	5		
Q31. The OLE server could easily be reached	17.8	53.0	23.5	4.8	0.9	2.18	2
Q32. The response time of OLE is acceptable	11.7	61.3	20.9	5.7	0.4	2.22	2
Q33. The supplementary course materials are helpful	18.3	59.1	20.4	2.2	0.0	2.07	2
Q34. Communication and collaboration can be enhanced	10.4	50.9	33.9	3.9	0.9	2.34	2
Q35. E-learning can help extend students' knowledge	11.3	53.0	31.7	3.9	0.0	2.28	2
Q36. It is effective at administrating the course online	17.0	42.8	37.2	1.7	1.3	2.48	3
Q37. It is better than that of other print -based course	16.1	38.6	40.9	3.5	0.9	2.54	3
Q38. TMA could be submitted, assessed and returned online	20.2	49.1	23.7	5.7	1.3	2.19	2
Q39. Prefer to take an online course again	15.0	46.7	31.3	6.2	0.9	2.31	2
Q40. E-learning meets the professional and workplace needs	20.0	53.0	24.3	2.6	0.0	2.10	2

Most of the time, respondents (71%) could reach the course server to access course materials. When connected to the server, the response time was acceptable to them. The supplementary course materials, such as presentation files, tutorial notes, course information, etc were found to be helpful. Regarding the course coordination, 60% of respondents agreed that the course was being effectively administrated and 37% of them were neutral. Sixteen percent of respondents agreed that the course coordination performed much better than if they were in an ordinary setting while 41% of them were neutral. Respondents (69%) believed that assignments could be submitted, assessed and returned online. When a choice is given, they (62%) would prefer o take an online course again. All respondents were asked to give their view on the statement "Overall, I would ate e-Learning as useful to my future, professional, and workplace needs." The response is strongly positive. Seventy-three percent of respondents agreed, 24% neutral, and 3% disagreed.

Conclusion

The challenge of Lifelong Learning and the knowledge-based economy require us constantly upgrading and expanding our skills to meet the future, professional and workplace needs. Technically, e-Learning is feasible for distance learners. Although anxiety and fear in using IT during the e-Learning process were reported initially, technical support, e-tutoring, and e-course administration could reduce these problems substantially during the course. It is well validated that the e-course could improve not only the quality of teaching and learning but also the cost-effectiveness of course administration.

Contact Details

John MAK is an Assistant Professor at the Open University of Hong Kong, where he teaches Information Systems courses, including Business Computing, Advances in IT, and IS Audits, Security & Control. His primary research interests are the applications of Internet Technology in Business Environment and Distance Learning Technology. He can be reached at +852 2768 6922 or via email at jmak@ouhk.edu.hk. His office is Room A821, 8th Floor, Block A, School of Business and Administration, the Open University of Hong Kong, 30 Good Shepherd Street, Homantin, Kowloon, Hong Kong (SAR), CHINA.

References

Available upon request.

BEST COPY AVAILABLE

The use of Internet in a PBL course at ITESM.

Ma. Magdalena Maldonado Avalos.
Instituto Tecnológico y de Estudios Superiores de Monterrey
Campus Estado de México
mmaldona@campus.cem.itesm.mx

Abstract: This paper is about how the Internet can improve the process of solving problem in a course design with the didactical technique called PBL (Problem based learning). Firs I presented the differences between the new model and the traditional. Second, what is PBL and the characteristics of good problems. And finally, the 7 steps of the process of solving problems and the use of Internet.

Introduction:

At Instituto Tecnológico y de Estudios Superiores de Monterrey (ITESM), we are working in a new model called "Rediseño" (redesign) , this model was designed in order to achieve the Mission 2005. The principal characteristic of this model is a new different role of the student: he or she has the responsibility of his or her learning.

In the next scheme it is possible to see the difference between the Traditional model and the new model:

	Teacher	*Student*
Traditional model	Transmit knowledge He is the only who evaluates He decides what and how is the process	Teacher's dependence Receptive Individualist
New model (Mission 2005)	Planner and designer Facilitator and guider Share with the students the decisions of the process.	Autonomous Participative Collaborative Engaged with the learning process.

So the students need learn to learn, this implies their role is active. That´s the reason why there were select four didactical techniques:

- ✓ PBL (problem based learning)
- ✓ POL (project oriented learning)
- ✓ CASES (cases method)
- ✓ CL (collaborative learning)

I am working in the Marketing Department. The class I teach is Marketing Services, and I decided to use PBL as the main didactical technique.

Characteristics of PBL

PBL is any learning environment in which the problem drives the learning. That is, before students learn some knowledge they are given a problem. The problem is posed so that the students discover that they need to learn some new knowledge before they can solve the problem.

The big deal is to design a problem that motivates the student, so they can understand why they are learning the new knowledge. Learning in the context of the "need to solve a problem" also tend to store the knowledge in memory patterns that facilitate later recall for solving problems. Problem solving is the process used to solve problem, so the students working in a PBL environment should be skilled in problem solving or critical thinking.

Characteristics of good problems

Some factors that are essential for good problems are:

1. An effective problem must first engage students' interest, and motivate them to probe for deeper understanding of the concepts being introduced. It should relate the subject to the real world, so that students have a stake in solving the problem.
2. Good problems require students to make decisions or judgments based on facts, information, logic and/or rationalization. Students should be required to justify all decisions and reasoning based on the principles being learned. Problems should require students to define what assumptions are needed (and why), what information is relevant, and/or what steps or procedures are required in order to solve them.
3. Cooperation from all members of the student group should be necessary in order to effectively work through a good problem. The length and complexity of the problem or case must be controlled so that students realize that a "divide and conquer" effort will not be an effective problem-solving strategy.
4. The content objectives of the course should be incorporated into the problems, connecting previous knowledge to new concepts, and connecting new knowledge to concepts in other courses and/or disciplines.

Relation between Internet and a PBL Course.

The model "rediseño", also known as The New Model, means that at ITESM we are working not only in the academic topics, we are considering also abilities, attitudes and worths. Also, this implies the use of a technological support that can be: Lotus Notes - Learning Space. (LN-LS), or Blackboard (BB).

In order to teach a class in this model required that all the design and the material that will be used during the period of classes be in the (LN-LS). Before to teach a class in this model a teacher must work in the design of the class. Next table show the database that are used in LN-LS and BB.

Database	LN- LS	BLACKBOARD
Schedule	Here we can find the programming of all kind of activities divided per week. (Our courses have 16 weeks)	
- Start Here		Course Information
- Weeks		Assignments
- Calendar		Course Calendar

Media Center	Here we can find all the material that supports the course: Videos, abstracts, presentations, printed advertising, etc.	Course Documents Course materia ls External links
Course Room - Discussion - Assignments	This is the space designed for make and send the homework (assignments) and the discussions, and also through this database the teacher can graded the tasks.	Discussion Board Virtual classroom Digital Dropbox
Profile - Instructor - Students - Groups	Here we have all the information about the participants of a course (instructors and students). And also here the students can know their grades and the annotations that the teacher made related to their work.	Staff information Use /modify users Groups
Assessment -Questions -Assessments	This space permits to create different types of evaluation like : quiz, exams, survey, self-Asses.	Assesments Pool Manager Online gradebook

Each course is created in a server at each campus. Then each student needs to replicate the course in his or her Laptop through the use of the WEB or the Intranet. So all the activities that a course implies are in the technological support. (LN-LS or BB).

The most important thing in PBL is the relation between the knowledge and the students, Internet is the most easy way of getting knowledge. The student can get information from his laptop, in the moment that he need the information, he can travel through Internet and get it.

In order to solve the problems, the methodology implies 7 steps.

Steps	***Description***	***Use of Internet***
1.Clarifyng terms (In groups)	Have the same information. Identify if there are some terms that need to be investigated.	To search the terms that are not clear.
2. Defining the problem (In groups)	Delimitate the topic	
3. Brain storm (In groups)	Give different alternatives to solve the problem, that need to be investigate.	
4. Classification of ideas (In groups)	Classification of ideas and their relations.	
5. Formulating the learning objectives. (In groups)	Based on the explanations, define what knowledge will be investigate.	
6. Self study (individual)	Make the investigation	Each student make this point, Internet is a good way to find the

		information.
7. Oral or written report by group.	Participate in the discussion in order to make the report.	The students share the information they found, and they can use the information that they found in Internet.

Conclusions

As a conclusion, the process of solving problem without Internet, it could be possible, but it takes a long time to get the information. Fortunately, nowadays we have Internet, so the process of solving problems of PBL, is quickest and more interesting to the students, and let them to have contact with the real world and how the knowledge can be used, some of the characteristics of good problems of PBL.

A Distributed E-Learning Tool Based on Learning Objects

Marco Grossi, Mauro Marinilli and Alessandro Micarelli
Università di Roma Tre, via della Vasca Navale 79
Rome, Italy
contact@marinilli.com

Abstract: We present in this paper an intelligent educational system employing a distributed, agent-based software architecture implemented using intelligent agents, P2P and collaborative CBR techniques. The system answers to user information needs by proposing a tailored sequence of learning objects on the given topics found over the Internet. Such learning objects are packed according to a pedagogical approach and the user characteristics. The system can be seen as an intelligent information searching engine at a higher abstraction level, capable of solving extemporary or continuative information needs by means of user-customized presentations (sequences of one or more Learning Objects, tailored to the current user). Instead of presenting documents passively gathered throughout the Web as current search engines do, it tries to explain the requested information need by means of a sequence of learning objects, found in a collaborative way by querying its fellow agents over the Net.

Introduction

Emerging specifications in E-Learning content representation have the power to foster a whole new host of intelligent services, though such potential is still largely unexploited. Our objective was to design from scratch a new intelligent educational system, that took advantage of adaptive technologies while adopting novel E-Learning specifications, as well as employing a distributed, network-centric software architecture. We used these techniques in an attempt to enhance the quality level of the Internet search process (using annotated learning objects instead of simple documents) while enhancing the quantity of the retrieved material (by using a P2P-based, distributed approach).

We are developing a distributed E-Learning system based on collaborative CBR (Case-Based Reasoning [Aamodt1994]) and User Modeling employing standard specifications for Learning Objects (as prescribed in ADL SCORM and IEEE LOM) and other related standards. The system can be seen as an information searching engine at a higher abstraction level, capable of solving extemporary or continuative information needs by means of user-customized presentations (sequences of one or more Learning Objects, tailored to the current user). Hence, instead of presenting documents passively gathered throughout the Web as current search engines do, it tries to explain the requested information need by means of a sequence of learning objects, found in a collaborative way by querying its fellow agents over the Net. The system is also able to create elementary Learning Objects that encapsulates simpler documents, providing a degree of reliability based on user satisfaction. Also solved information needs (known solutions to cases posed by users) are kept in the local agent library for future use so enlarging the overall available knowledge on the given domain. We used a collaborative CBR approach to manage the information needs. We employed CBR for creating new solutions re-aggregating parts of old ones using P2P networks of domain experts agents. We found this approach well-suited for the inductive nature of our information-rich problem-solving situation. The system is currently used as an extemporary information searching facility, on a restricted domain of interest where a human expert has provided a set of annotated Learning Objects. The system integrates such course material with documents extracted from a well-known Web search engine.

The typical scenario could be the following. A student wants to know more about a given topic, "Java Server Pages". After posting the query to the User Agent, this latter one invokes the Pedagogical Agent that creates a particular Infoneed representation (the current problem representation in our CBR system) relying on the user model, the chosen pedagogical approach and the user input. This data is submitted to a Domain Expert Agent, that coordinates a group of interacting experts (such experts are implemented as peers in a peer-to-peer network) that implements a collaborative CBR process. Each expert peer using its local CBR engine provides a set of candidate solutions (a given sequencing of learning objects plus other pedagogical data) that are newly adapted by the leader domain expert agent. The resulting solution is adapted again by the Pedagogical Agent for appearance and to match the current user needs. The final result is proposed to the user. that can give some feedback that is used to tune both the user model, the pedagogical approach chose and the content. We adopted a distributed algorithm based on the classic CBR nearest neighbor case retrieval technique for case indexing and retrieval. From a CBR point of view the system performs a complete, distributed CBR lifecycle (composed of the four steps Retrieve, Adaptation, Revise and subsequent Retain).

Architecture

The architecture can be described adopting the following functional decomposition:

- the **User Agent**. It acts on behalf of the user, provides the GUI to his/her and interacts with the Pedagogical Agent in order to solve the current information need. It uses a User Model in order to better suite the End User needs. Its proactivity is achieved in two ways. One towards the End User, following the user interface agent approach (as in [Maes1994]). The other is towards the Pedagogical Agents, querying autonomously for new information needs on behalf of the End User.
- the **Pedagogical Agent**. It is responsible of refining the information needs posed by the User Agent, to negotiate possible solutions with Expert Agents and to adapt the found solutions to the current User Agent. The Pedagogical Agent is responsible to bridge the information need as perceived by the user into an annotation suitable for automatic indexing by means of a CBR indexing module. For doing this, it uses other information apart from the user model and the information need he / she devised: a pedagogical strategy, and other context data. In future versions we plan to adopt different pedagogical strategies.
- the **Expert Agent**. It is the knowledge warden, organized as a case library. When queried for some information need it is capable of performing a distributed search among its fellow peers over the Net in order to find the most suitable Learning Objects. It adopts a specialized collaboration CBR algorithm. There are several different types of such an agent. The standard one, that acts as a pro-active CBR library for solving known information needs based on the past experience. Another type is interfaced with a standard authoring tool for allowing human experts to input Learning Objects (though this is a temporary solution, future version will use a specialized User Agent for knowledge input). Other dedicated Expert Agents versions are specialized in wrapping existing rudimentary online data sources (such as traditional search engines, news sources, etc.) on-demand. For a better quality the system elects a leader agent.

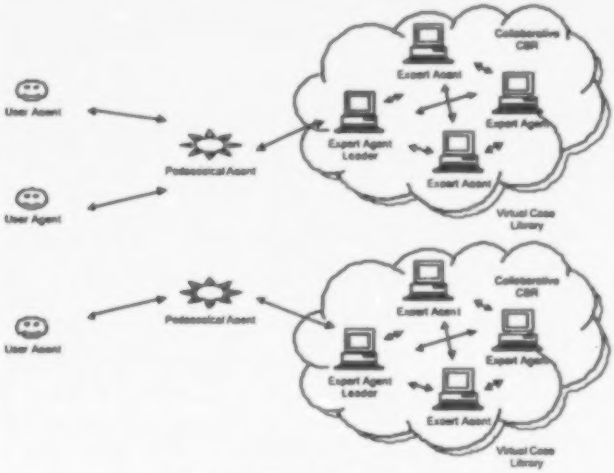


Figure 1. The Architecture

Such an architecture takes advantage of the latest Internet technologies in order to provide a flexible yet robust functional decomposition among the various software modules composing an E-Learning system. Given its top-down, high level approach, this architecture also turns out to be easily understood by non-technical people facilitating their interaction with the system.

BEST COPY AVAILABLE

Conceptual Model

Our conceptual model is centered around the *Infoneed* concept (an information need posed by the User). This is represented both at an abstract level, and as its concrete implementation (a given sequencing of learning objects provided by the Domain Experts Agents). Figure 2 below describes some of the details of our conceptual model using a UML notation.

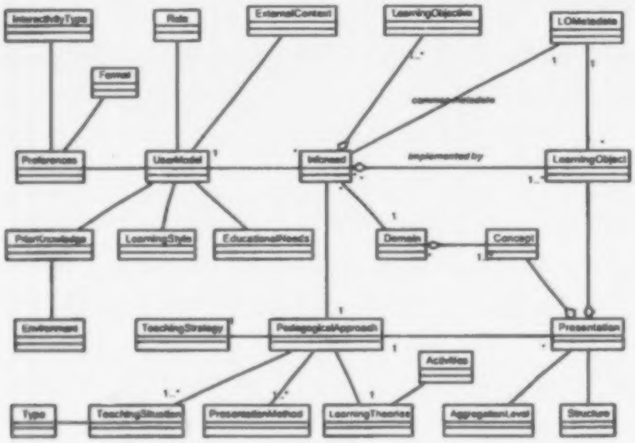

InteractivityType
Role
ExternalContext
LearningObjective
LOMetadata
Format
1..*
1
1
Preferences
UserModel
1
Infoneed
implemented by
LearningObject
1..*
1
PriorKnowledge
LearningStyle
EducationalNeeds
Domain
Concept
1..*
Environment
TeachingStrategy
PedagogicalApproach
1
1
Presentation
Activities
1..*
1..*
1
Type
TeachingSituation
PresentationMethod
LearningTheories
AggregationLevel
Structure

Figure 2. The higher-level conceptual model

In our system an Infoneed is represented as a CBR case comprising the following information:

- *User Model*. It is made up of some parts: the *role* (teacher, author, learner, manager, etc.), the *preferences* (type of interactive, format of the resource,...) the *prior knowledge* defined by the *environment* (primary education, secondary education,...,university first cycle,...), the *external context* (type of connection, type of computer, geographical zone,...), *educational needs*, the preferred *learning style* (constructivist, predefined) and other data.
- *Domain information*. It is composed of information regarding the content of the query posed by the user.
- *Learning Objectives*. This comprises information about the target skills, the competencies and the knowledge to be acquired.
- *Pedagogical approach*. It describes a theory of learning and education (empirical, rational and constructivism).the approach is composed by three elements: a teaching situation, a teaching strategy and a presentation method. A lesson consist of four *situations*: an introduction, an analysis part (that contains concepts, definitions, rules, the problem solving strategy,...), a reinforcement and a test. The strategy is implemented by a set of activities (observing, describing, analyzing, experiencing, studying, problem-solving, practicing, exploring, predicting, answer questions,...). The presentation method decides the format of the resources (video, mpeg, html document,...)
- *Learning Object Metadata*, as of the widely accepted IEEE LTSC LOM [IEEE2001].

Conclusions and Future Work

Our system is aimed at filling the gap of intelligent educational presentation, exploiting the best of the two worlds: dedicated, high-quality teaching material (traditionally strongly implementation-dependent) and the wealth of information the Web offers now and it will offer in the near future, when the E-Learning standards will be widely employed. Despite that, given the system capability of encapsulating pre-existing data sources and documents, it can be effectively employed at present time as an E-Learning system specialized in some given domain of interest, with the ability to extract (possibly with a lower quality) information from the Web. Furthermore, E-Learning courses and the related material is represented in a standard and reusable way, to allow exchange with other systems.

As regards future works in the agenda we are evaluating the porting of the system to the EDUTELLA framework [Nejdl2002] as a priority issue. Then we will explore the collaboration mechanisms between different Pedagogical Agents in order to promote a better pedagogical adaptation enhancing the overall learning experience.

BEST COPY AVAILABLE

References

[Aamodt1994] Aamodt, A. & Plaza, E. (1994). "Case-Based Reasoning: Foundational Issues, Methodological Variations, and System Approaches. AI Communications".

[SCORM2001] ADL Team (2001), "SCORM Specification", Version 1.2. http://www.adlnet.org

[IEEE2001] IEEE Learning Object Metadata Specification (2001) Working Draft 6.1. http://ltsc.ieee.org/wg12/index.html

[Lorraine2001] Lorraine McGinty and Barry Smyth (2001), "Collaborative Case-Based Reasoning: Applications in Personalized Route Planning", ICCBR'01 Proceedings.

[Maes1994] Pattie Maes, Yezdi Lashkari and Max Metral (1994), "Collaborative Interface Agents", Proceedings of AAAI '94 Conference, Seattle, Washington.

[Koper2001] Koper, Rob (2001), "Modeling Units of Study from a Pedagogical Perspective: the Pedagogical Meta-Model Behind EML". Technical report of the Open University of the Netherlands.

[Nejdl2002] Nejdl Wolfgang et al.(2002),"EDUTELLA: A P2P Networking Infrastructure based on RDF", WWW2002 Proceedings.

Theoretical framework: Towards a Grid for the Pedagogical Analysis of Online Courses

Martine Chomienne
Cégep@distance
Montréal-Canada
mchomienne@cegepadistance.ca

Abstract: After a review of reports on online learning and the evident lack of conclusive studies comparing online learning, traditional distance learning and classroom learning, a research team funded by the PAREA program of the Ministère de l'Éducation du Québec has developed a tool for comparing various online courses. This is based on the theoretical principals of multimedia communication, online collaborative learning and online instructor/student roles. The tool is applied in the learning impact assessment of a virtual program in the natural sciences.

Introduction

E-Learning has become a buzzword in the field of training and education where it is employed loosely to designate a wide variety of teaching situations. Industry Canada in a report from the Advisory Committee for Online Learning published in February 2001 said: "Online learning can be defined as what occurs when education and training (typically credit but also non-credit) are delivered and supported by networks such as the Internet or Intranets. Learners are able to learn any time and any place. In this report, we use the terms "online learning" and "e-learning" interchangeably. In either case, we mean both distance learning and the provision of technology -enhanced learning within a traditional classroom, lecture hall or lab." Therefore, on the one hand, we talk about online courses in which students have more or less infrequent access to web sites associated with classroom teaching and, on the other hand, courses designed entirely to be delivered via the net and followed from home.

Theoretical Framework

The theoretical framework adopted is based on Depover's (et al.) three dimensional model for interactive multimedia (1998), Henri's (and Lundgren-Cayrol) online student collaborative learning model (2001), and Teles' (2000) and Salmon's (2000) online instructor/student roles.

Student/Teaching Material Interactivity. Depover et al. define educational interactive multimedia as the computer-generated integration, distribution, and management of sound, text, and graphic. An interactive multimedia teaching material gains the attention of the learner through the *perceptive channels* (hearing, sight, etc.) and is composed of interactions between the machine and the user. This later must know what the system expects of him in order to navigate properly into the multimedia. Furthermore, interactive multimedia facilitates the *intellectual activity* of the student by proposing *teaching strategies* and by structuring the learning content into different kinds of knowledge representations. It includes all the information needed to build a model *representing the student* and to propose appropriate activities. Each of these intervention levels (perceptive, transaction-driven, cognitive, pedagogical and evaluative) must satisfy clarity, coherency, pertinence, analogy, redundancy and control criteria.

Student/Other Participant Interactivity. The interactivity between the student and the other participants is influenced by collaborative learning and by the role of the instructor. We have regrouped the student collaboration model by Henri and Lundgren-Cayrol (2001), the instructor role by Teles and the stages of student progress in online learning situations by Salmon (2000) into four components describing activities, tools and participant interventions.

Access and motivation allow students to become technically operational and to prepare themselves psychologically for active participation in their learning experience.

Online involvement and socialization consist in building a real sense of belonging to a virtual community and the development of group working methods.

Communication of ideas or information exchange, knowledge building and learner development constitutes the actual learning components.

Coordination includes all the operations that the instructor and the students do for managing the learning experience.

Each component implies interventions made by students and the instructor to be taken into account in some cases at the design phase of instructional material and for others during the delivery phase.

Steps for the Application of the Tool to Online Courses

To assess an online course with regard to teaching, one must examine the student/educational material interaction by determining first the symbolic systems in play. One must then determine the function of each of the system elements as to the five levels of interactivity (perceptive, transaction-driven, cognitive, pedagogical and evaluative) described by Depover et al. (1998). This is the first step and allows us to put together Table 1.

In the second step one must apply the six quality criteria (clarity, coherence, pertinence, analogy, redundancy and control) as proposed by Giardina and Mottet (1996) to each of the elements and for each level of interactivity.

And finally, in the third step, one must determine the elements making up the student/students and student/instructor-expert interactivity. This allows us to produce a series of tables for each component of this dimension. As an example Table 2 illustrates the dimension of Online involvement and socialization.

Conclusions

The tool has been applied to several courses in the virtual program in the natural sciences and has revealed an interesting progression in the use of the internet teaching potential. Courses designed in 2000 were more interactive than those designed in 1998-1999.

Furthermore, the tool is still at the final validation stage with a number of experts in the field. These people are testing it in an iterative process in other courses of the virtual DEC as well as in courses of Cégep@distance.

References

Depover, C., Giardina, M, and Marton, P, (1998). *Les environnements d'apprentissage multimédia – Analyse et conception.* Paris: L'Harmattan

Ducharme, R. Lizotte, F. and Chomienne, M.(to be published). *Évaluation du DEC virtuel.* Research report presented to the PAREA program of the ministère de l'Éducation du Québec

Giardina, M. and Mottet, M. (1996). Unpublished document

Henri, F. and Lundren-Cayrol, K. (2001). *L'apprentissage collaboratif à distance.* Québec: Presses de l'Université du Québec

Industry Canada (2001). The e-learning evolution in colleges and universities. A Pan Canadian Challenge Report from the Advisory Committee for Online Learning, p.25

Salmon, G. (2000). E-moderating: The key to teaching and learning online. London: Kogan Page

Teles, L. (2000). Investigating the Role of the Instructor in Online Collaborative Environments. Project 5.25 TeleLearning, project report

Acknowledgements

This paper reports on work undertaken as part of a project funded by the PAREA program of the ministère de l'Éducation du Québec (Canada).

Symbolic Systems	Perceptive	Transaction-driven	Cognitive	Pedagogical	Evaluative
Sounds : words, music, reading texts, songs, oral expression, etc.	Hearing (tone, pitch, volume)	Multimedia navigational information (written or oral commands, page-number indications in the section scrolling arrows.)	Explain, detail, specify, (adapted for the target population)	Determine the teaching objectives. Present the content and activities. Define and expose learning strategies, cognitive and meta-cognitive teaching strategies. Bold and capital letters, etc. are often used to attract attention, to accentuate something.	
Texts (attributes)	Sight				
Attributes of letters (fonts, style)					Present teaching and summative evaluations. Allow users to know their level of achievement of objectives, etc. Evaluate progress.
Hypertexts,		Click-on prompt	Define		
Drop-down menus		Click-on prompt	Detail		
Pop up			Specify		
Shading (colour changes)		Indicates places already visited.			
Flashing		Indicates who should intervene and where			
Colours		Indicate a section, a module, a unit	Hold a cultural meaning.		
Graphic	Sight				
- Icons		Can (but not necessarily) be click-on prompts	convey a command.		
-					
- Hourglass		Indicates that the system is busy	convey a notion, a concept.		
- Drawings		Can (but not necessarily) be click-on prompts	convey a notion, a concept.		
-					
- Photographs		Idem		Can be used to attract attention.	
- Diagrams		Idem			
- Comic strip, Animation		Idem			
- Trees		Idem	Structure content.		
- Tables		Idem			
- Arrows	Hearing and sight	Forward or backward prompts			
-					
- Video		Combine media effects	Combine media effects	Combine media effects.	

Table 1 : Student/Teaching material Interactivity

Components	Sub-components	Tools	Activities	Role of the Host-Instructor		Comments
INVOLVEMENT (HENRI AND LUNDGREN) ONLINE SOCIALIZATION (SALMON)	Group cohesion	Forum Chat Directory (student list) Visitor card Resums Messages	Participate in a forum or in a chat room, fill out the visitor card, Get to know the other participants.	Encourage the students to participate, to share their motivation and their expectations, to give personal information (hobbies, civil status, etc.) , to consult the visitor cards of every participant.	Communication space offered to everyone. Room for personal information on everyone.	This activity prepares the setting up of the teams.
	Belonging	Forum with interactivity sociograms	Training at collaborative learning:	Organise and supervise a group negotiation session concerning the collaborative model and the conditions which will apply in order to carry out the training activity (participation rhythm, frequency, intervention size, team constitution, kind of contributions from everyone, parameters or characteristics of group or team productions, work schedule and any other development which applies). Bring back those who tend to remain apart from the group, etc.	Public communication space	The group discovers, understands and evaluates its needs in order to later define the way in which the collaboration will work and which jobs will be done. The instructor studies the interactivity sociogram to intervene with those who do not participate sufficiently.
	Perception of group productivity	Forum Tool for following up projects. Instant questionnaires.	Fill out work-progress questionnaires regularly by the students.	Release the results of the questionnaire to students, informing them of their progress as a group and allowing them to reflect on their team effort.	Public communication space.	

Table 2: Student/Other participant Interactivity

Supporting Elearning in Engineering Education

Constantino Martins, Isabel Azevedo, Carlos Vaz de Carvalho
Instituto Superior de Engenharia do Porto (ISEP) - Portugal
const@dei.isep.ipp.pt

Lígia Ribeiro
Faculdade de Engenharia da Universidade do Porto (FEUP) - Portugal

Abstract: The purpose of this paper is to present the project "Supporting Elearning in Engineering Education". This project addresses research questions related with the identification of the requirements and evaluation of Web-based learning environments used in an on-campus context, to complement the traditional teaching and learning in engineering institutions of higher education. A set of undergraduate and postgraduate courses of the Porto Polytechnic Scholl of Engineering (ISEP) and the Faculty of Engineering of Porto University (FEUP) will be used as test beds.

Background

The accessibility and easy of use of information and communication technologies (ICT) to develop teaching and learning environments, accessible through a Web interface, is being increasingly explored by academic institutions and companies operating in the education "market" ([Flanagan, 2000] [Collis, 1998]).

The use of these environments as a complement to traditional education in undergraduate and postgraduate courses deserves increased attention. As a result diverse models and patterns have been developed and implemented ([Nachmias, 2000] [Seufert, 2000] [Cardoso, 2001]). Especially because studies show that on-line learning is economically sound and convenientOn-line learning is an important financial market for universities and access to education is enhanced and opportunities are expanded from a political point of view through distance learning opportunities.

Like most higher education institutions, ISEP and FEUP have launched a few e-learning initiatives on an experimental basis, whose results are being evaluated. However these initiatives have not been conducted in a systematic way and have not been integrated with existing information systems, taking profit of the management and communication facilities offered by them. Our view is that Information Systems also constitute an important tool to support the evolution of the pedagogical process (David, 2001). Their interconnection with e-learning systems is expected to have a value added contribution to the continuous education effort.

Objectives

The project will be conducted during the 2001/2002 academic year, focusing on a set of one-semester courses of ISEP and FEUP.

The **first phase** goal was to identify the requirements for a Web Based Environment, which advantageously complements the traditional learning process. For this purpose, a set of tools was designed to provide this information, taking into account the nature of the stakeholders (higher education institutions, teachers, and managers).

We synthesized these studies on these tools as well as case studies in other academic institutions. These results will be published elsewhere (Martins Constantino).

The **second phase** of the project (currently ongoing) will look into the adequacy and advantages of integrating the Web Based Learning Environment with existing Information Systems. The evaluation will take into account the defined requirements and analysis of cost/benefit.

The first step of this phase was the selection, acquisition and installation of a Web Based Learning Environment (WBLE) for each Institution, based on the fulfillment of the requirements identify in the first phase. In order to assess the advantages of the integrating the WBLE with the IS, one of the environments selected (ISEP) will not be integrated with an IS, while the other (FEUP) will be integrated with the existing IS of the Institution, SiFEUP (Ribeiro, 1997).

The next step in this phase has been the analysis of the facilities available on SiFEUP and the advantages of integrating the WBLE with it. This phase is currently under development.
Simultaneously some pilot courses were selected (and a corresponding teaching/learning methodology) in each Institution that will be used to test and evaluate the efficiency of each Institution environment. The assessment, through questionnaire, of student's technological profile was conducted before the beginning of the courses.

As it is difficult to demonstrate that a change in practice or in knowledge over time can be attributable to a single isolated resource (the WBLE+IS, in our case), the Integrative approach therefore looks at how the resource is used in conjunction with all the other resources that are available to its users. It will focus on users' opinions and level of use of the resource, and on how it is embedded into the course as a whole. The opinions of the administrative staff and technicians involved in this study will also be taken into account

Expected Results

The expected results are twofold: identification of the requirements and evaluation of the effectiveness of an integrated e-learning/information system environment in engineering education.

The results of this project may be useful for other engineering institutions of higher education that wish to create, manage access and share Infrastructures of "campus-learning", in an integrated and extensible fashion.

Conclusions

The Results of this project, here summarized, may be useful for other engineering institutions of higher education that wish to create, manage, access and share Infrastructures of "campus-learning", in an integrated and extensible fashion. We also think that the experience of this work represents an alternative view about the role of learning Web-based environments/systems in educational processes.

Learning is facing new challenges in the electronic age, and with no doubt on-line educational communities is one of those challenges where we want to focus ours research work. We think, by exploiting online learning communities, for the complement of traditional education, the academics institutions must consider the learning Web-based environment a strategic instrument of development and research.

References

Flanagan M., and Egert, C. (2002). *Courseware quality and the collaborative classroom: implementing IOS courseware to generate seminar-style interactions.* IMEj, 2(1);

Collis B. (1998). *WWW-Based environment for collaborative group work.* Education and Information Technologies, 3, 231-245;

Nachmias, R. et al.(2000). *Web-Supported Emergent-Collaboration in Higher Education Courses.* Educational Technology & Society 3(3);

Seufert Sabine (2000). *The NetAcademy as a Medium for Learning Communities.* Educational Technology & Society 3(3);

Cardoso Eduardo Luís, Altamiro B. Machado (2001). *A Problemática da Adopção de Ambientes de Ensino Distribuído no Ensino Superior.* 2ª Conferência APSI;

David Gabriel, Ligia M. Ribeiro (2001). *Impact of the Information System on the Pedagogical Process.* Proceedings of the 7th International Conference of European University Information Systems, EUNIS 2001 - The Changing Universities, The Role of Technology, pp. 249- 251, Berlin, Germany, 28-30 March;

Karaliotas Y. (1997). *Learning on and over the Internet: Dynamics and Limitations.* August 1997;

Martins Constantino. *Infrastructures of "campus-learning": applicability in the education of Engineering.* MSc. Thesis, in publication;

Ribeiro Ligia M., Gabriel David, Ana Azevedo, J. C. Marques dos Santos (1997). *Developing an Information System at the Engineering Faculty of Porto University*, Proceedings of the European Cooperation in Higher Education Information Systems, EUNIS 97, pp. 282-287, Grenoble, France, 9-11 September;

Teaching Argumentation in Secondary School Through Computer Based and Face-to-face Debate[1]

Miika Marttunen, Leena Laurinen and Timo Salminen
University of Jyväskylä, Department of Education
Finland
miika.marttunen@edu.jyu.fi

Abstract: This article describes a study in which 28 Finnish secondary school students engaged in a 12 week argumentation course. The course consisted of theoretical studies and exercises on argumentation, and argumentative debates in pairs through computer chat and face-to-face. The students' argumentation skills were tested before and after the course. The students also wrote an individual argumentative text before the face-to-face and computer debates and modified their text after the discussion. The test results indicated that the students developed in their argumentation skills during the course. The quality of argumentation in the students' texts improved from the text written before to the text written after the debate. Thus, the debates stimulated students' argumentative thinking and helped them reflect on the topic in question from multiple perspectives.

Introduction

In order to take part in argumentative discussions students are invited not only to construct and transform their own knowledge (Bereiter & Scardamalia, 1989) but rather to co-construct and create new knowledge structures together (Dillenbourg, 1999). For this reason argumentation is a very effective means to learning. Unfortunately, the prerequisites for argumentative co-construction of knowledge are not necessarily met simply by asking students to debate some argumentative topic because, instead of exploring the issue from different perspectives by considering the pros and cons of their arguments, students start very easily to dispute. Although argumentation skills are emphasised as one goal of school education, there is a limited provision in curricula of most countries to teach them . In this paper we present research results based on a teaching experiment aiming at teaching argumentation to secondary school students. The study focuses on the following research questions: 1) Did students' argumentation skills develop during the teaching experiment?2) Are there any differences between students' individually written argumentative texts before and after the argumentative discussions by either face-to-face or by using chat-tools?

Method

Subjects and Measurement of Students' Argumentation Skills

The data of the study were collected in the teaching experiment (12 weeks, 56 hours) carried out in one secondary school in Middle Finland. Before the experiment the argumentation skills of the students were measured by the pre-test. The students of the experimental group (n = 28) participated in the argumentation course while the control group (n = 27) did not study argumentation. The argumentation skills of both the experimental and the control group were measured again after the experiment by the post-test. The pre-test and post-test focused on the students' skills to a) analyse argumentative text by choosing the main claim and the supporting grounds from numbered sentences of the text, b) present their own grounded view (claim and supporting grounds) on a given topic, c) comment on an argumentative writing, and d) to choose valid grounds and correct conclusions from several choices (see Marttunen & Laurinen, in press).

---

[1] The research reported here was carried out within the SCALE project (Internet-based intelligent tool to Support Collaborative Argumentation-based LEarning in secondary schools, March 2001 - February 2004) funded by the European Community under the 'Information Societies Technology' (IST) Programme. Information on the project can be found at: http://www.euroscale.net/

Argumentation Course

The argumentation course was cross-curricular in nature and practically it was a combination of three sub-courses, one in Ethics and two in Mother Tongue. Two of the courses were obligatory (Power of Language and Good and Evil in Man) and the third course (Argumentation) was optional when it comes to the Finnish secondary school curriculum.

The first six week period of the course was based on the combination of the obligatory courses *Power of Language* and *Good and Evil in Man*. Studies during this period followed partly the text books and exercises included in the worksheets of the books. The first period was divided into introductory, theoretical and practical parts. During the practical part the students practised argumentative communication through two topics (Racism and Sexuality) by engaging in informal discussions, drama-sessions, group discussions and group debates.

The second six week period of the experiment was a specialization course of Mother Tongue (Argumentation) during which the students debated in pairs both face-to-face (20 minutes) and by using a synchronous chat tool DREW[2]) (40 minutes). The themes treated were Capital Punishment, Nuclear Power, and Genetically Modified Organism In this paper the focus is on the argumentative chat and face-to-face discussions about *Nuclear power*. The studies in both chat and face-to-face environments proceeded according to a four phase task sequence during which data were collected on students' performance both before and after the discussions in pairs (see SCALE project, 2002a). The *training phase* included one double-lesson (90 minutes) for practicing the use of the DREW software. In the *preparation phase* the students were given newspaper and web articles (5 in total) on nuclear power. They analysed the argumentative structure of the articles in small groups of 3 – 5 students, and presented the results of the analysis to the whole class. After working with the articles the students wrote their first individual text (total of 24 texts were collected). In the *debate phase* the face-to-face group (n = 10) debated on the topic about 15–20 minutes, and the computer group (n = 16) chatted with DREW about 30 – 40 minutes. After the debate the students reflected on the debate by filling in a graph on the debate collaboratively. Finally, in the *consolidation* phase students modified their original individual text as a function of the debate that had taken place. The articles were not available for the students when they wrote their individual texts.

Data Analyses

Analysis of Students' Individual Texts

The analysis examined how wide the space of debate in the students' texts was. The space of debate is wide when the text provides many relevant arguments with respect to the question, and takes into account the multiple points of view that can be held in the debate The analyses of the students' texts are based on a QED (Qualité de l'espace du débat; Engl. Quality of the Space of Debate) analyses method[3]. QED is a numeric measure which is calculated on the basis of the following analysis criteria of the text (for details see SCALE project, 2002b): 1) *Richness:* the text is rich when several arguments are presented; 2) *Elaboration (classification categories: poor, medium, high):* the text is highly elaborative when arguments are provided with sub-arguments, examples, and explanations; 3) *Balance:* the text is balanced when both pro and against arguments are presented; 4) *Coverage:* the text has a wide coverage when the arguments cover many different topics of the question. Coverage is the ratio of the covered topics in a given text with respect to the number of all different topics found when all the texts written by the students are taken into account; 5) *Coherence:* Coherence is the distance between the general opinion of the student (rather *pro*, rather *against* or *shared*) and the general balance of arguments in her/his text .

Pre-test and Post-test Analyses

---

[2] Drew (Dialogical Reasoning Educational Web too) is a collaborative Java environment designed by Universities of Lyon and St. Etienne during the European SCALE project. For more information on Drew see http://www.euroscale.net/

[3] The QED method was elaborated by M. Quignard (GRIC, Lyon), in collaboration with M. Baker (GRIC, Lyon), J. Andriessen and M. van Amelsvoort (Utrecht University). Details can be found in Deliverable 8 of the SCALE project, at: http://www.euroscale.net/

BEST COPY AVAILABLE

In the analyses of the students' answers to the task of *analysing an argumentative text* the text included one correct sentence which indicated the main claim of the text, and two partly correct sentences. The correct and the partly correct options were awarded by points. The grounds the students had selected were scored on the basis of relevancy to the selected claim. In the analysis of the task of *composing one's own arguments* the analysis of the claims clarified whether the claim a student had composed was understandable and clear in focus. The analysis criteria for the students' grounds were relevancy and sufficiency (see Bacig, Evans, Larmouth & Risdon, 1990; Walton, 1989). The analysis of the *students' comments on a short biased argumentative text* clarified how analytical their comments were. In the analysis of the *judging tasks of grounds and conclusions*, the different possible choices were scored on the basis of rational reasoning.

Results

The students produced higher quality argumentative texts after the debate compared to the text they wrote before the debate (Table 1). The texts after the debate were more covered with respect of the topics, included more and better elaborated arguments, and were more balanced in terms of arguments in favour and against. Consequently, the general QED scores were also higher in the texts written after the debate compared to the texts before. The improvement was equal in face-to-face and computer chat conditions.

Table 1 Differences (paired samples t-test) of the quality of the space of debate and related variables between faco-to-face and computer chat environments

MODE OF STUDY		VARIABLE					
		COV	WSA	WSAP	WSAA	BAL	QED
		% (M)	*ƒ (M)*	*ƒ (M)*	*ƒ (M)*		
Face-to-face (n = 9)	Text before	35.2	6.8	2.3	4.4	30.11	10.6
	Text after	51.2	14	4.1	9.9	39.11	17.9
	p	*.081*	*.000*	*.043*	*.002*	*.025*	*.030*
Computer chat (n = 12)	Text before	38.8	7.5	2.0	5.5	27.7	10.9
	Text after	48.6	12	2.8	9.3	38.5	19.3
	p	*.028*	*.000*	*.108*	*.000*	*.024*	*.017*
Total (n = 21)	Text before	37.2	7.2	2.1	5.0	28.7	10.8
	Text after	50.0	12.9	3.3	9.5	38.8	18.7
	p	*.006*	*.000*	*.008*	*.000*	*.001*	*.001*

COV = Coverage; WSA = Weighted Sum of Arguments; WSAP = Weighted Sum of Arguments Pro; WSAA = Weighted Sum of Arguments Against [The weighting is based on the level of elaboration]; BAL = Balance); QED = Quality of the space of debate.
Note: the range of variables COV, BAL and QED is from 0 – 100.

Table 2 Differences (paired samples t-test) between the students' pretest and posttest results

VARIABLE	EXPERIMENTAL GROUP (N=28)					CONTROL GROUP (N=27)				
	Pre-test	*SD*	*Post-test*	*SD*	*p*	*Pre-test*	*SD*	*Post test*	*SD*	*p*
Identifying claims	.92	.39	.92	.39	ns.	1.11	.42	1.15	.36	ns.
Identifying grounds	.31	.62	.69	.74	*	.70	.78	.56	.70	ns.
Composing a claim	1.08	.84	1.85	.37	**	1.63	.56	1.70	.54	ns.
Composing grounds	1.21	.74	1.83	.39	**	1.62	.57	1.92	.27	*
Analytical approach	.76	.83	.96	.84	ns.	.55	.70	1.04	.71	**
Judging grounds	1.58	.58	1.50	.51	ns.	1.67	.68	1.37	.63	ns.
Judging conclusions	1.44	.71	1.64	.76	ns.	1.19	.75	1.54	.81	ns.

Note: The range of the variables is from 0 to 2.

Table 2 indicates that the students of the experimental group improved in their skills in *identifying grounds* from an argumentative text (pre-test score.31, post-test score .69), *composing a claim* (1.08 vs. 1.85), and *composing grounds* (1.21 vs. 1.83). All the differences were statistically significant. The control group who did not take part in the combined argumentation course did not differ between the pre-test and post-test results in variables *identifying grounds* and *composing a claim* . However, the post-test scores of the control

BEST COPY AVAILABLE

group in the variable *composing grounds* were higher than their pre-test scores. It is, however, worth noticing that the task relating to composing grounds was different in the pretest and post-test: the theme on which the students were asked to compose the grounds was easier in the post-test. The easier theme in the post-test may have affected the students' better scores in the post-test both in the experimental and control groups. For this reason, in the experimental group the difference between scores of variable *composing grounds* in the pretest and posttest was corrected by the effect of the easier posttest task (i.e. control groups .30 improvement in the task), and the difference was tested once again (one sample t-test). The result indicated that the difference remained statistically significant ($t = 2.27$ $df = 25$, $p = .032$; missing values were replaced with the mean).

The students of the control group achieved higher scores in the posttest also in the case of variable *analytical approach* (1.04 vs. .55 in Table 2). The better scores of the control group are most obviously due to a test-wise effect (Borg & Gall, 1989 p. 644) since the task concerning this variable was the same in the pretest and posttest. The improvement in the scores of the experimental group (although not in terms of statistical significance) also supports this conclusion.

Conclusions

The students' texts after the debates included richer topical and more balanced argumentative structure than the texts they wrote before the debate. Thus, students benefited from both face-to-face and computer based debates on the topic. Argumentative discussions during which new approaches and points of view are aroused seem to stimulate students' argumentative thinking and help them reflect on issues in question from several perspectives.

The pre-test and post-test results showed that the students improved in their argumentation skills during the argumentation course. This result suggests that argumentation skills in general can be taught successfully during 12 week teaching interventions. The results are consistent with previous results that have shown that students learn argumentation skills even during shorter (6 weeks) teaching periods (Wesp & Montgomery, 1998). The results are also in harmony with the results of students' improved QED scores in their texts in this study since they support the assumption that during the argumentative debates the students not only improved in their space of debate, but learned argumentation skills as well.

References

Bacig, T. D., Evans, R. H., Larmouth, D. W. & Risdon, K. C. (1990). Beyond argumentation and comparison/contrast: Extending the Socrates CAI design principles to classroom teaching and the interpretation and production of other forms of discourse. *Computers and the Humanities*, 24, 15 – 41.

Bereiter, C. & Scardamalia, M. (1989). Intentional learning as a goal of instruction. In L. B. Resnick (Ed.) *Knowing, learning, and instruction: Essays in honor of Robert Glaser*. Hillsdale, NJ: Erlbaum, 361-192.

Borg, W. R. & Gall, M. D. (1989). *Educational research: an introduction* (5th ed.) New York: Longman.

Dillenbourg, P. (Ed.) (1999). *Collaborative learning: Cognitive and computational approaches*. Amsterdam: Pergamon.

SCALE-project (2002a). European Commission, project No IST-1999-10664. *First Year Deliverables. Deliverables 1 & 2*, 51 – 55. Available at http://www.euroscale.net/

SCALE-project (2002b). European Commission, project No IST-1999-10664. *First Year Deliverables. Deliverable 8*, 134 – 141. Available at http://www.euroscale.net/

Marttunen, M. & Laurinen, L. (In press). Argumentation skills of secondary school students in Finland, Hungary and United Kingdom. *Proceedings of the Fifth Conference of the International Society for the Study of Argumentation*. University of Amsterdam.

Walton, D. N. (1989). *Informal logic. A handbook for critical argumentation*. Cambridge: Cambridge University Press.

Wesp, R. & Montgomery, K. (1998). Developing critical thinking through the study of paranormal phenomena. *Teaching of Psychology*, 25(4), 275-278.

LLC Lecture Capture and Editing Tool for Online Course Delivery

Mark Apperley, Sam Jansen, Amos Jeffries, Masood Masoodian,
Lance Paine, Bill Rogers, Tony Voyle

Department of Computer Science
The University of Waikato
Hamilton, New Zealand
M.Masoodian@cs.waikato.ac.nz

Abstract: This paper describes a system for the capture and editing of live lecture presentations for redelivery locally or over the Internet. The system captures both audio from the presenter and the annotations made to the contents of the presentation material. For lecture capture, the system works in conjunction with standard PowerPoint™ presentation software. The audio editing is done using a stand-alone application, while the redelivery is done directly in PowerPoint™, or over the Internet and using a standard web browser. The captured version of the presentation includes the original lecture slides, graphical annotations made by the lecturer during the lecture, the audio recording of the lecture along with controls and indexing methods which allow easy access to different segments of the presentation. Presentations can be replayed in part or in full as required, preserving all of the content of the live lecture.

Introduction

In recent years the use of software such Microsoft PowerPoint™ has become an integral part of lecture preparation and delivery. Lecturers often prepare their material using some kind of presentation software, and then either deliver their lectures directly using the presentation software, or print their notes on transparencies and use overhead projectors for the actual delivery of the lectures. One of the main reasons for the use of printed transparencies, rather than the presentation software, is because it is easier to annotate the lecture material on transparencies during the course of a lecture. Although most presentation software allow annotation of slides during presentation, it is generally more difficult to use a computer mouse to draw or write on a slide than it is to simply use a pen to annotate a transparency. Also, in most presentation software, such as PowerPoint™, the annotations aren't added to the slides, which means that when one moves from one slide to the next then all the annotations on the previous slides are lost.

A further problem in the use of existing presentation software is the lack of support for redelivery of the lecture material. Conventional presentation software at best allows one to convert the lecture notes to Web pages and put them online for students to use after the lecture. However, this is clearly less than satisfactory because the students then only get the notes without the annotations, and more importantly the audio presentation of the lecturer. There is an additional cost here that is not immediately obvious. If it is not possible to annotate or if it is undesirable to put significant content into annotations because it will be lost in redelivery, the lecturer is forced to put significantly more time into preparation, and given a disincentive to vary content at delivery time in response to the questions and needs of the audience. With a good redelivery system, a lecturer could choose the level of advance preparation freely. In particular they could choose to do no advance preparation, except perhaps personal notes.

Although there is software which allows recording of lectures, both annotations and audio content, the majority of these tools place significant overheads on the lecturer to develop their material in a suitable form or using a special application (Jesshope, 2000; Gehne and Jesshope 2000). These overheads often divert the presenter from the real purpose, the delivery of the content, and focus attention on the form. The effort required is typically far in excess of the preparation of the same material for live delivery.

This paper describes the LLC (Lightweight Lecture Capture) software, developed to support the recording of lecture presentations for subsequent review and redelivery, requiring little or no effort in addition to that for the original live presentation. LLC is based on a standard presentation package, PowerPoint™, and requires only that the original presentation be produced in PowerPoint™ format. Capture is based on large interactive display surface technology, while review and redelivery require only a conventional desktop computer.

During this research we have developed a low-cost Large Interactive Display Surface (LIDS) which we utilize for lecture delivery and capture (Apperley et al., 2001). A typical LIDS system is an office whiteboard-sized

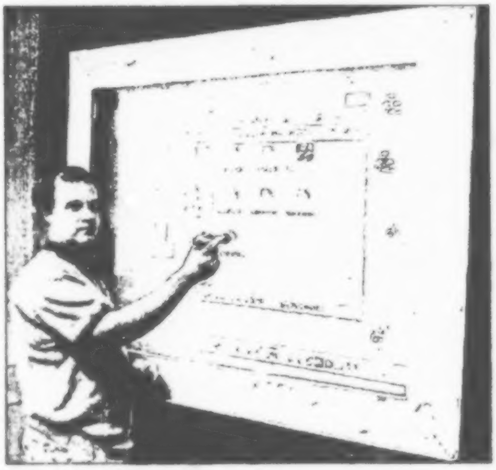


Figure 1: A prototype LIDS system as used for lecture delivery

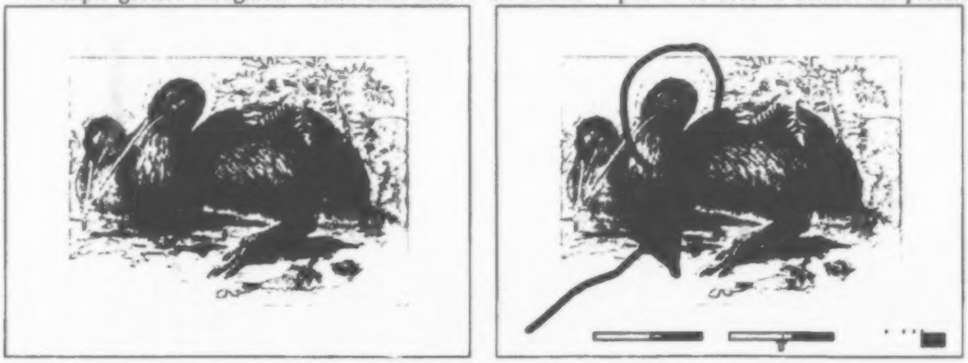
screen functioning as a computer display, with a Mimio™ (Virtual Ink Corporation, 2002) digitization equipment at the front allowing the users to directly interact with the screen using a pen (providing similar functionality to a mouse). A standard data projector and a rear projection screen are used so as to allow the users to work directly in front of the screen without occluding the image. A prototype LIDS system is shown in Figure 1.

Lecture Capture and Redelivery

The Lightweight Lecture Capture (LLC) software acts as an overlay to PowerPoint™, allowing the presenter to make annotations and additions to the individual slides during live presentations using Mimio™ pens. The presenter's voice is also recorded by the LLC software, and together with the annotations is written back into the original lecture notes at each slide transition in standard PowerPoint™ format. Annotations are inserted with timing information and PowerPoint™ animation settings to roughly approximate the time and manner of their drawing.

Figure 2a shows an original slide from a typical PowerPoint™ presentation, while Figure 2b shows the same slide after it has been annotated by the presenter (a circle and an arrow have been added to the image). Figure 2b also includes a set of controls at the bottom of the slide which have been added by the LLC software. These controls (enlarged in Figure 3) include a timeline of the recorded audio track (usually with a few words recognized and shown in the rectangular boxes), arrows giving an indication of the progression of the audio recording when it is being played back, and a set of indicators showing when the slide was annotated.

A simple gesture recogniser within LLC allows the Mimio™ pen to be used to control the presentation.



a

b

Figure 2: a) the original slide b) annotated slide with LLC controls added

BEST COPY AVAILABLE

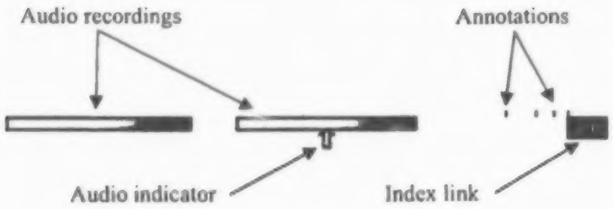


Figure 3: The controls added by LLC

Typical gestures include a right facing arrow to advance a slide, a left facing arrow to retreat through the presentation, and a scribble action to delete an annotation on the current slide. Gestures can also be used to edit aspects of the original PowerPoint™ file during the presentation.

During review or redelivery, which can be carried out on a conventional display screen, the presentation can be indexed at the individual slide level using the standard PowerPoint™ slide sorter view, or the LLC generated slides table of contents. Within an individual slide, animation and audio are synchronized according to elapsed time, although as mentioned earlier, individual graphic components are only crudely animated in themselves. Provision is made to have long silences in the audio minimized to one second, and the annotations resynchronized, again using elapsed time. Further, within a slide, a mouse click will skip forward to the start of the next graphic animation, allowing rapid browsing of both the graphic elements and audio at the annotation level.

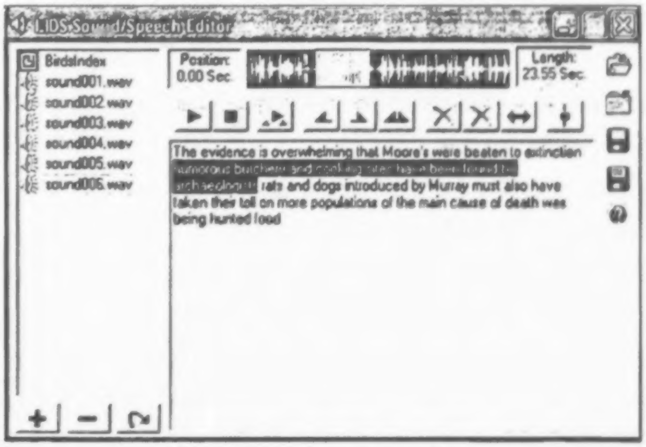
The PowerPoint™ presentation, as updated by LLC can be reviewed by students, using either directly using the standard PowerPoint™ system, or as Web pages with imbedded audio and animations, generated by LLC.

Audio Editing

Since the annotations, additions, and audio contents are written back into the PowerPoint™ lecture notes, it is very easy to further review and edit the slides after the presentation. A stand-alone audio editing tool has also been developed to allow editing of the audio recordings of the lecture presentations (Apperley et al, 2002).

The audio editor reads the contents of a given audio file and uses Microsoft Speech Recognizer to make transcriptions of each audio segment contained in the file. The sound segments are listed in the leftmost pane of the editor window (Figure 4). The example presentation shown in Figure 4 has six separate sound samples. Clicking on a sound sample brings its transcript up in the main text window, and shows a graph of the sound wave in the top window. Selection of text, by click and drag, highlights not only the text, but also the corresponding part of the sound graph. In Figure 4 "h(n)umerous butchery and cooking sites have been found by archaeologists" is highlighted. Selection snaps to whole words because the smallest unit on which the editor can operate is a word, as recognized by the recognition software.

A selected portion of sound can be "dragged and dropped" within the text area. The editor then performs the corresponding operation on the sound file. Spaces between words in the text file have no significance. They are



The evidence is overwhelming that Moore's were beaten to extinction numorous butchery and cooking sites have been found by archaeologists rats and dogs introduced by Murray must also have taken their toll on more populations of the main cause of death was being hunted food

Figure 4: The audio editor

BEST COPY AVAILABLE

added to improve readability. In the sound file long spaces have no mapping in the text file. Short spaces are taken to be part of the immediately following word.

Command buttons are provided to allow playback of either the entire sample, or the sample from a selected point, or the highlighted section. It is often necessary to select and play sections in order to find out what the spoken word actually was meant to be, because the speech recognition is not perfect. The middle group of command buttons adjust the selected area. Sometimes it is inconvenient to drag over a large selection. These buttons allow separate selection of either end of the selected region. The buttons labeled with a cross symbol are provided to delete either the selected segment, or all but the selected segment. The latter operation is the natural one to apply when selecting a small message from a longer text. In using this, it is often convenient to make a rough cut first, taking more than the required length of sound, and to then trim unwanted words from the beginning and end.

As one may notice from the transcribed text in Figure 4, the speech recognition software far less than perfect. However, since the purpose of transcribed text is only to allow locating and editing the sound itself, it is satisfactory enough for the editing purposes. If the user is unsure of a segment of the transcribed text then he/she can easily play it back by selecting it.

Conclusions

This paper has described a prototype system called LLC which has been developed to provide a lightweight capture mechanism for lectures. LLC allows the capture of both graphical annotations as well as the audio content during the original presentation with little or no additional effort on the part of the presenter. Although LLC is normally used with a large interactive display system during the presentations, the captured content can be reviewed and redelivered using the standard PowerPoint™, or a web browser if the content is converted to a suitable form.

A preliminary study of the LLC software in real lecture settings has demonstrated its effectiveness in capturing the annotations and audio contents of presentations. This study has also shown that the students find LLC generated slides very useful for reviewing the contents of presentations after the lectures.

Acknowledgements

The research described in this paper has been carried out with the support of the Foundation for Research, Science and Technology under the New Economy Research Fund contract number UOWX9910.

References

Apperley, M, Dahlberg, B., Jeffries, A., Paine, L., Phillips, M., & Rogers, W. (2001), Applications of Large Interactive Display Surfaces, Proceedings of SIGCHI NZ Symposium on Computer Human Interaction, Palmerston North, New Zealand, 3-7.

Apperley, M., Edwards, E., Jansen, S., Masoodian, M., McKoy, S., Rogers, W., Voyle, T., Ware, D., (2002), Applications of Imperfect Speech Recognition to Navigation and Editing of Audio Documents, Proceedings of SIGCHI NZ Symposium on Computer Human Interaction, Hamilton, New Zealand, 97-102

Elrod, S., Bruce, R., Gold, R, Goldberg, D., Halasz, F., Janssen, W.; Lee, D., McCall, K., Pedersen, E., Pier, K., Tang, J., and Welch, B., (1992), Liveboard: A Large Interactive Display Supporting Group Meetings, Presentations and Remote Collaboration. Conference Proceedings of ACM SIGCHI 1992, 599-607.

Gehne, R., and Jesshope, C. (2000), Tools for the Production of Small-Footprint, Low-Bandwidth, Streaming Multi-Media for Distance Education, Conference Proceedings of Lifelong Learning 2000, 240-244.

Jesshope, C. (2000), The Use of Multimedia in Internal and Extramural Teaching, Conference Proceedings of Lifelong Learning 2000, 257-262.

Smart Technologies (2002), http://www.smarttech.com/.

Virtual Ink Corporation (2002), http://www.mimio.com/.

Supporting Online Meetings between Research Students and Supervisors

Saturnino Luz
Department of Computer Science
University of Dublin
Trinity College
Dublin, Ireland
luzs@cs.tcd.ie

Masood Masoodian
Department of Computer Science
The University of Waikato
Hamilton, New Zealand
M.Masoodian@cs.waikato.ac.nz

Abstract: Face-to-face meetings between research students and their supervisors are very common. These meetings not only include the verbal interaction between the participants, but also often centre on research documents such as technical papers and reports. Therefore online meeting support systems need to facilitate audio communication as well as shared documents between meeting participants. Although currently there are systems which support audio interaction and sharing of documents, these generally do not provide any linking facilities between the recorded audio and textual contents of the online meetings. This paper discusses the results of a simple pilot study which shows that there is often a close link between the verbal communication and shared document interaction of research meeting participants. A prototype system called COMAP is being developed to allow indexing the recorded audio and textual contents of meetings based on the concepts of *temporal* and *contextual* neighbourhoods.

Introduction

Many university students, particularly at the postgraduate level, often conduct research work in collaboration with supervisors as part of their studies. The students generally meet face-to-face with their supervisors on a regular basis to discuss, plan, and monitor the progress of their research activities. In addition to verbal communication which forms an integral part of face-to-face meetings, research meetings also very often rely on written documents as the basis for discussion. Even when there is no shared document such as a technical report to focus on, the students or their supervisors are likely to take notes for future reference. These shared meeting documents, or personal notes would normally be annotated to include things such as changes, additions, responsibilities, future tasks, and so on which could then be used after the meeting to follow up on things that need to be done.

The audio content of meetings, on the other hand, is usually not recorded, and therefore lost. It is not uncommon for the meeting participants to forget details associated with some part of the meeting which is needed at a later stage. In some cases such details can be retrieved from meetings notes, if there are any, but often it might be necessary to contact the other meeting participants to find out if they remember the details. Clearly in the context of research activities, details or small bits of information can be critical.

An increasing number of students work on research projects with more than one supervisor, who may be located in different institutions or even different countries. In these situations it is not always possible to have face-to-face meetings, and as such, meetings may be conducted over the Internet. However, Internet-based remote meetings suffer from similar problems to those of face-to-face ones. Although there are systems which allow Internet-based audio conferencing, along with access to shared documents across distance, in most cases even if it is possible to record the audio and shared document contents of the meetings, it is not generally possible to link the audio recordings and shared documents.

The objective of this paper is to demonstrate that during research meetings verbal utterances of the participants are closely linked to their interactions with the contents of collaborative documents which form the shared group workspace. It is argued that due to this relationship it is useful to allow meeting participants to randomly access segments of the audio recordings using the indexed links between the audio and the contents of shared document. It is envisaged that such access would be valuable to users searching for information after the meeting. A prototype system is being developed to provide access to audio recording of the meetings using the contents of shared textual meeting documents. The system is based upon the concept of temporal and contextual neighbourhoods (Masoodian & Luz, 2001).

Nature of Research Meetings

The nature of group activities is largely dependent on the type of group task being performed by the participants. The range of research activities undertaken by research students in collaboration with their supervisors is diverse. Any system which aims to support online interaction between students and their supervisors needs to facilitate all these activities, which can be categorized as the following:

- Informal encounters where a shared textual tool acts as a focal point and serves as a medium for exchange of low level details. For instance, when people meet an exchange references, email addresses, etc.
- Formal meetings where a shared textual component acts as a focal point or as a collaboratively built lasting record of the transient speech interaction. For instance, research planning meetings.
- Document evaluation and revision meetings, particularly those supported by shared real-time editors in which text is loaded onto the collaborative tool at the beginning of the meeting, receiving only minor modifications as the meeting progresses. For instance, meetings to discuss a written thesis.
- The variants of collaborative writing described in (Posner & Baecker, 1993) as following a *joint writing strategy* in which people compose the text together, and even small components of the text are decided by group effort. For instance, when a research paper is being written.
- Shared projects, in particular the initial phases of such projects during which people discuss and agree on an interpretation of the problem, define their goals and plan their work, as well as the *integration phase* during which group members integrate their individual inputs. An example of this might be when a students and a supervisor are conducting an experiment.

What is common to all these activities is that they revolve around sharing information in the form of documents. Even when documents are not the focus, in most cases some form of a text artefact is used, such as minutes and action tables. Such documents generally assist people in working on collaborative activities, for instance by reminding them of the responsibilities they may have undertaken during the meeting, or perhaps providing them with information without which carrying out their task may be impossible. It is therefore clear that in many collaborative research scenarios, combinations of speech and text play a central role in the interaction process.

Participant	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**	**Average**	**Stdev**
No. Utterances	225	192	121	125	214	163	126	155	165	39
Duration Speech /2700 Sec (s)	1681	1784	1932	2032	1202	751	499	587	1308	589
Duration Speech %	62	66	72	75	45	28	18	22	48	22
No. Text Activities /2700 Sec	34	74	99	72	37	10	36	63	53	27
Duration Text Activities /2700 Sec (s)	256	605	598	349	426	52	427	533	406	175
Duration Text Activities %	9	22	22	13	16	2	16	110	15	6
Total Duration Speech and Text Activities /2700 Sec (s)	1937	2389	2530	2381	1628	803	926	1120	1714	655
Total No. Speech and Text Activities /2700 Sec	259	266	220	197	251	173	162	218	218	37
No. Simultaneous Speech and Text Activities /2700 Sec	42	96	85	74	48	6	36	27	52	29
Duration Simultaneous Speech and Text Activities /2700 Sec (s)	189	341	562	329	226	17	99	69	229	167
Duration Simultaneous Speech and Text Activities %	7	13	21	12	8	1	4	3	8	6
Duration Inactive /2700 Sec (s)	952	651	732	648	1298	1914	1873	1649	1215	507
Duration Inactive %	35	24	27	24	48	71	69	61	45	19

Table 1: Summary of the analysis of the text and speech interaction between meeting participants

Pilot Study

A small pilot study was conducted to investigate the presence of patterns in the speech and text interaction during research type meetings which might be usefully exploited by an online meeting support system. Pairs of academics took part in four physically remote meetings whose goals were to plan and discuss research and teaching. Meeting were supported by an Internet-based audio conferencing tool, and a shared text editor. The duration of these meetings varied from approximately 20 to 90 minutes. All interaction events were recorded and time stamped. A summary of the analysis of the text and speech interaction between meeting participants is shown in Table 1.

Interleave Factor

The data gathered in the pilot study shows a pattern of co-occurrence of speech and text events which may provide valuable clues for information retrieval. In order to assess the impact that these clues might have it is necessary to quantify the extent to which an action conveyed by the speech medium is accompanied by another in text. A metric based on the degree of "interleaving" of text and speech events during meetings, which is call *Interleave Factor* or IF (Luz, 2002) can be used for this purpose.

The meetings evaluated in the pilot study received varied IF scores. Figure 1 shows sample step function plots of audio and text activity for two participants (*A* and *B*) over a 600-second interval. The meeting segment on the left hand side received an IF score of 0.067 while the one on the right hand side received 0.242. It was observed that, in general, the higher the IF of a segment the greater the likelihood that that segment contained relevant information about a particular item, as opposed to low-IF segments where that particular item also occurred. This observation motivates content mapping technique described below.

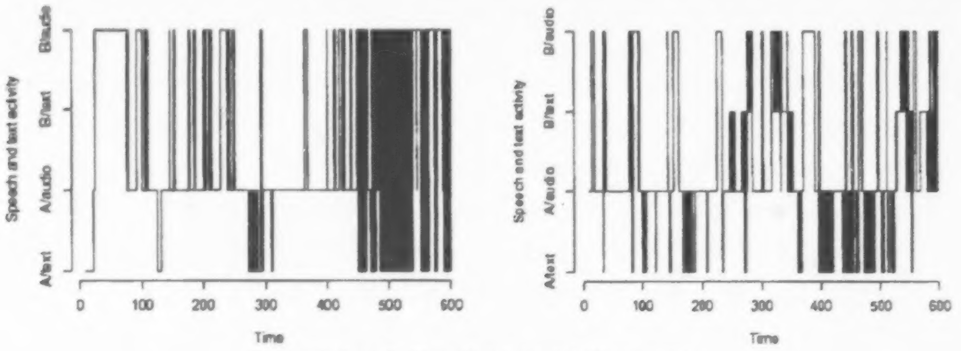


Figure 1: low (left) and high (right) IF segments.

Temporal and Contextual Neighbourhoods

A meeting support tool called COMAP (COntent MAPper) has been designed to allow indexing and retrieval of audio meeting contents using shared document contents. COMAP allows meeting participants to divide the contents of a meeting document into *logical sections*. These sections are then automatically linked by the system to different *segments* of the audio recording using the concept of *neighbourhood*. COMAP defines two types of neighbourhood:

- **temporal neighbourhood:** a segment of audio is in the temporal neighbourhood of a document section if that audio segment was recorded while the section was being *created*, *changed*, or *discussed* by the participants. There can be multiple audio segments in the temporal neighbourhood of a document section, each corresponding to different points in time when that section was *active* (see Figure 1).
- **contextual neighbourhood:** an audio segment is in the contextual neighbourhood of a document section when it shares a number of keywords with that section. There can be multiple audio segments in the temporal neighbourhood of a document section, each corresponding to different points in time when that section was *active* (Figure 2).

COMAP targets two basic scenarios: the system may act as a *listener* while the participants interact through the tools provided by COMAP, or the system may act as an *assistant* for browsing the meeting document along with the audio communication. Currently, COMAP assumes that the shared meeting documents will be textual. Since the text produced as a result of a meeting represents a more structured record of the information exchanged during the meeting, text is the starting point for the content indexing and browsing tools.

COMAP Prototype

A prototype has been built that explores one of the types of information mappings described above, namely, temporal neighbourhoods. The most attractive feature of temporal neighbourhoods from an implementation perspective is the fact that their extraction from a meeting record does not require any speech processing. Time stamps and keyword spotting are all that is needed. Figure 2 illustrates a text and an audio widget linked via temporal mappings. The timeline widget indicates presence of speech by means of horizontal bars stretching along the time axis. The words and phrases highlighted on the text pane are the starting point of the browsing activity. When related clusters of text are selected, the speech event viewer highlights the relevant segments.

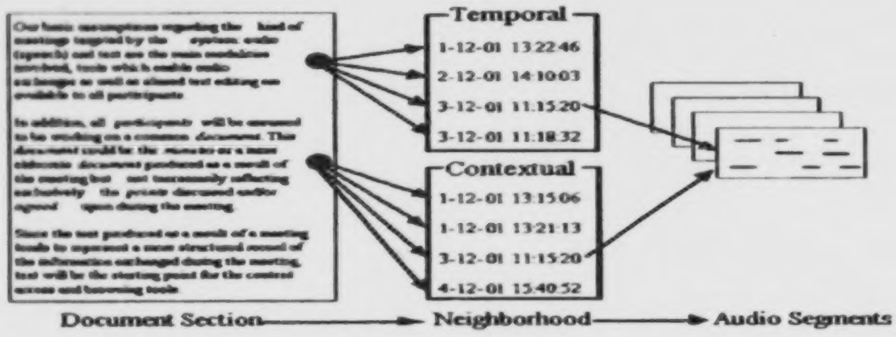


Figure 2: Temporal and contextual neighbourhood mapping

The architecture of the prototype basically consists of a *meeting memory server* and workstations which support a real-time shared editor and multi-party audio conferencing. During a meeting, both text and audio are multicast among the meeting participants using the RTP protocol (Schulzrine et al., 1999), and the COMAP server acts as a passive RTP listener, decoding RTP packets and recording audio and text on disk. After the meeting, these recordings can be accessed via the COMAP client. The shared text editor uses XML technology for tagging text segments and keeping track of document change history. At present, consistency is handled by allowing users to lock a particular node in the XML document tree. In this prototype, users are only allowed to lock paragraph nodes, since we have assumed that paragraphs are the relevant textual unit in temporal neighbourhoods. The audio client uses remote procedure calls to activate playback of audio segments linked to a particular paragraph, and the playback itself is performed via IP multicast. Both the shared text editor and the audio client are written in Java, which guarantees a certain degree of platform independence.

Conclusions

This paper presented an approach to structuring and accessing remote collaborative meeting audio and shared textual documents contents. It builds on notions of contextual and temporal neighbourhoods suggested by the levels of activity interleaving in trial data of student-supervisor meetings.

It is proposed that that our prototype COMAP system will be more useful for meetings which have a high text and audio activity interleave, measured using our notion of Interleave Factor (IF metrics). Future research directions include collecting a larger corpus of speech-and-text meeting data in order to further establish the relationship between IF and effectiveness of information access under varied circumstances, as well as the characteristics of temporal mapping in the presence of richer interaction logs.

References

Luz, S. (2002). Interleave Factor and multimedia visualisation interfaces. Proceedings of 16th British HCI Conference. London, UK. (in print)

Masoodian, M. & Luz, S. (2001). A content mapper for audio-mediated collaborative writing. *Proceedings of HCI International 2001* (pp. 208-212), M. J. Smith et Al. (eds.), New Orleans, LA, USA.

Posner, I. & Baecker, R. (1993). How People Write Together. *Readings in Computer Supported Collaborative Work* (pp. 239-250).

Schulzrine, H., Casner, S., Frederick, R. & Jacobson, V. (1999). RTP: A Transport Protocol for Real-Time Applications. *IETF Internet Draft.*

BEST COPY AVAILABLE

On-Demand Learning: Infrastructure Design and Management

Enid McCauley
Director, Product Development and Research
Open Learning Agency

Abstract:
On-Demand Learning: Infrastructure Design and Management, a research infrastructure grant from the Canada Foundation for Innovation and the British Columbia Knowledge Development Fund have provided the Product Development and Research Group at the Open Learning Agency the opportunity to explore new models for K-12 and post-secondary content development, storage, production, and sharing. It has also expanded the role of the Agency in the area of standards development nationally, and provided ways for us to address the issues of cultural change within the organization.

In 2000, the Open Learning Agency received infrastructure funding from the Canada Foundation for Innovation and the BC Knowledge Development Fund to further research and development initiatives into digital learning object design, development, and implementation. This five-year research and development project has had significant impact on the Open Learning Agency both in the way it conducts it's course development activities, and in its ability to play a substantial role in the area of standards development internationally.

The research focus of the CFI/BCKDF initiative is the design and implementation of instructional content, both SGML/XML structured content, and digital video content. It also focuses on learning environments and applications that provide on-demand, self-directed learning. This includes establishing and implementing an enterprise-wide repository for the development and management of "learning objects" (text, image, audio, and video), defining ways to effectively re-purpose and re-package these objects to meet the education and training needs of individuals, and designing web-based learning management systems that provide the learner with the ability to create their own "learning path" from the repository of objects.

The infrastructure being acquired to continue our research into effective strategies for the development and use of "learning objects" at an enterprise-wide level, and even more broadly in terms of sharing information, strategies and resources with partner institutions and programs across Canada, includes:

- Installation of Lightspeed's Astoria digital object repository and iEngine management system
- Development of prototype learning management systems (e.g. Learning Lab) and integration with existing learning management systems (e.g.WebCT)
- Hardware and software for development of digital media objects and structured course content.
- Publishing applications to move from structured information to the web or print.
- Web interface tools for distributed authoring directly into the repository.

Our research and development program addresses the critical design and management challenges facing education and training organizations as they begin to exploit new information technologies. These include:

- How to use structured information models in the design, development and delivery of distributed learning programs
- How to design granular learning objects (text, image, audio, video) that facilitate multiple pedagogical models and enable multiple user requirements in an on-demand fashion
- How to develop multiple output formats to meet particular and individualized client needs from unified development processes
- How to use metadata classification systems to facilitate open learning pedagogy and the transfer of assets between academic and business partners

- How to re-purpose and re-package "learning objects" to meet the education and training needs of individuals and organizations
- How to incorporate an enterprise-wide approach into the design, development, and management of "learning objects".
- How to manage the changing culture of post-secondary content development and delivery from the "cottage industry" to the "learning object" models.

The Open Learning Agency research and development initiatives into structured information are becoming core practice as we begin to change the traditional post-secondary development model. This difficult cultural change requires that a proven prototype in which traditional course designers and faculty can become involved be available for "practice", it requires significant staff training, it requires participation and buy-in from a wide variety of staff, and it requires strong leadership.

The Open Learning Agency research and development plan focused on three major projects to develop and test the model. Initially, we began with structured development in our K-12 program, developing 14 senior secondary courses in SGML for output to the web and to print. This major project, OSCAR, provided a wealth of learning for staff, and became the basis for all our further SGML work.

From this basis, we developed a resource-rich teacher education program using open source technology for self-directed learning (The Learning Lab), and a competency-based business program (the New Management Degree). As more and more post-secondary course development is beginning to follow the structured information process, the key issues which confront us are staff development, implementation of production workflow, output from the repository to high-quality web and print formats, and template design.

This presentation will provide an overview of the CFI/BCKDF project to date, and address the cultural change issues we face as we move towards a learning object economy.

E-Learn 2002 – World Conference on E-Learning in Corporate, Government, Healthcare, & Higher Education
Proposal
(Brief Papers)

Description of Project:

This project addresses the issues of university pre-service and K-12 teachers' perceptions concerning technology and the role of collaboration in utilizing technological applications presented in professional development sessions offered at the university. The dimensions addressed include Higher Education and K-12 in the *Application* domain, Human-Computer Interaction in the *Technology* domain, and Collaborative Learning and Work in the *Strategic Focus* domain. Through funding provided by a PT3 grant (Preparing Tomorrows Teachers to Use Technology Today) at the University of Houston-Clear Lake, university pre-service teachers in their first semester of internship were paired for technology training with their mentor teachers from the public schools. The two groups met at the university for numerous one day workshops which provided training and instruction in areas such as: creating web pages, exploring websites with teacher resources, the use of chat rooms, technology applications in the one computer classroom, numerous technology software packages, and various other computer applications.

After the semester long training, a questionnaire designed by the researcher was administered to 15 pre-service teachers and their public school mentors. The instrument focused on four major areas: 1) technology use 2) attitudes toward technology 3) role of collaboration in learning about and utilizing technology, and 4) perceptions of student engagement potential. Items listed in the questionnaire were determined by examining background literature as well as similar studies. To help validate the instrument, three Instructional Technology professors provided feedback and suggestions on the survey instrument used in the study. After administering the questionnaire, themes and patterns which emerge will be discussed and implications for future research will be noted.

Major Aspects:

The major aspects of the project include a review of the relevant literature and the findings from the questionnaire. The literature review focuses on pre-service and mentor teachers' attitudes toward technology, the ways in which they explore and learn about technology, how teachers incorporate it into their classrooms, and the role of collaboration in becoming literate in the area of technology. The major research questions for this project are:

What types of technology applications do teachers and pre-service teachers utilize?

What types of attitudes do teachers and pre-service teachers have about learning technology-based applications?

What differences, if any, are there among teachers' and pre-service teachers' perceptions about the impact of technology on student learning?

What types of interactions and collaborations (if any) take place as teachers seek to learn about and incorporate technology tools into their classroom communities?

Review of Literature

The review of the literature focuses on three major areas, primarily teachers' perceptions and attitudes dealing with technology, teachers' perceptions of the role of collaboration in learning technology, and teachers' perceptions of the effect of technology on student engagement levels. While there is much written about the evidence that the educational benefits of technology abound (Fletcher, Hawley, and Piele, 1990; Garner & Gillingham, 1996; Kulik & Kulik, 1991), relatively few teachers utilize technology regularly in their teaching (McKinsey, 1996; OTA, 1995). One part of this study seeks to identify the types of applications that teachers and pre-service teachers are familiar with and utilize.

Simply receiving training in technology, though, is no guarantee that it will be infused into the learning environment of the classroom. In a 1998 survey by the U.S. Department of Education, 78 percent of teachers reported that they had participated in professional development about integrating technology into the grade or subject they taught during the last twelve months. In spite of this level of participation, only 20 percent said they felt well prepared to integrate technology into their day to day teaching (National Foundation for the Improvement of Education, 2000).

Perhaps one way to address this issue is to facilitate collaborative efforts within the scope of professional development opportunities. In the process of learning about new technology related applications and making the shift to actual using the information, collaboration can serve as a pivotal force in implementation. Our training at the university sought to do this by allowing the mentors and pre-service teachers to attend the training sessions together. There is much research to show that more sophisticated learning occurs when collaboration takes place. Teaching and learning become interwoven and the learning environment becomes one that is designed for exploration and interaction, and learners are given the opportunity to creatively apply new information (Ferguson & Kopp, 1998). In addition, teachers working together to explore the teaching and learning arena is directly linked to effective schools (Johnson, 1986; Glatthorn and Fox, 1996).

Ideally then, teachers can experience some of the same things we want public school students to experience- engagement with the experience at hand.
Support for this view comes from various sources, starting with the work of Jean Piaget who found that children who are actively engaged assimilate new information more efficiently. The trend in education is moving toward a constructivist view which contends that learning is achieved through relevant, hands-on, socially constructed activities (Ferguson & Kopp, 1998).

The socially constructed nature of learning and the importance of experiential experiences are tapped into to bring about a shift in learners' technological schema. In addition, technology has the added benefit of being a motivational tool. Used appropriately, the use of technology has the potential to affect student engagement. In Means' case studies of 17 classes which incorporated computer usage at nine reform-oriented schools (collected during 1991-1993), it was found that the most common or nearly universal teacher reported effect on students was an increase in motivation (Means and Olson, 1995)

Another promising piece of research shows that exposing teachers to the notion that technology can be an empowering tool to facilitate higher level learning activities can be enough to bring about incremental change. Heath and Burns et al (2000) found that for many teachers knowing how computer technology could be used to enhance learning and being able to plan effective learning activities were more important than having strong personal computer skills. In other words, even teachers who do not feel that they have totally mastered technological applications can begin to think of ways to use technology to advance higher order thinking in their students.

Technology has already had a hand in reshaping business, industry, and the global economy. It has the power to reconfigure the world of education by providing a tool to enhance teaching and learning; but to do this, teachers who currently work in our schools as well as those pre-service teachers who are the future of our schools must be supported and provided with appropriate arenas to explore and implement technology into classroom communities.

References

Ferguson, K.M. & Kopp, O. P. (1998). Technological collaborations: K-12 and Higher Education. Phi Delta Kappa Fastbacks, no. 4387-41.

Fletcher, J.D., Hawley, D.E., & Piele, P.K. (1990). Costs, effects, and utility of microcomputer assisted instruction in the classroom. American Educational Research Journal, 27 (4), 783-806.

Garner, R., & Gillingham, M. (1996). Internet communication in six classrooms: Conversations across time, space, and culture. Mahwah, NJ: Erlbaum.

Glatthorn, A. A. & Fox, L.E. (1996). Quality teaching through professional development. Thousand Oaks, CA: Corwin Press, Inc..

Johnson, S. M. (1986). Incentives for teachers: What motivates, what matters. Educational Administration Quarterly, 22 (3), 54-79.

Kulik, C.L. & Kulik, J.A. (1991). Effectiveness of computer based instruction: an updated analysis. Computers in Human Behavior, 7, 75-94.

McKinsey, I. (1995). A nation of opportunity: Realizing the promise of the information superhighway. A report prepared for the National Information Infrastructure Advisory Council.

National Foundation for the Improvement of Education (2000). "Professional Development and Information Technologies." Connecting the bits: A reference for using technology in teaching and learning in K-12 schools.

The Canadian Design Website:
An Evaluation of Process and Product

Laura April McEwen, Department of Education, Concordia University, Canada, laura@education.concordia.ca

Gretchen Lowerison Department of Education, Concordia University, Canada, gretchen@coreidea.com

Lydia F. Sharman, Department of Design Arts, Concordia Univeristy, Canada, lydia@vax2.concordia.ca

Abstract: The Canada Design Website is a pedagogical resource project located at http://design.concordia.ca/canada_design/. Initially, conceptualized as a pedagogical resource focused on Canadian industrial design, the project has expanded to include the collaborative efforts of undergraduate, graduate and faculty members of the Department of Design Arts at Concordia University. Currently at the end of the second phase of the project, a review of the site to date and an evaluation of the process engaged in by student contributors was initiated. Preliminary findings revealed that learners gained valuable practical experience through this innovative learning initiative but felt that this positive experience might have been enhanced with more clearly defined roles and responsibilities. Several important recommendations from the media/pedagogical expert for improvements to the site included navigation instructions for visitors and enhanced interactivity.

Introduction

A common purpose of course related websites is to serve as an information-delivery medium (Hall, 2002). The World Wide Web has allowed innovative ways to present material. Learners can be presented with text, graphics, animation and multiple ways to navigate through the site. In this multi-media environment, there is an opportunity to engage the learner and enhance the educational experience (Kuh and Vespers, 2001). However, the effectiveness of the media will dependent upon how it is designed in connection with the curriculum (Whitston, 1998).

Hypertext can be used as a cognitive tool. When the learner is presented with material in a hypertext environment, such as the World Wide Web, the locus of control shifts from the designer to the learner. Within this context, learners stand to gain greater control over the learning environment (Hutchings, et al. 1992). Such advantages are dependent upon characteristics of the site design. For example, material might be linked to learning activities that would allow the learner to become proactive, promoting deep-level learning. However, in a more static site, the learner remains passive, knowledge is more declarative and learning is more surface-level.

Background

The site is a scholarly information site presenting Canadian industrial design content. The pilot project was conceptualized in 1996 by Dr. Lydia F. Sharman. As a professor in the Department of Design Arts at Concordia University, she struggled with the lack of pedagogical resources and often drew on personal archive to support her pedagogy. Out of this practical pedagogical need grew the idea for Canada Design Website (CDWebsite). The web offered a particularly appropriate medium as it made it possible to present, in a dynamic form, designers and their products as well as external links to sites of relevance.

During Phase One of the project, content was drawn from Dr. Sharman's archives assembled over a thirty years period. Phase Two of the project involved student researchers developing content from archives and additional primary sources.

An evaluation of the process engaged in by student contributors and the CDWebsite is currently underway. This paper presents the results of the media/ pedagogical expert's review of the site and the preliminary findings from interviews with graduate and undergraduate learners regarding their experiences as content developers. Site development is ongoing and additional data collection and analysis is planned.

The Website Evaluation

Objectives

The purpose of the Website evaluation was to examine the quality of the product to date. The goal of the evaluation was to provide recommendations for improvements to the site.

Methods

Instrument

Evaluation Rubric: The rubric used to evaluate the Canadian design site was developed by the media/pedagogy expert based on the work of Rathswohl, (2002). The following six general areas of focus were identified: (a) General features such as name, URL, author and contributors, (b) Purpose and objectives of the site such as scholarly versus personal, clearly stated purpose and target audience, (c) Navigation and Accuracy such as ease of access, modes of access, internal and external links and accuracy of content, (d) Structure, such as display, quality of graphics and professional design qualities, (e) Pedagogy, such as locus of learner control, interactivity, communication, context, sensory features and information, and (f) Coding features, such as accessibility and browser support of material.

Procedures

Website Evaluation: To meet the objective of ascertaining the pedagogical value of the site, two types of expert reviews were planned: (a) content, and (b) media/ pedagogical. Guided by the evaluation rubric, a media/ pedagogical expert reviewed the presentation and effectiveness aspects of the site. Content reviews with university professors from outside Concordia are planned, as well as several one to one reviews with student volunteers to establish end-users perceptions.

Results

Navigation	• Should be more intuitive, currently visitors must rely on trial and error to discover how to gain access to material. • Links should be uniform throughout the site and easily identifiable as hyperlinks/graphics. • A navigational option other than the browser back key should be incorporated to facilitate returning to the start page.
Pedagogy	• More learner control is recommended. Information is presented fairly linearly, visitors may choose the order of module presentation, but are unable to explore the content of the module prior to selecting it. • Instructions should be made available to visitors unfamiliar with rollover functionality. • Adding an element of interactivity would allow the users of the site to be more dynamically involved and perhaps to exchange information and opinions. This would increase the learning potential of the site.
Coding Structure	• A document type declaration should be added. • The use of frames may cause accessibility problems for those without frame capable browsers, and potentially lead to navigational problems for visitors with disabilities. • ALT tags should be used to describe images on pages for people using non-visual browsers • A title for every page should be included • To facilitate maintenance of the site and reduce the size of HTML files, cascading style sheets could be used to specify font, size and color.

Table 1: Findings and Recommendations

The Evaluation of Process

Objectives

The purpose of the evaluation of process was to explore the process engaged in by student contributors. The goal of the evaluation was to (a) define roles and responsibilities, (b) identify the type and sources of support, (c) determine the personal impact of involvement in project and (d) describe personal learning gains.

Methods

Procedures

To meet the objectives listed above, interviews were conducted with three categories of learners. The details of the process evaluation are presented in Table 2. Learners' responses to interview questions were compiled in tabular form in order of their occurrence and then grouped into categories that emerged from the data. Examples of some direct quotes are included in Table. Ongoing informal interviews with Dr. Sharman also provided information regarding learner support. The instructor of the course *History of Canadian Design* also completed a questionnaire, however these results are not included in this paper.

Results

	Category of Learner		
Information gathered	**Former Design Arts student**	**Graduate student, Design Art**	**Undergraduate** (UG) **Students in *Canadian Design History***
Type of Contribution	Web Designer	Research Assistant/ Content Developer	Content Developers
Define role and responsibilities	Evolved from site developer to include project management aspects and learner support.	Reported initial confusion regarding role and responsibilities. Had anticipated taking on a site development role.	Strictly content development role, • "write short factual summaries on various aspects of the Montreal Metro's design"(UG1) , • "Condense research paper, define segments of intensity"(UG2) Both students hoped the project would allow them the opportunity to engage in web development.
Identified types and sources of support	• Provided guidance to graduate student regarding issues of accessibility related to site design. • Developed template for student contributions. • Provided guidance regarding the focus and organization of content.	Team meetings • held every one and a half months. Dr. Sharman • individual content focused meeting. • Editing via email was fast and informative. Web Designer/Project manager • Discussed web design issues (re: image selection, file format)	Canadian Design History Instructor • provided strong support for the development of research skills. Dr Sharman • provided examples of other contributions and links to completed modules on the site. • Ongoing feedback on drafts via email. Web Designer/ Project manager • offered guidance regarding file formatting, image selection. • provided supported for the content development stage Team meeting—were invited once and found this to be very advantageous.
Determined personal impact of involvement in project	Launched career in Web Design.	"I learnt that design with Dreamweaver is not what I'd want to do for a living"	UG1: access to designer of Montreal Metro for personal interview. UG2: "The opportunity to work with Dr. Sharman, someone with such extensive knowledge and interest in Canadian Design".
Describe personal learning gains	Gained important project management experience.	Improved English language writing and research skills.	• Developed Interview skills (UG1) • Both learners mentioned access to primary source material

Table 2: Preliminary Interview Results

Concluding Remarks

The Canadian Design Website

The Canada Design Project is a very professional looking site. It serves as an information-delivery medium rather than a dynamic site. A search through Google (http://www.google.com) indicates that this is a unique resource for Canadian Design content. In order for the site to become an effective learning tool interactivity needs to be increased.

It is important for the designer to accommodate students' different learning rates and styles as well as diverse background knowledge. In order for the site to be effective, it should attract the attention of the learner but not be so overwhelming that the material is distracting. Hannafin, et al. (1996) points out that students can have trouble navigating in a hypermedia environment when the environment is new. For this reason, it is important to include navigation instructions.

The Evaluation of Process

According to preliminary findings, all categories of student contributors gained substantially from this innovative learning experience. Proponents of constructivist pedagogy support the use of project-based learning initiatives such as these, based on this potential diversity of learning gains (Linn & Burbules, 1993). However, learners' responses indicate a degree of confusion and disappointment regarding respective roles and responsibilities at the outset of the project. Additional data not included in this report would suggest that this confusion was the result of unanticipated challenges related to (a) learner competencies and level of engagement, and (b) limitation in terms of access to technology tools. This inevitably resulted in the subsequent scaling back of student involvement in the web design aspects of the project. Given the obvious enthusiasm for this aspect of the project, it is highly recommended that additional resources be allocated to ensure students more hands on experience with web design in the future.

References

Hall, R. (2002). Aligning learning, teaching and assessment using the web: an evaluation of pedagogic approaches. British Journal of Educational Technology, 33(2), 149-158.

Hutchings, G.A., Hall, W. Hammond, N.V., Kibby, M.R., McKnight,C. & Riley, D. (1992) Authoring and evaluation of hypermedia for education. Computers and Education, 18, 171-7.

Kuh, G.D., & Vespers, N. (2001). Do computers enhance or detract from student learning? Research in Higher Education, 42(1), 87-102.

Linn,C. and Burbules, N.C. (1993). In Tobin, K. (Ed.). *The Practice of Constructivism in Science Education*. AAAS PRESS: Washington, DC.

Rathswohl, E. J. (2002). A technique for teaching website effectiveness in undergraduate I.S. Classes, InSite, June 2002. Available online at http://ecommerce.lebow.drexel.edu/eli/2002Proceedings/ papers/Raths238techn.pdf

Whitston, K. (1998). Key skills and curriculum reform. Studies in Higher Education, 23(3), 307-319.

Acknowledgements

We would like to acknowledge Concordia University and the McConnell Family Foundation for the on-going funding of this innovative pedagogical resource.

Personality as a theoretical construct for the development of effective school leaders

Lead Presenter
Dr. Michael L. McFrazier
Director of Graduate Programs
Assistant Professor, Ed Leadership and Counseling
Prairie View A and M University
P.O. Box 2355
Prairie View, TX 77446 2355
Michael_McFrazier@pvamu.edu

Co Presenter
Dr. Pamela Barber Freeman
Prairie View A and M University
P.O. Box 4349
Prairie View, TX 77446 4349
Pamela_Freeman@pvamu.edu

According to research, the personal attributes of effective leaders have been examined for decades. In fact, during the turn of the 20th century, theorists believed that leaders were born not made (Davis 1998). This premise is no longer accepted in institutions of higher education because of the large numbers of educational leaders graduating from colleges and universities. This research project examined, via technology, the personality strengths and developmental needs of students enrolled in their first semester of course work at Prairie View A and M University.

After almost two decades of school reform efforts in America, there are still millions of children being left behind. Specifically, the Texas Public Schools Statistic (1999) indicates that African American students comprised 18.7 percent of dropouts while Hispanic Americans made up 51.3 percent. According to research, one reason for this failure is due to the quality of leadership as well as the lack of sensitivity to the cultural dynamics within our nation (Wallace Reader's Digest 2000; Astin and Astin 2000).

There is a critical need for educational leaders to develop a keen understanding of the challenges faced by students. Today's students come from a variety of cultures, religions and economic levels; consequently, arriving to school at different ability levels. In addition, environmental conditions may have circumstances that challenge students' time and attention that could or should be devoted to learning. To cope effectively and creatively with these emerging trends, future leaders will need to possess new knowledge and skills as well as displaying a high level of emotional and spiritual wisdom and maturity (Astin and Astin 2000). As the public sector becomes more sophisticated, as well as impatient, critical questions are being asked and stringent limitations will be placed on institutions of higher education. Institutions of higher education play a major role in developing and shaping the quality of leadership in modern American society (Astin and Astin 2000). Thus, it is imperative that institutions of higher education begin to develop a conceptual framework to train and support leaders who will expand the variety and character of their school district's educational programs. After all, it is character, not money that fosters prosperity.

The face of our society is literally being altered due to the tremendous changes in the economic, educational, and demographic forces. The rapid change in the demographics of the United States has made diversity one of the most significant social facets of our society. Due to differential birthrates and immigration patterns, America is experiencing a major ethnic shift with increased numbers of African Americans, Hispanic Americans, and Asian Americans becoming more evident within our schools. In Texas, African Americans and Hispanic Americans youth constitute 53 percent of the school age population and have the highest dropout rate of any other ethnic group within the state. In postsecondary institutions enrollment of the diverse groups are declining. With the continuous increase of a diverse population, it becomes quite apparent that the dynamics of the culturally heterogeneous world have become both complex and problematic. In fact, one of the most compelling needs of our time is to reach for the "forgotten half" of our population who have the capability of leading but are being left behind by the new economy. Specifically, educational leaders do not begin to reflect public school diversity with only 12 percent of the nation's superintendents being female, and only 5 percent being people of color. In addition, leadership positions are expected to increase by 16percent by the year 2008, making it the largest increase of any other major occupation (U.S. Department of Labor, 2000). Thus, creating a greater need for more inclusion of all ethnic groups who have the theoretical and methodological tools to help frame and answer questions that concern all Americans.

Accepting the premise that higher education is the pipeline for developing productive citizens, academia must take the opportunity to lead the way and demonstrate to the rest of the nation how to accept and nurture a diverse community of leaders. Consequently, the question is whether institutions of higher education are up to the challenge of meeting the needs of this diverse population. Therefore, it seems practical as well as necessary for those institutions (HBCUs) that are graduating the largest numbers of diverse students to become an active and viable component in developing leaders, in reforming curriculum standards and providing training for personnel who will lead and educate America's future citizenry. Because education is a continuum (not just Kthrough12), it is imperative that programs/institutions that educate and train preservice and inservice leader become active with educational reform. Since HBCUs facilitate the largest numbers of diverse leaders on the educational continuum, there are needs for leadership centers on HBCU campuses to provide our nation and the world with leaders equipped with new knowledge and strategies for educational reform.

During the sixteenth century, Martin Luther is noted for stating, "...when a man knows his own heart, he knows the heart of other men." Specifically, if educators have a strong grasp of their attributes, learning styles and personality preference they become more in tuned to their students regardless of ethnicity. Consequently, this research was based on the above premise in order for future educational leaders to reach their educational, professional and personal potential, they must be actively involved in developing and implementing instructional models. The primary outcome sought through this research was to promote what Franke, Carpenter, Fennema, Ansell, and Behrend (1998) call "selfsustaining, generative change." Selfsustaining, generative change is when individuals make changes to improve their methods of leadership and instruction to ensure continued growth and problem solving. To ensure that selfsustaining, generative change is on going, a personality assessment was conducted. One's personality is without question the most important driver influencing career choice, relationships, health and sense of well being (Shaughnessy, 1998). To understand the full potential of one's personality, it is critical to first measure and then gain insight into your strengths and developmental needs through examining the results of personality.

In 2001, The American Association of Colleges for Teacher Education (AACTE) cited Prairie View A and M University as fourth in the nation in the production of school administrators. Prairie View, the 2nd oldest institution of higher education in the state of Texas, is committed to providing state of the art training to individuals who will lead and educate America's future citizenry. Data for this research project were gathered during the month of July during the 2nd summer session at Prairie View. One hundred educational leadership students enrolled in their 1st semester of course work were used as research participants for this study. Each student was asked to complete a personality assessment (Keirsey) via technology. Ninety three usable personality assessments were returned. Research participants were also asked to provided additional data in the following areas: Age: 0 through 24, 25 through 35, 36 through 45, 46+; Gender: Female, Male
Career: Elementary, Middle, Secondary, Other; Race: African American, Caucasian, Hispanic. Currently, the data are being analyzed and prepared for presentation. The preliminary findings suggest that over 50 percent of the students assessed are Guardians, which indicates that they have the temperament for leadership!

Distance learning supports: The intentionality of pre-assessment surveys

Patricia McGee
University of Texas at San Antonio
Department of Interdisciplinary Studies and Curriculum and Instruction
The University of Texas at San Antonio, US
pmcgee@utsa.edu

Abstract. One response to high attrition rates in distance learning has been strategies devised to support the learner during their course and, in some instances, before they begin a course. Pre-assessment surveys are the most common pre-course support. This study investigates the content of surveys used in higher education as they relate to research on successful learner attributes. Findings indicate that most surveys are designed, whether intentionally or not, to discourage or eliminate learners who do not posses successful skills, knowledge, or attributes and which may account for reported low dropout rates.

Attrition rates remain higher than in campus-based courses (Phipps & Merisotis, 1999; Kelman, 1997; Naidu, 1994; Garland, 1993; McKinnon, 1993), and tend to be higher for first-time distance learners (Morgan, 2000). Research suggests that although attrition rates are high in distance learning courses, the reasons for these rates are not clear and research has not conclusively identified causes (Sheets, 1992, Thompson, 1997; Parker, 1999). Often demographics (Thompson, 1997) are attributed to attrition, such as learner maturity and motivation, age, gender or instructor experience and expertise (Carr, 2000). Other factors include conflicts with work schedules (Henke & Russom, 2000), poor time management skills, and ill-defined educational goals (Parker, 1995). In those cases where attrition rates are low, explanations are suspect because there is little evidence that success in a distance learning course is nothing more than a matter of learner characteristics. Even for the experienced distance learner there is no guarantee that the context, interactions, or conceptualization of content will resemble previous course experiences. Most distance learning programs attempt to provide services that support the distance learner once they are enrolled in a course to reduce drop-out rates (Oliver, 1999; Morgan, Dingsdag, & Saenger, 1998; Portier & Wagemans, 1995; Wright, 1991).

One commonly used pre-course service is a self-assessment tool that either allows the student to measure his or her preparedness for taking a distance learning course or serves as an anticipatory set[1] by intimating the nature of a distance learning course. Such self-assessment tools are typically in the form of a 10-15 question survey in which the respondent answers 'yes' or 'no' to a series of learner behaviors attributes, or competencies such as those identified by Rowntree (1995): computer skills, literacy/discussion skills, time management skills, and interactive skills. These types of self-assessment instruments assume that the learner will (a) complete the survey, (b) reflect upon and honestly respond to the queries, and (c) take in consideration the analysis when determining to take a course. However, there is no assurance that potential students use the survey to determine whether or not they should take an online course but may serve to eliminate students that do not fit a successful profile.

This study examines US university-delivered distance learning courses, (rather than programs) which are offered as options to brick and mortar campus course offerings. If pre-course surveys are intended as a support to the learner then they should identify skills, knowledge, and abilities necessary for successful completion of the course. An initial review of such surveys (McGee, 2001) suggests that such instruments are written to identify the traits of the *successful* distance learner and whether intentionally or not, serve as a self-selecting tool to eliminate those learners who do not have the desired attributes. The research question is: What content are pre-course surveys derived from?

Method

After searching online course directories, 50 institutions that offered distance learning courses and had Web sites were identified. Each site was examined for online supports to prepare the distance learner; typically these were in the form of a survey or a Frequently-Asked-Questions page. From the 50 sites identified, 38 offered pre-assessment surveys. All 38 were selected as the study sample. Survey items from the 38 pre-assessment surveys were analyzed and categorized holistically. Since many of the items from different surveys were ver batim, it was not difficult to group like items. Categories were determined based on existing ontologies of disciplinary concepts, i.e. motivation, learning style, self-regulation, etc. A literature review identified characteristics of (a) successful distance learners and (b) learner

---

[1] Relates prior experiences to new learning.

BEST COPY AVAILABLE

practices for success in a distance learning course. These attributes where then correlated with topics identified through data analysis.

Findings

A topical analysis of survey items identified three major areas of skills, abilities, and knowledge: environmental preferences, learning preferences, and cognitive skills, see Figure 1. Many surveys were identical suggesting that surveys had been borrowed or copied form similar sources. Due to space limitations, only significant findings are reported here.

Figure 1
Pre-assessment Survey Analysis (N=38)

Traits	#	Literature
Environmental Preferences		
Technology Preference	20	Eastmond (1995); Willis (1994)
Flexible time schedule	29	Liviertos & Franks (1996); Willis, (1994); Hyatt (1992); Hezel & Dirr (1991)
Convenience	13	Willis, 1994; Hezel & Dirr, 1991)
Self-Regulation[2]	31	Parker (1995); Laube (1992)
Independent learner	15	Suet (1998);Cook, (1997); Hardy & Boaz (1997); Barrell (1995); Biner, Bink, Huffman, & Dean, (1995); Burge (1994) Diaz, (2000);
Internal locus of control[3]		Dille & Mezack (1991); Jonassen & Grabinger (1988); Stone (1992)
Motivation	26	Burge (1994); Schlosser & Anderson (1994); Souder, (1993); Laube (1992);Office of Technology Assessment (1989)
Time Management	31	Hardy & Boaz (1997); Stone (1992)
Technology Proficiency/Comfort	18	Gunawardena (1992)
Learning Preferences		
Interaction	14	Coggins (1998)
Classroom Discussion	16	Powers & Mitchell (1997)
Instructor	16	Burge (1994)
Cognitive Skills and Abilities		Smith & Dunn, (1991)
Reading Literacy	28	
Writing Ability and Comfort	13	Stovalt, Kelly, & Lieberman (1998)

Discussion

Findings indicate that pre-assessment surveys focus on either research-based characteristics of the successful learner or extrapolations from the same. For example, maturity is often cited characteristic of a successful online learner. Maturity is often cited as an indicator of persistence, motivation, and responsibility. However, if maturity is often defined in terms of age rather than other indicators which may more accurately define maturity, such as decision-making or problem-solving abilities. Research that explores more deeply into the reported experiences of the learner and their characteristics suggest that learners' reported data might not be reliable (Rubenson & Woodley, 1987). Morgan and Tam (1999) found that when questioned at length about reported reasons for not completing a course or their poor performance, learners often gave very different reasons from what was specified on a questionnaire or survey[4]. Clearly pre-assessment instruments are self-selecting tools to recruit learners with the most likely traits for success. More importantly, few contingencies or supports exist (in most online learning environments) that can aid a potential distance learner in acquiring skills or knowledge necessary to succeed in an electronic learning environment. Without these supports novice distance learners may be at risk of failure (Dille & Mezack, 1991). Additionally, there is no evidence that accommodations for a range of abilities, skill levels, or learning styles are part of distance learning course design. It is a one-size fits all approach assuming that distance learners are a homogenous group. Yet the notion of distance learner as "static" rather than dynamic is increasingly questioned and believed to be invalid (Thompson, 1997; Holmberg, 1995).

---

[2] Self-regulation as it relates to academic settings involves the abilities to plan, organize, and manage learning experiences while accessing appropriate resources, and self-evaluate progress (Bandura, 1997 as cited in King, Harner, Scott, and Brown , 2000). Includes persistence.

[3] Although locus of control is not directly stated in any of the surveys, the attributes of internal locus of control were evident, including: takes responsibility, independent, self-motivated, persistent, and proactive.

[4] Morgan and Tam found that barriers to success and course completion fell into one of four categories: situational, institutional, dispositional or epistemological.

The increasing trend toward transforming face-to-face courses into virtual ones with little or no preparation on the part of the course instructor necessitates informed, calculated, and strategic study and implementation of effective adragological approaches to teaching online as well as providing seamless supports and alternatives for all learners.

References

Bandura, A. (1997). *Self-efficacy: the exercise of control.* New York, NY: W. H. Freeman and Company.

Barell, J. (1995). *Critical issue: Working toward student self-direction and personal efficacy as educational goals.* Retrieved on May 27, 2001, from http://www.ncrel.org/sdrs/areas/issues/students/learning/lr200.htm.

Biner, P., Bink, M., Huffman, M ., and Dean R. (1995). Personality characteristics differentiating and predicting the achievement of televised-course students and traditional course students. *The American Journal of Distance Education 9* (2), 4 - 18.

Brent, F.L. & Bugbee, A.C. (1993). Study practices and attitudes related to academic success in a distance learning programme. *Distance Education, 14* (1), 97-112.

Brown, B. M. (1998). Digital classrooms: Some myths about developing new educational programs using the Internet. *T.H.E. Journal* {online}. Available : http://www.the journal.com/magazine/98/dec/feat04.html

Burge, E. J. (1994). Learning in computer conferenced contexts: The learners' perspective. *Journal of Distance Education, 9* (1), 19-43.

Carr, S. (2000, February 11). As distance education comes of age, the challenge is keeping the students. *The Chronicle of Higher Education.* pp. A39-41.

Coggins, C. C. (1988)). Preferred learning styles and their impact on completion of external degree programs. *The American Journal of Distance Education, 2* (1), 25-37.

Cook, K. (1997). Locus of control and choice of course delivery mode at an Ontario community college Unpublished research report. Retrieved on April 1, 2000 from http://www.oise.utoronto.ca/~kcook/qrp.htm

Diaz, D. P. (2000). Comparison of student characteristics, and evaluation of student success in an online health education course. Unpublished doctoral dissertation, Nova University, Fort Lauderdale, Florida. Retrieved on March 2002 from http://www.LTSeries.com/LTS/pdf_docs/dissertn.pdf

Diaz, D. P., & Cartnal, K. B. (1999). Students' learning styles in two classes: Online distance learning and equivalent on-campus. *College Teaching, 47* (4), 130-135.

Dille, B., & Mezack, M. (1991). Identifying predictors of high risk among community college telecourse students. *The American Journal of Distance Education, 5* (1), 24-35.

Eastmond, N. F. (1995). *Alone but together: Adult distance study through computer conferencing.* Cresskill, NJ: Hampton Press.

Egan, M.W., Sebastian, J., & Welch, M. (1991, March). *Effective television teaching: Perceptions of those who count most...distance learners.* Proceedings of the Rural Education Symposium, Nashville, TN. (ED 342 579)

Garland, M. R. (1993). Student perceptions of situational, institutional, dispositional, and epistemological barriers to persistence. *Distance Education, 14* (2), 13-24.

Gee, J. P. 1990. *Social linguistics and literacies: Ideology in discourses*. London:Falmer Press.

Gunawardena, C. (1992). Changing faculty roles for audiographics and online teaching. *The American Journal of Distance Education, 6* (32), 58-71.

Hardy, D., & Boaz, M. H. (1997). Learner development: Beyond the technology. *New Directions for Teaching and Learning, 71*,41-48.

Henke, H, & Russom, J. (2000). Factors Influencing Attrition Rates in a Corporate Distance Education Program. *Education at a Distance Journal, 14* (11). Retrieved on April 4, 2002 from http://www.chartula.com/ATTRITION.pdf

Hezel, R., & Dir, P. (1991). Understanding television based distance education: Identification of barriers to university attendance. *Research in Distance Education,3* (1), 2-5.

Holmberg, B. (1995). *Theory and practice of distance education.* New York: Routledge.

Hyatt, S. Y. (1992). *Developing and managing a multi-model distance learning program in the two-year college.* Paper presented at the Annual Conference of the National Institute for Staff and Organizational Development on Teaching Excellence and Conference of Administrators, Austin, Texas.

Jonassen, D. H., & Grabinger, R. S. (1988). *Independent Study: Personality, cognitive and descriptive predictors.* (ERIC Document Reproduction Service ED 295 641).

Kelman, A. (1997).Distance learning at the LSE with virtual tutorials. *IT Review, 7* (1). Retrieved on June 1999 from http://elj.warwick.ac.uk/jilt/sw/97_1lse/default.htm

King, F. B., Harner, M., Scott, & Brown, W.. (2000). Self-regulatory behavior influences in distance learning. *International journal of Instructional Media, 27* (2), 147-155.

Laube, M. R. (1992). Academic and social integration variables and secondary student persistence in distance education. The American Journal of Distance Education, 15 (2), 279-290.

Livertos, B., & Frank, J. (1990). Alternative learning modes: Spring '92 telecourse and weekend college enrollees. Columbia, MD. (ERIC Document Reproduction Service ED 385 311).

McGee, P. (2001). *Novice Distance Learners: A Web-based Simulation-game Orientation.* Technical Report written for the Joint Advanced Distributed Learning Co-Lab. Orlando, Florida.

McKinnon, N. C. (1993). *An assessment of using technology and learning contracts with adult learners in distance education.* Unpublished doctoral thesis, University of Toronto, Ontario.

Morgan, B. M. (2000). *Is distance learning worth it? Helping to determine the costs of online courses.* Retrieved on June 27, 2001 from http://www.marshall.edu/distance/distancelearning.pdf

Morgan, C. J., Dingsdag, D., & Saenger, H. (1998). Learning strategies for distance learners: Do they help? *Distance Education, 19* (1), 142-156.

Morgan, C. K., & Tam, M. (1999). Unravelling the complexities of distance education student attrition. *Distance Education, 20* (1), 96-108.

Naidu, S. (1994). Applying learning and instructional strategies in open and distance learning. *Distance Education, 15,* 23-40.

Office of Technology Assessment, U.S. Congress. (1989, November). *Linking for learning: A new course for education.* Washington, DC: U.S. Government Printing Office.

Oliver, R. (1999). Exploring strategies for online teaching and learning. *Distance Education, 20* (2) 240-254.

Parker, A. (1999), A study of variables that predict dropout from distance education, *International Journal of Educational Technology, 1* (2).

Parker, A. (1995) Distance Education Attrition . *International Journal of Educational Telecommunications, 1* (4) 389-406. Retrieved on April 4, 2002 from http://www.aace.org/pubs/ijet/v1n4.html

Phipps, R. A., & Merisotis, J. P. (1999). *What's the difference? A review of contemporary research on the effectiveness of distance education in higher education.* Washington, DC; American Federation of Distance Learning in Higher Education Association.

Portier, S. J., & Wagemans, L. J. J. M. (1995). The assessment of prior knowledge profiles: A support for independent learning? *Distance Education, 16* (1), 65-87.

Powers, S., & Mitchell, J. (1997). Student perceptions and performance in a virtual classroom environment. Chicago, IL: American Educational Research Association. (ERIC Reproduction Service No. ED 409 005).

Rowntree, D. 1995. 'Teaching and Learning Online : a Correspondence Education for the 21st Century?'. *British Journal of Educational Technology* 26: 205-215 (3).

Rubenson, K. (1986). Distance education for adults: Old and new barriers for participation. In G. van Enckevort, K. Harry, P. Morin, & H. G. Schutze (eds.), Distance higher Education and the Adult Learner: Innovations in Distance Education, Volumne 1 (pp.39-55). Dutch Open University, The Netherlands.

Schlosser, C. A., & Anderson, M. L. (1994). *Distance education: A review of the literature.* Ames, IA: Iowa Distance Education Alliance, Iowa State University. (ERIC Document Reproduction Service ED 388 159).

Sheets, M. F. (1992), Characteristics of adult education students and factors which determine course completion: A review *New Horizons in Adult Education,* 6 (1), pp. 3-19.

Smith, P., & Dunn, S. (1991). Human and quality considerations in high-tech education. *Telecommunications for Learning, 2,* 168-172.

Souder, W. E. (1993). The effectiveness of traditional vs. satellite delivery in three management of technology master's degree programs. *The American Journal of Distance Education, 7* (1), 37-53.

Stone, T. E. (1992). A new look at the role of locus of control in completion rates in distance education. *Research in Distance Education, 4* (2), 6-9.

Stovalt, I., Kelly, M., & Lieberman, J. (1998). *What makes a successful online student?* Retrieved March 2000 from http://www.ion.illinois.edu/IONresources/onlineLearning/StudentProfile.html

Thompson, E. (1997), Distance education drop-out: What can we do? In Pospisil, R. and Willcox, L. (Eds.), *Learning Through Teaching,* Proceedings of the 6th Annual Teaching Forum, Murdoch University, February, 1997, pp.324-332. Available online: http://cleo.murdoch,edu.au/asu/pubs/tlf/tlf97/thom324.html

Thompson, G. and Knox, A.B. (1987). Designing for diversity: Are field-dependent learners less suited to distance education programs of instruction? *Contemporary educational psychology 12*(1). 17-29.

Willis, B. (1994). *Distance education: Strategies and tools.* Englewood Cliffs, NJ: Educational Technology Pubs.

Wood, H. (1996). Designing study materials for distance students. Retrieved on July 2001 from http://www.csu.edu.au/dvision/oli/oli-rd/occpap17/design.htm

Woodley, A. (1987). Understanding adult student drop-out. In D. Thorpe & D. Grugeon (Eds.), Open learning for adults (p. 68). Essex: Longman.

Wright, S. (1991). Critique of recent research on instructional and learner support in distance education with suggestions for needed research. *Second American Symposium on Research in Distance Education.* University Park, PA: Pennsylvania State University.

The Calibrated Course: Considering the Limits of Standards and Standardization

Online courses at post-secondary institutions are proliferating faster than the statisticians can count. With better than 78% of all higher education institutions offering distance education in some form (nearly 60% offering online learning, National Center for Education Statistics, 1999), it is understandable that issues of quality in distance education should arise. Like the Internet itself, online course offerings have generally come about almost randomly as distance learning programs have produced an online course in whatever subject there was an instructor willing to teach online; hence, developers, administrators, faculty–all seek guidelines in this new instructional medium. Early adopters, entrepreneurs, professional organizations, consortial committees, but rarely faculty and institutions themselves, began issuing an almost steady stream of "best practices" or standards, each claiming to be the definitive guidelines for distance education. In their best use standards have been applied intelligently to complement the criteria worthy institutions already have in place for quality assurance. In less effective use the standards have been recast as a template, enabling a distance learning unit to calibrate its production machinery, cobbling courses for mass production that subscribe to the letter, if not the spirit, of distance education. As Howard and Discenza (2000) point out, "Technology does not replace the human factor in education....technology is not as important ...as some other factors that affect the learning process such as student motivation, learner characteristics, and the professor" (p.153).

While regional accrediting agencies have distance education criteria, those standards issuing from educational organizations hold considerable credence because they are viewed less as evaluative measures and more as development measures. Standards from *DETC, WICHE, SREB, NACADA, ACE, for example, detail pedagogical theory, measurable outcomes, course elements, and other distance learning accoutrements, seeming to suggest definitive molds into which course content and instruction can be poured. A comparison of the lists will reveal very similar approaches to distance education standards. For example, on all lists institutional purpose is a touchstone: "Program is consistent with the institution's role and mission (WICHE)." "Institution has a clearly defined and simply stated mission that describes the general purpose and specific objectives of the institution (DETC)." "The program or course is consistent with the institution's role and mission (SREB)."

Why Do the Rules Sometimes Fail?

There is a common thread running through each list–the classroom model. The assumption appears to be that an online course should feel, look, and sound as much like a classroom course as possible–only "virtual." The underlying premise is that students learn best in a classroom setting; therefore, the more the online course emulates the classroom course, the better. At the same time, detractors of distance learning determine by circular argument that the Internet cannot duplicate the classroom setting and, therefore, cannot provide equivalent instruction. By allowing standards to be rooted in the classroom model, even online course advocates are in effect undermining online instruction.

There are other reasons why a rigid set of rules for online instruction fail to assure quality education. Among them is faculty and course individuality. With the exception of basic courses, seldom does an academic department prescribe how a body of material in the discipline is to be taught. It is assumed that the faculty–the content expert–is the best judge of the sequencing, selection, organization, and presentation of material. This assumption is sometimes optimistic, as few faculty have had pedagogical training. However, most faculty do fair-to-excellent jobs of teaching, simply because teaching involves common sense. The faculty who does not offer students multiple ways of learning, means of assessment, explanations, opportunity for questions, and other aspects of effective teaching usually does so not out of ignorance of method, but of a conscious choice to teach in a particular way. The imposition of standards in these cases legitimately falls as the responsibility of the academic department, not with the distance learning unit. Sensitizing faculty to students' learning needs, not a set of rules, makes for improved teaching online or in the classroom. For the rest, the faculty may well craft the online course to be uniquely his/hers.

Gilliver, Randall, and Pok (1999), like Williamson (1996), insist the act of teaching has not fundamentally changed, but is only assisted by the new educational technologies; "technology provides nothing more than a framework and delivery infrastructure to enable educators to be as imaginative, creative, and flexible as they wish" (p. 18). Some view "best practices" as rules circumscribing a uniform model that may ignore not only faculty individuality, but students' personal learning traits, and even subject matter characteristics. For example, WICHE asks "What provisions for instructor-student and student-student interaction are included in the program/course design and the course syllabus?" The ideal distance learning course or program "provides for appropriate interaction between faculty and students and among students," SREB states. Both of these criteria overlook truly independent study courses, which do not operate with a cohort group, or the fact that group discussions may not be appropriate in courses where learning content does not require peer interaction. As Oblinger, Barone, and Hawkins (2001) point out, "The future of distributed learning—and of higher education—will not be a one-size-fits-all approach" (p. 2).

Why Are There Rules Anyway?

Why rules indeed! Has not the Internet grown like Topsy because it was unfettered and in the hands of the masses? Though the growth of the Internet has seemed entirely spontaneous, the provision of academic credit-bearing courses does require some regulation to assure students of quality. The rules after all are about quality, and to suggest that the some rules are unfounded or may be unnecessarily complicated, tedious, and punitive rather than motivational, is not to suggest that rules themselves are unnecessary. Without rules, anything in HTML could be an online course. Even if it is agreed that a new medium calls for a new orientation outside the classroom model, the growing body of knowledge about learning confirms some generally held beliefs about how learning takes place, and learning is the goal of all courses–online or otherwise.

An online course grounds its quality in appropriate instructional objectives. A course is a quality course in direct proportion to the extent it enables students to meet those objectives. A point here about the relationship between technology and learning: While most distance education programs understand technology and learning are not equivalent terms, there is a still a disjunct between technology and the presentation of content. The assumption that media generate courses implies that games, animations, color, and layers of programming make learning happen better than simple screens with minimal text and straightforward organization. The actual difference in degrees of course quality lies between engaging the learning so that learning may take place and dazzling the learner so that the attention, but not the intellect, is stimulated. It is on this point that standards for production make good sense. Building on a general ambience of simplicity-- "less is more," the quality of production should focus on the basics first, such as ease of navigation, intuitive screens, limited distractions, grammatical accuracy. At this point the technology should become transparent, and the content paramount.

So What Are "Best Practices"?

Best practices are rules-of-thumb generally designed to be emulated; therefore, they are often based on what another institution has done with some degree of success. Best practices can involve the macro-level of institutional or even system planning, or on the micro-level the development of a single course.

At whatever level, best practices should have little to do with trappings and everything to do with the facilitation of actual learning. A quality course, for example, may have or may not have a bulletin board, essay questions, a grade archive, or multiple web links; as Ken White and Bob Weight in *The Online Teaching Guide* say, "teaching is about student learning and deals with establishing conditions for facilitating" (p.vii). Best practices must be thought of in terms of the learner–how does it change him or her? At the least a course presents the material, concepts, skills to be learned. No amount of flash, pedagogical theory, or artificially created community can substitute for a course's prime responsibility to the student–show him/her what is to be learned.

Second, it could be suggested also that a quality course involves metacognitive skills, that is, stimulates the student to think about what he/she is learning, because "learning" is more than cerebral digestion; it is learning to learn. Via the course the student might learn to

a. Connect the content of the course to the larger body of knowledge
b. Demonstrate what she/he has learned
c. Find resources for additional skills, remediation, review, further information
d. Understand the application, particularly the transferability of what he/she is learning

Conclusion:

The online environment is *sui generis*. Its possibilities as a learning environment are limitless. As more advanced technologies become standard on newer computers, succeeding generations of students and faculty will be completely at home in this environment. It is time to take off down new avenues of instruction. It can be assumed that an infinite number of ways of presenting material and of learning material will be possible, that faculty will know distance communication as second nature, as they now know classroom communication techniques, and that students will become completely comfortable with independent learning. Standards and standardization will be only the handmaidens of learning, not ends in themselves.

*Distance Education and Training Council, Western Interstate Commission for Higher Education, Southern Regional Education Board, National Academic Advising Association, American Council on Education; see respective websites below

References

1. Gilliver, R.S., B. J. Randall, and Y.M. Pok (1999). The orbicular model–cognitive learning in cyberspace. *Educational Technology Review* (12), 18-22.
2. National Center for Education Statistics. *Distance Education at Postsecondary Education Institutions: 1997-98.* U. S. Department of Education: Office of Educational Research and Improvement, December 1999.
3. Oblinger, Diana, Carole Barone, Brian Hawkins. Distributed Education and Its Challenges: An Overview. ACE, 2001 http://www.acenet.edu/bookstore/pdf/distributed-learning/distributed-learning-01.pdf
4. White, K. and B. Weight. (2000). *The online teaching guide.* Needham Heights, MA: Allyn and Bacon.
5. Williamson, S.R. (1996). When change is the only constant: Liberal education in the age of technology. *Educom Review* 31 (6), 22-25.

Organization Websites

American Council on Education
http://www.acenet.edu/
Distance Education and Training Council (DETC)
http://www.detc.org/
National Academic Advising Association
http://www.nacada.ksu.edu/
Southern Regional Education Board–Electronic Campus
http://www.electroniccampus.org/
Western Interstate Commission for Higher Education
http://www.wiche.edu

Mobile What? The Educational Potential of Mobile Technologies.

Thomas Fox McManus, Ph.D.
Assistant Professor of Educational Technology
Saginaw Valley State University
7600 Bay Rd.
University Center MI, 48710
(517)790-4060
mcmanus@svsu.edu
http://www.svsu.edu/~mcmanus

Abstract: Each new technology brings with it a certain potential for teaching and learning. This potential is based, in part, on the unique characteristics and capabilities of the technology. What can a learner or instructor do with the technology that they cannot do as well with any other? The advent of mobile technologies has sparked a trend, occasionally called m-Learning, or Mobile Learning, which is being touted as the next thing in learning. In this article we present a picture of what mobile technologies and environments may look like in the next few years. We examine the theoretical implications of mobility and ubiquity, the primary characteristics that separate these mobile technologies from other learning technologies. And we discuss the search for a pedagogical model for the creation of collaborative mobile learning environments.

What is Mobile Learning?

Mobile learning is effectively a sub-category of the larger concept of e-Learning. According to Clark Quinn mobile learning is "the intersection of mobile computing and e-learning: accessible resources wherever you are, strong search capabilities, rich interaction, powerful support for effective learning, and performance-based assessment – e-learning independent of location in time and space" (Quinn, 2000). The difference between e-learning and m-learning is an addition of capabilities and limitations, more evolutionary than revolutionary. Briefly defined, mobile learning is the combination of mobile technologies and appropriate pedagogy to allow learners to interact with learning environments, and other learners, at any time from any location. To expand upon this definition, it is first necessary to describe the sorts of technologies and pedagogies used.

Mobile Technologies

Mobile technologies include any system or device that allows a learner to access information or to communicate without the limitations of power cables or network wires. The term could encompass such technologies as radios, portable cassette players, calculators, dictation devices, or alphanumeric pagers. In most cases though, at the current time, the term mobile technologies usually refers to one or more of wirelessly networked laptops, WAP enabled mobile phones, or handheld computers. Future developments of mobile technologies are likely to include convergence, or the combination of several functions in to a single device, eventually leading to a pervasive or ubiquitous computing environment.

Wireless networking, which allows computers and peripherals to share data without being in physical contact, uses electromagnetic airwaves (radio and infrared) to communicate information from one point to another (WLANA, 2001), is becoming more common in educational settings. Handheld Computers are another new technology that is beginning to be seen in educational settings. Handheld computers, sometimes referred to as Personal Digital Assistants (PDAs), are small devices designed to fit in one's hand or pocket. While many companies produce these devices, there are three widely used operating systems (OS) which act as almost generic names; the Palm OS, the PocketPC (formerly WindowsCE) OS, and the EPOC OS. While most handhelds are capable of interfacing with a desktop computer through a synchronization cradle, many of the newer handhelds are being offered with built-in or add-on wireless connectivity. This allows them to connect to the Internet at anytime, greatly enhancing their utility as an educational tool. Mobile phones, and their attendant technologies such as WAP (Wireless Application Protocol, SMS (Short Messaging Service), and mobile Internet connectivity are the other class of mobile technologies that are being used in learning environments. The next generation of messaging services,

BEST COPY AVAILABLE

MMS (Multimedia Messaging Service) will extend the capabilities of these devices by adding media to the messages. This system has yet to be proven in wide scale use.

The Future of Mobile Technology

The current trend towards a single device being capable of handling multiple functions and media types is called convergence. This tend is already visible in the recent release of smartphones such as the Nokia Communicator (www.nokia.com) or the Handspring Treo (www.handspring.com), which combine the functionality of mobile phones, WAP, and SMS with the data processing capability of an Internet connected handheld computer. The idea behind convergence is that phone, computer, audio, video, and Internet can all be combined into one easily portable device. The prototype CyPhone, developed at Finland's University of Oulu (http://www.ee.oulu.fi/projects/CyPhone/), is just one example of such a device. Many futurists predict an era of what is called "ubiquitous computing" where computers are everywhere, in everything, constantly interacting in the larger digital world. Computer will cease to be discrete devices, their capabilities being integrated into most technologies. Ubiquitous computing means a fundamentally different way of interacting with the tools and appliances of our daily lives; and of their interacting with each other (Burbules, 2000). In educational terms this has the potential for tremendous impact. As students become more accustomed to this digital world they will expect, and demand, to see it reflected in the schools.

Unique Characteristics of Mobile Technology

In discussing the merits and capabilities of any technology for use in education it is essential to determine its unique characteristics (Kozma, 1991). The unique characteristics of mobile technologies differ with each type of technology you examine. For instance wireless laptops, PDAs, and mobile phones all have significantly different processor, input, and display capabilities. But they also have certain things in common. The most notable of these, and most important for mobile learning, is their mobility.

This begs the question of what characteristics of mobility may have some effect on learning or teaching. The UniWAP Project (UniWAP, 2002) is looking at the added value of mobility in higher education. They have described three aspects of mobility that impact education: convenience, expediency, and immediacy. Convenience, in their work, deals with the fact that mobile technologies allow a person to engage in educational activities from anywhere they happen to be, even while moving. They point out that while this characteristic seems to have little pedagogical relevance, it does effect how the technology is used. Expediency describes the capability of a learner or teacher to be mobile in some particular place or context that is relevant to the content being studied or taught. Immediacy describes the capability of mobile technologies to allow us to access learning environments or to engage in learning activities at any time, from anyplace, not just when we are sitting at a desk bound computer.

There are other characteristics that can be used to describe mobile learning technologies. Elliot Solloway of the HI-CE project (www.hi-ce.org) often touts the affordability of inexpensive handheld computer, as compared to laptops, or desktop systems currently used in K12 schools. He asks what it means for schools when every student has access to computing technology in the learning environment. While this is a good point it is not always true. At the time of writing, it is possible to buy a handheld computer for under $200, well under the cost of any other computer system with the equivalent versatility. But the more capable devices, those with wireless access and multimedia capabilities can cost more than $600. While still cheaper than even the low-end laptops, this price is equivalent to that of a low-end desktop computer. Perhaps the most intriguing characteristic of mobile technologies it the current trend towards ubiquity. The idea of a person having constant access to a computing device has several theoretical implications.

Mobile Pedagogy

When looking at the use of mobile technologies for learning it is important to determine a pedagogical paradigm that suits the characteristics and capabilities of the technology and the content. The use of modern technologies in education has always allowed the learner to place a certain amount of the cognitive load onto the computer (Scardamalia, Bereiter, Brett, Burtis, Calhoun, & Lea, 1992). Spreadsheets, for example, allow students and scholars to concentrate their limited cognitive resources on drawing conclusions from data rather than spending the cognitive energy performing complex statistical calculations. New wireless and handheld technologies have the potential to increase this effect many times. What will it mean when a learner, whether in a classroom or in the field, has access to the near unlimited information of the Internet, voice and data connections to any number of experts or collaborators, and the data storage and processing power of a modern mainframe; all in the palm of her hand? What will the "effects with" such a technology be? How can we, as educators, design learning environments to take full advantage of these synergistic effects? Distributed Cognition, Situated Learning, and Cognitive Apprenticeship are some of the learning models that researchers are looking at as the basis for a mobile and ubiquitous pedagogy.

Distributed Cognition (Salomon, 1993) looks at the interaction of learners with each other and with the technology itself. Distributed Cognition emphasizes how cognitive efforts are distributed across not only artifacts and internal and external representations, but across individuals and groups as well. In doing so, it dissolves the traditional divisions between the inside/outside boundary of the individual, the technology, and the group. If a learner always has a mobile learning device with him or her, the learner and the device begin to interact, in essence becoming more than the sum of their parts as the learner offloads some of the cognitive effort onto the device, enabling the learner to free up more cognitive resources for learning. If the same device enables the learner to keep in touch with a larger community of learners then the cognition can be distributed over the entire community, as well as their devices, allowing for larger scale social construction of knowledge.

Situated Learning theory (Cognition and Technology Group at Vanderbilt, 1993) is based on the idea that learning that takes place in an authentic context is more likely to transfer than learning that happens in an artificial environment. The Cognitive Apprenticeship model (Järvelä, 1996) is also stresses the idea of situating learning in a realistic context. This means creating learning environments that either mimic the authentic environment where the skills and information learned will be used, or creating a learning environment that actual incorporates the authentic environment. Technology allows for either of these goals to meet more easily. Because mobility allows for learners to go to the authentic environments for their learning, it may be possible to design mobile learning environments that follow the tenets of Situated Learning theory and the Cognitive Apprenticeship model to help support the students' learning. This could lead to the development of location or context dependent learning. That is learning that is greatly enhanced when it happens in a particular location or context. Imagine scientific field work or visits to historical landmarks as the context and think of how a mobile device could allow learners to access pertinent information, remediation, evaluation, or suggested further study as the learner comes in proximity to a location.

Research Findings

Most published articles dealing with the use of mobile technologies incorporate training or K12 and Higher Education been anecdotal rather than research oriented. There have been a few more scholarly examinations of mobile learning, but the field is still very new and in-depth scholarly research takes time to perform and disseminate. Earlier studies looking at the use of laptops, though not specifically looking at laptops with wireless connectivity, showed some benefits and trends which may be reflected, or even increased when those laptops are freed from their stationary connections to the Internet. Some studies noted a shift toward more student-centered classroom environments (Stevenson, 1998; Rockman, 1998), increased student motivation (Gardner 1994, Rockman, 1998), and improved school attendance over students not using laptops (Stevenson, 1998). According to Rockman (1998), a majority of teachers in laptop schools reported an increase in both project-based instruction and cooperative learning. Fisher and Stolarchuk (1998), in a study involving the use of laptops in middle school science classrooms, found that emphasis on the process of inquiry positively impacted student learning and attitudes. Roschelle and Pea (2002) examined the way mobile devices change the way people collaborate and the creation of shared knowledge spaces. Perhaps the largest study to date is the Palm Education Pioneers (PEP) Program (Crawford, Vahey, Lewis, & Toyama, 2002). The report is based on data collected from more than 100 schools around the US who received PEP grants. Teachers using the PDAs gave evaluations of the use of PDAs as instructional tools, with responses over 90% positive. Portability and ease of access were cited as benefits, as were the integration of the handhelds into a variety of instructional activities, the increase in student motivation, and the use of collaborative and inquiry based instructional methods. It must be noted that this research was funded by a handheld manufacturer. Nonetheless, the findings are encouraging for the acceptance of the technology into the traditional classroom.

Conclusions

Distance Education has always been about allowing learners access instructional environments that they could not otherwise access. Mobile Learning is another answer to the same need. But it also provides the opportunity for learners to access those environments at any time or from any place. This extra opportunity for ubiquitous access is the value that mobile learning adds to the educational mix. Mobile learning has the necessary characteristics to become a basic element in the structure of learning and education. The increase in access and the flexibility associated with mobile learning will move students from passive to active roles. They will be able to tailor the content and framework of the qualifications they require, and determine the mode, pace and delivery of study that is best suited to their own personal circumstances. While mobile learning research is still in its infancy, it is obvious that the trend towards ubiquitous computing needs to be matched with a sound theoretical model for educators to make the most of the new technologies.

References

Burbules, N. C., (2000), "Why Philosophers of Education Should Care About Technology Issues," Retrieved March 5, 2002, from http://faculty.ed.uiuc.edu/burbules/ncb/papers/philtech.html

Cognition and Technology Group at Vanderbilt (1993). Anchored instruction and situated cognition revisited. *Educational Technology, 33(3)*, 52-70.

Crawford, V., Vahey, P., Lewis, A., & Toyama, Y., (2002). Palm Education Pioneers Program: March 2002 Evaluation Report Retrieved April 6, 2002, from http://www.palmgrants.sri.com/PEP_R2_Report.pdf

Fisher, D., & Stolarchuk, E. (1998). The effect of using laptop computers on achievement, attitude to science and classroom environment in science. "Proceedings Western Australian Institute for Educational Research Forum 1998." Retrieved April 23, 2002 http://cleo.murdoch.edu.au/waier/forums/1998/fisher.html

Gardner, J. (1994). "Personal portable computers and the curriculum." Edinburgh, Scotland: Scottish Council for Research in Education. (ED 369 388)

Järvelä, S. (1996). Qualitative features of teacher-student interaction in a technologically rich learning environment based on a cognitive apprenticeship model. *Machine-Mediated Learning, 5*, 91-107.

Kozma, R. B. (1991). Learning with media. *Review Of Educational Research, 61(2)*, 179-211.

Larkin, J. H., & Simon, H. A. (1987) Why a diagram is (sometimes) worth ten thousand words. *Cognitive Science*, 11, (1)

Quinn, C. (2000) "mLearning: Mobile, Wireless, In-Your-Pocket Learning" Retrieved January 12, 2002, from www.linezine.com/2.1/features/cqmmwiyp.htm

Rockman, et. al. (1998). "Powerful tools for schooling: Second year study of the laptop program." Rockman, et. al: San Francisco, CA. Retrieved May 26, 2002http://rockman.com/projects/laptop/

Roschelle, J., & Pea, R. (2002). A walk on the WILD side: How wireless hand-helds may change CSCL. In G. Stahl (Ed.), *Proceedings of the CSCL (Computer Supported Collaborative Learning) 2002*. Hillsdale, NJ: Erlbaum

Salomon, G. (Ed.) (1993). *Distributed cognitions. Psychological and educational considerations.* NY: Cambridge University Press.

Scardamalia, M., & Bereiter, C. (1991). Higher levels of agency for children in knowledge building: A challenge for the design of new knowledge media. *The Journal of the Learning Sciences, 1(1)*, 37-68.

Uniwap, (2002). "The UniWAP Project" Retrieved May 26, 2002, from http://ok.helsinki.fi/sivut/inenglish/ENuniwap_mlearning.html

The Simulation Game: Discussing the Educational Potential of Online Multiplayer Games.

Thomas Fox McManus, Ph.D.
Assistant Professor of Educational Technology
Department of Educational Leadership and Services
Saginaw Valley State University
College of Education 160
7400 Bay Road
University Center, MI 48710
(989) 964-4060
http://www.svsu.edu/~mcmanus/index.html
mcmanus@svsu.edu

Abstract: Computers and games are a natural pairing. And these computer games occasionally have real implications in educational technology. In part this is because new technologies are often utilized in computer games long before they make their way into the class room or training lab. In this article we discuss the rise of a new class of computer games, the Massively Multiplayer Online Role Playing Game, and its possible implications for the development of complex social simulations for education and training.

Introduction

New technologies are often utilized in computer games long before they make their way into the class room or training lab. Distributed interactive virtual environments, have long been a goal of educational technologist. Immersive graphical environments where learners from all over the world could interact with each other and with the environment: this goal has been achieved in the online gaming industry and has far reaching implications for education and training. The rise of the Massively Multiplayer Online Role Playing Game (MMORPG), such as Everquest, Ultima Online, and Acheron's Call, has shown that the technology to build this sort of complex virtual world works. The problem is that it is still far too complex for a teacher or an instructional designer to create or run one of these virtual worlds. Recently new games have been released that include a tool set which allows a user to create a virtual space, stock it with artifacts, people it with characters, and run numerous other users through it in real time. Currently the tool set is being used for user created game content. But the same tools can allow a teacher or instructional designer to create a social simulation and adjust it in real time based on the interaction of the learners as they go through the virtual world. These tool sets may turn these games into real instructional tools.

The Origins of Online Games

Before discussing the characteristics and capabilities of current online role-playing games (RPG) it is important to have some idea how they developed and the traditions from which they arose. There are three components that go into the make up of online role-plying games; the traditional role-playing game, the computer game, and the Internet. Today's RPGs developed from more realistic war games, which have been around, and used instructionally, for some time. Napoleon used war games to help train his officers. War games in this case refer to table top games, simulating troop placement and interaction with counters on a map. Chess is a simplified exa mple of a war game. More complex and realistic war games require some sort of rules to determine the results of actions and interactions. There have been many such rule sets over the years. For example, in 1913 H. G. Wells wrote **Little Wars,** a set of rules for war gaming.

But there is a difference between war games and role-playing games. RPGs incorporate the idea of actions and outcomes defined by rules with the setting and narrative quality of traditional literature. Perhaps the most important influence on modern role-playing games has been the J.R.R. Tolkien's **The Lord of the Rings** trilogy, published in 1954. This very popular series introduced a generation to a rich environment of traditional archetypes and mythical narrative structures. After the resurgence of fantasy literature sparked by the popularity of Tolkien's works, there were several attempts to combine the fantasy characters and settings with complex war gaming rules. In 1974 Gary Gygax published the first edition of the **Dungeons and Dragons** rules. This became the first widely popular fantasy RPG. Though over the years since, many other rule systems and genres have achieved popularity, it could be argued that no other game has been as influential in the field as **Dungeons and Dragons (or D&D)**, indeed many use the name D&D to refer to the entire field of role-playing games.

Computers and games are a natural match that has existed since the early days of the technology. In 1962 students at MIT developed what is thought of as the first computer game called **Space War**. In 1969, **Adventure**, a text based fantasy game was introduced. It combined the fantasy setting from the popular literature with the computer's ability to present interactive environments. Once graphic displays became available, games gained graphical features. **Pong**, which first appeared in 1972, is widely thought of as the first "video game". In 1979 Richard Garriot developed **Akalabeth**, one of the first graphical fantasy games. It attempted to be D&D on the computer.

In the years since there have been a plethora of role-playing games on the computer. These games have had certain advantages when compared to table top, or face to face, RPGs. Games on the computer usually include high quality graphics, often immersive 3d graphics that present a world of beauty and grandeur matching those described in books or presented in movies. The story line of these interactive narratives can also be extremely complex with dozen of non-player characters (NPCs), that is characters that are run by the computer rather than the player, with whom the player can interact. And, unlike face to face games, which require that you gather several people into a room together at the same time to play, computer RPGs allow a person to play any time they wish regardless of the availability of other players. On the other hand these games have limitations which are impossible to overcome, based on the fact that the game and all its structure are created long before the player begins play. If a player wants to interact with an NPC, he or she is limited to those interactions predetermined by the game creators. This can lead to a sense of limited choice, as well as social isolation.

The Internet, the world's largest computer communications network, seems like a natural venue for relieving this sense of social isolation, and it has proven so. Since the early days of the Internet, it has played host to various sorts of online gaming. Play by email, where all interaction is non-synchronous and takes place via email, is a modern equivalent to the venerable tradition of play by mail gaming. MUDs, Multi-User Dungeons, are text based game spaces that allow players and game masters or story tellers to interact with each other over intercontinental distances in real time. Virtual Worlds bring graphics to the idea of the MUD. But most Virtual worlds are simply chat spaces with pictures. They lack the rules and narratives of the RPGs. That is what led to the Massively Multiplayer Online Role-playing Game (or MMORPG).

The Massively Multiplayer Online Role-playing Game

The MMORPG combines many of the aspects of its predecessors into an immersive, persistent, gaming environment where dozens, or hundreds, of people from, all over the world can play and interact in real time. These games are characterized by complex storylines and character development, where a story arc can take months of real time to resolve and characters grow and interact for years, instead of the days or weeks most other computer based games last. This long term character persistence leads to complex social interaction and group dynamics. In an MMORPG there may be thousands of players online at any given moment. While the worlds portrayed by these games are large enough that those players are spread out and usually not interacting with all the other player at one time (a recipe for pandemonium when it occurs), they are still interacting with other characters, played by real people, as opposed to dealing only with computer controlled NPCs. This sort of real interaction leads to the growth of complex social structures, some of which are supported by the design and genre of the game, and some of which are not. For instance in some game worlds player characters (PCs) will join together to form ad hoc teams to defeat powerful enemies or pursue difficult goals, while in other games there are formal structures, often called guilds or alliances, where members can benefit from the growth or success of other members.

There is also the potential for negative social interaction as well. Some players choose to use the relative anonymity and freedom of the game worlds to act out anti-social fantasies. This can range form verbal (or in most cases textual) attacks on other players to character assault, murder, and theft. Most MMORPGs are based on some type of heroic adventure genre. And, as in most adventure literature, violence and conflict play important parts of the story lines. In many games it is possible for a player character to attack another player character, even killing them, in game. As players put a lot of time and effort developing a character in these games, character death is seldom permanent. But it usually has some negative consequences. When a PC kills another PC it can cause various levels of consequences to the murdered character, including loss of in game money or goods, as well as taking the player's time and attention. It is even possible for these in game social misdeeds to have real world consequences. Part of the story line common to most MMORPGs is the hunt for treasure. Certain treasured items are very rare and highly desirable in the game world. This has lead to a booming economy in the real world sales of virtual artifacts. For instance a magical sword may be very useful to a character in a game. If one character accumulates more than one of these swords they may choose to sell the surplus. Often this is done on eBay, or some other real world auction service. A virtual magic sword may sell for $100 real world dollars. It is even possible for a player to sell an entire character or account. If a player has spent several months or even years playing a character until that character is very powerful, many choose to then auction that character, sometimes for several hundred real world dollars. This means that if an anti-social character kills a PC who had this desirable magic sword, they might steal it, then sell it for real money on eBay. Some of the social structures in many of these games have evolved to deal with these sorts of undesirable character actions.

There are currently three popular, successful MMORPGs that have been around for several years. The most popular in the US, with membership nearing half a million players, is **Everquest**. It is occasionally facetiously referred to as EverCrack, as it is said to be almost addictive in its draw for its players. It is a traditional fantasy RPG environment based loosely on the D&D game. The second most popular in the US is **Ultima Online**, based on one of the most popular computer based fantasy RPG series. It differs from most of the others as it uses a 2d interface instead of the more common 3d. It is also the oldest of the popular MMORPGs. The third of the "Big Three" is **Asheron's Call**, distributed by Microsoft. It is also a fantasy game, though the environment is original rather than based on some other property. There are several new games that have reached some popularity in the last two years, many which move away from the fantasy genre, and there are dozens of new games under development, including updated versions of the big three.

The Future of MMORPGs

Two trends in new technologies are most likely to affect the shape of MMORPGs in the next several years; the increase in graphics capabilities and the increase in network bandwidth. Combined with the like advent of head mounted displays and kinesthetic feedback systems, immersive virtual reality will take on a new meaning. As the verisimilitude of these virtual worlds increase, so will the involvement of the players. Even as each game becomes more realistic, the development of social structures and game design combine to create more complex interpersonal interactions. What are sometimes called "next generation" games often include mechanisms to discourage or prevent anti-social behaviors. The popularity of, and revenues from, theses sorts of games often lead people to call MMORPGs the entertainment form for the next century. Whether this is more than mere hype, only time will tell.

It is also possible; likely even, that the basic technology that is the backbone for the MMORPGs, the persistent, shared virtual world based on large scale network systems, will spawn other, non-game related applications. In industry it is easy to imagine virtual meeting spaces where groups from around the world meet and interact with high fidelity avatars. It has also bee suggested that this sort of interface could be combined with tele-control systems to have simulated factories building real products or with tele-presence systems to enable real long distance medical procedures. It has even been proposed that this sort of technology be used for virtual conferences where hundreds of people meet, interact, watch or make presentations, complete with slides and video. Tele-government is another potential use of this technology,. Where legislatures and other government bodies meet and vote in a virtual space, which is in turn open to any voter who wishes to attend.

Creating Educational Simulations

One of the most interesting of the new games, and possibly the most important from an educational point of view, is **Neverwinter Nights** (NWN) from Bioware. This is a multiplayer online role-playing game setting in a traditional fantasy setting. It is based on the Dungeon and Dragons rules (3rd Edition) and allows up to 60 players to interact in the environment in real time. The thing that makes NWN so different, and so interesting, is the inclusion of the **Aurora Toolset**. This toolset allows a user to create their own online 3d immersive environment, people it with NPCs, and most importantly, manage the environment in real time as the players run their characters through it. This means a game master (GM) can design a city, dungeon, or landscape, populate it with people and monsters, giving each a series of preset interactions and responses to the characters and their actions, but if those presets prove ineffective, the GM can, in real time, take over the NPC and cause it to reply or act in the manner most appropriate to the player's actions. This sort of control turns the game into a potential tool for powerful immersive, distributed social simulations.

There are four basic types of simulations: physical simulations, which simulate physical objects, i.e. a frog or a machine; procedural simulations, which simulate a particular activity such as flying an airplane or performing heart surgery; situational simulations, in which the learner is a participant in the larger situation, and can interact with and change the environment; and process simulations, in which the learner sets variables then watches the results of a process. The Aurora Toolset seems best suited for developing situational simulations. If an instructor or designer can shape a virtual environment with complex social interaction, then educators can create social and historical simulations, virtual field trips, even virtual classrooms where the learners can interact with each other as well as with the instructors and preprogrammed characters. One example might be a discrimination awareness simulation where the learners take the role of a discriminated minority with in a society. The reactions of the non-player characters, as well as those controlled by the instructors would should both subtle and overt examples of differential treatment for the learners' characters, all with in the context of a larger society. Or it could be possible to reenact the original Constitutional Convention, with learners each taking the role of a delegate from a particular state, trying to represent the views of that state on the important issues being discussed.

Currently the Aurora toolset is both complex to use and limited in its capabilities. The most noticeable of its limitations is the inability of the content creator to break away form the medieval/fantasy graphics inherent in the game. It is likely that a tool, provide either by Bioware, or by a third party developer, will overcome that limitation in the near future, but for the moment any environment or character created will have a definite fantasy flavor to it. One of the questions being addressed in this research is the importance of verisimilitude in these sorts of simulations. How distracting, or detrimental, is it to learners to have the simulated Abraham Lincoln and Jefferson Davis; look like knights in armor or elves, when seated at a simulated peace conference table. At the time of writing, the author and his colleagues are using the Aurora Toolset to develop educational social simulation environments. Later publications will explore the use of the toolset and the effectiveness of the simulation environments.

The Psychological Dimensions of Communities of Practice and their Relation to Online Learning

Dr Donald W. McMurray
School of Social and Workplace Development
Southern Cross University
dmcmurra@scu.edu.au

Abstract: In 1998, Southern Cross University adopted an action research methodology to design and deliver online units. Each action research cycle involves learning and reflection wherein necessary changes are instituted and the outcomes evaluated to assess the efficacy of online learning compared to conventional distance education learning (Hayden, Saenger & Parry, 1999). Feedback was mixed especially with respect to collaborative learning (McMurray & Dunlop 2000).

In a subsequent iteration of the action research cycle a community of practice concept was promoted where students were encouraged to organise themselves into a community of learners with the goal of supporting each other in their learning (Wilson & Ryder 2001).

In the most recent cycle, a conscious effort was made to simulate the culture and climate of real-world organisations (? ? ? ? ? ? ? ? ? ? ? ? ?? ? ?). It was found that the sense of community for online students was in many ways richer than that experienced by face-to-face students.

INTRODUCTION

The notion that the Eclassroom adds increased flexibility to the delivery of distance education is well established in higher education institutions today. Distance is vanishing, time is collapsing and relationships are becoming central to success (Olson 2001). There is also some evidence that the opportunity to interact and collaborate leads to richer learning experiences (Lander 2001; McMurray & Dunlop 2000). It is argued that the effectiveness of online learning activities rests on the manner in which they encourage interactivity and collaboration in establishing a community of learners. This paper examines evidence for the existence of a community of practice concept in an online setting as compared with a face-to-face class studying the same unit.

THE INITIAL ACTION LEARNING CYCLES

Staff within the School of Social and Workplace Development adopted an action research methodology to design and deliver online units within the Bachelor of Social Science. Each action research cycle involves learning and reflection wherein necessary changes are instituted and the outcomes evaluated. The process resembles a hermeneutic spiral (Gummesson 1991) where each turn of the spiral builds upon the understanding flowing out of the previous turn

Since first semester 1999 when five units were offered completely online, there has been an increase in demand by traditional distance education students wishing to utilise this communication technology. Presently 176 units are being delivered online all of which contain discussion forums and group collaborative work areas. In preparing units for online delivery, there has been a deliberate repositioning of the instructor away from the role of knowledge transmitter to that of facilitator, coach and resource guide. Emphasis is given to engaging the collaboration of the students in creating their own knowledge.

At the end of each semester units were evaluated to assess the efficacy of online learning compared to conventional distance education learning (Hayden, Saenger and Parry 1999) using a questionnaire adapted by Dunlop (1999) from Creed (1996). Initial feedback showed that while distance learning students value the interaction with and access to the lecturer, they found collaboration with each other to be problematic, especially where it led to a shared grade.

It was decided to pay more attention to each learner's basic communication needs when operating in a group. Computer supported communication is devoid of important social cues that are important for message validation and, therefore, the building up of trust (Collins & Berge 1996). Moreover, according to Dunlop and Scott (2001), online groups need sufficient time to become acquainted with each other and develop cohesion (King 1999) as well as the necessary social protocols. Only then can successful collaboration take place which, in turn, can lead to the facilitation of shared meaning (Allen & Griffith 1997).

THE PREVIOUS ACTION LEARNING CYCLE

The reflective phase of the initial action learning cycles led to a decision to create a community of practice for online learners since this has been found to be lacking amongst distance education learners (De Vries & Wheeler 1996; Martin

1999). Communities of practice describe informal settings in which people learn by doing. It has its epistemological roots in constructivism which assumes meaning is jointly constructed and arises out of ongoing activities of a community of learners. Here knowledge as well as action is fundamentally social in origin (Henning 1998). Stamps (1997) claims that communities of practice are not actually created but emerge as a function of people becoming united as they work collaboratively towards a common goal.

Accordingly, with the online launch of an undergraduate unit entitled *Organisational Communication*, it was once again decided to focus on a requirement for the students to interact and collaborate. In previous units of study the setting up learner centred groups had been undertaken by the instructor. In this iteration, however, the process of organising themselves into groups was left entirely to the students, including the naming of their virtual organisations. This was an unhurried process that occupied the first two to three weeks of the semester and produced a number of communicative activities, ranging from one-to-one dialogues using email and the telephone to the use of the discussion area inside the course delivery shell by the whole group. Very little instructor-to-learner communication occurred at this stage and this proved to be beneficial for the groups in forging a sense of community amongst themselves.

Once the online groups were established the asynchronous chat room quickly became the vehicle for conducting and archiving discussions. Many exchanges occurred between the two organisations as members explored boundaries and developed a sense of cohesion in and around their new 'organisation'. Initially these discussions were almost exclusively social and yet the creation of this social community served as an important bridge to the formation of the academic community that was to follow.

The evaluation of *Organisational Communication* at the conclusion of semester 2, 2000 confirmed the growing appeal that online learning holds for distance education students. The frequency of visits to the student discussion areas in this unit was almost three times as great as that recorded in two earlier surveys (McMurray & Dunlop 2000). It is contended that this increased interactivity was a product of the community building that took place at the outset of the unit. What began essentially as social interaction transformed into exchanges of a more academic nature. The students could see the merit in interacting with each other in this way. Eighty-six per cent of students rated the real-time chat sessions with other students as having "great value" or "very great value" (Newton & Ledgerwood 2000). In its virtual chat room *CourseInfo* records threads of conversation as online discourse in a way that allows every thought to be captured for future examination, reflection and extension by their peers (Owston 1997). The result is richer, more thoughtful discussions arising out of shared understandings which in turn contribute to a different kind of knowledge building from that which students are able to accomplish on their own.

Reflecting on this action learning cycle it was realised that if meaningful and useful collaboration is to become an integral part of computer assisted education, it is essential that the students are motivated to participate (Prendergast 1996). Further, it appears that for collaboration to be truly successful, the learning environment should be structured by the participants themselves. This includes reaching agreement about shared goals as well as the purpose of the collaborative enterprise.

THE CURRENT ACTION LEARNING CYCLE

The reflections flowing out of the second action learning cycle led to a number of important determinations. First, interactivity which occurs online is qualitatively different from that which takes place in a face-to-face environment. For example, a sense of immediacy is missing, along with an absence of non-verbal cues. For this reason it was decided to encourage the current cohort to make greater use of the virtual chat room. It was hoped that this real-time contact would promote a shared understanding of concepts and allow them to experience diverse and multiple kinds of feedback ahead of that received from the unit instructor. It was also hoped that this kind of interactivity would serve the dual purpose of fulfilling both academic and social needs of a geographically disparate group of adult learners.

The group of students presently studying *Organisational Communication* are all female and include two from the USA. They refer to their organisation as *CyberF.com*. From the outset the instructor once again maintained a relatively low profile while the group set about the business of developing their community of practice. While the instructions were clearly stated in the unit outline, control of the decision making process concerning how unit objectives were to be achieved was placed in the hands of students. Interestingly this type of instructor style was interpreted by one of the students as being somewhat laissez faire.

Towards the end of the unit members of *CyberF.com* were surveyed to ascertain what happens when students congregate to provide mutual support for their learning. The instrument used was designed to reflect perceptions of organisational climate. Moran and Volkwein (1992) see

> ? [as]? ?
> ?
> ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ?views? ?
> ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? -
> ?
> ?
> ?

???
??????????????????
??þ.??

At the same time students studying via conventional distance education techniques were also surveyed as to their perceptions about the climate as determined by their learning mode. Differences were found between the two groups with respect to 'cohesion', 'support' and 'trust'. For example, only 21% of distance education students reported feelings of cohesion with the school or their fellow students as compared with 90% of *CyberF.com* students. Similarly, almost twice as many online students felt supported in the studies as compared to external studies students.

Overall, the results provide evidence for the existence of a healthy climate amongst the online group that was not found in the conventional distance education mode. It is suggested that these factors are important requisites to the formation of a community of learners and are themselves the products of sustained interaction and collaboration.

BUILDING LEARNING COMMUNITIES ON THE WEB

There are a number of techniques that can be identified for those wanting to develop effective online courses. First, online learning needs to be viewed as a process not a sequence of structured activities. Action learning offers an appropriate lens through which to view these processes as they unfold.

Second, there should be a deliberate attempt to provide an environment that is intimate, inviting and authentic if quality learning is to occur. Ideally, this can occur within a community of practice. Hill (2001) outlines a number of strategies for establishing online communities of practice. These include:

- appealing to their sense of adventure from the outset by providing a vision that causes an air of excitement;
- providing communicative mechanisms that facilitate interaction;
- ensuring a safe and protected environment free of outside criticism and interference;
- assuring them of a constant connection with the instructor as needs dictate;
- enabling them to interact and communicate in a number of different ways; and
- working hard to avoid or remedy technological problems that may potentially thwart their community building.

Third, encourage a diversity of participants since geography does not matter in an online community. Nevertheless, adequate attention needs to be paid to cultural demographics. Finally, as instructor, it is important to provide the human touch by visiting the chat rooms, staging teleconferences, recording audio messages and sending e-mails. The prime objective here is to encourage students to reflect on their own learning and to analyses these metacognitive activities for future reference.

CONCLUSION

This paper has traced the emergence of a sustained positive shift in attitude towards collaborative online learning for distance education students over a number of action learning cycles. It is concluded that the establishment of a virtual community of practice involving common goals and a desire to learn from each other are key drivers behind the shift. Technology, in and of itself, does not foster collaboration. As Adams and Freeman (2000) found, the establishment of a community of practice serves the purpose of supplying the necessary human infrastructure for the creation of knowledge with the Web providing the technological tool. Student feedback suggests that collaborative online learning yields richer learning than simply requiring individuals to interact with materials that have been web-mounted (Hiltz & Benbunan-Fich 1997).

REFERENCES

Adams, E. C. & Freeman, C. (2000). Communities of practice: Bridging technology and knowledge assessment, *Journal of Knowledge Management*, 4, (1), 38-44.

Allen, D. & Griffith, R. (1997). Vertical and lateral information processing: The effects of gender, employee classification level and media richness on communication and work outcomes, *Human Relations*, 50, (10), 23-31.

Collins, M. & Berge, Z. (1996). Facilitating interaction in computer mediated online courses. Paper presented at the Florida State University Distance Education Conference, Tallahassee, FL, June. http://star.ucc.nau.edu/~mauri/moderate/flcc.html.

Creed, D. T. (1996). Project ADEPT (Assessment of Distance Education Pedagogy and Technology). http://www.users.csbsju.edu/~tcreed/adept/desrv1.html

DeVries, Y. E., & Wheeler, C. (1996). The interactivity component of distance learning implemented in an art studio course, *Education*, 117, (2), 180-184.

Dunlop, M. (1999). *The Impact of Computer Delivered Distance Education on the Participation.* Unpublished BSocSc(Honours) Thesis, Southern Cross University Press: Lismore.

Dunlop, M. & Scott, D. (2001). An Examination of the impact of aspects of online education delivery on students. In Treloar, A. and A. Ellis. (Eds.). AusWeb01, Proceedings of The Seventh Australian World Wide Web Conference Southern Cross University Press: Lismore, 269-283.

Gummesson, E. (1991). *Qualitative methods in management research.* Newbury Park: Sage.

Hayden, M., Saenger, H. & Parry, S. (1999). *An evaluation of online units delivered in first semester 1999 at Southern Cross University.* Report compiled by *The Teaching and Learning Centre.* Southern Cross University: Lismore, NSW.

Henning, P. H. (1998). Ways of learning: An ethnographic study of the work and situated learning of a group of refrigerator service technicians. *Journal of Contemporary Ethnography,* 27, (1), 85-136.

Hill, J. R. (2001). Building community In Web-based learning environments: Strategies and techniquies. Paper presented at Ausweb 01 - Seventh Austyralian World Wide Web Conference, held at Southern Cross University, Coffs Harbour, NSW April, http://ausweb.scu.edu.au/aw01/papers/refereed/hill/paper.html

Hiltz, R. & Benbunan-Fich, R. (1997). Supporting collaborative learning environments in asynchronous learning networks. Invited Keynote Address for the UNESCO/Open University Symposium on Virtual Learning Environments and the Role of the Teacher. Milton Keynes, England April 28 1997. http://eies.njit.edu/-hiltz/CRProject/unesco.htm.

King, K. (1999). Group dynamics for the online professor. Paper presented at AusWeb99, Fifth Australian World Wide Web Conference, Southern Cross University, Ballina, April, http://ausweb.scu.edu.au/aw99_archive/aw99/papers/king/paper.html.

? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? (??? ?). I? ?, *? ? ? ? ? ? ? ? ? ? ? ? ? o? s*, 44, (3), ? ? ? ? ? ? ? ?

Lander, D. (1999). Online learning: Ways to make tasks interactive. *UltiBASE,* 24 May 1999. http://ultibase.rmit.edu.au/Articles/may99/lander2.htm.

Martin, W. A. (1999). Being there is what matters. *Academe*, 85, (5), 32-36.

McKey, P. (2000). The total student experience. Keynote presentation at ASCILITE 99, Queensland University of Technology, Australia, December 6-8.

McMurray, D. W. & Dunlop, M. E. (2000). The collaborative aspects of on-line learning: A pilot study. *UltiBase,* July. http://ultibase.rmit.edu.au/Journal/journal.html.

? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? ? (????).T? m? ? ? ,*? ? ? ? ? ? ? ? ? ? ? ? ? ? ?* ?45, (1), ?? ? ? ?

Olson, R. (2001). Looking to 2010 and beyond. *Association Management.* 53 (8), 78-84.

Owston, R. D. (1997). The world wide web: A technology to enhance teaching and learning? *Educational Researcher, 27*, (2), 27-33.

Newton, D. & Ledgerwood, T. (2000). School of social & workplace development online student feedback survey, October 2000. Unpublished Report, Southern Cross University, Lismore.

Prendergast, G. (1996). *Using Computer Supported Cooperative Learning to Deliver Effective Work Place Training.* University of Melbourne Press: Melbourne.

Stamps, D. (1997). Communities of practice, *Training,* 34, (2), 34-43.

Wilson, B. & Ryder, M. (2001). Dynamic learning communities: An alternative to designed instructional systems, unpublished paper at http://carbon.cudenver.edu/~mryder/dlc.html (accessed 1 May 2002).

WEBQUESTS: INSTRUCTIONAL and DESIGN TECHNIQUES

Donna J. McNierney
Beeghly College of Education
Youngstown State University
United States
mcnier@zoominternet.net

Abstract: Using multimedia and computer generated web-based instructional activities; such as the WebQuests is a non-traditional instructional approach for teaching subject area content. This instructional method is designed to meet the learning needs of the student related to visual literacy, problem solving, discovery, and critical reflectivity. Transforming traditional instructional methods using critical pedagogy, promotes the teacher to examine current practice and ways to integrate technology with classroom instruction.

Introduction

This paper has two primary purposes. The first purpose is to review current research related to visual learning and learning theory and to discuss the resulting critical pedagogical implications within teacher education methodology and technology courses. The second is to describe the design of WebQuests as a learning activity so that teacher education students will learn the importance of integrating technology with instructional use in their classrooms as a web-based instructional tool. The learning experience for the students of designing WebQuests helps to challenge the teacher to engage in critical reflectivity of lesson planning and to promote the learner's ability in visual learning, problem solving, and discovery. Inherent in a review of the research is an understanding of the importance of the critical reflectivity process itself. Critical pedagogy theorists argue that teacher education programs must include methods in the curriculum which engage education students in a critical reflective process - a process which results in their discovery and examination of traditional teaching and current practices. Engaging students in this process, using theoretical frameworks from researchers such as Dewey, Jung and Wink, ultimately assists in setting the parameters for designing successful instructional and methodologies which include the integration of technology. As a teacher educator at the university level, my education students in the technology courses need to learn that "critical pedagogy forces educators to look again at the fundamental issue of power and its relationship to the greater societal forces that affect schools" (Wink, 1997). Students need to know how current teaching practice that is enhanced with appropriate and challenging web-based activities, such as WebQuests, changes the teachers role but also gives power back to the students by challenging them using a constructivist approach by using problem solving and inquiry based learning.

Dondis stated that the traditional educational system places too much emphasis on the "verbal mode to the exclusion of the rest of the human senses and with little sensitivity to the visual character of the child's learning experience" (Dondis, 1973). Teaching and learning with visual images is usually of secondary importance in a curriculum. Many educators believe that when students are engaged in a visual learning activity, the learning is often passive, not personal or interactive. The dominant teaching style in traditional classrooms then remains teaching by telling.

How do we provide both the ideological and physical conditions important and necessary to educate all future citizens? How do we challenge all students in the dynamics of critical literacy, constituting a basis for a well-informed citizenry in a democratic society? (Giroux, 1988).

For example, if lecturing remains a popular method in our traditional classrooms, how do we know if it is the most egalitarian? How do we know if most of our students learn by listening through the auditory senses? How do we know that they can apply the principles and concepts of their subject matter merely by hearing? The answer, apparent to most informed educators, is that we do know and the answer is that most students do not and cannot learn merely by listening. How much of the students' learning is through the visual?

Jung's research, however, on psychological type helps to illustrate the importance of visual learning by identifying how students prefer to perceive and interact with their world. Jung's definition of the psychology and structure of consciousness yields "four basic functions which are constitutionally present in every individual: thinking, intuition, feeling and sensation" (Jung, 1992). These functions are also referred to as the functions of consciousness or typology.

John Dewey, another prominent educational theorist, contributed interest and effort to the learning process. Dewey (1985) stated that the learning experience of the student is enhanced when interest is "secured in a given set of factors or ideas; we can be perfectly sure that the student will direct his/her energies toward mastering them" (p.159). According to Dewey, the level of interest in a given topic and the amount of effort it takes to complete that task, "necessitates that genuine interest is the accompaniment of the identification through action, of the self with some object or idea, because of the necessity of that object or idea for the maintenance of a self-initiated activity" (Dewey, 1985, p.159).

Interest is first active; second, objective; and third, personal. To be interested in performing a task, students must have a direct concern in it and recognize that because of this required personal commitment the outcome is important to them. Students must identify the task/idea as their own and thereby achieve both a sense of pride as well as a positive self-concept when their goals are met. Due to the personal interest attached to the attainment of the goal, students are willing to put forth the effort. The cliché, time flies when you are having fun, is appropriate in describing the students' interest level.

Nowhere are Dewey's ideas more pertinent in today's educational process than in how they relate to visual learning. How many times have students failed to correctly answer a geometry question but won a friendly game of pool? To play the game first hand requires both visual and critical thinking of the laws of physics and geometry and an interest. Students who cannot successfully memorize the mathematical formula for a passing grade can successfully envision a bank shot into the corner pocket. They understand the concept of angles and speed and apply them first hand -- because they are interested and because they are visual. In essence, they are successful in decoding the images.

For a lifetime of learning and literacy that extends far beyond the walled boundaries of a school, the learned ability to accurately recognize, identify and interpret visual messages, actions, objects, and symbols encountered in the world is an important critical element in encouraging the processes of reflectivity and critical literacy. Visual images are a language, visual literacy is the ability to understand and produce visual messages (Heinich, 1996). Recent research and study in the field has focused on the importance of the development of teaching and learning strategies to increase students' abilities to evaluate, create and think critically about the images presented. Findings from the visual literacy field of research are increasingly important because due to the ever-widening role of the mass media in our society, students need to be informed and knowledgeable so that they can decode both wanted and unwanted communicated message

All prospective teacher educators in this multi-dimensional information age need to develop and transform instructional methods by integrating technology and web-based activities. As a teacher educator, it is important that I model instructional methods and develop activities in the classroom which centers on students to rethink how their subject/content area can be taught in the future.

The Design

According to Dodge, developer of the WebQuest strategy, the World Wide Web has become a popular wide ranging method for students to browse for factual information, online graphics, cyber communication, and global awareness. Using the Web "can revolutionize student learning." (Dodge, 2002) "WebQuests were designed to address the dilemma of using progressive learning theories, such as, constructivism, authentic assessment, cooperative learning, and scaffolding by integrating them together for effective teaching practices into one integrated student activity." (Dodge, 2002)

WebQuests engage students curiosity and often increase their motivation to learn to make conceptual connections that are related for example to a particular topic, theme, or problematic situation. Depending on how the WebQuest is designed by the teacher, students may need to respond to real world problems, confront issues, or work cooperatively with peers. (Dodge, 2002) The primary goal of using WebQuests as an instructional and learning tool is to engage students in higher order thinking skills. A good website to use as a framework for the development of the WebQuest is located at http://webquest.sdsu.edu. Included in that website are the six elements necessary for designing and formatting the structure of the WebQuest. They are the following:

1. Introduction
2. Task

BEST COPY AVAILABLE

3. Information sources
4. Process
5. Guidance
6. Conclusion

The website is particularly good because it defines the six elements needed to create the WebQuest in addition the site provides great examples of short and long term WebQuests for diverse susbject areas and grade levels.
http://www-bioc.rice.edu/precollege/k12resources/webquest/links.html (Marty Daniel, Oct. 10, 2001)

Once familiar with the construction of the WebQuest and the situation or scenario for the basic framework for the students to investigate is planned, a web editor or software needs to be chosen. One of the more sophisticated and highly recommended web editors available is Macromedia's Dreamweaver. The ability to design in layout view is a powerful feature for creating a web page because it is visually stimulating for the designer and because writing code or being a programmer is not the major factor in the overall creation. Dreamweaver does have a valuable function that allows for both views to be observed, code and design.

Another aspect to Macromedia's web editing software is the easy integration with Fireworks and Flash. The graphics, images, or video the designer may want to include is made possible with Macromedia's software packages that integrate seamlessly with one another.

Conclusions

The traditional definition of literacy has referred only to the reading and writing of verbal information. However, in today's world the concept of literacy assumes a much broader meaning in interpretation. "The term visual literacy refers to the learned ability to interpret visual messages accurately and to create such messages" (Henrich, 1996).

This paper had two primary purposes. The first purpose was to review current research related to visual learning and learning theory and to discuss the resulting critical pedagogical implications within teacher education methodology and technology courses. The second was to describe the design of WebQuests as a learning activity so that teacher education students will learn the importance of integrating technology with instructional use in their classrooms as a web-based instructional tool.

The created learning experiences which are first-hand, which are of interest, and which incorporate the students' prior experience and knowledge are engaging visual literacy skills that are strengthened by using a multimedia approach to learning. WebQuests add to the instructional and learning environment for the student because of the non-traditional approach to teaching as well as encouraging students to use higher order thinking skills to achieve the task.

Teacher educators, in their technology and methodology courses, should take a leadership role in the use of computer technology and media. Such multimedia approaches, as the WebQuest, can contribute to visually-oriented thought-provoking lessons. The design of instructional technological lessons identifies teacher educators as significantly transforming their own teaching in the classroom, through reflection, action, and the recognition that, indeed, a picture is sometimes worth a thousand words.

References

Dewey, John. (1985). *Essays on Philosophy and Psychology 1912-1914*. Carbondale and Edwardsville: Southern Illnois University Press, 159.

Daniel, M. WebQuest Links Oct. 10, 2001

Daniel, M. Teaching With WebQuests Oct, 12 2001

Dondis, Donis A. (1973). *A Primer of Visual Literacy*. Cambridge, Massachusetts, and London, England: The MIT Press, 9.

Dodge, B. The WebQuest Page at San Diego State University Oct. 21, 2001)

Ellsworth, Elizabeth and Marianne H. Whatley. (1990). *The Ideology of Images in Educational Media, Hidden Curriculums in the Classroom.* New York: Teachers College Press.

Gardner, Howard. (1983). *Frames of Mind.* New York: Basic Books, 336.

George, Paul, Gordon Lawrence and Donna Bushnell. (1998). *Handbook for Middle School Teaching.* New York: Longman, 86.

Giroux, Henry A. (1988). *Teachers As Intellectuals.* New York: Bergin & Garvey, xxxiii.

Heinich, Robert, et. al. (1996). *Instructional Media and Technologies for Learning.* Englewood Cliffs, New Jersey: Merrill, 67.

March, T., ozline.com - Why WebQuests? Aug.1,2002

Pascal, Eugene. (1992). *Jung To Live By.* New York: Warner Books, Inc., 16.

Vygotsky, L.S. (1978). *Mind in Society.* Cambridge, Massachusetts: Harvard University Press,.

Wink, Joan. (1997). *Critical Pedagogy.* New York: Longman, 36.

Sustaining Instructional Design Strategies to Enhance E-learning Among Learners at Open University Malaysia

Mustafa Md. Hanafiah
Associate Professor Dr. Abtar Kaur
Center for Instructional Design and Technology
Open University Malaysia
Malaysia
mustafa1@hotmail.com
abtar@pc.jaring.my

Abstract: The OU Malaysia views the use of advance technologies, especially e-learning as important as the University espouses a life-long learning culture with the intention to produce knowledge workers. This paper will showcase how the implementation of e-learning efforts in OU Malaysia through three methodologies: providing basic information, providing multimedia content and conducting online interactions. These efforts are in use to cater the different needs and expectations of the learners. This paper also explores on the various attributes in WebCT that are exploited to create a culture of e-learning. The e-learning design process, the adoption of the constructivist and objectivist approaches and the attributes of motivation are further described in this paper to sustain the instructional design strategies to enhance e-learning among learners at OU Malaysia.

Introduction

OU Malaysia was officially established on 10 August 2000 and our first program was offered in August of 2001. Our mission is to provide flexible, easily accessible and affordable life long learning opportunities to open and distant learners. Currently OU Malaysia has 12 undergraduate and diploma programs offered through five schools, that is School of Business & Management, Information Technology & Multimedia Communications, Education & Humanities, Science & Foundation Studies and Engineering. To support our learners we have thus far produced an estimate of 60 print-based modules and four sets of multimedia courseware (on CD ROM) and another four sets of multimedia clips for the web. To cater for all this needs, the Centre for Instructional Design and Technology was set up on January 1 2002. Its main responsibility is to assist the schools develop open and distance learning materials that are used in their programs. The center has been given the task to create more e-learning materials. Thus to start the discussion on our paper, we will look at a definition of e-learning that will help keep us focused on our e-learning efforts.

According to Rosenberg (2001), e-learning refers to the use of Internet technologies to deliver a broad array of solutions that enhance knowledge and performance. It combines both the online and knowledge management attributes. Some of the success factors for e-learning includes creation of a learning culture, receiving support of leaders, creating a nurturing environment, sustaining change throughout the organization, having formal instruction but goes beyond it, is happening all the time, has intellectual capital build-up and the individual and organizational performance is increased. In creating and exhorting the elearning culture, the instructional design (ID) process employed must be sustained throughout the learning continuum. Instructional Design according to Reigeluth (1985) is 'the process of deciding which methods of instruction is best for bringing about desired changes in student knowledge and skills for a specific student population'.

E-Learning Efforts at OU Malaysia

E-Learning efforts at OU Malaysia are implemented through 3 methodologies: a) providing basic information about the course that is being offered, b) providing multimedia content and c) conducting online interactions. The purpose of this variety is to cater for as much individuality as possible in terms of learning styles, aptitudes and time constraints. WebCT is the learning system that has been adopted by OU Malaysia and most of the e content is uploaded into the WebCT.

Providing Basic Information

Basic information consists of putting up course information such as syllabus, course objectives, readings, relevant websites and announcements. In OU Malaysia, e-executives carry out this function for those courses where faculty is not permanently with us. For those faculty which are permanently with OU Malaysia, they upload the information on their own.

Providing Multimedia Content

Multimedia content consists of two types: courseware and stand-alone multimedia clips. Courseware is created for those subjects that are difficult to understand and need a lot more e-support. The courseware is normally loaded onto CDROM. With courseware, the learner is allowed to practice a lot more and feedback is given to help the learner attain learning objectives. Courseware also consists of problem-solving strategies whereby the learner is able to immediately check his/her understanding. Stand-alone clips are normally loaded into the WebCT and the purpose of the stand-alone multimedia clips is to allow the learner to view/listen to it and then discuss the issue related to the clip using the online discussion board in WebCT. A team of experts consisting of multimedia programmers, graphics artist, animators and audio and video specialist creates the multimedia content. The content is first visualized and designed by a team of instructional designers and subject-matter experts. In the process of developing courseware, Gagne's Nine Events of Instruction are adopted by OU Malaysia. Gagne (1992) suggests that learning tasks for intellectual skills can be organized in a hierarchy according to complexity: stimulus recognition, response generation, procedure following, use of terminology, discriminations, concept formation, rule application, and problem solving. The primary significance of the hierarchy is to identify prerequisites that should be completed to facilitate learning at each level. Prerequisites are identified by doing a task analysis of a learning task. Learning hierarchies provide a basis for the sequencing of instruction.

Conducting Online Interactions

Online interactions are crucial in e-Learning efforts especially for open and distance learners as these interactions allow them to discuss shared experiences, which may otherwise be lacking. Online interactions are conducted via the WebCT learning system. Two of the most popular interactions are the email system and the online discussion board. The online moderator is the face-to-face tutor who meets the students once a fortnight at OU Malaysia's selected learning centers. Each online moderator has between 20-25 students. The online moderator has two important roles to play. One, is to answer student queries related to content. For this the students are advised to use the email. The other role is to moderate online discussions related to the content under study. As each subject is divided into 5 study units, the discussion is designed in such a way that, every two weeks, there is a discussion on one of the units. In this way, issues related to the subject is covered quite adequately.

According to the official WebCT website, WebCT has five attributes which can be applied to the innovation of technology in our university. The attributes are relative advantage, compatibility, complexity, trialability, and observability. The table below describes the five attributes. These attributes also contribute to sustaining of instructional strategies to enhance e-learning among learners in OU Malaysia and are elaborated in the section below.

Attribute	WebCT as innovation
Relative Advantage	• Automated marking of tests (multiple choice, short answer, matching and calculated questions) • Easy course administration • Communication (synchoronous and asynchoronous) between lecturer-students and students-students
Compatibility	WebCT is used for both residential (via the Intranet) and distance (via the Web education)
Complexity	WebCT is very user friendly and lecturers/tutors find it easy to use
Trialability	Lecturers/tutors can choose which WebCT functions they want to use, e.g. • Provide access for students to the current teaching material, study guides in the form of text • Communication via the Bulletin Board, E-mail, Chat rooms, • Testing which is graded by the computer and the grades are statistically processed • Course management, e.g. the student class list, student tracking
Observability	• Any function which the lecturer/tutor wants to use, is

	immediately available to view

Table 1: WebCT attributes that sustain instructional design strategies.

E-learning Design Process

According to Shank (2002), the key step in the e-learning design process is the creation of the plan for "interaction design". A series of criterion are considered before embarking on the plan: a) To determine what kind of courseware to create in the first place b) The size of the content to be developed c) The kinds of activities it should cover d) The kinds of coaching and support should it include.

The steps taken to determine concretely what needs to be taught with the solution being expressed in a specific work product are specification of teaching points, design theme, project timeline, prototype, production plan, implementation review, and functional specification.

The first activity is to gather data on what the specific need is. To get teaching points, experts and practitioners are interviewed. Teaching points are a refinement of information gathered during weeks of research and interviews. The goals of the course are to be described, and written documentation must be examined. In order to make an impact on performance when teaching, one needs to identify impact behaviors that will have the greatest effect on learners' performance and success on the job.

In determining a design theme the development team essentially chooses certain design architectures and past project experience as a style of interaction to use. A general approach 'hypothesis-driven investigation' is then adapted to assist in the designing of theme. This also involves in the planning out and dividing the design into tasks or activities and the time spent for each activities or tasks.

Before a task is designed it is structured by choosing a sample problem which is taken from a book. A learner's input is taken into the design process by having some learners work the problem using the books with the involvement of the tutors. A graphical representation of a design is done at this stage. A simple checklist is created in the forms of bulleted lists as a specific sense of how the core task is to be structured in the content.

At the production stage it describes what to be taught and how we plan to teach it. There are several decisions yet to be made as the design is structured - How will the details of the interaction be staged? What specific materials will be required to implement the interaction? How will the specific decisions the user makes be structured? How will the user be led to generalize from the specific scenario to the overall task?

After decisions have been made a walkthrough using a simple template is created. This creation is actively done by the design team members, to subject matter experts and in some cases, a representative of the user group. The design team and subject matter experts at the implementation review stage pose several review questions such as: a) Will this be an effective design? and b) How much effort will it take to create?

The final step of the e-learning instructional design process is to convert the walkthroughs into an overall learning system to the users. This also involves getting feedback from the learners and deciding on the solutions to the feedback. Adjustments are then made to improve and also to make the development of e content a cost-benefit content.

Sustaining the Instructional Design

Instructional design of e-learning is sustained by adopting a constructivist as well as an objectivist approach to learning. This is crucial as open and distance learners at OU Malaysia come from various backgrounds, experiences, and learning abilities. Constructivist learning strategies will suit the more advance learners, those who are in-charge of their learning and are ready to move forward. On the other hand, students who need to be lead, coached and monitored closely, may use the multimedia courseware to help them attain their learning needs according to their styles. These students may also use more of the emailing system to take advantage of the one-to-one coaching. However, this does not mean that they stay completely away from the online discussions. In fact online moderators are trained to identify learners who are not very active and coerce them to join the discussions. Instructional design of e-learning is also sustained when students are encouraged to contribute discussion topics for online discussion. In this manner, the student curricula is also met.

In a more physical sense, instructional design of e-Learning is sustained by providing students with computer facilities at OU Malaysia's learning centers. This is especially crucial in remote areas especially on the Borneo Island where students do not have ready access to Internet and computers.

According to Moshinskie (cf Rossett, 2002), organizations implementing e-learning projects are facing high attrition rates. During the online course, several strategies can be adapted to create and maintain motivation. These include a) maintain a conducive environment – is related to how learner is influenced by environment factors, people support, learning design strategy, and technology accessibility, b) proper chunk of information – this includes review of pre-requisites, an overview of objectives, interactive presentation of materials, job-related exercise, and a summary, c) build on the familiar- interest is build on by incorporate learners' beliefs and examples, d) vary the stimulus – vary information presentation by using audio, video, and animations, e) provide human touch – chat rooms, email, electronic office hours, video streaming and online mentoring can supply the human touch not only from tutors, also from fellow learners.

Future Plans

With the increased number of students using the WebCT, OU Malaysia has set an incredible pressure on the infrastructure, and more specifically on the availability of computers for our remote students. With the growing number of our Learner Support Centers in Malaysia it is hoped that the involvement of learners with technology will immensely improve their knowledge acquiring capabilities. This will ensure the implementation of WebCT or alternative learning system as part of a broader strategy to guarantee the creation of an e-learning environment. What we are therefore seeing as emerging is an integrated approach to sustaining instructional design strategies to enhance rich e-learning experiences in the flexible and affordable environment.

References

Gagne, R.M. Briggs, L.J. & Wager, W. (1992). *Principles of Instructional Design, (5th Edition).* New York:Holt. Rinehart and Winston.

Reigeluth, C.M. (1983). Instructional Design: What it is and Why is it? In C.M. Reigeluth (Ed.), *Instructional Design Theories and Models: An Overview of Their Current Status.* Hillsdale, NJ:Lawrence,Eralbaum

Rosenberg, M.J. (2001). *E-Learning – Strategies for Delivering Knowledge in the Digital Age.* New York: McGraw Hill.

Rossett, A. (2002) *The ASTD E-Learning Handbook - Best Practices, Strategies, and Case Studies for An Emerging Field.* New York: McGraw Hill.

Schank, R.C. (2002). *Designing World-Class E-Learning - How IBM, GE, Harvard Business School, and Colombia University Are Succeeding at E-Learning.* New York:McGraw Hill.

WebCT Resources, Available: http://www.webct.com/wyw (20 August 2002).

Acknowledgements

We would like to thank Halimatolhanin Mohd Khalid, Hamitha Abd Kader, and Sharifah Sariah Syed Hassan for making initial contributions towards this paper.

A New Paradigm For OnLine Science Laboratory Learning *Environments*

Gerald W. Meisner, Physics Dept., UNC Greensboro, US, jm@curie.uncg.edu

Harol Hoffman, Physics Dept., UNC Greensboro, US, hh@curie.uncg.edu

Mike Turner, Physics Dept., UNC Greensboro and Guilford County Schools, US, mturner@curie.uncg.edu

Abstract Robust online courses in the sciences must be based on: (1) sound, research–based pedagogy, (2) rich laboratory environments with skills and operational knowledge transferable to the wet lab, (3) a paradigm that is economically scalable. LAAPhysics courseware meets these challenges in the distance-learning field, using server/client technologies to develop and build a complete online physics laboratory learning environment comprised of equipment and instrument objects and interactive curriculum modules. Client/server data includes dialog (guide agent/tutor and student), white board discussions with virtual peers, assessment and capstone investigations. Complete portfolios of student performance are generated, permitting individual and aggregate analyses not only of conceptual understanding but also of peer to peer interactions and student understanding of various representations of experimental data.

LAAPhysics courseware is being authored to provide rich laboratory-based learning environments in the sciences for those unable to obtain such experiences in traditional college and secondary school settings. One problem the science education research community faces is the lack of data on the effectiveness of good online science laboratories. The reason for that lack of data is that no one has solved the problem of how to successfully port the science laboratory to a meaningful online environment. Without good online laboratories, we lack the necessary tools to conduct basic research on student learning in these settings. This is a recipe for a closed loop. To date, there has been no sustained and successful effort to bring together experts in content, technology, design and discipline-based education research to address these two interrelated problems. LAAPhysics uses internet-based technologies and physics education research results to create pedagogically sound teaching and learning laboratory online courseware environments. This approach will increase opportunities for individuals who currently lack them and transform the current limitations imposed by traditional classroom settings. It will also make available to pre-service and in-service teachers a research based 'online textbook' which can both increase their content knowledge and influence the way in which the discipline can and should be taught.

The LAAPhysics *system* consists of a number of innovative subsystems, which are now in various degrees of completion. All are in at least alpha stage, with beta testing of selected introductory physics 'tutorials' incorporating many of these subsystems to start during the fall of 2002. We are:

- developing open-ended 3D laboratories for the physical sciences that permit exploratory student investigations in which students are interactively engaged with their environments of space, equipment, instruments and data analysis tools. These laboratories will use research-based guided inquiry pedagogies from the science disciplines (such as *Workshop Physics*, the *Modeling Method*, and *Physics By Inquiry)* along with the most appropriate current computer technologies. A virtual tutor will guide students, as would an expert modeler, in, say, Hestenes' Modeling Workshop. We are initially authoring in Mac OS X, with Windows XP to follow.
- using a research model pedagogy to script interactive and guided laboratory-based tutorials in physics, chemistry and astronomy for students of diverse populations in diverse settings. LAAPhysics permits students to experience the scientific investigation paradigm in the context of a guided learning

experience, with branching logic enabling faculty to accommodate students of various backgrounds and levels of understanding.

- assessing student content understanding within the tutorial settings under varying conditions. Students are exposed to both higher-level concepts/tasks in which they deploy their developed models in novel situations, and lower level tasks in which they learn how to use instruments and equipment, or how to identify dependent and independent variables in an experimental investigation. Assessment and evaluation (A&E) questions are currently being authored which go beyond the common algorithmic questions at the 'end of the chapter'. Online environments permit a richness of A&E not possible with hard copy texts, provided appropriate courseware tools are authored for faculty and student to use. We have authored a variety of tools which permit faculty access to instantaneous qualitative A&E grading tools hitherto lacking: LAAPgraph, LAAPAnalysis, LAAPVector and LAAPMotionMap. These are being beta tested in the coming months. As with all online developments, midcourse corrections can be easily and quickly executed. The extensibility of the LAAPhysics approach, along with authoring tools we are developing, will permit a community of developers to quickly emerge, both here and in other countries.

LAAPhysics will not be an encyclopedia of all possible subject matter, which could be discussed, in an introductory, algebra-based course. We will author those which are most appropriate for constraints imposed by pedagogy, medium, funding and 'less is more' philosophy.

LAAPhysics uses selected IT tools, current advances in cognitive science, pedagogy research, and user interface design considerations from both the scientific and the entertainment sectors. From this array, LAAPhysics is developing an integrated software package composed of the following modularized interconnected components:

- a Physical Reality Engine (PRE)©™ that re-creates real-world phenomena in a simulated 3D environment. The open-ended laboratory workspace will contain virtual laboratory equipment and apparatus objects, the parameters of which can be varied by the user in an experimental setting. The open-ended nature of the lab space will provide enhanced environments suitable for visualizing abstract concepts, and will allow users (students and faculty) to employ the environment in unlimited creative ways;
- an Interactive Engagement System (IES)©™ that serves as the central management system of the application. The IES provides interactive content to the learner within a collaborative learning environment where students work together asynchronously with 'virtual peers' guided by a virtual tutor/guide agent. The IES monitors student progress and dynamically responds to student input with contextual modifications that individualize instruction. Through the script branching features, the IES thus guides the learner through appropriate sections and activities within each learning module, providing remedial experiences where needed;
- a System Tools Package (STP) that contains Learner Tools (LT) and Authoring Tools (AT). Each tool is a stand-alone component that can interface with various other components of the application. LT are student research tools that include graphing and data analysis tools. AT include an XML-based editor and development tools that will enable faculty to modify and extend either the engine environment or the content environment with minimal programming skill or knowledge;
- an Information Storage System (ISS) that sorts and stores student and course data on a remote server and furnishes that information to the IES for display to the user (student and/or faculty).

We are in the early stages of:

- developing research methodology on the effectiveness of LAAPhysics learning approach compared to traditional methods of teaching. We will assess both content knowledge (using accepted instruments) and laboratory skills of students who learn in the online environment, comparing this to those students from various conventional learning situations. .
- developing research methodology on the interface between student and machine in this interactive environment. Student interaction, such as use of graphs, tool selection, mouse actions, time on task and data analysis strategies, will be stored in databases that can serve as a research base for understanding important user interface and design issues.

- investigating techniques to enable those students with visual impairments to use and benefit from LAAPhysics.

The beneficiaries of the LAAPhysics approach to online laboratory based courses are:

- Students: Underrepresented populations: inner city minorities, native Americans, and others missing from the MSET mix; whose labs are inadequate or missing: from poor regions of the country, economically strapped community colleges, under-funded high schools, and colleges with inadequate space; those with scheduling difficulties due to work, family or geographic location; those who are ill, injured or who have disabilities.
- Faculty: who are interested in conducting research on student learning in online environments; who are interested in conducting research on student conceptual learning by means of a detailed LAAPhysics portfolio which is automatically created for each student; who want the option of "customizing" course material, and those who want to adopt the role of mentor rather than dispenser of information.
- Institutions: where economic realities make it unfeasible to pay for the high cost of laboratory space; where there is a conflict between lab space and other space demands; where the number of well trained lab instructors is limited; where home schools or struggling charter schools are used.
- Distance Learning Community: where the current absence of scientific laboratory work places severe constraints on distance learning.

LAAPhysics is a generalized simulated 3D laboratory learning environment that models an open-ended laboratory and thus facilitates the transfer of skills and experience from the virtual program space to real world classrooms and laboratories. The system allows students the freedom to make errors, which will be corrected through a further dialog between mentor (written script) and student. The modifiable software package is modularized and designed to provide an extensible interactive online learning environment for authoring introductory laboratory courses in physics (now), astronomy, and chemistry (in the future) and for conducting research on student learning in web-based environments. Our claim is not that the LAAPhysics is better than *in situ* guided inquiry laboratory based courses. Rather, LAAPhysics addresses those instructional situations where *in situ* introductory courses are less than ideal: those that are based on lectures alone, or where students have limited access to laboratories outside of scheduled class time, and/or where students may lack the apparatus and instruments that have been central to scientific investigations of the 20th century.

The Use of Course Mentoring Websites for Collaborative Curriculum Design and to Support Adjunct Faculty Teaching For Lesley University

By Dr. Linda Mensing Triplett Ed.D.
And
James A.J. Triplett M.S.

April 8, 2002

Abstract

Course mentoring websites (CMW's) have proven to be powerful vehicles for providing support and professional development to adjunct faculty teaching required courses for the Technology In Education Department at Lesley University. Adjunct faculty teach courses in many different locations across the United States, using a variety of course delivery models (delivery models include face-to-face courses that meet once a week, weekend courses, online courses, and hybrid combinations of online and face to face instruction). CMW's provide adjunct faculty with access to experienced professors who serve as online course mentors. CMW's are accessible to all the faculty members and furnish a medium for defining and publishing course standards, for giving faculty access to high quality instructional resources, and for maintaining consistency in the delivery of required courses. In addition, CMW's foster a sense of intellectual community among the faculty teaching each course. The goal is for each faculty member to consider themselves an active participant in an ongoing, online curriculum development process. CMW's provide the online context for communication and collaborative course development, and they can be constantly adapted to changing needs, to advancing technologies, and to the realities of diverse teaching environments.

Experienced faculty serving as course mentors establish and are responsible for the continued development of each CMW. The faculty mentor communicates and collaborates with all other faculty members teaching the same course, to gather resources in an ongoing way, and for the purpose of continually improving the CMW.

CMW's are organized to provide faculty with easy access to a variety of resources. Lists of prerequisite skills that students taking the course will need in order to participate in a meaningful way are made available, as is a set of resources that can be provided to students who feel they need to work on these prerequisite skills. The framework being used for online curriculum development requires that each course have a list of overarching goals related to NCATE/ISTE standards, and that each of these overarching goals be accompanied by an essential question and connected unit goals. Each unit goal has a set of suggested activities which can support the achievement of that goal. These sample activities can be used by faculty for creating course syllabi. Unit goals also have a set of outcomes and/or culminating performances that will help both the instructor and the students determine if goals have been achieved. Performance assessments accompany each activity (i.e. a set of scoring rubrics). The website lists software and technologies that are to be used in the course and a set of technical skills that will be learned. The website also includes an updated set of sample syllabi from adjunct faculty, as well as the

URL's of course websites that have been developed by faculty and are used for teaching the course.

CMW's are built upon technologies that provide access to information and resources, and support both communication and collaboration. Each CMW includes technical tools for collaboration between faculty. These tools are designed so that it is easy to create and continually modify curriculum. Tools include message boards and discussion forums, chat rooms, and visual cues as to when and who last updated a particular part of the course. Publication space is provided for all faculty. Curriculum materials and resources, such as worksheets and handouts can be attached, and these can be made available for various computing platforms (i.e. Mac and PC). Links to web pages are provided, as are NCATE/ISTE standards pages and appropriate help for integrating these standards into the course. Each CMW has built-in support for using technologies to enhance teaching of the course, including models and examples of technology integration in the curriculum. Models of effective pedagogical methods and principles are also provided. Examples of exemplary student work on major projects are included in each CMW, with accompanying performance assessments.

Faculty responsible for developing CMW's recognized the need to develop online course content in a production mode similar to computer software programming. Thus is was determined that CMW's would be designed in "course content modules". The Sharable Course Object Reference Model (SCORM) under development by Advanced Distributed Learning Network (ADL) provided an example and standards for construction of course content modules. Reusable course content modules are appealing because - although Lesley University is a traditional academic institution where individual faculty offer learning experiences that are unique and result from their own expertise and creativity - the productivity, richness, and high degree of maintainability of "course content modules" and the ease of sharing these among faculty members via web technologies has begun to change traditional academic thinking. Economic and competitive pressures, as well as rapid expansion of programs within the Technology In Education Department have also driven online development of course content modules.

Initial CMW design efforts were built on the Blackboard Course Management System becaus it facilitated web delivery while providing as set of integrated tools for communication, access to publishing spaces for faculty, and resources for measuring course outcomes. However, Blackboard uses a proprietary approach for constructing course modules, as well as for importin and exporting course content. Its template oriented framework did not provide the necessary flexibility or allow for development of course content modules that could be easily utilized by faculty working in a variety of other web formats.

For these reasons, it has been necessary to move away from the use of a Course Management System like Blackboard for this project and to establish technical standards that would permit interoperability and free exchange of content developed in various software packages. The recent development and deployment of tools for building websites and web-based information systems that are usable at all levels of expertise gives Lesley University the opportunity to builds it's systems on Internet-standard technologies using commonly available free or inexpensive tools.

Starting with a standard shared-server Unix-based website, one can layer open-source software systems to provide the desired functionality. Basic requirements for a CMW include easy upload and download using FTP or tools such as MS FrontPage or Macromedia Dreamweaver; a dynamic webpage creation environment using a scripting language such as PHP; and an SQL database such as MySQL accessible from that scripting environment. Because this platform is commonly used throughout the Internet, it is easy to build a user environment with sophisticated features like user-personalization, discussion forums, and individual upload capabilities, using freely-available software packages. For their course development work, faculty are able to use inexpensive commercial packages like FrontPage or Dreamweaver, or free tools such as Arachnophilia or CuteHTML.

Learning Cubes: A Model for Online Education

William P. Messier
Coordinator, Multimedia Management and Production
McLennan Community College, Waco, TX, United States
wpm@mcc.cc.tx.us

Abstract: This paper describes how a faculty development project was designed for the World Wide Web. The paper also describes interactions that took place between faculty to illustrate how collaborative learning and problem solving can be facilitated and implemented by the web. The project assignment content focused on instructors (students) being immersed in an authentic learning environment. The students actually experienced a form of technology based learning while undertaking specific tasks. The paper concludes with some pedagogical discussion about the use of cooperative learning as a teaching strategy for online education.

Introduction

Online learning is a relatively youthful field, which is still being classified as a discipline. As Administration and faculty members struggle with decisions about how to structure online courses for collaborative, cooperative learning, faculty perspectives of successful strategies can provide valuable insights for decision-making. Few studies have been conducted that examine the impact of the collaborative teaching/learning strategies in the distance-education setting (Hardwick, 2000). This paper presents general research findings pertaining to collaboration in online learning along with personal insights into what makes a project-based online assignment successful as a collaborative learning experience.

While online learning offers administrators, faculty, and students many advantages over traditional campus-based learning, problems do exist. Attrition is one such problem for online learners. Attrition is brought about in large part by a sense of isolation (Adelskold, Aleklett, Axelsson, & Blomgren, 1999). One teaching/learning strategy, which can improve this sense of isolation, is cooperative or collaborative learning. Collaborative learning involves students in social communication, as groups work together to discover knowledge, think critically, communicate effectively, reflect, and solve problems. Social interaction among learners plays an important part in the learning process, in fact, it can have a significant impact on learning outcomes. (Jonassen, et. al. 1995, Eastmond and Ziegahn 1995, Berge 1995). Students in online education programs, though separated spatially, can gain a sense of community as they distribute and simplify ideas, actively contribute to a team, and cooperatively solve problems (Cecez-Kecmanovic & Webb, 2000).

With progress in telecommunications and computer technologies, it is now possible to offer collaborative learning experiences in a cost-effective way. In the past, collaborative approaches to distance learning were limited by the cost and sophistication of the technology. Recent advances in technology coincide with a general shift in educational theory to a collaborative origin of learning, which recognizes the learner's need to share control and assume responsibility for problem solving in the context of a peer group (Anderson & Garrison, 1998). Collaborative learning is an outcome of cooperative learning, in that students must develop cooperative learning skills in order to use them in self-directed, high-performing teams. These collaborative groups conduct free investigation and members jointly discover and solve problems. Success in cooperative learning is grounded in the skills students develop within the context of the academic organization provided by the facilitator/instructor. More importantly, in distance learning, students must possess or develop the technical skills necessary for online communication, as well as acquire and practice social skills necessary for collaboration (Kemery, 2000). Cooperative learning involves requiring individuals be accountable so that each participant does a fair share. It involves effective cooperative social skills, effective and appropriate communication skills to bring the task to completion. Research shows that such cooperative learning practices lead to more efficient and effective processing, increased achievement, positive relationships among students, and efficient exchange of information (Johnson, Johnson & Smith, 1997).

Overview of the Model

Since collaborative learning is an outcome of cooperative learning, learning cubes is a product of both teaching strategies. Learning cubes is another name for peer learning and teaching, peer tutoring or team learning. The major difference between these learning strategies and leaning cubes is who is delivering and the amount of information delivered to the student at one time. With learning cubes one student will take responsibility for a certain prescribed amount of information and teach it to a small assigned group of students. This prescribed amount of Information disseminated by the group will be small, challenging, and productive. Prescribed information can be layered assignment to assignment allowing connections of previous taught material to be made while threading new ideas or skills to be learned from the group. Group size for the learning cube is usually small between two or three students. This size increases effective interaction between students while extending the learning process. Some positive interdependence is built in to the experience so that members need one another to accomplish common goals of constructing knowledge. Learning cube, team learning, and peer tutoring works best for some students and it may not work well for all but in most cases students increase learning while not hindering the learning of others (McKeachie, 2002, Larson, 1984). Students become active partners in the learning process and may learn effectively from interacting with their peers. Instructors may need to spend more of their time in the role of facilitator, organizing students, managing students, and helping students work together effectively.

BEST COPY AVAILABLE

Within a faculty development classroom, nine newly hired McLennan Community College (MCC) educators participated in an online collaborative project-based assignment. This faculty development was mandatory for all newly hired instructors. The educators taught in various fields of study. All educators were given two preliminary workshops using Blackboard, the e-learning course management system software.

As students, the instructors were given two weeks to complete the assignment. As learners via the web, the instructors could interact with one another from different geographical locations either in synchronous (real time) or asynchronous (delayed) mode via text-based communication for the purpose of dialogue. All members of the group had to complete the activities assigned. For assessment purposes, students were required to demonstrate newly learned skills in two pieces of work: 1. after learning how to create a web page from a Word document, each student must create a HTML document reflecting the pros and cons of cooperative learning, and 2. another HTML document reflecting upon items given on their pre-survey.

Model Structure

Within Blackboard the interface structure was designed for ease of use. There were eight categories of interactive buttons designed on the left side of each web page. The categories were in the following order: 1. ***Announcements*** – this category welcomed students online, reinforced what the emphasis of the activity is about, gave minor reminders about the use of Blackboard and the assignment, allowed students to take a pre-survey, and gave day and times the assignment help desk could be accessed for technical support. 2. ***Course Information*** – this category gave clear and precise responsibilities for the groups teachers and students. 3. ***Course Documents*** – this category gave clear and precise instructions for downloading a digital streamed video movie. 4. ***Assignments*** – this category allowed students to take a pre-survey, study a streamed movie, apply new knowledge learned to a simple activity, and teach this new knowledge to the group. 5. ***Books*** – this category gave references as books and websites about cooperative, collaborative, and team learning. 6. ***Communication*** – the communication category gave students access to e-mail or a real time virtual chat room. 7. ***Virtual Chat*** – this category allowed students to browse the archives for a previous virtual chat room sessions as well as access to the virtual chat room. 8. ***External Links*** – finally, this category allowed students to access educational data bases like ERIC.

As group members mastered making a web page using Word, each member of the group had to demonstrate new knowledge by completing their own HTML documents. Completed assignments were then forwarded to an email address on the assignments web page.

Pre-Activity Assessment

For feedback purposes, each member of the group was asked to participate anonymously in a pre-activity assessment. The survey was designed to stimulate thoughts concerning the topics of cooperative learning. All survey questions were designed using Blackboards management system. At the end of the required assignment, this survey will be used as a reflective evaluation. The following questions are from this pre-activity assessment: 1. Do you feel that high quality learning can take place without going to a traditional educational facility? Why or why not? 2. Do you like the idea of sharing your work, life and educational experiences as part of the learning process? If your answer is yes or no explain why? 3. Do you think it is possible for increased learning to take place when work/knowledge/life experiences are shared with peers? Why or why not? 4. Do you accept the value of facilitated learning as an advantage over the more traditional lecture based learning process? Why? 5. Have you incorporated cooperative learning into instructional methods? If so, how?

Faculty Interaction: Pre-Activity Assessment

To **question one**, do you feel that high quality learning can take place without going to a traditional educational facility? Most faculty members felt that high quality learning outside the traditional educational facility happens all the time such as people learning at the work place, reading/learning at home, or people learning about a new sport. Many instructors still feel that there is distinct value in face-to-face communication with students and teachers. **Question two**, do you like the idea of sharing your work, life and educational experiences as part of the learning process, most instructors commented positively? All instructors felt that their rich learning experiences should be shared with their students. **Question three** asked, do you think it is possible for increased learning to take place when work/knowledge/life experiences are shared with peers? All respondents had positive statements about this question. **Question four** inquired, do you accept the value of facilitated learning as an advantage over the more traditional lecture based learning process? The comments for this question were mixed positively and negatively. For the most part, many instructors felt that it would depend on the circumstances. **Question 5** asked, have you incorporated cooperative learning into instructional methods? This question also got mixed responses. Five instructors answered positively saying that they have used this teaching strategy before. Some faculty used cooperative learning a little, while others did not use it all for instruction.

Faculty Interaction: Post Survey

At the end of the two weeks, all instructors involved in the project-based assignment were given a simple post survey. The post survey primary contained open-ended questions about the direct impact this assignment had on the users as teachers. The questions were: 1. How were you actively engaged? 2. What aspect of the project-based assignment will you immediate incorporate into your teaching? 3. What was missing that would make this project-based assignment more valuable to you?

BEST COPY AVAILABLE

Most instructors completed the online collaborative project-based assignment within two weeks. Instructors who had experience using computers or the software program Blackboard had finished the assignment early. Faculty who had limited computer experience took the full two weeks to complete. Although the participants did not choose their own group members their post survey answers indicated that they were actively engaged in the project-based assignment. This was primarily because of the pre-activity assessment, the watching of the streamed tutorial movie, and the engagement of making a HTML document from within a Word document.

Instructors also commented on what aspect of the project-based assignment would they immediately incorporate into their teaching. Most commented positively.

Instructors also commented on what was missing that would make this project-based assignment more valuable to them. One instructor commented, "perhaps a little more detail on the value of cooperative and its integration to be used in web pages." Two instructors said, "I would have liked to learn this from a traditional classroom setting." While most instructors commented that nothing really stood out, a few still had problems following directions or working with the methodology. These instructors commented, "a little hard following instructions," "this was very time consuming," finally, "it was too hard to get into this."

Pedagogical Issues

Cooperative or active learning methods may not be appropriate for every institutional setting (e.g., part time students working full time). For new teachers beginning to implement cooperative strategies, the idea of using students' as instructors teaching small amounts of information may be somewhat intimidating. If you are teaching specific content or cognitive processing, each session must facilitate an environment conducive to collaboration. For learning cubes, team learning, peer tutoring to work, the groups and the content delivered must be small and effective. Further, the team project or assignment must be challenging enough to insist teamwork. Besides, challenging assignments replicate real world situations and help prepare students to be productive life-long learners.

To have effective group members, instructors should provide guidance for students on how to work successfully in collaborative teams. The social characteristic of successful teams should be clearly taught and not assumed. Successful teams will have certain member qualities. Among those sought-after qualities are an interest in other team members beyond the task at hand, the capacity to clarify and commit to goals, an open and honest evaluation of team performance, an understanding of others' perspectives, a wish to confront conflict positively, a commitment to make decisions inclusively, the valuing of individual differences, a willingness to freely contribute ideas and encourage that in other team members (Robbins & Finley, 1995). Group members play an important part in the success of the assignment. From the group's perspective, clear and distinct roles for each member can aid in the groups communications. Among group members, a clear understanding of assignments and work responsibilities can make task management easier for each student. Tasks and authority in the given areas of responsibility must be well defined. Individual team members may be given more decision-making authority in their various areas of expertise.

In planning your courseware design for online education the instructor must provided the following: 1. provide effective technology workshops for students if new hardware and software will be used in the session 2. provide a technology help desk with appropriate days and times users can receive help 3. provide students purposeful asynchronous and synchronous help sessions 4. provide useful creative chat sessions for office hours with appropriate days and times. Additionally, flexibility in meeting assignment requirements facilitates students to develop ownership of the assignment, aids in the development of critical thinking and problem solving skills, imparts room for originality, and encourages a sense of group individuality and unity. Providing a plan for group formation is imperative for team success and cannot be underestimated. Helping students choose team members intelligently will aid in the formation of group member roles, allow members of the group to fill needed areas of expertise, and provide a solid foundation for shared esteem among group members.

In a collaborative group effort, certain individuals may be chosen as project manager for the purpose of setting task deadlines or resolving conflicts of opinion. Once set, group members should hold each other responsible for meeting deadlines with weekly meetings and encouragement. In every group effort there will be differences of opinions. Decisions must be based on ideas and not on personalities.

Conclusion

This brief paper has provided insights into the nature of cooperative learning as a teaching strategy for online education. Online collaborative project-based assignments can be a rewarding experience if certain factors are incorporated into the teaching strategy. A skillful facilitator, capable of balancing guidance with flexibility is one crucial factor. Another is a group with the skills, both technical and social, to truly collaborate the learning process. When those crucial factors as well as other pedagogical issues come together in a learning setting, collaborative online assignments can result in a product exceeding the expectations of the teacher. It is hoped that a useful model will be developed to enable instructors to use online software management systems like Blackboard. It is also hoped that the pedagogical issues of teaching online discussed throughout this paper will be used by educators. As higher education institutions seek to make decisions about how to structure online courses for collaborative, cooperative learning, it is hoped that administrators and faculty alike can gain valuable perspectives and insights for the decision process.

References

Adelskold, G., Aleklett, K., Axelsson, R., & Blomgren, J. (1999). Problem-based distance learning of energy issues via computer network. Distance Education, 20(1), 129-143.

BEST COPY AVAILABLE

Anderson, T. D. & Garrison, D. R. (1998). Learning in a networked world: New roles and responsibilities. In Gibson, C.C. (Ed.), Distance Learners in Higher Education: Institutional Responses for Quality Outcomes (pp. 1-8). Madison, WI: Atwood Publishing.

Berge, Z. L. (1995). Facilitating Computer Conferencing: Recommendations From the Field, Educational Technology, January-February, 35(1), 22-30.

Cecez-Kecmanovic, D. & Webb, C. (2000). A critical inquiry into Web-mediated collaborative learning. In Aggarwal, A. (Ed.), Web-based Learning and Teaching Technologies: Opportunities and Challenges (pp. 307-326). Hershey, PA: Idea Group Publishing.

Eastmond, D., and Ziegahn, J., (1995). Instructional Design for the Online Classroom. In Computer Mediated Communication and the Online Classroom, Volume Three: Distance Learning (Eds. Berge, Z. L. and Collins, M. P), 1995, Hampton Press Inc., New Jersey, p29-36.

Hardwick, S. W. (2000). Humanising the technology landscape through a collaborative pedagogy. Journal of Geography in Higher Education, 24(1), 123-129.

Johnson, D. W., R. T., Johnson & K. A., Smith M., (1997). Academic Controversy: Enriching College Instruction Through Intellectual Conflict. Washington, DC.: ASHE/ERIC.

Jonassen, D., Davidson, M., Collins, C., Campbell, J., and Haag, B.B., (1995). Constructivism and Computer-Mediated Communication in Distance Education. The American Journal of Distance Education, 9(2), 7-26.

Kemery, E. R. (2000). Developing on-line collaboration. In Aggarwal, A. (Ed.), Web-based Learning and Teaching Technologies: Opportunities and Challenges (pp. 227-245). Hershey, PA: Idea Group Publishing.

Lai, K. W. (1999). Net-Working: Teaching, Learning & Professional Development with the Internet. Dunedin, New Zealand: University of Otago Press.

Larson, C. O., et al. (1984). Verbal Ability and Cooperative Learning: Transfer of Effects. Journal of Reading Behavior, 16, 289-295.S

McKeachie, W. J., et al. (2002). Teaching Tips: Strategies, Research, and Theory for College and University Teachers. Boston, MA: Houghton Mifflin Company.

Robbins, H. A., & Finley, M. (1995). Why Teams Do Not Work: What Went Wrong and How to Make It Right. Princeton, N.J.: Peterson's/Pacesetter Books.

Public Relations Writing Moves from the Classroom Online: An Experience Report

by Alton Miller
Fellow, Center for Teaching Excellence
Acting Director, Public Relations Studies
Columbia College Chicago
United States
amiller@colum.edu

and Margaret Sullivan
Chair, Marketing Communication Department
Columbia College Chicago
United States
msullivan@colum.edu

Abstract: Distance learning techniques developed according to previously existing Internet models do not always produce educational tools that serve students well. Rather than adhere to the "supermarket" templates typically used by commercial Web sites seeking to attract and dazzle consumers, which require users to master the rules of navigating among a range of global options, I have found that a *linear* model based on email communication conventions better addresses students' needs. The complex challenges associated with learning public relations writing via the Internet are made simpler through the use of relatively low-tech online presentations. The emphasis is on creating relationships with and providing prompt feedback to students, and sharing information among students, to better replicate many successful pedagogical techniques of the classroom. I hope that my experience teaching writing courses in the classroom and online simultaneously will provide valuable comparisons of useful techniques for teachers in other disciplines.

Introduction

I teach public relations writing. In today's marketplace of ideas, the craft of public relations writing is an important tool for effective advocacy. Public relations writing is often more than a necessary skill in the global arena of contesting ideas – in many cases it *is* the arena itself.

Public relations writing is a complex process involving three sets of skills: research and organization ("pre-writing"); the writing itself, necessarily the product of an individual talent; and rewriting, often a consensus effort requiring a process of compromise among several interested players.

To develop these skills, students employ several styles of learning. As they are introduced to techniques of research and organization, they are acquiring and assembling information and putting it into practice, much as a physics student might. As they discover the disciplines of editing and rewriting, they are internalizing an essentially social process involving both interior and interpersonal negotiation, much as an actor or dancer might. And as they develop skills in the "actual writing," they are working individually, under the eye of a master, to perfect technique, much as a medieval crafts-guild apprentice might.

Writing as a Process

Public relations writing is made more complex by the fact that public relations writers actually serve not one but three masters – the story, the editor and the client. To tell any story, students must acquire basic writing skills; sadly, this is not a given in today's undergraduate population. By basic writing skills I mean not only the ability to develop a theme, paragraph by paragraph, but even the awareness of what constitutes a good paragraph. Second, students must learn to express themselves within the disciplines of journalistic style, a style for which most English composition classes have not prepared them. A generation ago, a general familiarity with news style was naturally acquired, through habits of newspaper reading; this is no longer the case. Third, students must learn to persuasively focus a client's message in terms that please the client, as well as in a style acceptable to news editors.

Thus the process of public relations writing implicates three sets of skills, and three different objectives for the writer. The order in which these activities unfold is ultimately not important – the professional writer will develop personal work styles out of individual preferences. But I have found that my students avoid confusion and do their best work when they acquire these skills in a certain order, advancing to the next stage only after demonstrating an understanding (though not yet mastery) of the preceding one. The details of the order are less important for my present point, than the fact that there exists an optimum order for the presentation of the elements of an education in this discipline.

Substitute Techniques

In the classroom experience, that optimum linear order is maintained in real time, by the content of each class discussion and exercise, and by attentive monitoring of students' progress. (Also important is the fact that Columbia limits each writing class to fifteen students.) Online I have had to develop substitute techniques.

Objective assessment indicates that my in-class students progress from mediocre to very good over the course of each fifteen-week term, and their level of accomplishment serves as the basis by which I make evaluations of my online students. This comparison is made easier by the fact that I teach both sections simultaneously using the same syllabus; I am able to monitor, week-by-week, the progress on both sides.

When I undertook to create an online course at Columbia College Chicago, I established as a key principle that the online experience would be asynchronous and strictly online. That is, students would be able to sign on and do their coursework at any hour, independently of whether I, or other students, were online at the same time; and there would be no requirement for a personal meeting (with the possible exception of a final exam), nor would students be required to chat with me or with each other in real time. A student should be able to complete my course from a computer on the moon. My purpose was to develop a genuine distance learning system -- I had already long been providing online enhancements for my in-class students, and did not intend merely to shift from a preponderance of classroom instruction to a preponderance of online instruction.

The other guiding principle was that my online students should be afforded all the advantages that my classroom students enjoyed, though it was clear that this would call for some ingenuity in devising recipe substitutes. While my online colleagues will recognize this as an inherently impossible objective, they will also appreciate that with a little redefinition, nothing is impossible.

The three most difficult amenities to substitute were the teacher's personality in conveying information, the benefits of continual evaluation and feedback, and the students' ability to learn from other students. My success online, as well as in the classroom, I am convinced, depends upon the quality of the teacher-student relationship I am able to foster; continual feedback; and the dynamics by which students learn from other students ("If he can do that, so can I.")

Email Relationships

I began by rejecting the "supermarket" template typically used by commercial Web sites seeking to attract and dazzle consumers, which requires the user to master the rules of navigating among a range of global options. Like any teaching activity, an online course must work to engage students; but it need not "sell" them. Put bluntly, the online student is a captive audience and the combined effect of design and language can be put to the service of educating rather than capturing attention and convincing the user to keep turning the page.

I decided, instead, to build on the observation that young Internet users develop real relationships with others via email and real-time chatting; and the related fact that the easiest and most intuitive Internet activity is the use of email. My first communications with each student are personal email messages, in the week or so before classes begin. I provide general orientation, and also pose questions that require a response from students. In some cases (depending on how quickly they respond to each message) I have exchanged as many as six rounds of email before the first lesson.

Some of these email messages – and, later in the course, some email messages that complement the lesson material – are group messages, not personally composed. But from the standpoint of the student, they appear to be individually directed. I achieve this illusion without undue deception, simply by addressing the email message to my own address, with "blind" copies to the student list. I maintain my email relationships strictly in the second-person singular.

Once the student is provided with a username and password, the focus shifts to the lessons posted online. In Week One, only Lesson One is available – and not via the syllabus/lessons links (which will be activated later), but as a "Next Page" link from the introductory page of the course site. Even though the student has now been launched into the course trajectory, I continue to maintain an email correspondence – usually simple, short messages – especially when I think the student will benefit from a little prodding.

Personalization + Interactivity = Feedback

To make my system more personal, I chose to use a "stand-alone" course site, physically located on the server at Columbia College Chicago. Rather than begin at a course management Web address, students reach their lessons by clicking on a link in their email (taking them to http://prwriting.columbiacollege.net, a URL I personally own, aliased to redirect to the Columbia site). Students arrive immediately at the first page of the course. The design is crisp and clean and easily legible, uncomplicated by any row of icons leading to an array of options; above all, the Web pages are low-tech, without extraneous graphics, devoid of animated features. Each page loads quickly.

The first page is illustrated with a casual photo of the instructor, and a personal message, signed with my handwritten signature. The message is, in style, theme and content, a continuation of the email correspondence we – the student and I – have already enjoyed. Each week's lesson begins with a similar page and, of course, a fresh message introducing the work at hand.

From the outset the pages are laid out in a one-way sequence: they may be read only in one clear narrative path. In the navigation bars there are links to a variety of resources, but initially each of those links evokes only a firm but gentle admonition that these resources are not yet available. In the first week, the student advances from page to page in a strict sequence.

Lessons average about seven Web pages, of varying lengths. Every two or three pages there is provision for some interactivity – a questionnaire to complete, an interactive exercise demonstrating a principle, or a page calling for a short essay response to an online article. Every lesson also includes a quiz, which doubles as a review device. Though they are disguised as various forms of online communication, these interactive interruptions are all simple HTML forms which, when submitted, automatically generate an email response to me. By tracking these responses I am able, not only to evaluate each student's understanding of the lesson material, but also to follow his or her progress through the lesson. I know when students have signed on, and how quickly they are advancing, and I am able to email a student who is not leaving a trail, and inspire him or her to get with the program – or consider dropping the course.

Online educators are familiar with the problem of otherwise able students losing their way in an online course. My experience is that students need to be told repeatedly, while they are still able to drop the course without penalty, that an online course will make serious demands on them. I have developed a short litany of admonitions, delivered within the initial sequence of emails as well as in the introductory lesson material, to the effect that there is no shame in dropping a course you can't handle, but no excuse for falling behind once you've confirmed your commitment to the course. Online courses are flexible (study when you want), but there are deadlines (turn in assignments when I want), and late assignments are just as late for online courses as for in-class courses (or clients' expectations.) I have found that when I stress these points early, those students who remain in the course perform to higher expectations.

Another important lesson for me has been the students' need for immediate feedback. There is a tendency among online instructors to manage the workload by batching certain types of work and responding, by category, on the instructor's timetable. My system encourages me to treat my students as I would any other email correspondents. I acknowledge receipt of their assignments as soon as I notice their arrival; I address, point for point, every email message, almost always on the same day; and I edit and annotate students' assignments (see below) as soon as possible, almost always by the following day's end.

Students Learn from Students

Links on the navigation bar become effective in the second or third week, and students may then browse through a wide range of examples and other resources. After all the students' first assignments have been completed, they may take a look at how other students have solved the same problems. When I begin assigning letter grades (usually not until the fifth week of the fifteen-week course) they may study examples of real student work that earned an "A," a "C" and an "F." Though I have the capability of putting classmates' papers online, I use examples from previous semesters, rendered anonymous. In these and similar ways, I share students' work with students, without requiring them to interact with one another.

I have experimented with real-time chats among students, and a "Conference Room" where students could post asynchronous messages to one another. I have also experimented with a system whereby students could post responses to a question posed, and read one another's replies. These capabilities were derived from course management systems I had investigated. They seemed to be desirable features – until I questioned the premises of that desirability. I have not found that students were in any way assisted by these hoops through which I asked them to jump, and I have discontinued all efforts to create the illusion that students are together in a "class." In fact, I find such efforts counterproductive to the more important objective of creating a teacher-student, editor-writer relationship.

Often, during the first or second week, a student will email me asking for a further explanation of lesson material. This is a natural extension of the email relationship we have cultivated, and the request is not unreasonable. In the classroom, one way a student learns from another student is to hear a question asked and answered; both the question and the answer are educational. I should add, the question can also educate the teacher, and sometimes the emailed question will cause me to reconsider how I have presented the lesson. However, if the online student's question has already been addressed in the lesson, it is usually the case that the student is asking for private tutoring beyond the scope of the class. In such cases – and they are the norm – the students will find that their questions are answered with questions – "Look again at Lesson 2, page 2, and tell me what *you* think." – and my questions are not rhetorical: I follow up and insist on answers to questions raised by their questions. I have found that this additional demand on the student's study time gently but firmly nudges him or her toward the full use of the online material and away from an expectation of private tutoring, or other abuse of the one-on-one email relationship.

By the final weeks of each semester, students are producing drafts of press releases and other public relations writing, and I am editing and returning them as quickly as I receive them. This calls for a system of folders to keep them sorted, and a system of renaming files before sending them back. I require students to use a strict system of nomenclature – a standard prefix ("PRW"), a hyphen, their last name, another hyphen, and the assignment identifier – in both the attached filename and the "Subject" field of their email message. For example, "PRW-Smith-HeartPR" identifies a press release on "From the Heart" by Smith. After editing I simply append a hyphen and a letter grade (or, early on, an "x") to each filename, before attaching and returning it.

When I edit a student's work, I use an open file of "Notes" adjacent to the student work on my computer monitor. "Notes.doc" is a Microsoft Word document containing twenty or so "Text Box" comments representing the most frequently called-for observations and edits. I drag appropriate comments from the "Notes" file to the student's work, and always personalize at least one of them, and sometimes otherwise tweak them. I also make free use of the "Rounded Rectangular Callout," "Strikethrough," "Arrow" and "Highlight" features for my comments. I then email the marked-up assignment to them as an Microsoft Word attachment.

Conclusion

There is a consensus among online teachers I have interviewed, that unless the course is carefully managed, an online course can require significantly greater work output per student, than an in-class course. This is not surprising: there's a reason why we collect students together in one room for group work. If online education is to be a viable alternative to in-class education, the workload issues must be addressed. However, high-quality standards of online education are unsupportable if the course is simply an interactive textbook. The techniques I have developed are work-saving devices that support genuine one-on-one relationships without going overboard in the direction of private tutoring. I continue to experiment with ways to promote those relationships, without which genuine education cannot take place – and to complement the course material with the means for expeditious feedback, and ways for students to learn from other students.

"Virtualizing": A Brazilian Initiative for Upgrading Media Knowledge of K-12 Public School Teachers

Nilson Modro, MEng.
Distance Education Laboratory,
Graduate Department of Production Engineering,
Federal University of Santa Catarina, Brazil
modro@led.br

Leslie Paas, MEng.
Distance Education Laboratory,
Graduate Department of Production Engineering,
Federal University of Santa Catarina, Brazil
leslie@led.br

Alejandro Martins Rodrigues, Dr.
Distance Education Laboratory,
Graduate Department of Production Engineering,
Federal University of Santa Catarina, Brazil
martins@led.br

Ricardo Miranda Barcia, PhD.
Distance Education Laboratory,
Graduate Department of Production Engineering,
Federal University of Santa Catarina, Brazil
rbarcia@led.br

Abstract: This paper describes a project-in-progress for upgrading Brazilian public school teachers' media literacy skills. The project, called "Virtualizing", is currently being applied at a municipal level, in the city of Florianópolis, Santa Catarina (Brazil), to 180 K12 teachers with generally little or no knowledge of computers and the internet. An constructivist educational design strategy was developed in partnership with the Distance Education Laboratory (LED) of the State's Federal University (UFSC), aiming at maximizing the teachers' exposure to informatics and internet technologies via the use of an online learning environment (VIAS-K). After describing the program circumstances, objectives and strategies, the authors focus one of the program's courses (AVA II), designed specifically to further demystify new media and give teachers a renewed sense of control and participation in the information society.

Virtualizing: Project Circumstances & Objectives

Reality of the Brazilian Public School System and Recent Legislation

In Brazil, there is a 2-tiered education system: private and public. While private schools in Brazil are comparable in quality to those of the North America, Public Schools at the K-12 level tend to have fewer resources, with lower teacher education levels and technology available. However, efforts have been made to improve these differences. For example, in 1997 the Brazilian Ministry of Education decreed that computers and access to the internet be issued to all public schools, under the condition that the schools present an appropriate pedagogical strategy [MEC 2001]. This has made the public schools' concerns the same those concerning all educators around the globe: how to appropriately use computers and networks in the classroom? Another law recently implemented decrees that all school teachers must have at least an undergraduate uiversity degree. At least 50% of the Brazilian school teachers will have to upgrade their skills.

This paper describes a constructivist strategy for upgrading 180 Brazilian K-12 public school teachers' skills, via demystifying computer and internet technology. The authors participated in the instructional design and system design process, aiming toward objectives and results that could be examplary for both public and private school teachers, throughout Brazil and around the globe.

Virtualizing Project Objectives

The Virtualizing project is a partnership between the Ministry of Education of the Municipality of Florianópolis and the Distance Education Laboratory (LED) of the Federal University of Santa Catarina (UFSC). The program consists of courses for 180 teachers from 19 elementary and junior high schools with computer labs. The teachers were selected from various subject areas: Language Arts, , Geography, Mathematics, Biology, etc. The principal objective of the program is to encourage, via immersion in an e-learning environment, a culture of technology use and appropriate pedagogical strategies for the municipality's public education system.

BEST COPY AVAILABLE

Program Resources & Strategies

VIAS Knowledge

VIAS Knowledge (VIAS-K) is an educational platform that offers a broad set of interactive models, including learning environments for users, multimedia content, tools for collaboration, support and system management. The platform unites stateof-the-art information technologies with appropriate pedagogical methodologies. It aims to attend to the growing demand for education in Brazil and is modeled toward continually improving efficiency during the learning process. [Freitas et al 2001]. VIAS-K was conceived in October of 1999. In March of 2001 it was ready to support its first users - a 1 year distance education program for 600 students (teachers from the areas of maths, chemistry, biology and physics who had not yet finished undergraduate studies).

Since many of the learners are new to computers and networks, an important aspect of the VIAS-K learning environment is its user support system. In addition to online support tools and information, every course offered via VIAS-K relies on the added support of live course tutors. The tutors help students and professors to use the technology and act as facilitators in the communication and learning process.

Another aspect of the VIAS-K platform worth highlighting is its model for accessing the system. The first screen the student accesses is a Portal of information related to the course, managed and automatically updated by administrative members (in this case, member of the Ministry of Education) through online forms allowing for the upload of text and graphics. The Portal model serves to keep the group informed as a whole, with timely and relevant information, as well as providing news to the public in general. The Portal also contains the point of login for students, professors and tutors. Upon entering a valid user ID and password, users have direct and unlimited access to course content and support tools. Fig 1. illustrates this access dynamic.

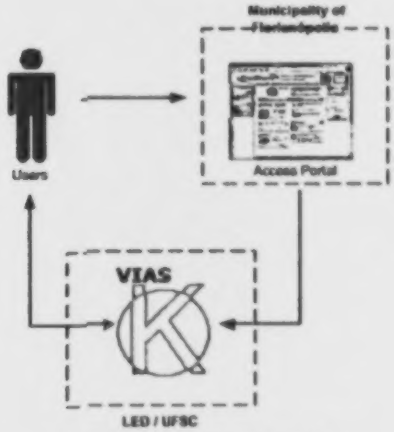


Fig 1. VIAS-K access procedure

Fig. 2 presents the VIAS-K main page and its elements: 1. navigation content tree (a graphic organization of educational content); 2. content area (once a topic is selected in the navigation content tree, it is shown in this area); 3. user identification; 4. tools (divided into 5 categories: personal tools, administrative tools, collaboration tools, support tools and on line-help); and 5.logout area.

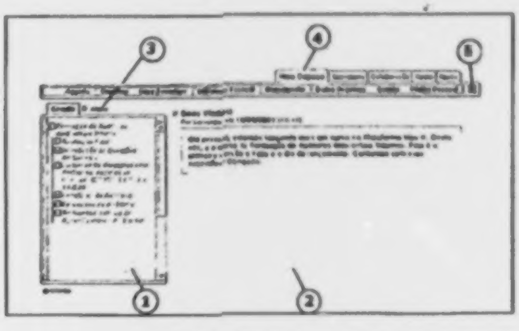


Fig 2. VIAS-K main page and its elements

BEST COPY AVAILABLE

Fig. 3 to follow shows some screen shots of the Virtualizing program.

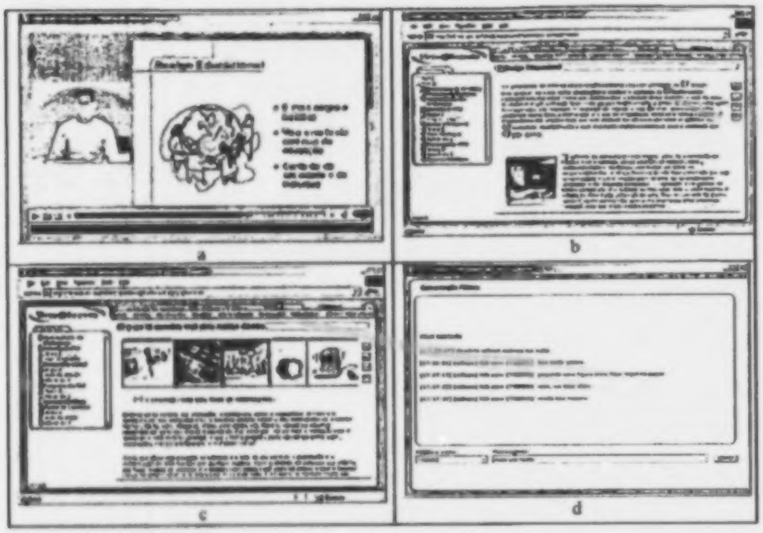


Fig. 3 Virtualing Program screen shots: a) online video being viewed; b&c) content in hypermedia documents; d) chat tool in action.

Strategies

The 180 teachers were divided into 6 groups. Each group selected a course according to their interests / needs. The courses mixed face-to-face and on-line learning, as shown in table 1 below, during a period of 3 months (April 25 – August 30, 2002).

Group #	Courses	Total Number of Participants	Total Hours	Hours	
				F-t-F	On-line
All	Virtual Learning Environment I	180	20	14	6
1	Media and Knowledge	30	40	17	23
2	Accessibility and Technologies	30	30	9	21
3	Digital Workshop: constructing texts	30	20	6	14
4	Digital Libraries and Knowledge Management	39	40	17	23
5	Virtual Learning Environments II	30	30	9	21
6	Multimedia production technologies	30	20	6	14
Total number of Hours		**200**			
Total hours Face-to-Face		**34 meetings / 64 hours**			
Total hours on-line		**136**			

Table 1: Virtualizing course structure

The Virtualizing program began with the all participants taking the course "Virtual Learning Environments" - I (AVA - I), divided into their respective groups, ten hours per week for a period of 2 weeks (April 25th to May 10th, 2002). The objective of this course was to facilitate the digital immersion of all the participants into the program. The mainconcepts covered included basics of on-line learning, and how to operate and collaborate in the program's virtual environment (VIAS K). This was an important first step, since nearly all of the teachers in the program were novice computer users.

The authors, involved in the instructional design and systems design process of VIAS-K for the Laboratory of Distance Education, were responsible for designing a subsequent course AVA II for the Virtualizing program, highlighted in grey in table 1 (above), and discussed in detail to follow.

Course AVAII

The course Virtual Learning Environments II -AVA II, was specifically designed to extend the teachers' knowledge of virtual learning environments and digital resources in general, aiming to empower them with the knowledge and attitude necessary for managing classrooms in today's information society. The course was divided into 6 modules: Introduction; Components of Virtual Learning Environments; Educational Design for the Information Society; Strategies for Technology Use in the Classroom; Using the Web for Didactic Resources; Methodology for Constructing Virtual Learning Environments. The information in each module was offered in 3 distinct ways: 1. A descriptive hypermedia document, containing images exemplifying ideas and links to various related sites/documents; 2. A fictitious narrative about a grade school student's experiences interacting in a futuristic learning environment; 3. Tests for auto-evaluation, and instructions for relevant individual or group activities. Activities included contributing reflections on provided literature in an online discussion forum and chats, evaluating online educational material and creating an

BEST COPY AVAILABLE

annotated bibliography of internet sites relevant to each participant's subject area, creating a basic home page for the subject area (via online forms), and devising a strategy for a classroom activity which would use the internet.

The content was made available on the VIAS-K platform in a non-linear manner - each user could access any part of the modules in any order he/she wished. However, a suggested course chronogram was provided to guide users towards course completion. The course chronogram was designed so that topics covered in synchronous meetings (chats, videochats and face-to-face) coincided with AVA II course content and activities in a progressive way. Evaluation was informal (critical feedback without giving a grade), geared toward encouraging and helping participants to successfully complete the course activities. A motivational strategy was designed based on project exposure - each participant was expected to publish his/her site on the Virtualizing Program Portal, thereby making their findings available to local colleagues and teachers around the world.

Long-term Objective: Sustainability and Growth

The authors designed AVA II with long-term objectives in view. Each time the course AVA II is completed by a group, the number of teachers' sites published on the Portal will increase, annotated lists of internet resources will be updated and participants experiences documented, thereby creating a rich data base of useful and relevant information. These long-term objectives are designed to give a sense of continuity to the program, and are expected to be a motivational factor as the knowledge constructed by participants in the program is exposed and shared.

Final Considerations

The basic premise of the Virtualizing program is that the best way for teachers to upgrade their computer skills is through immersion in digital environments. For many participants of the program, logging on to the system and accessing course materials were major first steps. In the course AVA II, many of these novice internet users took seemingly giant leaps forward by conducting searches and evaluations of educational internet sites, and creating their own home pages and classroom strategies for internet use, something most of them couldn't conceptually imagine being able to do in the weeks preceding the course. The hands-on approach helped to demistify the media as well as give a sense of empowerment to the teachers. However, an indispensable element of the instructional design is the mixture of face-to-face and online activities and the support of tutors, to clarify difficulties and avoid feelings of isolation that can arise in pure distance education settings.

References

CISCO Systems, Inc (2000). *Reusable Learning Object Strategy: Definition, Creation Process, and Guidelines for Building*. in http://www.cisco.com

MEC Ministério da Educação (2002). Programa Nacional de Informática na Educação. http://www.mec.gov.br/seed/proinfo.shtm (accessed July 2002)

Freitas, J. O. J., Martins, A., Barcia, R. M., Pacheco, R. C. S., Martins, J. G., Tissiani, G. (2001).VIAS Teaching Environment. *7TH. International Conference on Virtual Systems and Multimedia* ,. Berkeley, CA, USA.

Tschang, F.T. & Della Santa, T. (2001). *Access to Knowledge: New Information Technologies and the Emergence of the Virtual University UNU/IAS.* Elsevier Science Ltd. Oxford, UK.

Valente, José Armando. (1993). *Diferentes Usos do Computador na Educação*. http://www.proinfo.gov.br/prf_txtie2.htm

Visser, Jan. (1999) *Changing Learning Environments: The Real and Not so Real of Reality and Virtuality* http://www.unesco.org/education/index.html

Technological Applications in a Graduate Special Education Program
Le Petite Technology

Maribeth Montgomery Kasik, Ph.D.
Governors State University
University Park, Illinois 60466, USA

Technology usage in higher education classrooms for service delivery has increased tremendously over the past 30 years. As an illustration of this point, this writer offers the following timeline as an example. As an undergraduate student in the late 60s and early 70s the only technology required of students was perhaps a calculator and typewriter. Professors lectured in large lecture halls with the use of chalkboards, overhead projectors, slide and movie projectors. This technology requirement for the "beginning teacher" was to be prepared via the "AV" da jour. Classroom teachers were equipped much the same way as the university professor. The public schools this writer experienced between 1970 and 1981 did not offer to their teachers or students computers for service delivery. There were initial computer hook ups at some schools in the city of Chicago that were linked to mainframe computers at the University of Illinois. However, these large computers were reserved for an elite few and not available to the general student and faculty populations.

As a student, the very first course in computer technology experienced was in 1969. The room was filled with keypunch machines and monitor-less keyboards "hooked up" to a main frame 200 miles away. There equipped with our plastic flow chart stencils, and computer paper, we learned the basics of "computer-speak" such as FORTRAN, COBOL, Pascal and of course BASIC. The fun everyone waited for was the opportunity to insert their cards into the key punch machine. The terror came waiting to see if those punched cards would actually run the program that we created.

At this very same time that the computer was emerging into the general population, the technological advances for the computer were being used in government agencies and some industries. As a college student in education, computers were not something essential if one was to be a teacher, let alone a teacher of students with special needs. Faculty really did not give computers any thought about being part of their daily existence. The next encounter and first university requirement to use computers in higher education for this writer came in 1977 as a graduate student where statistical research had to be entered into the computer mainframe using keyboards (this time connected to monochrome monitors) while sitting on a stool bolted to the floor in a large modern computer lab. After one's data was entered, one would wait at the job bin for their "job" to be processed.

Not until 1981 while a doctoral student at Southern Illinois University at Carbondale did PCs enter into this writer's daily reality. Statistical data was still entered into the university mainframe at this time; faculty did not have computers on their desks (nor did the staff). The IBM Selectric typewriter was the main technology for word processing. One day an Apple IIe computer showed up in the department office. It sat in a box for months because no one wanted to set it up or learn how to use it. With permission from the head of the department, this writer, on her way to becoming a certified "geek" set this computer up and running with little effort. Yet, it was not until 1984 that money was available to purchase her first Apple IIe computer for personal use.

Concurrently, this professor began teaching at Governors State University in Illinois where she re-designed a graduate program in Multicategorical Special Education. This program was to be a state of the art program for Master teachers to provide them with the skills that would make them and their students the most successful. As part of that curriculum, she developed a course: Educational Applications of Microcomputers in Special Education. The initial intent of this course was to help teachers see the need for computers; the uses for computers; learn of assistive technology and overcome any fears of computers.

Very rapidly through the 80's and 90's one could barely keep up with the almost daily advances with computers and technology. Computers began appearing in the public schools and university classrooms. There were personal decisions to be made about commodore, apple series and IBMs. As much as this user of technology loved the Apple series, in 1992, the IBM series leaped ahead. Presently used as a favorite is a Present Dell Laptop with 1 Gig Processor and 40 Gig Hard Drive 256 Meg RAM.

The early years of this course found the professor spending a great deal of time working on the elimination of basis techno-phobias among graduate students. Early lectures and class applications included learning Apple Basis, Logo, DOS, How to turn the computer on and off, Simple Assistive Devices, Computer Assisted Learning, How to Initialize a disk, etc. Students appeared excited in the university classroom about using the computer in their jobs, but found resistance came on the part of administrators and parents who felt that the computer was a toy such as Atari and just games like PacMan. Students could not learn if they were allowed to play games. Many graduates would report back that they were not able to use the school computer lab or that there wasn't time to use the computer sitting in the back of their classroom. For many years, this was the only exposure to technology that students in the graduate program would find.

During the 1990s the emergence of computer labs began to flourish and develop further. The computer was just beginning to be seen as something that could be used daily rather than once in a while by students and faculty. There were those that resisted even using telephones with voice mail systems at our institution. Many have memories of a professor stomping his telephone into pieces while proclaiming how he hated technology and would never use it. Even this professor had a change of heart when the day came that he could bring up his New York Times on the screen in his office.

Today we have technology standards, initiatives and guidelines. Students at several universities are required to have Personal Digital Assistants (PDA)s to bring to class with them. Some school districts are sending teachers to technology workshops to learn to use PDAs and other emerging technologies. Universities are finding it necessary to have "SMART" classrooms with projectors and internet connections and PCs for each student. Teachers and Professors have to be intelligent consumers of technology and the internet.

As of today, the use of technology has spread rapidly throughout the entire graduate program in special education. What began as just one course with technology has now grown to using the same applications in the majority of the classes. In 1984, 10% of the program was devoted to or delivered via technology. Today over 80% of the activities for the program require technology.

Hardware and software exist to deliver educational and vocational benefits to those with disabilities just as they exist for other people. Microcomputers as tools to which the effectiveness of depends upon the training and understanding of the use. with the changing educational environment as a result of the microcomputer, the special education uses of microcomputers have become endless as the technology, special educators need to be competent users of the resources available to them.

What follows are some of the slides that will be part of the PowerPoint presentation to accompany the text for this paper. The slides are illustrations from the current WebCt version of Educational Applications of Microcomputers in Special Education. WebCt is used by the professor as a supplement to the course. Included in the presentation are sample of student PowerPoint presentations and other technological applications.

(Please e-mail author for copy of slides)
Slide 1 My WebCt Support
Slide 2 Home Page
Slide 3 Sample Assignment Page
Slide 4 Sample Assignment Page 2
Slide 5 Calendar Page
Slide 6 Course Map
Slide 7 Graded Student View

Sample Student Projects

[A powerpoint is available for each of the listed topics]

- 1 Assistive Technology
- 2 Memory
- 3 Managing the Learning Environment
- 4Learning Strategies
- 5 Managing Classroom Environment
- 6 Coping with Tragedy September 11, 2001
- 7 Visual Strategies and Autism
- 8 Web Design Techniques

For further information or a copy of the PowerPoint presentation please e-mail
Dr. Maribeth Montgomery Kasik at m-kasik@govst.edu

CardioResearch: Supporting Knowledge Management in an Academic Cardiology Environment.

Mariella A. Montoni[1], Catarina Rocha[1], Marcus V. de Souza[1], Kathia Oliveira[3], Ana Regina Rocha[1],
Álvaro Rabelo Jr. [2], Lísia Rabelo[2], Beatriz Salvador[2]

[1]COPPE Sistemas - Federal University of Rio de Janeiro
Caixa Postal 68511 – Cep 21945-970 - Rio de Janeiro – RJ

[2]Fundação Bahiana de Cardiologia/ Unit of Cardiology and Cardiovascular Surgery
Federal University of Bahia - Rua Augusto Viana S/N – Cep 40140-060 - Salvador-Ba

[3]Catholic University of Brasília
SGAN 916 Asa Norte – Cep 70790-160 – Brasilia - DF

email: {mariella,darocha}@cos.ufrj.br, {kathia}@ucb.br

Abstract: Knowledge management offers support in decisions making through the capture of the acquired knowledge in the organizational processes and on new technologies, the access to the domain of the business model, collaborative work and knowledge reviews among the employees. CardioResearch is a web-based tool that supports scientific research activities in an academic cardiology environment. CardioResearch can help physicians and cardiologists in decisions making during the execution of their tasks, and it can also help students gaining new insights while the organization preserves its intellectual capital. CardioResearch is part of a knowledge management environment, CardioKnowledge, configured and adapted according to *Fundação Bahiana de Cardiologia/Unit of Cardiology and Cardiovascular Surgery*'s goals and particularities.

1. Introduction

The ability to systematically capture and manage the intellectual capital of an organization regarding its employee's experience, understanding, know-how and skills is emerging as the central theme in business [1], [3]. In an academic environment, there are new scientific findings every day, which means that knowledge is being generated faster than ever before. Medical knowledge is estimated to increase fourfold during a professional lifetime, that means physicians cannot practice medicine without constantly updating their knowledge [3],[4].

According to [1] and [2], the *Fundação Bahiana de Cardiologia/Unit of Cardiology and Cardiovascular Surgery* can be considered, in cardiology domain, as an academic Research and Development (R&D) organization. Its focus is scientific research in cardiology and development of medical informatics software.

R&D, in *Fundação Bahiana de Cardiologia/ Unit of Cardiology and Cardiovascular Surgery* takes place in four different aspects: (i) participation in Clinical Trials; (ii) research in master and Phd thesis; (iii) research while providing medical assistance to patients in the ambulatories; and, (iv) research in medical software developing.

These four aspects require from the physicians skills in various areas, including application domain, computer science technologies and research methodologies [1].

Motivated by these aspects, CardioResearch has been implemented to support scientific research activities in an academic cardiology environment, helping physicians and cardiologists in decision making, helping students in generating new knowledge and the organization in the creation of innovative and creative solutions.

2. CardioResearch

Taking knowledge management as quality differential in the process of organizations with different business types, such as consultancy, medical assistance and research and software development, a knowledge management environment named CardioKnowledge has being configured and adapted according to *Fundação Bahiana de Cardiologia/ Unit of Cardiology and Cardiovascular Surgery*'s goals and particularities.

CardioKnowledge aims to support knowledge management's main functionalities[7]: (i) *knowledge identification*, identifies organization's goals in a way to be configured and adapted for it; (ii) *knowledge acquisition*, captures, in a structure way, organization's internal and external knowledge; (iii) *knowledge use*, uses the knowledge acquired in a way to support business organizational process; (iv) *knowledge creation*, creates new knowledge through use and reuse of existing knowledge; (v) *knowledge dissemination*, defines manners to deliver relevant knowledge in the right moment to the right person; (vi) *knowledge valuation*, utilizes metrics to evaluate knowledge; and (vii) *knowledge maintenance*, eliminates irrelevant and obsolete knowledge.

In this context, a web-based tool of the environment CardioKnowledge, named CardioResearch, has being developed to support knowledge creation functionality, as illustrated in Figure 1. This supports is given through knowledge use and reuse in a basic environment in terms of innovation and creativity.

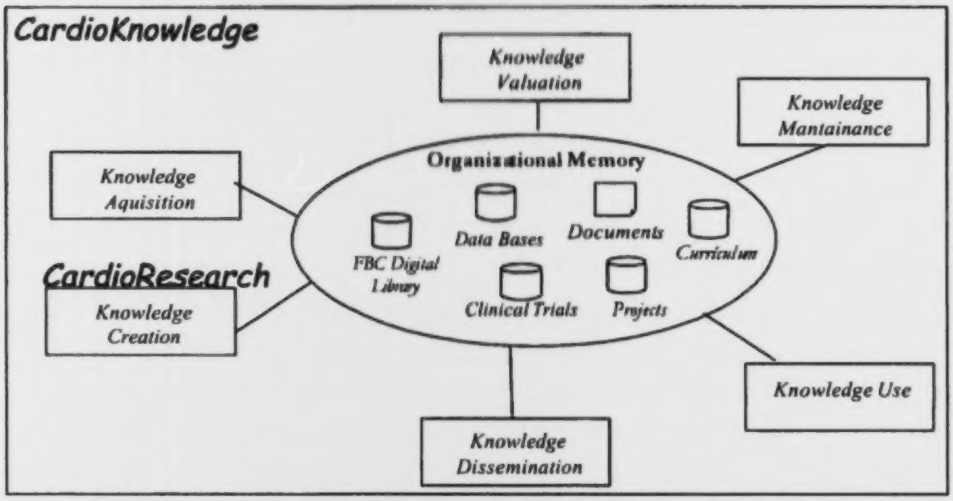


Figure 1: CardioResearch, a web-based tool to support knowledge creation functionality.

The *Fundação Bahiana de Cardiologia/ Unit of Cardiology and Cardiovascular Surgery* (*FBC/UCCV*) does four types of research: (i) participation in Clinical Trials; (ii) research in master and Phd thesis; (iii) research while providing medical assistance to patients at the ambulatories; and (iv) research in medical software developing.

CardioResearch can support the activities, at clinical trials participation and research in the ambulatories.

"Clinical Trials are a type of research study that tests how well new medical treatments or other interventions work in people. Such studies test new methods of screening, prevention, diagnosis, or treatment of a disease. The study may be carried out in a clinic or other medical facility." [8].

The ambulatories of *FBC/UCCV* have the following objectives: (i) provide cardiologic attendance to the patients; (ii) promote cardiology teaching to students of the Federal University of Medicine of Bahia and the residents of cardiology at *FBC/UCCV*; and (iii) to accomplish scientific researches.

The *FBC/UCCV* participates in several clinical trials studies and accomplishes a great amount of researches in the ambulatories, thus the research in a cardiology domain is knowledge intense process. Such knowledge, at *FBC/UCCV*, is easily lost, because it is not documented in its organizational memory; besides that, this knowledge is distributed in the employees and doctors' mind, hindering the accomplishment of the researches.

With the purpose to support cardiology researches in decision making while executing their tasks, the CardioResearch tool was proposed. It is integrated into the knowledge management environment CardioKnowledge, which seeks the explicit representation of the *FBC/UCCV*'s organizational memory, see Figure 1. CardioResearch can support the research activities in the following ways:

First, in order to form a qualified team to participate in clinical trials is necessary to combine physician's experiences to clinical trial's particularities. CardioResearch indicates qualified physicians combining key-words in their curriculum with clinical trial's characteristics filled out, previously, in forms. CardioResearch storages and retrievals documents in a document repository located in the organizational memory, in that way, clinical trial's results can be documented and shared allowing exploitation of experiences acquired from past trials and consequently avoiding repetition of mistakes. CardioResearch also provides tutorials to train the clinical trial time. This tutorial contains the workflow process of the clinical trial and varies according to its purpose.

Second, to start a research project through patient's assistance in ambulatories, research's requirements are identified, a team of physicians and medicine students are defined, and an infrastructure is prepared to support research in the project. In this context, CardioResearch offers a module to help physicians organize research's information (e.g. research's main goals, project team, results, etc) through hypermedia forms. All this information is stored in and can be retrieved from a project repository in the organizational memory. To help selecting qualified students to set a team, CardioResearch promotes calls for participation with forms that are filled by students and evaluated by the coordinating team. To train selected students CardioResearch provides manuals describing procedures that must be following facilitating knowledge reuse.

Third, CardioResearch also promotes a learning environment where the student can be involved in patient cardiologic care receiving specific training. At this moment education, takes place in two ways: in the ambulatory, physicians and students discuss and analyze patient's records in order to reach a conclusion of patient's therapeutic plan; and in clinical meetings, where students and cardiologists discuss critical analysis, statistical results of clinical cases and current cardiology issues, correlating them with ambulatory cases. CardioResearch also uses a personalized digital library [5], adapted to *FBC/UCCV*, named CardioLibraryFBC, with the purpose to capitalize knowledge gained by the students after finishing their degrees. This tool stores students' thesis and scientific papers facilitating organization's library collection management and literature's research and study. This helps students in gaining new insights performing and achieving the state of the art in their academic works.

Four, to prepare an infrastructure for research in patient's assistance ambulatory, medical software development is required. In order to provide that, a software engineering team develop medical databases used by CardioResearch to provide chart analysis to demonstrate research solutions and results in classes, conferences and meetings.

3. Ongoing Work

CardioResearch is still a work in process; the approach that is being used integrates knowledge management concepts and organizational processes.

The approach includes the following phases: (i) knowledge identification, in this phase requirements were identified building relevant knowledge; (ii) organizational process's identification and knowledge acquisition; (iii) process modeling through workflow; and, (iv) development of CardioResearch. The first and the second phase were completely finished and we are on the third phase validating the processes of *Fundação Bahiana de Cardiologia/Unit of Cardiology and Cardiovascular Surgery*, in meanwhile we are specifying CardioResearch's development.

4. References

[1] von Wangenheim C., G., Lichtnow D., von Wangenheim A., (2001), "A Hybrid Approach for Corporate Memory Management Systems in Software R&D Organizations", In Proceedings: Software Engineering Knowledge & Engineering 2001, pp. 326 – 330.

[2] von Wangenheim C., G., Lichtnow D., von Wangenheim A., Comunello E., (2001), "Supporting Knowledge Management in University Software R&D groups", K.-D Althoff, R.L. Feldmann, and W. Müller (Eds): Learning Software Organizations, Lecture Notes in Computer Science 2176,pp.52-66.

[3] Fuka K., Syrjänen E., Hanka, R., (2000), "Knowledge Management in Helthcare", In: Proceedings of IRIS 23, Laboratorium for Interaction Technology, University of Trollhättan Uddevalla,2000.

[4] Dove R., (1998), "RealSearch: A Framework for Knowledge Management and Continuing Education", Presented at IEEE March 1998 Aerospace Conference, pp. 1-19.

[5] Rocha C., Xexeo G., (2002), "MyLibrary: a Web Personalized Digital Library", To be publish in Proceedings: Ed-Media 2002, July 24th – 29th, Denver Colorado.

[6] Abecker A., Bernardi A., Hinkelmann K., Kühn O., Sintek, (1998), "Towards a Technology for Organizational Memories", May/June 1998, IEEE Intelligent Systems, pp.40-48.

[7] Probst G., Raub Steffen, Romhardt K., 2000, "Managing Knowledge – Building Blocks for Success", John Wiley & Sons, Ltda, New York, 2000.

[8] http://www.phoenix5.org/glossary/clinical_trials.html

Developing a WICeD® Team

Peter Moodie
WICeD®
The University of Waikato
New Zealand
p.moodie@waikato.ac.nz

Abstract: The University of Waikato has a very successful e-learning story to tell. This paper looks at how the Waikato Innovation Centre for e-Education (WICeD – pronounced 'wicked') team develops e-learning software and explains why it has been so successful since its formation. A research project highlighted some particular tools and techniques used daily in WICeD to focus development efforts on the teaching and learning rather than on the technology. This paper reflects on the use of those tools and makes suggestions for the formation and development of any e-learning development team as a result.

Introduction

This paper is not about e-learning tools, systems or even specifically about the pedagogy of e-learning. It examines the establishment of a successful and innovative e-learning development team in a university environment. By taking a close look at the development of one component of our e-learning environment we have discovered some important points about the way in which an e-learning development team can be constructed and can work together to produce very successful results. In this paper I will outline the processes which led to the creation of our e-learning programme and development team and will propose some key points to keep in mind for the development of any e-learning development team.

The University of Waikato has been formally involved in online teaching and learning since 1996 when we ran our first pilot online course. Before this the University had not been involved in teaching at a distance either online or via correspondence. I was involved in the establishment of the pilot and took on the role of the technical specialist. Following the success of the pilot, my involvement in the technical development of online learning grew until I became Learning Systems Manager at the beginning of 2000. I have taken and adapted this role to focus specifically on developing our online capabilities through the development of online communities. My role is now that of the E-Learning Systems Development Manager in the Waikato Innovation Centre for Electronic Education (WICeD).

Developing our roots in e-learning

Since the inception of e-learning at Waikato growth has been enormous. We have moved from providing one course fully online with 30 students to providing 130 courses fully online with over 800 students. In addition to this, we now also have over 700 campus based courses utilising e-learning technologies – catering to over 5000 students. The original focus of our e-learning activities was in the field of teacher education and has continued through to other disciplines that tend to be taught in a collaborative mode. It is this growth, along with both solicited and unsolicited feedback from learners and teachers, which has led us to believe that our e-learning programme has been a success.

The information and communication technology used by the University has matured over the period we have been learning to teach online. When we began online teaching we, like so many others, started by trying to teach using a software package designed for the "transmission" model (TopClass). It taught us a lot about teaching and learning in the e-learning mode. The key lessons were that learning always comes before technology, that the transmission model of teaching was no more effective in the online environment than face-to-face and that the strengths of our institution were in the field of collaborative and community based e-learning.

1988

In retrospect these conclusions seem fairly self evident. They will not come as a surprise to any experienced e-learning institution. However, the process by which we learned these facts was important for the formative years of WICeD and the development of its in-house e-learning tool ClassForum™.

By 1999, TopClass was proving to be inappropriate for supporting the collaborative style of online teaching and learning developed at Waikato. The search was on once again for a tool which would allow us to concentrate on teaching and learning activities – picking up particularly on the collaborative and community based approach to learning – without being forced into a rigid courseware framework. Several tools seemed to meet many of our needs, however, none of them was designed specifically as a Learning Management System (LMS). The final selection criteria, therefore, was the ability to programmatically adapt the tool and build in links to student administration, authentication and assessment systems.

ClassForum, conceived early in 1999 at Waikato, was born in late 1999 and is based on *Web Crossing 4.1* which is a powerful and fully customisable online community package. ClassForum, along with the underlying Web Crossing technology, has undergone a great deal of evolution and enhancement since we began. Development started with simple enhancements to assist in classroom management such as class lists and user interface changes. Then came the development of more sophisticated teaching and learning tools such as peer assessment modules and personalised workbooks. Development is now underway on the ClassForum Learning Object Library (LOL) which is a means of collecting and sharing innovations and teaching methods and tools within the ClassForum teaching community.

Also, during 1999 the University re-visited its strategic goals and as a result of the review listed "Leadership in E-Learning" as one of the "five key strategic objectives by which the University will achieve its vision and strategic intent"(Gould 2000). One of the main outcomes of this focus in strategic direction was the formation at the beginning of 2001 of the Waikato Innovation Centre for Electronic Education, which is referred to as WICeD. In the year leading up to the formation of WICeD the development and growth of the ClassForum system continued in the Campus Media unit of the ITS Division.

Reporting directly to the University Vice-Chancellor, WICeD is a team of 17 staff who are dedicated to furthering research and development in the field of e-learning. Many of the WICeD staff were recruited from the ITS division – including the Director, who gave up his long term role as Director of ITS to take on this new venture. The staff of WICeD include: four Learning Designers, three software developers, an e-learning systems manager, a video producer, audio developer, usability specialist, 3D modeller, two graphic artists and two administrative staff.

Designing a new e-learning support tool

In 2001 I completed a Postgraduate Certificate in Tertiary Teaching. This was to further my understanding of teaching and learning in Higher Education and because I recognised the need for ever improving approaches to development within my workplace environment. As a result, an assignment component of this qualification was a research project in which I examined techniques for developing elearning tools within a Higher Education organization. The title of which is *Focussing on Teaching and Learning in the Development of an E-learning Tool*. It examines the process of developing a new set of tools within ClassForum by the development and learning design team in WICeD. What follows comes from this research.

Initially, I assumed that I would be involved with, and reporting on, a fairly typical user centred software development process. The aim of the development was to design, program and implement a wizard based tool to enable teaching staff to create complex teacher-to-student and student-to-student group discussion systems within their online teaching space. The prototype system had been developed by myself in 2000 in conjunction with one teaching staff member who had requested a tool to create private teacher-to-student 'Portfolios' which allowed for a space in the asynchronous discussion tool shared only between the individual student and their teachers.

Now that WICeD was established and there was a very skilled team of professionals available to work on the enhanced project I expected a larger, more robust and flexible Portfolio type system to be developed. This new system was to be known as the Electronic Workbooks System (EWS). In the process of developing the EWS I made a number of interesting discoveries.

The first key educational issue was determining the extent to which teachers should be involved in the development plan. Would using a team of teachers on this development project lead to an outcome suited to the needs of the majority of eventual users? My initial thoughts on this were that it had to be an improvement over having the opinion of just one user participant in the design process, as had happened with the prototype tool. However, the difficulties of such an approach seemed equally obvious based on our experience in several previous design and development projects. The process of forming a user (teacher) consulting group would immediately present two problems which could compound the initial problem. The group would be self-selecting. Teachers who volunteered would very likely do so for one, or both, of the following reasons. There is a high likelihood that they would be keen users of the software and early adopters of new technology into their teaching practice. Secondly, those who took the time to be involved would be more likely to have their own specific needs in mind and, therefore, may approach the task with a narrow focus while WICeD enjoys the luxury of having an overview for the whole University.

In the case of those who were typically early adopters of new teaching technology, the feedback may not clearly reflect the needs and approaches to using software that a 'typical' teacher might have. Their prior experience, and often even enjoyment of using new tools, where they had to explore and learn from mistakes, could cloud their judgement in favour of a system more complicated than is ideal. For those with their own specific needs in mind, many aspects of a tool's use might be ignored in favour of the specific need they identified. The final problem was, of course, the fact that time considerations during the development 'window' meant that there was a high likelihood of not being able to get enough time from any teaching staff. This debate regarding representation is central to questions about finding the balance between technology and educational needs.

It was this difficulty, and the approaches we took to alleviate it, which led to the discoveries we made and to clarifying why our approach to the development of e-learning tools has been so successful.

Using WICeD expertise in the design process

Early in the design phase of the EWS project the decision was made by the development team to include a wide group of teachers later in the development process than we would normally feel comfortable doing. This was as a result of the difficulties in finding that elusive character, the perfectly representative teacher. The plan was to design and develop a working version of the tool using our own ideas and knowledge of the problem teachers were trying to solve – then test our understanding against a group of teachers in a formal usability study.

Given the risk of failure this posed, we had to use some techniques to attempt to maintain our user and pedagogical focus throughout the design and development process. Two techniques, role playing and conversation, were used to try and do this.

The first technique was to use role play during the design and development phases of the project. This was part of the action research approach I had adopted. My official role in the development team was 'architect and project manager'. Another member of the team was one of our learning designers and his role in the development process was to maintain focus on the pedagogical aspects of the development. Aside from our formal roles in the project, we both agreed at the outset to deliberately role-play as teachers who would use the software throughout the development process. During the project development cycle we did not mention this decision to the other members of the team.

Secondly the meetings throughout the project were conversations held between colleagues with a common goal in mind rather than formal agenda based meetings. Clark (2001) says of a good conversation; "Good conversations demand good content … good conversation resists the bounds of definition … is voluntary … happens on common ground … requires safety, trust and care … good conversation develops" and "good conversation has a future". The meetings held during the development of the new Portfolios tool displayed all these general characteristics of good conversation.

Using conversation in the development process was not a new phenomenon for WICeD, but evaluation of transcripts of these conversations did demonstrate that the conversation style of meeting allowed for more 'thinking aloud' which led to many holes in the product being plugged before implementation. The combination of role-playing and using conversations led to a very good representation of the characteristics of the general user community.

User feedback after four months in operation has been consistently positive. Requests for enhancements and additions to the EWS system are now he norm rather than requests for assistance in creating workbook equivalents. Faculty have gone on to use the EWS in ways that even the original design and development team had not imagined. This has demonstrated to us that the flexibility and robustness of the tool which was enabled through the thinking aloud and role playing techniques has been effective.

Conclusions

Evaluation of the development process for the EWS led to a very important discovery about how the way WICeD was formed, and the way it works is applicable to other e-learning development teams. The WICeD team was established as a result of the organization recognising the need at a strategic level for central funding to establish the development of an e-learning innovation centre. Of the 17 staff who currently work in WICeD, eleven have had some, or in many cases, considerable teaching experience in the Higher Education sector. Those members of the development team consistently approach their work with teaching and learning foremost in their minds. For a technology development unit this is exceptional – for an e-learning technology development unit perhaps it should be the norm.

Without keeping teaching and learning at the forefront of e-learning developments, the results will continually drift towards technologically 'tidy', but pedagogically lax results. The supportive and proactive climate at the University of Waikato, which led to the formation of the WICeD team from a group of pedagogy aware technologists and technically aware teachers, has proven to be a successful model for the formation of an e-learning development team. Innovative approaches to teaching and learning are set to continue at a pace in WICeD.

References

Clarke, C. (2001). *Talking Shop* – authentic conversation and teacher learning. Teachers College Press: New York

Gould, B. (2000). University of Waikato Strategy Statement. Web Publication:
http://quality.waikato.ac.nz/strategystatement.shtml (accessed 9 April 2002)

Increasing Teacher Certification through a Multi-Campus (Blackboard) Praxis Network

William E. Moore, Willa M. Moore, Ann W. Henderson and Mous Diack
Colleges of Education and Sciences
Southern University
Baton Rouge, Louisiana 70813 USA
billsubr@aol.com

Abstract: In this paper we describe the development and implementation of a test preparation network for students enrolled at four universities in the state of Louisiana. The network uses the course management software *Blackboard* as a medium for test preparation, posting resources, and conducting collaborative projects among universities. The network has a strong accountability component and provides for good statistical tracking of student activities. One noteworthy and unique feature of this project is that the network enables students from four universities to benefit from the general strengths and faculty expertise from four institutions. We will illustrate several of the local instruction models we have developed and indicate how the methods may be implemented on a larger scale.

Introduction

The popularity of e-learning is evidenced by the unusual proliferation of online courses and degree programs. Despite this unprecedented growth, controversy prevails regarding the effectiveness of this mode of instruction (Chamberlin 2001). Two years before this date, we had begun to capitalize on a middle-ground approach that combined face-to-face instruction and online learning. We then extended this methodology to include a network of four universities (The J. K. Haynes Consortium) addressing the common problem of preparing students to pass threshold examinations for teacher certification. Initially activities were confined to individual campuses and we reported our findings in annual faculty development and planning conferences. The participating institutions included Grambling State University and Southern University Campuses at Baton Rouge, New Orleans and Shreveport.

In the summer of 2001 we discovered that our consortium of schools possessed an ideal infrastructure for establishing a web-based network. For example, it could provide learning resources for students, serve as a medium for faculty development and program planning, and provide opportunities for collaborative learning among campuses. Equally as important, the network would allow the consortium to fill gaps in knowledge so that we could witness higher passage rates on the Praxis examination. To this end, we elected to use the course management software system, Blackboard, as the central tool for implementing the network. The uniqueness of this collaborative network is that students from four campuses benefit from the faculty expertise from these universities and that it provides a medium for the rich exchange of ideas among students and between students and faculty. The archives also provide valuable documentation and elements of accountability. In this paper we describe model activities that were carried out on the Baton Rouge campus of Southern University.

The Study

In our local model, we chose to employ the middle-ground approach involving students from four different classes. This arrangement included two sequential six-week Saturday workshops with an average of 47 students per six-week session. This program was part of the J. K. Haynes outreach initiative and the sessions involved regular university students and some commuters who traveled as much as 130 miles to receive face-to-face instruction. The second component involved two eight-week reading classes that were offered concurrently in the summer of 2002. One class was devoted to teaching reading for elementary school and the other reading class focused on teaching reading at the secondary level. A third component of the local network involved a *Blackboard* faculty development thrust designed to create a Praxis-based e-learning culture. For clarity, these initiatives will be discussed separately.

The Saturday Outreach Workshops

The class associated with this activity met four hours each Saturday (9:00 a. m. to 1:00 p. m.) for six successive weeks. During this time period, four faculty members offered instruction around the various components of the Praxis II examination. The first week was devoted to administering a diagnostic test and familiarizing the students with features of Blackboard. The former enabled faculty to determine student deficiencies requiring intensive work or individual attention. The latter was designed to enable students to begin using Blackboard immediately. For this purpose, we created a test bank of approximately 860 discrete multiple choice test items. By the end of the first week, students could access the available test items at their convenience. The faculty could monitor student progress and use the information to determine appropriate types of intervention. When we analyzed the Blackboard statistics, we began to see a strong correlation between usage and performance on the actual Praxis Examination. A student who had average scores on 12 of 15 Blackboard exams showed a greater likelihood to pass Praxis than one who had high scores, but only took three of fifteen exams during the same time period. In short, the intensive Praxis based instruction the students received on Saturdays proved to be an appropriate complement to Blackboard usage during weekdays.

The Summer Reading Classes

In the summer of 2002, .approximately 29 students were enrolled in each of the two reading classes for education majors to learn methodologies for teaching reading at the elementary and secondary levels. For the purpose of Blackboard activities, the classes were placed in the same Blackboard classroom. However, they were not physically combined and students never met one another except through a non-class coincidence. In this way, the students were able to take advantage of available test items and which gave the faculty the opportunity to experiment with collaborative learning across the physical boundaries of brick and mortar classes.

In the collaborative learning project, students were divided into groups of six each, with three students coming from each of the reading classes. Each group was given a name (Piaget, Bloom, Montessori, Locke, etc) and placed in the Discussion component of Blackboard. Access was restricted to members of a given group.

The entire *Blackboard* class was given 15 analytical reasoning problems and instructed to solve them collaboratively. They were informed that each student was required to provide leadership in discussing three problems and was required to participate in the discussion of all problems. They were given a deadline of midnight July 23, 2002, to complete the problems and submit a consensus report .In this section student interaction was high but some did not complete the consensus reports. More than 70% of the students indicated that they benefited from the asynchronous cross-fertilization. In an earlier study we had conducted in a similar class, the consensus reports were much higher -- largely because we had grade bonus points attached to acceptable completion of the reports.

Students in the reading classes were also required to develop home pages and place Praxis relevant material at these respective sites. These included case histories and other activities involving reading and writing skills. We found that some students had significant gaps in knowledge regarding human development, assessment and education in the courts. To this end, we created Power Point review activities and placed them in the course document section of Blackboard..

An important aspect of the reading activities was that seven faculty members were placed in this combined class as observers who could also engage in exchanges with students and offer them advice or cues to their respective problem. This part of the model is a scaled down representation of what would happen at four universities across the state of Louisiana. In this case we envision a group of students from four universities working on an assignment and having faculty members from these universities provide clues, mentoring support and insight through the Blackboard discussion forum. The preliminary results we have received suggest that there is vast potential in this application (Horton 2000).

Discussion

The results we have obtained from the four classes we have studied locally suggest that Blackboard can serve an important role for creating a culture that will accommodate e-learning and teacher certification. The creation and use of the 800-plus item test bank provides evidence of its utility. We have also demonstrated that asynchronous, peer-based collaborative learning is an important tool for filling gaps in knowledge. We further show that there is a strong positive correlation between frequency of Blackboard usage and performance on the actual Praxis examination. We are equally convinced that web-based faculty development is workable and that it provides a powerful means of exchanging ideas and teacher certification resources.

The next step in the Praxis preparation process is to implement the multi-campus network. This will include faculty development, local face-to-face instruction and a robust combined Praxis virtual classroom for students of the four campuses. We will track course statistics and provide rigorous evidence of the effectiveness of the various components of this classroom.

References

Chamberlin, W. Sean (2001). Face –to – Face versus Cyberspace. *Syllabus* 15:5

Frayer, Dorothy A. (1999). Creating a campus culture to support a teaching and learning revolution. Cause/Effect 22:2.

Horton, Sarah (2000). Web Teaching Guide: A Practical Approach to Creating Course Web Sites. Yale University Press.

McCormack, Colin, & Jones David (1998) Building a web-based education system.. New York:Wiley Computer.

Acknowledgements

This work is supported by a planning contract from the Louisiana Board of Regents Distance Education Initiative (LA-DL-DEI-07-01/02). This project also received generous support from the Southern University Office of Technology and Network Services.

The authors gratefully acknowledge the technical assistance of Ryan Knight and Evan Thomas for creating and maintaining the examination data base.

Analysis of Students' Eye Movement in Relation to Contents of Multimedia Lecture

MURAKAMI Masayuki
Faculty of Foreign Studies, Kyoto University of Foreign Studies, JAPAN
Email: masayuki@murakami-lab.org

KAKUSHO Koh MINOH Michihiko
Academic Center for Computing and Media Studies, Kyoto University, JAPAN

Abstract: In this article, we report our analysis about relation between the content of lecture and the students' eye movement in order to clarify the criterion to capture image information for distance learning. We classified content of lecture into nine instructional process categories: introduction, presentation, explanation, illustration, assertion, query, reply, question, and response. As the result of analysis, we get the characteristic of students' eye movement in each instructional process category in practical lecture. And our research suggests the practical guide for selecting of image information for distance learning

1. Introduction

The rapid advancement of the Information Technology (IT) such as the Internet has been changing education, particularly distance learning. In the case of distance learning, lecture with multimedia material is shot by some cameras, and the image information is recorded and transmitted. It is necessary to convey the content of lecture effectively, so we need the criterion to decide what we should capture by camera.

In the previous work, they proposed some automatic shooting systems and archive systems for lecture (Kameda et al.,2000, Onishi et al., 2000). These works were interesting in the visual point of view. But, we propose that it is important to consider contents of lecture for selecting of image information. Since students depend on contents of lecture in order to decide what they look at, we pay attention to students' eye movement.

Our purpose is to clarify the criterion to select image information for distance learning and WBT. Then, we report our analysis of how the students' eye movement is affected by the content of lecture.

2. Instructional process category

Lecture with multimedia material consists of lecturer, material and students. Multimedia material continues to be shown during the lecture. Students choose an object (material, lecturer and the other students) at which they look to get information. We define the style of this lecture as "multimedia lecture". In this multimedia lecture, the roles of lecturer and material change according to the situation. In this research, we examine the roles of lecture and material which affect students' eye movement.

A criterion is necessary to partition the multimedia lecture into parts based on contents. Then, we define "Instructional Process Category" referring to the past research of instructional analysis (Flanders, 1970, Hough et al., 1970, Mizokami et al., 1998) and teaching method. We classified contents of lecture into nine categories: introduction, presentation, explanation, illustration, assertion, query, reply, question, and response.

Introduction: Lecturer tells students about the preliminary knowledge and the outline of lecture so that he/she expects students to be motivated the lecture. In this process, lecturer gives students advanced organizer. We define this part as "introduction".

Presentation and explanation: We propose that the process of learning multimedia material classifies into two parts, referring to process of learning text (Kintsch, 1994). First, they learn of multimedia material. They try to recognize and understand the multimedia material in order to construct text-based model to replay and summarize the contents. We define this part as "presentation". Next, they learn from multimedia material. They try to integrate information and knowledge in order to construct situation model to apply the integrated knowledge. We define this part as "explanation".

Illustration: Lecturer shows a concrete example to help students understand. We define this part as " illustration".

Assertion: Lecturer asserts his/her argument and tells his/her experience. We define this part as " assertion".

Developing and Integrating Resources in a Virtual Learning Environment

Raul Morales and Yoneo Yano
Information Science and Intelligent Systems Department
Tokushima University
2 – 1 Minami Josanjima-Cho, Tokushima 770, Japan
{raulms, yano}@is.tokushima-u.ac.jp

Abstract: This paper presents an approach to develop and to integrate highly diverse resources in learning spaces via personalizable interfaces and virtual collaboration areas. Digital libraries comprise vast digital repositories and wide range of services, users' environments and interfaces, all intended to support learning and collaborative research activities. We are developing a distributed learning environments for which services and interfaces include, for example, web-based learning systems using annotation environment, adaptive WBL, agents-based asynchronous virtual classrooms, computer assisted language learning using video and annotation, teacher support environment in web-based training system, videoconference-based CSCL environments, user agents for video information retrieval and access to digital documents that support specific courses and projects. In order to assist users in dealing with this complexity, we are designing environments, termed collaborative personal and group spaces, which provide users with means to access and control all available resources in a uniform fashion from a single vantage point.

1. Introduction

This paper analyzes some of the majors problems faced by users when using collections and services provided by network learning environments or digital libraries and presents an approach for the integration of learning environments resources which is based on the concepts of personal and collaborative learning spaces. We posit that users should have at their disposal means to create virtual areas within the learning environment in which they can place information objects that are relevant to their interest and ongoing tasks. We refer to this sort of virtual space as a collaborative personal space (CPS). Additionally, digital libraries and learning environments should also provide users that usually work remotely with virtual spaces where they can meet to discuss objects and topics of interest and to work collaboratively on group projects while maintaining the capability to access materials in digital collections. We refer to this second category of virtual place as a collaborative group space (CGS).

Our group has been conducting research in the areas of computer supported collaborative learning (CSCL) and digital libraries (DL) and has produced advances both in the construction of digital contents and in the provision of e-learning for users in the context of distributed system architecture. In this context, we are designing and implementing one version of collaborative personal spaces and other of collaborative group spaces. We report our design and development experiences in this particular area of our learning environment.

2. Environment Context

One part of our group has been working in a system architecture for a learning environment in a Digital Library that addresses the needs for information management, communication and collaboration among a highly distributed community of users. We have aimed to build both a practical, functional learning environments and a

BEST COPY AVAILABLE

testbed for research of open issues in the field, including aspects of personalized and groups interfaces, collaborative work and information visualization.

The realization of our learning environment has called for research and developed efforts in three major areas: building content, designing components that provide general infrastructure such as information retrieval services, multimedia management and agent essentials, and user interfaces and environments. Our advances in the area of general infrastructure include a distributed framework that integrates services and interfaces, with implementations using KQML, servlets and RMI as well as components implementing various popular information retrieval mechanisms. Finally, in the area of user interfaces and collaboration environments, our work has resulted in various access and visualization mechanisms.

One distinctive element of our work in leaning environments is our view of information and collaboration spaces as comprising both the digital and physical realms. We believe the needs posed by learning activities can be satisfied if traditional resources as well as the novel digital facilities are accessible to users at any given time in a seamless fashion. In this regard, we have been integrating traditional on-line learning material and user services in to our new developments. As can be expected, software components such as CoCoA, AVC, Sharlok and LeComm consider that both digital and physical resources should be accessible to users.

Even though each software component may facilitate seamless access to some learning resources, the diversity of such components as well as the size and dynamic nature of digital collections and user communities have the potential to make the digital library a complex and unwieldy environments for end users. Means are needed to ensure that individual users have access to exactly the resources they are entitled to according to their roles, needs and preferences. Providing more that a user needs unnecessarily increases the system's complexity and the user's cognitive overload. On the other hand, limiting access excessively would result in system under-utilization and user frustration. The needed compromise should be the result of electing and addressing every user's needs and preferences. Learning environments users typically need to work collaboratively as in a school or in a physical library. More often than not, a given user belongs to more than one regular group of users. It is also possible that learning or library resources are disjoint for every group a user belongs to, or that some materials need to be used in several work groups. Thus, for example, a user may participate in a class discussion for which he is the instructor or facilitator and also in a technical committee that is reviewing a paper submitted to a conference. For him class, he may suggest a reading (available at the digital library) which happens to be, say, a missing reference in the paper being reviewed by the other group in which he participates.

The work described in this paper aims to advance along these lines: facilitating the creation and maintenance of personalized areas (which we call collaborative virtual spaces) that integrate resources relevant for a given user , and making possible for users to easily move from personal to group areas sharing digital content in an adaptive video-CSCL environment.

3. Collaborative Virtual Spaces

In the context of a learning environment, we define collaborative personal space as a virtual area that is generated, owned and maintained by a user to persistently keep resources like objects, agents, etc. or references to resources which are relevant to a task or set of tasks the user needs to perform in the learning environment. Collaborative personal spaces may thus contain digital documents in multiple media, personal schedules, visualization tools, and user agents. Resources within collaborative personal spaces can be pre-assigned according to the user's role. For example, a research student would have access to research-specific topic materials, visualization tools and interfaces to communicate (video, audio or text based chat) with his colleagues. Agents may be available for recommending research or library materials that are relevant to the research topic and the collaborative personal space could be enriched by the agent's suggestions.

Similarly, we define a collaborative group space as a virtual area in which learning environment users can meet to conduct collaborative activities synchronously or asynchronously. Explicit collaborative group spaces are created dynamically by a group leader or facilitator who becomes the owner of the space and defines who the participants will be. Implicit collaborative group spaces can be generated automatically when a number of users have been detected to have similar user profiles or interests around a given topic or task. In addition to direct user-to-users video-communication, users should be able to access research and learning materials and make annotations on them for every other group participants to see.

4. Implementation

We are developing prototypical implementations of collaborative personal and group spaces concepts in order to provide a homogenous interface to the various user services and environments described in last section. We based our designs on the well-known room metaphor [Greenberg and Roseman 1998; Henderson et al. 1986]. Collaborative personal spaces are thus conceived as rooms that every user may configure and adapt by defining some characteristics as color, furniture, layouts and by adding learning resources that are used frequently or support user tasks. We also have emphasized the role of every user in our prototypical interface design [Shineiderman and Plaisant 1994]. When users register to access the learning environment, they specify the role(s) the will be playing in the system. Typically, a user selects or is assigned a combination of the various existing roles; research, graduate or undergraduate student, full time or part-time professor, research staff, or system administrator. The initial collaborative room configuration is determined by the user's role.

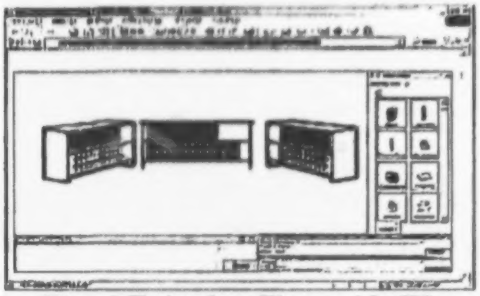


Figure 1. The interface of Hyzone – 1 for CPS.

Our first CPS prototypical implementation, which we termed Hyzone-1, is being developed to users in Java applets that could be downloaded and run at the client level. Figure 1 illustrates the interface of Hyzone - 1. The idea is straightforward: Users may configure their collaborative personal space by changing a room's physical characteristics and placing sheets icons (representing learning resources) into bookshelves that can be added and moved around at will. Drag-and-drop functionality can be applied practically to any element in the prototypical interface. The figure also shows icons for search tools and recommender agents. Menus include options for adding and removing elements from a room, associating learning resources with icons, sending instant messages to active users (same interest) and new elements can be shared by clicking pull-down menu.

Our current version of Hyzone – 1 implements explicit collaborative group spaces (as per our definition in the previous section): any user of the learning environment may create a CGS and send invitations to users who are members of a team or who are potentially interested in a particular discussion subject.

Figure 2 illustrates a session of five users who have started a discussion in Hyzone -1. Upon entering the "room" representing the CGS, every user sees a picture or video of himself, images or videos of the other users currently logged in, as well as icons that represent learning environment, which have been brought to the room to support the discussion. Users participate in the discussion by posting their comments via text interface and pointing to learning resources. Users can make annotations on shared materials (images and videos) and see other users' annotations. The entire discussion can be saved so latecomers may join a meeting and get up to speed quickly, or the discussion may be suspended and retaken by the group at different time.

In Hyzone -1, users can drag their own image or video and drop them near another user, group of users or learning resources. This is intended to reflect natural positions in a discussion in a visual fashion that can be perceived by all group participants. Alternative, new rooms or sessions may be created to include different sets

BEST COPY AVAILABLE

of users for addressing sub-topics or new discussion topics.

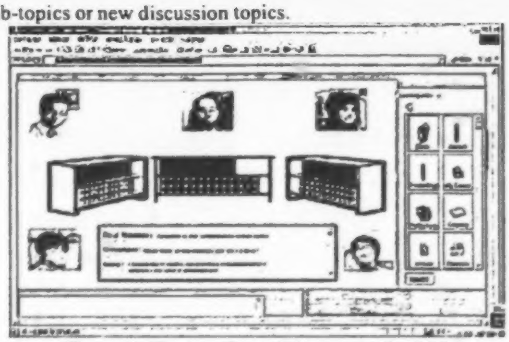


Figure 2. The interface of Hyzone – I for CGS.

Our ongoing-work implementations of collaborative personal and group spaces have undergone various usability and performance test with encouraging results. We have focused initial tests to our main target communities: college students, professors and research staff. For our tests we have used small collection of digital videos, articles, technical information and online information.

In addition to usability inspections test, we have been observing users experiment with the prototypes. With only minimal initial guidance, users of Hyzone – I have been able to personalize their information space by creating rooms, changing their appearance, and more importantly, by gathering learning materials and references (online entries) and placing them in bookshelves. From their collaborative personal space, users also have been able to open digital documents and launching applications such instant messaging and videoconference tools. However, some of the services and applications described in this paper have become available more recently.

From our results thus far, we believe collaborative personal and groups spaces are a promising approach to the integration of highly distributed, heterogeneous information spaces. Our design and prototypical implementations shows that our approach may effectively help users in coping with the size, complexity and dynamism of digital learning content.

REFERENCES

Ellis, C.A., Gibbs, S.J., & Rein, G.L. 1991. Groupware: Some issues and experiences. *Communications of the ACM* 34, 1, 38-58.

Henderson, D. Austin, and Card, Stuart. 1986. Rooms: the use of multiple virtual workspaces to reduce space contention in a window-based graphical interface. *ACM Transactions on Graphics* 5, 3, 211-243.

Lakos A., Gray C. 2000. Personalized library portals as an organizational culture change agents: Reflections on possibilities and changes. *Information Technology and Libraries 19*, 4 (December), 169-174.

Morales, R., and Yano, Y. 2002. Effective collaboration in a videoconference-based CSCL environment. *World Conference on Educational Multimedia, Hypermedia & Telecommunications.* (in progress*)*.

Sanchez, J. A., Leggett, J. L. 1997. Agents services for users of digital libraries. *Journal of Networks and Computer Applications 21*, 1, 45-58.

Shneiderman B., Plaisant, C. 1994. The future of graphic user interfaces: personal role managers UMD CS-TR-3285, CAR-TR-713, ISR-TR-94-48 People and Computers IX, British Computer Society's HCU 94 (Glaswow, Scotland, Aug.) CU Press (Cambridge, U.K.) 3-8

BEST COPY AVAILABLE

The Use of Virtual Learning Environments in UK Higher Education - Are VLEs Supporting Student-Centred Learning?

Sue Morón-García
Institute of Educational Technology, The Open University, United Kingdom
s.d.moron-garcia@open.ac.uk

Abstract: This paper reports on doctoral work in progress investigating whether Virtual Learning Environments (VLEs) are being used to support student-centred learning in UK Higher Education (HE). VLE is the term used to describe the package of integrated software tools that make use of Web or Internet-based technologies and are used to put courses online. The focus of the research is the lecturer (HE teacher), because it is they who set up the learning environment for the student. The findings of a pilot study into the use of Web and Internet-based technology to support learning in HE were used to develop a main study which concentrates on the use of VLEs by humanities and social science lecturers in face-to-face education.

Introduction

This research investigates whether lecturers are moving towards a more student-centred model of teaching, facilitated by the use of Virtual Learning Environments (VLEs). The aim is to identify factors relating to the VLE, the context in which it is used and a lecturer's pedagogic model that may support or prevent this happening. The research questions are:

- Can Virtual Learning Environments support student-centred learning and how does the functionality of the system affect lecturers?
- What are motivating factors for lecturer use of Virtual Learning Environments and what prevents them being used?
- How are lecturers using them, what methods are they using, and how does this fit into their overall pedagogy?

The focus of this research is the lecturer (HE teacher), because it is they who set up the learning environment for the student. The findings of a pilot study into the use of Web and Internet-based technology to support learning in Higher Education (HE) were used to develop interview questions for a main study concentrating on the use of VLEs by humanities and social science lecturers to support face-to-face education. The main study also used the Approaches to Teaching Inventory (ATI – Prosser and Trigwell, 1999) to help identify a lecturer's pedagogic model.

Virtual Learning Environments

The most recent manifestation of Web and Internet-based technology packaged for educational use and promoted as a way for universities to get their lecturers online is the Virtual Learning Environment (VLE). The two most commonly used VLEs in the UK currently are WebCT and Blackboard. Some VLEs are based on specific pedagogic models, for example COSE (Stiles 2000), emphasising the use of communication and collaboration tools. The aim is to encourage a different model of teaching and a move away from the uploading of large amounts of content (the first stage of use for many lecturers) and the replication of what can already be achieved through print. According to a recent report the institutional motivation for the adoption of VLEs ranges from increased efficiency to the enhancement of teaching and learning, greater flexibility and a move towards distance education (Jenkins *et al*, 2001).

The Benefits of Using Web and Internet-Based Technology

Much of the writing and research relating to the use of Web and Internet-based technology deals with the perceived benefits for the learner. Those highlighted include the enhancement of study skills and the ability to participate in subject activities (Martin and Fayter, 1997) as well as the creation of transferable skills (Harrison, 1994). It is claimed that the new collaborative tools and new media actually afford a better learning experience for students (Gibbs, 1999), aiding understanding (Pimentel, 1999) and facilitating the sharing of knowledge (Harasim, 1989). It is claimed that the use of Web or Internet-based technology can facilitate the creation of a student-centred learning environment (Collis, 1996) and the adoption of a student-centred method of teaching (Westera, 1999). Student-centred approaches are advocated as a way of equipping students with the skills they need to survive in today's complex world.

Factors Affecting a Student-Centred Approach to Teaching

It is widely argued that student-centred teaching approaches encourage students to adopt higher quality approaches to learning - what Biggs and Moore (1993) among others call a deep approach to learning - and aid the development of critical abilities. It is argued that student-centred learning and learning environments designed with reference to constructivist theories of learning will produce in students the critical and cognitive skills that Higher Education aims to develop (CNAA, 1990, Jonassen *et al*, 1993, Thorpe, 2000). However, there may be pressures on lecturers to use particular approaches in their teaching. Trigwell and Prosser (1997) found that lecturers who felt that they had more control over their teaching (what is taught and how) were more likely to adopt student-focused approaches. These approaches were affected detrimentally if the class size was thought to be too large, student diversity too great and workload too heavy.

Elements in the institutional environment may affect lecturer usage of the Web and Internet-based technology such as access to equipment, training and support. Barnard writes about an obstacle course of barriers that have to be overcome if teachers are to move "from being non-users of technology to being fluent users who could integrate technology into their teaching" (1999, pg. 352). These include anxiety, unfamiliarity with the technology, resourcing, perceived usefulness, personal philosophy, the influence of colleagues and classroom dynamics.

Lecturers' beliefs about teaching and learning and how to create the most effective learning environments are fundamental to improving student learning. Previous research has shown that lecturers' conceptions of teaching correlate with teaching approaches that in turn correlate with student learning approaches and learning outcomes (Kember, 1997 for an overview). Trigwell *et. al.* (1999) built on previous research to show that lecturers' teaching methods correlate with the approaches to learning of their students and that student-centred methods are linked to deep learning approaches in students that in turn are linked to better learning outcomes

The Pilot Study

The pilot study was conducted in order to find out what was actually happening in Higher Education (as distinct from what the literature indicates may be happening):

- Were lecturers using Web and Internet-based technology?
- What sort of technology and how?
- Was pedagogy influencing the use of the technology?
- Were lecturers aware of their pedagogy?

The objective was to develop a series of interview questions that would facilitate the collection of data to answer the research questions.

Twelve lecturers from four universities were interviewed about their teaching and their use of Web and Internet-based technology, including VLE use. Consideration was given to the possibility that some lecturers may be more comfortable with the use of Web and Internet-based technology and that some lecturers may be more able to explain and justify their pedagogy. For this reason education lecturers and those teaching computer science were interviewed. A third category of lecturer, social science or humanities, with no obvious reason to feel comfortable with the technology or a reason to be familiar with pedagogic terms was also interviewed.

Findings

- The use of VLEs is not widespread, even within those universities that support use. The newer universities were more likely to have an institutionally supported VLE and have an institutional policy that encourages use.
- Use is restricted by access issues, student and lecturer IT literacy, student expectations and colleague use, time available to create resources and to become familiar with technology.
- The 'electronic filing cabinet' was thought to be valuable – it was convenient for both students and lecturers.
- The use of e-mail as a means of communication was becoming the norm, discussion forums were used with varying degrees of success, but there was some resistance from students and lecturers were unsure how to make best use of it; 'chat' was only used by one lecturer.
- Technology was used to support group work, reflection, contact with the lecturer, sharing of work, engagement with materials and content outside class time.
- Teaching methods adopted by lecturers were dependent on class size and influenced by the way in which they were taught, observing others and any training they had received, but the same method (for example, a lecture) meant different things to different lecturers.

Developing questions for the main study

There were discipline differences in the way Web and Internet-based technology was used that made comparison difficult, therefore it was decided to focus on the social science and humanities discipline areas where it was hoped there might be more of a pedagogic pull than a technology push.

It had proved difficult to identify a lecturers' teaching model, the same method, for example a lecture, could mean different things to different people and talk about VLE use had often been mixed up with talk about general teaching. Research relating to teachers' and lecturers' conceptions of teaching indicates that there is a disjunction between lecturers' conceptions of teaching and their claimed educational practice; so even if lecturers say that they are using student-centred methods they may not be in practice. Prosser and Trigwell (1999) developed the Approaches to Teaching Inventory (ATI) to overcome this disjunction and aid in identifying the intended and actual strategies used by lecturers. It was decided to use the ATI as one of the instruments for the main study. Lecturers were asked to focus on a specific example of VLE use when completing the ATI and to talk about the way in which the VLE supported and facilitated the teaching methods used in that context.

Questions in relation to a lecturer's level of IT literacy had not worked well, personally defined levels of expertise are highly subjective and mean little in comparison to other's self-claimed levels. It was decided to ask lecturers to define (and give examples of) their own comfort level with software applications and tools relevant to VLE use, for example a word processing package, a presentation package, Web authoring software and computer mediated communication tools. The data had also indicated that there were a number of other factors that influenced the use of a VLE such as the types of students being asked to use the VLE and the ethos of the department and institution in which the lecturer works.

Thirty-two lecturers across ten universities were individually interviewed about their use of their university's VLE (three of these were trial interviews, as part of the process of developing the interview instrument). The interview data is currently being analysed.

References

Barnard, J. (1999) *Factors Affecting the Use of Computer Assisted Learning by Further Education Biology Teachers.* Unpublished PhD thesis, The Institute of Educational Technology, Open University, Milton Keynes, UK.

Biggs, J.B. and Moore, P.J. (1993) *The Process of Learning*. 3rd ed., Sydney, Australia: Prentice Hall.

Collis, B. (1996) *Tele-learning in a Digital World*. London: Thomson Computer Press.

Council for National Academic Awards (1990) First degree courses in computing in polytechnics and colleges, June 1990 *quoted in* Council for National Academic Awards (1992) *Case studies in student-centred learning*. London: The Council for National Academic Awards.

Gibs, G.R. (1999) Learning how to learn using a virtual learning environment for philosophy. *Journal of Computer Assisted Learning*, 15(3), pp. 221-231.

Harasim, L. (1989) On-line Education: A New Domain *in* MASON, R. and KAYE, A. Eds. (1989) *Mindweave: Communication, Computers and Distance Education*. [Online] Available: http://icdl2.open.ac.uk/mindweave/chp4.html [30th July, 2002].

Harrison, C. (1994) The role of learning technology in planning change in curriculum delivery and design. *Association for Learning Technology Journal*, 2(1), pp. 30-37.

Jenkins, M., Browne, T. and Armitage, S. (2001) *Management and implementation of Virtual Learning Environments: A UCISA funded survey* [Online] Available: http://www.ucisa.ac.uk/TLIG/vle/welcome.htm[30th July, 2002].

Jonassen, D., Mates, T. and McAleese, R. (1993) A Manifesto for a Constructivist Approach to Uses of Technology in Higher Education In T.M. Duffy, J. Lowyck and D.H. Jonassen (Eds.), *Designing Environments for Constructivist Learning* (pp.231-247). Berlin: Springer-Verlag.

Kember, D. (1997) A Reconceptualisation of the Research into University Academics' Conceptions of Teaching. *Learning and Instruction*, 7(3), pp. 255-275.

Martin, A. and Fayter, D. (1997) Cross-curricular tools for university students: developing an effective tool. *Association for Learning Technology Journal*, 5(1), pp. 70-76.

Pimentel, J.R. (1999) Design of Net-Learning Systems Based on Experiential Learning. *Journal of Asynchronous Learning Networks*, 3(2) [Online] Available:http://www.aln.org/alnweb/journal/Vol3_issue2/pimentel.htm[30th July, 2002].

Prosser, M. and Trigwell, K. (1999) *Understanding Learning and Teaching: The Experience in Higher Education*. Buckingham: SRHE and Open University Press, 1999.

Stiles, M.J. (2000) *Effective Learning and the Virtual Learning Environment* [Online] Available:http://www.staffs.ac.uk/COSE/cose10/posnan.html [30th July, 2002].

Thorpe, M. (2000) Pedagogical implications of flexible learning. In Jakupec, V. and Garrick, , J. (Eds.) *Flexible Learning, Human Resource and Organisational Development: Putting theory to work* (pp. 175-192). London: Routledge.

Trigwell, K. and Prosser, M. (1997) Towards an understanding of individual acts of teaching and learning. *Higher Education Research and Development*, 16, pp. 241-252.

Trigwell, K., Prosser, M. and Waterhouse, F. (1999) Relations between teachers' approaches to teaching and students' approaches to learning. *Higher Education*, 37(), pp. 57-70.

Westera, W. (1999) Paradoxes in Open, Networked Learning Environments: Toward a Paradigm Shift. *Educational Technology*, 39(1), pp. 17-23.

E-Learning & the Global Interface

This short paper begins with effective communications principles in contemporary multicultural and multinational classrooms and differing national and personal styles of discourse, and proposes their broader application to e-learning environments.

It examines several instances of their embodiment in sound screen and website interface design principles.

The paper closes on some design issues for new technologies (beyond the desktop Web browser) that will impact learning, stimulated by the author's Summer 2002 semester as an exchange professor in Japan.

Michael R. (Mike) Mosher has been an interface, Web and instructional animation designer for Apple Computer, IBM Almaden Research Center and Cisco Systems. He is now Assistant Professor of Art/Communication Multimedia at Saginaw Valley State University. Mike is the author (with R. Shepherd) of Creating Web Graphics, Audio and Video, Prentice-Hall Publishers, 2002.

Collaboration as a Response To Individualism

Robert Muffoletto, Ph.D.
College of Education
Department of Curriculum and Instruction
Appalachian State University
Boone, North Carolina

Abstract: This paper addresses issues related to the conception of collaborative learning as a design form for the Internet environment. Collaborative learning is positioned in opposition to the liberal/modern notion of the individual. In other words, how we construct the individual within a collaborative learning environment counters how western industrial society's attempt to construct the notion of the individual as a free agent responsible for their own success or failure. This paradigm counters how we think of students within a traditional learning environment-- one based upon merit and the business model.

Introduction

The Internet and related technological developments have allowed educators and students alike the opportunity to consider alternative forms of educational environments ranging from traditional instruction centered environments to community-learner centered learning environments. This paper will begin to outline a context for issues related to ideas concerning the individual in light of these movements. In doing so I am not taking a technological determinist perspective, but position technology as a systematic relationship to various processes and devices, woven together through ideologically based theories of application and practice, working within and through society.

There is no denying that developments in computer related technologies have effected how we think about education, leading to a paradigmatic shift framing teachers, students, and knowledge in a different manner. The Internet as a multi-mediated learning environment is providing "design forms" to educators through which to engage their students in the active pursuit of knowledge and application. The traditional classroom, the role of students and teachers, have been questioned and challenged as the result of the teaching and learning paradigm shift. It is now possible to create learning environments, over instructional environments that re-define the definition of teaching, learning, and the classroom. As we consider educational possibilities that include collaboration and cooperative models of interaction and learning, we need to re-think how the resulting learning environment constructs and re-constructs the idea of the individual within a perceived community of learners, over the autonomous individual within a crowd.

To consider the development and definition of collaborative learning environments we need to move beyond the "common sense" notion of technological and educational neutrality. We need, in a reflective manner, to contextualize the "idea" of collaborative learning communities within a historical and geographic construct. Not to do this will further lead to the mystification of process and the glamorization of technology as progress.

Why Talk About Collaboration

Talk concerning collaborative learning environments attempt to localize collaboration as a response to a history in the United States of "rational individualism" in education and educational technology. In other words, to consider learning environments based upon a notion of collaboration is in itself a direct response to the environment found in classrooms that is competitive, centering the curriculum within an instructional framework.

In thinking about a collaborative learning community, it is important that we see it in opposition to and different from, a non-collaborative environment centered on liberal individualism, progress, and technology. In education, liberal individualism is present in neo-behaviorist learning theory, which is centered on merit and individual measurable achievement. From this perspective, progress or learning in education is based upon presumed objective, measurable criteria, resulting from individual effort, and natural intelligence.

From this perspective, our educational system in the United States has been built upon an ideology of progress, science, and control. Education in the United States has been constructed on late 19th century and more developed 20th century models of management and control over labor and knowledge. In the modern world of the twentieth century we have witnessed how the individual was engineered by capitalism and a business ideology as an object to be controlled for the perceived good of a few over the needs of the many. In the post-modern world, where questions of identify and social justice drive much of the thinking, the individual is recognized as a member of a larger community bound together through history, language, culture, and geography. Post-modernism in education moves the discussion away from the individual as an object to be formed, to the individual as an emerging subject.

The construction of the individual from an object on the assembly line to the individual, as defined in an individualized, self-paced integrated learning system is a small step, but a major element in hegemony of the "ideology of the self" within a capitalistic, competitive merit based society. It is an ideology where the individual is held responsible for her or his development and progress. A progress defined by the system itself. This notion of progress is found in the current movement towards a standardized curriculum and high stake testing.

Contrasting the notion of the individual found in the community formed within the modern urban industrial society, to the concept of the individual as found in rural America, southern and eastern Europe, we see the individual woven into the fabric of the rural community. The individual in the rural agrarian community, gained her identity within the life of the community, and in return had responsibilities to that community. Whereas, the individual in the urban industrial community was defined by the system as an objectified object, a free agent, an independent contractor, who is responsible for his or her own condition and future. In one instance, the community engaged the individual within its own survival and definition, where in the other case, the individual existed in solitude in control of its own destiny.

If we reflect on the "idea" of the individual as an autonomous being, responsible for its own condition, it is radically different from understanding the individual as a member and defined by a community. In this case, the community shares responsibility for the individual, and the individual is responsible to the community. These forms of communities are held together through religion, family history, economic ties, and various practices. Communities of practice define their members, not as individuals, but as members. We can find examples of communities of practice in different locals. Individuals who share common labor practices, shared physical space, shared ideological perspectives, history of oppression, histories of wealth, team members, and class mates, all have borders (discourses) of different thickness and depth which unify them into communities.

In an educational system and its focus on the merits of the individual student, the individual teacher, and the individual school, the student, as well as the teacher, is constructed not as a member of a community of practice, but as an individual, who is judged by their behaviors in light of pre-determined outcomes and economic needs.

To speak of collaborative learning environments is to speak in opposition to the current dominant paradigm, which hosts individualism, competition, and an objectified measurable knowledge base. To speak of collaborative and cooperative learning environments is to embrace notions of democracy, community, shared responsibilities, and diversity. To speak of collaborative learning environments in traditional face to face classrooms, or in geographically dispersed ones, moves education away from an historically grounded, "instruction centered" paradigm, to a "learner centered" one. In a collaborative learning environment the shift is away from the search for "a" truth, to the recognition of truth and meaning as socially constructed, resulting from an understanding of history, the boundaries of geography, membership, and reflective analysis.

Any discussion or analysis of learning communities, collaborative learning environments, or democratic classrooms found on the Internet or not, is not a simple matter. Any discussion of collaborative learning is an analysis and critique of the established discourse and collective consciousness which benefits certain "ways of knowing" and the construction of individuals as objects. To reflect on what appears to be a "common sense" reality of educational practice is as complex as attempting to understand reality from any perspective.

Educational Technology as a Method of Control

In the first part of this paper I attempted to create a framework for considering the notion of the "individual" in education. I would like to now shift our attention to a brief discussion to contextualize the field of educational technology as a discourse of control and benefit. First of all, technology is about systems not objects or devices. Educational technology emerges out of a systematic approach to the identification of educational needs or problems, and their solutions. Educational technology systems frames a relationship between hardware or devices, software-the curriculum, and theories of instruction and learning which also draws from the fields of communication, learning, evaluation, and information design.

Before 1940, various devices served the classroom teacher as an aid to their instruction and as an enhancement to the learning process. Audio Visual aids, or AV, served the classroom teacher in her attempt to bring the world to the classroom, as seen with film and still images (with accompanying sound). Most of devices from this time period were seen as "aids" to the teaching process, not as a delivery system of instruction and the curriculum.

After the 1940s and into the 1950s there was a shift away from audio visual aids to a technology of instruction. Educational technology was a merging of engineering principles and devices – with roots in the social engineering movement of the late nineteenth century; psychology- with its roots in behaviorism, and education given the responsibility of preparing our youth to be productive and participate in the modern world (which usually meant the world of labor), educational technology could provide a scientific rationale and process for making education more efficient, effective, and accountable to the dominant culture and their perception of a good society.

Out of the merger of engineering, psychology, and education, emerged the current field of educational technology. As far back as the first decade of the 20th century we have witnessed the merging of system concepts with educational needs. Taylorism applied to education is a good example of that effort to separate the "conception and development of curriculum" from its delivery in the classroom, as well as the management of the educational factory. In the 1920s and beyond, we find in the work of Franklin Bobbit, WW Charters and others, the efforts to bring a scientific process to the development of curriculum. But it was not till after World War II that we witnessed the emergence of a technology of instruction to address what was seen as the weakest link in the educational endeavor—the classroom teacher.

I feel it is important that we contextualize our thinking about "collaborative learning environments" within this history because it is this history that student centered, collaborative education is in opposition to.

Collaborative Learning Environments

From what I have argued above, collaboration, people working and learning together, is in opposition to a system which constructs individuals as autonomous isolated objects.

How we (the collective we) construct educational environments through the Internet will be dependent upon the paradigm brought to our endeavors. The environment we create will be dependent upon the paradigm we employ, the constructs of knowledge we elicit, and the educational philosophy we practice.

Educational environments created on the Internet will define the individual as either an autonomous agent or as a member of a community of learners. In either case, the nature of knowledge, the vision of futures, and the identity of the self, will be formed respectively. Classrooms located on the Internet or within the walls of the institution will look differently. Each will define through its own framework the notion of legitimate knowledge and what it means to learn.

Issues related to building and practicing collaborative learning environments (communities) begin with opposition to the concept itself. Teachers, administrators, and learners have internalized the dominant definitions of what it means to teach, learn, and hold class. Questions concerning teacher work and student evaluations will arise. Issues related to a fixed or constructivist view of knowledge will need to be discussed and reflected upon. In short, collaborative learning engages the whole notion of what it means to teach and learn. It brings everything into question. There is no safe ground when the status quo is questioned and challenged. A guiding question within the debate will be: "Who benefits from the way education is now and who will benefit if it changes?"

The Internet offers to us who have access to it, a world of possibilities to increase democratic practices and to redefine what it means to teach and learn. A collaborative learning community challenges dominate forms of knowing, allowing those who have been marginalized an equal voice in constructing social reality.

E-Learning: "Self Service" Does Not Equal "Self-Directed"

By Felicity Mulgan
Content Alive
felicity.mulgan@contentalive.com

Abstract: This paper examines the distinction between self-service learning and self-directed learning in relation to e-learning strategies. Based on the findings of a series of case studies of Canadian corporations with e-learning strategies, it argues that e-learning alone is not the solution for businesses that want to nurture and grow their knowledge capital. Rather, e-learning in conjunction with a deliberate strategy to increase employee self-directedness is a more effective solution. It further argues that although traditional e-learning strategies may bring about small, incremental improvements towards greater employee self-directedness, these will only occur on a wider scale if an organization sets out to develop more of what Rosenberg terms a "learning culture" (2001).

Introduction

As more organizations adopt e-learning strategies, training delivery is moving towards a self-service model, where learners are expected to take more responsibility for taking and completing required training.

The self-service model offers many benefits to organizations, particularly in terms of cost and efficiency. Gone are the expensive classroom courses and the costly trainers. Gone are the days when the course schedule determined when training took place, or when enforcing training consistency across the organization was a challenge. Organizations can now administer standardized training from a learning management system, establish job-related curricular, track employee progress and enjoy the efficiencies of disintermediation that e-learning affords.

While benefits like cost savings and efficiency may appear to be worthwhile goals in the short-term, it is pertinent to ask whether the typical self-service e-learning model that business organizations are adopting is really providing them with the learning system they need to meet the demands of doing business in the 21st century. Our series of case studies of Canadian corporations with e-learning strategies suggests that despite implementing e-learning, many organizations still take a traditional approach to training. Our findings also suggest that a key barrier to change lies with organizational attitudes towards learning, and that e-learning in conjunction with a deliberate strategy to increase employee self-directedness is a more effective way to ensure knowledge and skills are developed and shared within organizations.

E-learning Strategies and Self-Directed Learning

Current theories of e-learning identify two opposing paradigms: the traditional approach reflecting a "training culture", where knowledge and skills are transmitted to learners, and the value drivers for the organization are cost, efficiency, access and consistency; the progressive approach reflecting a "learning culture", where learning takes a "transformation" approach, and where the value drivers for the organization are "synergistic", and include the ability to create more self-directedness, build communities, share knowledge capital and integrate employees more fully in the business (Berge 2000, Pearson 2002, Rosenberg 2001).

The progressive approach, it is argued, is a better response to the ongoing social, economic and technological changes that organizations now face. A workforce of flexible, self-managing and self-directed employees is a critical part of this approach. This belief is supported by studies that have found a positive correlation between self-directed employees and improved workplace performance (e.g. Guglielmino & Guglielmino 1988, Long and Morris 1995).

E-learning provides organizations with the means to support and develop self-directedness amongst employees in a way that was never available before, but not all e-learning is created equal in this regard. Within the range of e-learning practices and strategies, it is possible to find both traditional and progressive approaches to training/learning, and to find strategies that are more about enhancing self-service than self-directedness. This is an important distinction to make, since self-service and self-directedness meet different organizational needs. The former is a method of administering learning that cuts out the "middle man", and provides some flexibility to learners within an ultimately controlling environment. Indeed LMS's can be a boon to organizations that want to tighten control over who learns what and when, and keep track of employee development. The latter, self directedness, means employees play a greater role in shaping their own personal development, setting their learning goals, and managing their own development. It means developing in employees what Senge has called "personal mastery" (1990), and embracing the concept of continuous learning.

To illustrate, many e-learning practices, such as online courses, continue to reproduce the standards of more traditional delivery mechanisms (linear structure, fixed content, completion through a test, etc.), while the typical learning management system perpetuates the concept of training as a series of pre-determined one-time events rather than as an ongoing process that is responsive to individual needs (Harrison 2000). By contrast, e-learning practices that can encourage greater self-directedness have less in common with traditional delivery mechanisms, and include self-assessment tools, performance support tools, collaborative learning spaces, online mentors, online resources, decision support tools, content development tools and knowledge management systems. Used as part of a strategy that encourages self-directedness, they can be powerful tools for both employee and organizational development (Rosenberg 2001).

To understand why many organizations have not adopted the more progressive practices of e-learning, it is necessary to examine the role of self-directed learning in the workplace. Knowles defined self-directed learning as "a process in which individuals take the initiative, with or without the help of others, in diagnosing their learning needs, formulating learning goals, identifying human and material resources for learning, choosing and implementing appropriate learning strategies, and evaluating learning outcomes" (1975). Two concepts here, learner control and learner initiative, have rarely been a feature of workplace learning. However, much of the literature on self-directed learning finds that for self-directed learning to take place, learner control and initiative are among the critical success factors (e.g. Tough 1979, Candy 1988, Guglielmino et al 1988, Morris Baskett 1993, Bouchard 1994). The challenge for business organizations, therefore, is to foster these traits in employees in a way that is meaningful to the success of the organization. This usually means aligning the employees' desire to learn with the goals of the organization.

A useful framework for measuring the degree to which training or learning is self-directed in the workplace is Piskurich's Self-Directed Learning (SDL) Continuum (1994). His assertion that at a certain point along the continuum, the locus of control shifts from the organization to the employee/learner, ties in with the traditional/progressive paradigms discussed earlier. If we analyse the e-learning practices of an organization in relation to the continuum, we can easily identify how far the organization is organized upon the principles of employee self-directedness. The locus of control concept also helps to identify practices that are more about self- service than self-directedness.

Findings of Study

Our series of case studies of e-learning strategies at Canadian corporations looked at how far their e-learning strategies were promoting employee self-directedness. It found that in the majority of cases, the strategies were focused around basic online course delivery, usually via a learning management system. Though these strategies were promoting the self-service model, they were not promoting the concept of employee self-directedness. No practices were identified that belonged far enough along Piskurich's SDL Continuum for the locus of control to have shifted to the employees. A summary of findings include:

- Standard, linear tutorial type courses were most common
- Tutorials were typically presented in 30 minute or longer chunks of information at the subject or competency levels, rather than at task levels
- Courses were expected to have a shelf life of over a year, so were not always tailored to immediate needs
- Courses had associated tests; passing a test was deemed to indicate that the skill or knowledge had been acquired
- No specific training or tools were offered to help employees become more effective learners
- Training interventions were limited to job-related skills and knowledge

- Opportunities to take training outside a job-related curriculum were almost non-existent
- Employees were rarely able to identify own learning needs
- Knowledge management or knowledge sharing was either not practiced or was in its infancy, and took on a "push" characteristic, not a shared characteristic

An investigation into the culture and attitudes towards learning at these organizations further underlined the finding that these organizations were promoting self-service, rather than self-directedness. In all cases, although learning was considered a strategic necessity, it was also considered distinct from productive work, and was therefore thought of as an organized type of activity that employees participated in, rather than as an integral part of work that could happen at any time, with any one. These organizations were only prepared to sponsor or underwrite learning interventions that could be clearly linked to specific job skills, and all personal development was tied strictly to an employee's current position or to the development of skills in preparation for a particular career move. Employees were offered virtually no e-learning opportunities to explore other avenues of knowledge, particularly those that had less direct relation to the organization, and there were no examples of the use of e-learning practices such as collaboration, two-way knowledge sharing, and other methods associated with the progressive paradigm. Although the implementation of LMS's had successfully reduced the gate-keeping role that managers used to play in relation to employee training, managers continued to set work priorities and remained strongly focused on traditional notions of productivity, which were seen as distinct from learning.

On a more positive note, our study also found signs that employees appreciated the independence that self-service learning gave them. Other small, incremental changes in relation to self-directedness were also discernible, which may lead to greater expectations of learner autonomy in the future. At the more senior levels, employee expectations around personal development were also found to be high, and organizations were thus under pressure to provide more access to training and learning opportunities. This reflects a more general trend identified in relation to employee training and retention (e.g. Moss Kanter 2001), and one that is likely to trickle down through all levels of the organization as the population in general grows used to being able to find the information it needs online.

Conclusion

A workforce of self-directed learners is an asset to an organization that wants the flexibility to respond to the pressures of today's economy. However, self-directed learning is partly about control: who controls what, when, how and why an individual learns, and who determines whether they have reached an appropriate standard. Currently, e-learning strategies appear to mirror the culture of the organizations in which they are implemented, particularly in terms of who controls learning goals and resources. The results of this study of a sample of Canadian organizations suggest that the implementation of e-learning does not, in itself, transform an organization from having a training culture to a learning culture. Despite e-learning's potential to change the way employees learn, e-learning is viewed by some organizations as a cost efficient alternative delivery mechanism rather than a vehicle to overhaul approaches to learning, and control over learning goals and resources remains firmly in the hands of the organization.

Organizations such as those featured in this study may be missing opportunities to develop a more flexible, self-managing, self-directed workforce that can respond effectively to ongoing change. All those involved in developing e-learning strategies, from training managers, to e-learning vendors and consultants, can play a role in helping organizations see that e-learning is not a homogeneous solution to training a workforce, and that sometimes more fundamental organizational changes need to take place in order to develop the best and most effective employees.

References

Berge, Z. (Ed.) (2001). *Sustaining distance training:Integrating learning technologies into the fabric of the enterprise*. San Francisco: Jossey-Bass

Bouchard, P. (1994). Self-directed professionals and autodidactic choice. In H.B. Long, & Associates (Eds.) *New ideas about self-directed learning*. Norman, Oklahoma Center for Continuing Professional and Higher Education, University of Oklahoma.

Candy, P. (1991) *Self-direction for lifelong learning*. San Francisco: Jossey-Bass

Guglielmino, L.M., and Guglielmino, P.J. (1988). Self-directed learning in business and industry: An information age imperative. In H.B. Long & Associates, *Self-directed learning: Application and theory*. Athens, Georgia: Adult Education Department, University of Georgia.

Harrison, R. (2000, July-Aug). Learner managed learning: Managing to learn or learning to manage? *International Journal of Lifelong Education, 19*, (4), 312-321.

Knowles, M.S. (1975). *Self-directed learning*. Englewood Cliffs, NJ: Prentice Hall.

Long, H. B., and Morris, S. (1995). Self-directed learning in business and industry: A review of the literature 1983-93. In H.B. Long & Associates (Eds.), *New dimensions in self-directed learning*. Norman: Public Managers Centre, College of Education, University of Oklahoma

Morris Baskett, H.K. (1993) *Workplace Factors which enhance self-directed learning*. Paper presented to 7th International Symposium on Self-Directed Learning, West Palm Beach.

Pearson, R. (2002, February). *E-learning. Is all the hype warranted?* Paper presented at the Human Resources Professional Association of Ontario Annual Conference, Toronto, Canada.

Piskurich, G.M. (1994). The current state of SDL in business and industry. In H.B. Long & Associates, *New ideas about self-directed learning*. Norman, Oklahoma: Oklahoma Research Center for Continuing Professional and Higher Education.

Rosenberg, M. J. (2001). *E-Learning: Strategies for delivering knowledge in the digital age*. New York: McGraw-Hill.Senge, P. (1990) *The fifth discipline*. New York: Doubleday.

Tough, A.M. (1979) *The adult's learning projects*. (2nd ed.) Toronto, Canada: Ontario Institute for Studies in Education.

Questions and Answer (query, reply, question and response): Lecturer often interacts with students by verbal communication in the lecture. We call this part "questions and answers". We classify this part into four parts in detail. When speaker is the lecturer, we define as "query" and "reply". On the other hands, when speaker is a student, we define as "question" and "response".

3. Experiment

We have practiced TIDE (Trans-Pacific Interactive Distance Education) project between University of California Los Angeles (UCLA) and Kyoto University (Yagi et al., 2000, Murakami et al., 2001).

"Japanese Economics" were offered from April to June 2001. Several professors of Kyoto University give this course. For Kyoto University students, this lecture is regarded as usual multimedia lecture. In this research, we select this distance lecture as experimental lecture.

Figure 2 shows the figure of classroom of Kyoto University. Left screen shows Web material, and right screen shows students of UCLA. Lecturer makes the lecture on the center of the classroom. In this situation, students' eye movement changes depending on what they look at, among lecturer, students of UCLA on the screen, and material. Two cameras in the front of classroom recorded students so as to catch the direction of their eye movement. Whereas the camera behind the classroom recorded lecturer and two screens in order to check the contents of lecture. And, the first author attended all lectures and recorded the state of classroom in field notes. After that, we classified the recorded lecture into instructional process category.

We select two lectures as experimental lectures among course. Two lectures were practiced by different lecturer. Table.1 shows time of each category.

We extracted 9 students from each lecture as target of analysis. We checked what students look at per 10 second. Additionally in order to analysis in detail, we select some parts of lecture, which cover all categories, so we checked per second about the select data.

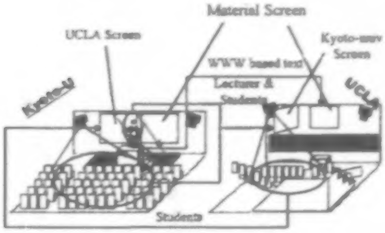


Figure 1 Distance Lecture System

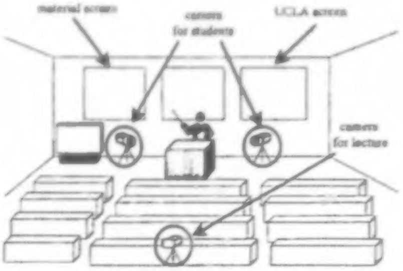


Figure 2 Classroom of Kyoto University

Table 1 Time of Each Instructional Process Category

We consider ratio of observation and pattern of eye movement as indicator. The ratio of observation is calculated by (the number of students looking at the object)/(the number of all students). The pattern of eye movement is based on cycle of eye movement and what student looks at first. We define cycle of eye movement as (when he/she looks at lecturer) + (when he/she looks at material next), or in the case of reverse order. We think that the continuous is important factor, so that we analyze the data by the following methods. If student looks at different object in only a second (for example, lecturer in 3 seconds, material in 1 second and lecturer in 4 seconds), we regard that student looks at same object continuously (above example, lecture in 8seconds).

4. Analysis

4.1 Result

	introduction	presentation	explanation	illustration	Assertion	query	reply	Question	response
lecture1	4:30	11:10	18:30	4:30	8:30	0:30	7:10	7:20	1:40
lecture2	4:00	20:00	12:30	9:40	5:20	2:00	5:30	4:00	3:00
Average	4:15	15:35	15:30	7:05	6:55	1:15	6:20	5:40	2:20

BEST COPY AVAILABLE

Firstly, in order to clarify the character of ratio of observation on each category, we calculated average of the ratio of observation per 10 second on each category. The result shows Table 2.

Table 2 Ratio of Observation on each Instructional Process Category

	introduction	presentation	explanation	illustration	assertion	query	reply	question	response
material	41.3%	81.3%	50.1%	93.5%	24.3%	22.2%	8.6%	6.6%	4.5%
lecturer	47.9%	17.4%	48.0%	6.5%	71.2%	57.8%	59.3%	20.3%	37.7%
students	10.8%	1.3%	1.8%	0.0%	4.5%	20.0%	32.1%	73.0%	57.8%

Secondly, we analyze eye movement of each student on each category. Results of analysis about introduction, presentation and explanation show figure 3-5. In these figures, 2 of y-axis shows looking at lecturer, 1 shows material and 0 shows no object.

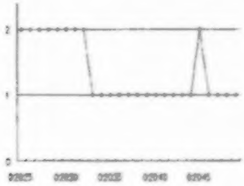


Figure 3 Introduction

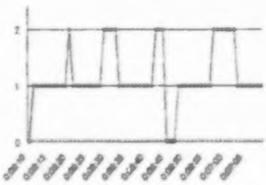


Figure 4 Presentation

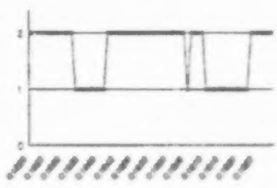


Figure 5 Explanation

Thirdly, we sampled cycles in these data, and add up them on each category. Histogram of cycles about presentation and explanation show figure 6,7. The x-axis shows time of cycle and the y-axis shows the number of times. The average of cycle of presentation is 11.60 second and standard deviation is 3.38, whereas the average of cycle of explanation is 20.21 second and standard deviation is 6.85.

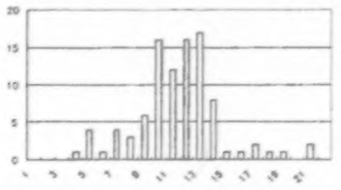


Figure 6 Cycle about Presentation

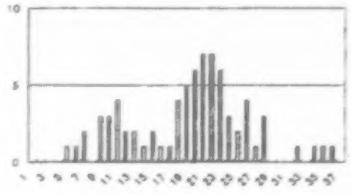


Figure 7 Cycle about Explanation

4.2 Relation between Category and Eye Movement

We discuss the relationship between instructional process category and eye movement from the results of analysis described in 4.1.

Introduction: The ratio of looking at material is much the same the ratio of looking at lecturer from Table 2. As concerns the pattern of the eye movement, students gazed at lecturer at first, and next looked at material from Figure 3. It is thought that they tried to acquire advance organizer from the lecturer.

Presentation: The ratio of looking at material is very high, 81.5%, from Table 2. From Figure 4 and Figure 6, students mainly stared at material for about 15 seconds and sometimes peered at lecturer for about 3 seconds. They learned of multimedia material during presentation, so that they mainly stared at material. And they looked at lecturer in order to complement understanding.

Explanation: From Table 2, the ratio of looking at material is close to the ratio of looking at lecturer. From Figure 5 and Figure 7, the cycle of eye movement is about from 19 seconds to 29. The cycle is the longest than other course process categories. They learned from multimedia material during explanation, so that students stared at the object which they regard as important to understand the lecture.

Illustration: The ratio of looking at material is the highest, 93.5%, from Table 2. As the reason of high ratio, it is thought that material offered main information source.

BEST COPY AVAILABLE

Assertion: The ratio of looking at lecturer is very high, 71.2%, from Table 2. They gaze at lecturer because of interaction between lecturer and students.

Question and answer: Generally, students looked at speaker. But in the case of "query" about material, they change their focuses on material and lecturer by turns frequently. It is thought that students tried to grasp information of lecturer and material in order to answer to the question.

4.3 Guideline

Based on the result of analysis, we discuss the practical guide for select of image information. In introduction, we should select image of lecturer for several seconds first in order to give advanced organizer. In presentation, we basically select image of material, but we occasionally insert image of lecturer. In explanation, we should present image of material and lecturer by turns for about 20 seconds. In illustration, we should select image of material. We should select image of lecturer in assertion. In questions and answers, we basically select image of lecturer, except the case of the query about material. In query about material, we should alternate image of lecturer and material frequently.

5. Conclusion

In this article, we report our analysis about relation between the contents of lecture and the students' eye movement in order to clarify the criterion to select image information for distance learning and WBT. As the result of analysis, we get the characteristic of students' eye movement in each instructional process category in practical lecture. And based on these results of analysis, we propose to apply these results to selecting image for distance learning.

Reference

Flanders, N. A. (1970) Analyzing Teaching Behavior, Addison-Wesley

Hough, J.B., Duncan, J.K. (1970) Teaching: Description and Analysis, Addison-Wesley

Kameda, Y., Ishizuka, K., Minoh, M. (2000) A Study for Distance Learning Service - TIDE Project -, IEEE International Conference on Multimedia and Expo, Vol.3, pp.1237-1240.

Kintsch, W. (1994) Text Comprehension, Memory, and Learning, American Psychologist, Vol.49, No.4, pp.294-303

Mizokami, S., Ozaki, H., Hirakawa, J. (1998) Aimed at Analyzing Teaching Process with Students are Satisfied, Kyoto University Researches in Higher Education, Vol.4, pp22-64 (in Japanese)

Murakami,M.,Yagi,K.,Kakusho,K.,Minoh,M.(2001) Evaluation of Distance Learning Course shared by UCLA and Kyoto University., ITHET2001

Onishi, M., Izumi, M., Fukunaga, K. (2000) Blackboard Segmentation Using Video Image of Lecture and Its Applications, The Transactions of the Institute of Electronics, Information and Communication Engineers D-I, Vol.83-D-I, No.11, pp.1187-1195 (in Japanese)

Yagi,K., Kameda, Y., Nakamura, M., Minoh, M., M, A, Abdalla.(2000) A Nobel Distance Learning System for the TIDE Project, ICCE2000, Vol.2, pp1166-1169

ON-LINE STUDENT SUPPORT SERVICES (OSSS)

A Pre-Testing Opinion Survey of Distance Learners on OSSS

Dr. K. Murali Manohar
Professor of Distance Education and
Programme Director, DEQSTI, SDLCE
Kakatiya University, Warangal (AP) India

Distance Education (DE) is known for its 'learner-centeredness' and precisely due to this reason it evolves and provides all possible support services through every possible means to facilitate the learners complete their 'learning objectives'. Most of the DE institutions provide a wide variety of support services to reach each and every student based on their needs and requirements. The institution may use print or telephone or other mode to interact with the students for various purposes ranging from providing information and other services from pre-entry level to post-entry to after-course completion levels. The students under distance mode of learning will naturally seek endless information raising a number of questions, doubts and various other queries time and again till they get satisfied. In the recent times most Universities are found to have been using Internet and web technologies to maintain on-line communication with the students.

In a traditional system of ODL, there will be a Reception / PR Centre or Academic Services Division which would deal with the academic questions and problems of students and resolve them instantaneously on its own or by referring to the administrative units concerned. In a modern ODL system instead of doing these activities manually or through correspondence, it will provide the services concerned through electronic means via website. Under this system each University will have an interactive website while facilitating the students to have exclusive access to the On-line Student Support Services (OSSS) system. It would provide access to students via Internet about any information (being updated every time) regarding the courses and programmes available, with full particulars and details of eligibility conditions, academic schedules, fee and its procedure for payment including on-line payment of fee via credit card, submission of receipts, confirmation of admissions or cancellations, academic counseling, information relating to Regional/Study Centers and their activities on-line chat rooms with faculty members involved instructional materials (with down loading facility), assignments, feedback forms, news letters, student forums, all types of academic time tables, results, grades, marks, certificates and messages relating to deadlines, general information and other academic details in which the students may be interested to know or the institution may be interested to make others know.

The system can provide all possible information, clear options, needed access with 'dos and don'ts' or 'proceed or do not proceeds' and other instructions and instantaneous resolution of problems and 'on-line acceptance or rejections' with full opportunity to students to continuously interact, make alterations needed and get other related things done. It will provide access to services while increasing one to one interaction and enabling self-based learning. Further it gives complete security of information and protection from hackers on on-line transactions with student access No. and password facility to activate the system any time, from any where and for any purpose and facilitating the students to seek needed support and guidance at all levels of their study. There will be automatic mail-back system, messaging, remainders to students e-mail account, auto-reply system on all simple and programmed queries, answers to any general or specific or frequently asked questions etc. At appropriate levels and stages, audio and video facility also will be made available for appropriate institution - student interaction. As things move and as facilities improve more and more information could be added thereby and the OSSS system is continuously upgraded and strengthened. The institution under this system may provide free Internet access points in all Regional and Study Centers or at appropriate places where study centers are not available for student free access and use and this will relieve the student's burden. Since the Internet facility is available everywhere and in every town and city and not being very expensive in the open market, more and more student's 'will come forward' to use it. Provision for a little more skill or training can make the student more perfect in 'accessing and approaching' the institution by activating the OSSS. This system is new to Indian ODL institutions and except to some extent at IGNOU, a few IITs and other technical institutions which provide distance mode of education, no full-fledged OSSS system is now available any where in India's University education system. Thus the introduction of OSSS in any University system in India would still be an 'experiment' and in this connection Indian ODL Institutions are to learn many lessons from the experience of advanced institutions.

Present Study: 'The What and Why' Issues

The present study deals with the concept and a model of on-line student support services system (OSSS) and makes an attempt to elicit student's opinion on a programme specially proposed (at the pre-introduction-level) of an on-line student support services system at a 10 year old Duel Mode University operating in Southern part of India with 62 programmes (from Certificate level to Ph.D. level) and 36,000 students to its credit. It has already setup a website and permitted students to seek answers from the institution through e-mails. It is found that an estimated 30 per cent of post-graduate students had e-mail account and interestingly eighty per cent of them had the account with yahoo.com, around 12 per cent in their offices, 2 per cent in their homes and the remain with other companies. It is estimated that to create and setup a dynamic website with necessary staff at the Head Quarters and Internet facility along with necessary equipment in around 50 study centers it will cost a one-time capital expenditure of around Rs. 20.00 lakhs and an annual recurring expenditure of Rs. 8.00 lakhs which is in any case not a burdensome proposition to the institution which had Rs. 600 lakhs annual revenue income to its credit. The institution under reference recently took a decision to introduce the system and hence the survey to know its feasibility.

The University under reference thus based on its proposals to introduce a system called OSSS, a 'pre-induction' survey has been conducted both by using electronic mail and printed questionnaires while contacting 300 students via e-mails and 300 students by pre-paid postal media for collecting their opinions and responses on various connected issues of 'creation, induction and implementation of OSSS scheme'. For the purpose of the survey, all the respondents chosen were drawn from urban and semi-urban areas pursuing post-graduation courses through distance mode. The response rate is relatively high through electronic media (about 212 out of 300) which is a healthy sign as far as the 'introduction of the proposed system' is concerned. About 180 (out of 300) responses were received by postal means which is also not much discouraging. The responses indicate that students seem to have felt very much happy for approaching them and showing concern like this and extended full cooperation to respond to a wide variety of questions with a feeling of involvement and a sense of responsibility. To be straight and brief, the main results of the survey are summed up below while highlighting various aspects covered.

Availability of Internet Facility

An overwhelming majority of students as around 82 percent (95 percent of Internet users and 62 percent of correspondence respondents) had said that Internet facility is available in their places and they are for introduction of OSSS response system in the University. Most of them however pleaded that 'free Internet access' with a little training for handling it may be provided to them and all study centers/regional centers/ other centers may extend such services to all the bonafide students. Further 18 percent of the students had already had the Internet facility in their homes/offices which they can make use of and around 30 percent of the students had the experience of using Internet earlier for different purposes.

OSSS and its Need

An overwhelmingly 88 percent of students supported the idea of OSSS, provided it does not effect the prospects of other support services and replace the old one. Almost all the respondents believe that Internet is increasingly a fast penetrating medium replacing the phones, fax and mail as a preferred method of communication and offers quick, easy, powerful and timely response to the users. It is significant to observe that most of the students had already had some idea about the on-line services available 'outside' and in different western universities. A majority of them have had the access to different computer and Internet magazines and through which they had learnt the benefits of the system. Most of them had even developed a liking for the system.

Coverage of OSSS

Majority of respondents had felt that OSSS scheme should offer a package of services that should be comprehensive enough to cover the entire gamut of support they needed. Coupled with the facilities already available at study centers, they think that it should serve as a 'full-fledged information support system' to be guided constantly by the 'net'. They said that 'individualized redressal of grievances' and 'a continuous and active flow of information' is possible through OSSS. Thus, apart from serving the purpose of an 'information provider', OSSS system may also offer the facility of processing and confirming admissions, accepting credit card or on-line payments, making needed altercations of programmes / centers / combination of courses, supply of additional instructional materials other than the course materials supplied available as well as on-line, in print form, handling assignments, declaration of results, providing score cards, marks sheets etc., the respondents added. It should otherwise provide a virtual campus facility keeping in view of the changing needs of the students on the one had and encouraging creativity, independent thinking and problem solving on the other.

Cost Component

Majority of the students however seem to have 'vigilant and cautious' as far as the matters relating to the 'cost component' is concerned. A vast majority of the respondents said that it should not involve any additional cost on their part and impose any additional financial burden to meet the expenditure towards this purpose. More respondents who had no Internet accessibility at home and office, pleaded that necessary equipment must be provided at the study centers with full and free accessibility of the net service. They should also be provided a minimum knowledge of technology - both hardware and software in a specially conducted induction programme.

Some Apprehensions

In the overall analysis, though a couple of apprehensions were also raised especially about the need for increased access to technology, increased speed in connectivity, greater-band width, its relevance and applicability to all courses, availability of required hardware and software at the study centers, data up gradation and improvements, promptness of service and quality of maintenance of OSSS system, there is widespread agreement on the need for such a support service.

Implications and Conclusions

On-line delivery of support services making use of new information and communication technologies has a lot of potential for providing quality and prompt on-line support service to the students. The response from the students towards the need for a system called OSSS is overwhelming and they were willing to accept the use of Internet and web technologies for strengthening the institutional student support system. Since Internet facility is available everywhere in the open market with costs decreasing, it appears that provision for OSSS in any University and especially the University under reference is feasible and manageable. the willingness and commitment on the part of the institution to strengthen the student support services and its level of efficiency in managing it would give greater results for the benefit of both the institution as well as the students. But the issues relating to the cost component and preparedness of the ODL institutions to provide the service, provision for necessary budgetary allocations, creation of additional inputs such as expertise to man the service and provision for machines at the HQs and study centers etc., still, remain matters of serious concern for the institution to offer. The whole programme seem to be still dependent upon various other factors such as the design, facilities and maintenance of the website of the institution, the bandwidth, greater penetration of information and communication technologies, greater access and increased speed in connectivity, openness to cultural variables affecting the machine-human interactivity etc., still remain as crucial issues. In spite of all these, the positive results of the feedback from the students provide a valuable data on how these programme could be introduced and implemented with facilities available outside and in the open market, costs decreased and access increased, coupled with appropriate and

2019

need-based changes in the whole programme, introduction of OSSS will be of great use to the students and provide a strong base for a complete on-line education in the near future.

References:

Cahoon, B., (1997) 'Exploring the World-wide web', [http://www.gactr.uga.edu/exploring/]

Carr - Chellman, Alison and Duchastel, Philip (2000) 'The On-line 'Course', British Journal of Educational Technology. 31(3) : 229-241.

Carswell, Linda et.al (2000) "Distance Education via the Internet: The Student Experience', British Journal of Educational Technology, 31(1): 29-46

Harasim, LM, Calvert, T. & Groeneboer, C (Eds), 1997, 'Virtual-U: a Web-based System to Support Collaborative Learning', (Vol.I), Englewood Cliffs, NJ: Education Technology.

Hiltz, S.R. (1994). The Virtual Classroom: Learning without Limits via computer Networks, Norwood: NJ Ablex Publishing Corporation, Human-Computer Interaction Series.

Joshi (2000), 'Information Technology-Advantage India', http://www.isda.india.org/an-aproll.html

McAlpine, Iain (2000) 'Collaborative Learning On-line', Distance Education, 21(1): 66-80

McCartan, Audrey (2000) 'Use of IT in a Postgraduate Distance Learning Course: Part-I: Students' Experiences', Innovations in Education and Training International, 37(3), August 2000: 181-191

Morgan, Christopher (1998). Tutoring via Electronic Mail, Open Praxis 1:26-28.

Oliver, Ron (1999) 'Exploring Strategies for On-line Teaching and Learning', Distance Education, 20(2): 240-253.

Owston, Ronald D (1997). The WWW: A Technology to Enhance Teaching and Learning. Educational Researcher, 26(2), 27-33.

Prasad, Janardhan (1999), 'Modern Media and Education Practice. New Delhi, Kanishka.

Srinivasa Kumar, P & Subhash Maji (2002): 'Meet of Internet and Worldwide Web (WWW) in Distance Education', paper presented at IX Annual Conference of Indian Distance Education Association, 13-15 March, 2002, Jammu University, and Jammu.

Subramanyam, VV: M. Learning - A Mobile Learning Era, paper presented at IX Annual Conference of Indian Distance Education Association, 13-15 March, 2002, Jammu University, Jammu.

Venkateshwarlu & Subhash Maji, 'E-Learning in Distance Education', paper presented at IX Annual Conference of Indian Distance Education Association, 13-15 March, 2002, Jammu University, Jammu.

Internet-based Distance Learning in Slovakia

Klara Nahrstedt*, Julius Bajcsy**

(*University of Illinois, USA - klara@cs.uiuc.edu, **Slovak Technical University Bratislava Slovak Republik - julius@pluto.elf.stuba.sk)

Abstract

Many universities in USA, Canada and West Europe have extensive experiences in offering distance education courses to remote students and utilize the advanced Internet and multimedia technology for appropriate interaction. In Eastern Europian countries, the Internet-based distance learning programs are being setup only recently, however for different reasons and under different conditions when compared to programs in Western Europe, Canada and USA. Having learned from past experiences of Internet-based distance learning programs at top ranked universities around the world, we present a design of an Internet-based distance learning program for technical universities in Slovakia. We discuss the overall design process through the case study program, initated at the Slovak Technical University in Bratislava.

1. Introduction

There has been an explosive growth of multimedia computing, communication and educational applications during the past years, extensively utilized in Internet-based distance education at various universities (e.g., University of Illinois, Stanford, McGill). Internet-based distance education represents an educational form where students are located outside of the classroom and reach educational material as well as the instructor via remote multimedia electronic tools such as video conferencing such as NetMeeting from Microsoft, Web service, email, ftp service, and others. Current computing and communication environments, consisting of high-end PCs, cable modems, Ethernet LANs, or DSL communication lines, at many universities and homes allow for interactive communication and on-demand multimedia information access. Instructors of distance learning programs are able to (1) distribute their teaching material, auxielary papers, detailed instructions to the remote students via web, email, ftp services, (2) receive comments, and questions via email and newsgroups, and (3) conduct discussions via newsgroups and other chat programs. Remote students of distance learning programs are able to (1) access all teaching material remotely through web services, and other Internet services, (2) communicate easily with instructors and their local student fellows, and (3) conduct remote experimentation, using expensive equipments on the campus, during their laboratory work.

Many universities in USA, Canada and West Europe such as Open Universities (e.g., in England), Stanford, UIUC, McgGill, and others, have extensive experiences in offering distance learning courses to remote students in other countries and utilize the advanced Internet and multimedia technology for appropriate interaction [1,2,7]. However, many top ranked universities have also reserved attitude about offering distance learning programs such as master programs to remote students in foreign countries [3]. In Eastern Europiancountries, the Internet-based distance learning programs are being setup only recently, although for different reasons and under different conditions when compared to USA, Canada, and West Europe. Having learned from past experiences of Internet-based distance learning programs at top ranked universities around the world, we present a design of an

Internet-based distance learning program for technical universities in Slovakia. We discuss the overall design process through the case study program, initiated at the Slovak Technical University (STU) in Bratislava.

The paper outlines in Section 2 the history of distance learning at STU in Bratislava. In Section 3 we present the goals, justification and implementation of the Internet-based distance education program at STU, and in Section 4 we discuss organization and business issues of the distance learning program . Section 5 concludes with leassons learned from other distance learning programs that will be seriously considered during the execution of the STU experiment.

2. History of Distance Learning at STU

Distance Learning at STU in Bratislava has a long tradition and history [4,5]. The first form of distance learning program started during the school year 1952/53 through the Resolution of the Slovak government about extraordinary forms of study, November 11, 1952. The department of Electrical Engineering at STU established the Consultative Center for Remote and Evening Study, which was directed by the Institute of Remote Study at STU. In 1956, the organization and control of the distance learning programs was moved from the Institute of Remote Study to the departments (to the associate dean for educational technologies).

The distance learning program took on three different forms:

- **Six years distance learning undergraduate study** (during 1983/84 this program was renamed to Distance Learning on the Job). The student was able to finish the first two years of study any time in consultative centers, established outside of the university.
- **Six years evening dstance learning undergraduate study.** This study was organized and possible for resident students on the campus of the university who worked during the day and took classes during the evening hours.
- **Three years specialized suplement distance learning study for teachers of secondary teachnical trade schools.** This program started in 1976/77.

All three forms of the distance learning program required that the students met twice a month with the instructor (Friday and Saturday), as well as at the end of the semester, they would go through laboratory exercises of courses that required experimental skills. The students of these distance learning forms used the same lecture material, such as books, papers, provided by the instructor, as the regular registered students on the campus. The last set of students who graduates via these distance learning program forms graduated in 1994/95.

3. Internet-based Distance Learning at STU

The goal of the Internet-based distance learning program at STU in Bratislava is to provide undergraduate bachelor degree to remote students outside of STU and Bratislava. There are several reasons for the demand of Internet-based distance learning: (1) For many students outside of Bratislava, the **cost of living** in Bratislava is too high; (2) There is an **acute shortage of professors and teachers** in technical disciplines at technical universities outside of STU; (3) The **cost of traveling** for teachers and students is very high; and (4) The **equipment budget**, universities receive from the Minis tery of Education, is very low, therefore sharing and remote experimenting with expensive laboratory equipment is neccessary. Hence,due to the reasons above, and due to the modern Internet-based technology development, which allows not only paper material distribution, but also interactive electronic communication (e.g., email, web service, multimedia conferencing) with remote students and remote experimentation with laboratory equipment, the distance learning program at a new level is neccessary in Slovakia. In 2001/2002, the Department of electrical engineering and information technology at STU[1] in Bratislava started to offer an undergraduate degree via Internet-based distance learning program in the area of electrical power engineering. The department plans to expand the areas and to offer an undergraduate degree in the area of automation in 2002/2003.

To implement successfully the distance learning degree programs in power engineering and automation, the STU set up three local centers for distance learning throughout Slovakia in Bratislava, Zvolen and Kosice six years ago. These centers were prepared and participated in the development of the technical infrastructure, needed for Internet-based distance learning. The material and technical infrastructure setup were strongly supported by international projects TEMPUS, PHARE and LEONARDO [6]. The centers gained alot of experiences by organizing various preparation courses for entrance exams in the area of mathematics, physics and chemistry, as well as provision of courses in industrial management.

4. Organization and Financial Support of Internet-based Distance Learning at STU

For a student to complete the undergraduate degree via the new Internet-based distance learning program, it is planed to take six years. The first two years of the educational plan are already clearly outlined, and plans for the next four years are in preparation. Long-time experienced teachers are contracted and are working on creating the electronic and traditional educational material for the Internet-based program. The requirement is to deliver the requested educational material to the centers one year before teaching of the course is offered[2].

The remote students receive advising and other help for their course work through Internet-based communication with the course instructors directly or through Internet-based communication with the teaching assistants assigned to the course. All teaching personel in the Internet-based distance learning program is contracted and the conditions for usage of Internet services when communicating with remote students are clearly defined, including financial agreements for performed activities.

The financial support for the Internet-based distance learning program comes from three sources: (1) **fixed cost** for creation of the teaching material, honorarium for authors/instructors, and financial support for acenter comes from the internal departmental budget, which is given to the department by the Ministery of Education according to the number of students (Undergraduate degree for every student is paid by the Slovak government), from sponsorship donations, and from international projects; (2) **variable cost** for written material, mail, telephone cost and others come from the students who purchase educational material; and (3) **other direct cost** for equipment, used in laboratories, comes from the departmental budget.

5. Conclusion

The Internet-based distance learning in Slovakia is in progress and it is now matter of time to show its successful path as well as lessons learned. The program was established on sound base of many experienced international programs[1,2,4,6,7], hence there is an optimism that this distance learning effort will (1) **save the living and**

---

[1] In Slovakia, the official name for the Department of Electrical Engineering and Information Technology is the *Faculty of Electrical Engineering and Information Technology*.

[2] The material, delivered one year ahead, is only conceptual material, not the final electronic delivery format.

transport cost of many new students, (2) **address the current shortage** of instructors and teachers at technical universities in Slovakia, and (3) **allow students to share** expensive and advanced laboratory equipment via Internet-based technologies.

6. References

[1] Quantum Master Degree Distance Learning Program, http://www.cs.uiuc.edu

[2] Distance Learning Program at Stanford University, http://www.stanford.edu

[3] Faculty Minutes about Quantum Program, January 2002, University of Illinois at Urbana-Champaign

[4] From bulb till Internet. Publis her: Slovak Technical University, Bratislava 2001

[5] Faculty of Electrical Engineering and Information Technology - Annual Report 2001. Edited by S. Milovska, Bratislava 2002.

[6] Local Center of Distance Learning, http://www.kar.elf.stuba.sk/lsdv

[7] Distance Learning Program at McGill University, http://www.mcgill.ca/distance

Putting the E to Work in E-teaching

John C. Nash
School of Management
University of Ottawa
Canada
jcnash@uottawa.ca

Abstract: We consider university teaching from a viewpoint of the activities in which students and professors engage while taking or giving courses. We seek to apply software and procedural tools to make these processes more efficient, following in general terms Deming-style process improvement. Our ultimate goal is to have technology that is so familiar and obvious that students and professors use it naturally without training. Tools we have developed or improved to date include homework submission (with identification and automatic routing by section), random "volunteer" selection (PICKSEAT), image grab and send, a simple web forum for consolidating student and professor contributions, and image consolidation and captioning. None of the above tools is new in concept, but we believe there are important benefits from the level of simplicity achieved.

Motivations

In teaching statistics to business students, we have found it highly effective to "teach from the back of the room", even in classes as large as 80 students. This tutorial style allows the professor and other students to witness mistakes or gaps in student background and provides an opportunity to correct the deficiencies. At the same time we show that problem-solving requires a willingness to learn from mis-steps. We would like to adapt this teaching style on the Web, especially if the sessions could be saved for replay as web-pages. To limit resource demands, we seek a low-bandwidth solution. We also want system components to be useful in themselves so that we can use developed software as soon as possible, in particular to deal with the province of Ontario "double cohort" (www.occta.on.ca/pdfs/ontdblcohort.pdf). The components described below may succeed even if the totality, named *E-tutor*, does not.

Consider the activities in which students and professors engage while taking or giving courses. From this viewpoint, we seek to apply software and procedural tools to make these *processes* more efficient, following in general terms Deming-style process improvement. "Efficient" in our context is measured by comparing the relative or marginal time, effort and resources needed to accomplish a given task in different ways. That is, we accept existing infrastructure as given and apply relative costings. Our ultimate goal is to have technology that is so familiar and obvious that students and professors use it without training and without taking particular note of it. Some of the tools we have developed or improved to date include:

- File uploading by students for homework submission and subsequent downloading or retrieval by the professor or teaching assistant. The software must modify file names to identify the student and also permit block download by the professor or assistant.
- Choosing a "volunteer" to solve a problem in class (PICKSEAT) in a way that is random so that there is no favouritism or victimization.
- A web forum to allow students to pose questions and/or answer queries by others (CO4).
- Image grab and send (ET-GRASED), needed to allow a student to communicate written or drawn material to the professor and the class, since at low-bandwidth we do not wish to use video.
- Simple web forum for consolidating student and professor contributions.
- Image consolidation and captioning.

None of the above tools is new in concept, but we believe the level of simplicity we have achieved – by efforts that belie that ultimate simplicity – has been worthwhile. Moreover, the tools are usable alongside or within other e-teaching systems and will be made available under an open-source licence. We intend that they be consolidated into the full Etutor system, which is the long-term objective. The design for Etutor was proposed by the author in 2000 and reviewed and assessed in early 2001 (K. Leblanc, 2001). An exchange of ideas with other practitioners, particularly those whose starting point is pedagogy, is welcomed. In the spirit of continuous improvement, we consider all our efforts to be in a state of development.

Experience to date

The School of Management has operated a simple file archive (called DocDepot) since 1999 which has proved extremely useful for supplying information to students on a full-time, 24/7, basis. It has been very popular among students. For example, it eliminates much of the concern about lost or misplaced course outlines or assignment documents, and saves students travel time and parking costs to obtain such materials. Indeed, the success of DocDepot has raised student expectations so that professors are essentially forced to put materials there. However, we still need better mechanisms for upload, control, and deletion of files by professors and others in a sensible manner.

DocDepot has allowed the posting of student work. Students may read and learn from others, and are encouraged to cite any ideas they use. Marks are *not* included, but students quickly judge which work is good. While not provable, we believe posting all work provides a brake on plagiarism. Work that we would term a "disaster" due to misunderstood assignments has largely disappeared. We have observed the incentive to excellence a couple of good papers provide.

Delivery of assignments is therefore an important task. In large, multiple section courses, delivering the student work to the right marker, with proper identification, is an annoying clerical task that creates many difficulties. Homework uploading, with proper sorting and identification, has proved very helpful, and much simpler than either email or diskettes. We have now used a simple file uploader in roughly twenty tasks across a variety of courses plus the first round of the 2001 National Advanced Technology Management Competition, where the competitors were geographically distant.

Students submit material in Adobe Acrobat format (PDF files). We provide documentation and links so such files may be prepared without the need to purchase the Adobe Distiller or PDF Writer. The major advantage of such files is that they are not dependent on the printer definition used in document creation. The marker reads the document (either on-screen or printed out) in the layout and style that the student prepared. Two particular features of our homework submission tool(s) are worth mentioning. One is that the student log-in provides the student number, and this is pre-pended to the filename of the submitted file so that "noname" assignments are not possible. The other is that the marker can choose to download all the submitted work for a given task as a zip file. This saves time during downloads.

Overall, both students and professor have been very happy with the submission tools. Students can work from home, saving time as well as travel and parking costs. The professor similarly does not have to travel to retrieve submitted homework. We found that the typical cycle time from submission of homework to reporting of marks to students dropped by a factor of three. Students had positive comments about this. To date, we have had very few technical problems. Indeed the major "glitch" concerned omission of student names from class lists provided by the administration, so a couple of students could not log in.

Students generally are reluctant to step forward to attempt the solution of a problem. To choose a volunteer" in a way that is random, PICKSEAT was developed. It requires the seat arrangement for each classroom to be set up as a simple character graph in an ordinary text file. If a chosen seat is empty, we proceed to the (professor's) right and then forward row by row until an occupant is found. The program is executed on the classroom display computer. Students seem to regard it as a sort of game, and acceptance has been smoother than anticipated.

Automated consolidation and captioning of images is useful in building some teaching and related materials. We first developed FOTOHTML for use in organizing family photographs in a large genealogical collection. We found it particularly important that the tool assist in verifying that both the image collection and caption list match properly. It is also helpful that the resulting HTML files each display a small number of images (default 10) so the files do not take too long to load in a Web browser.

Other tools are still undergoing tests, but we hope some results will be available by October 2002.

Methods and approaches

We have been developing two variants of the homework submission tools: ETPRL, a tool to handle just one assignment or task, implemented as simple scripts in the Perl programming language, and ETPHP, which is programmed in the PHP programming language and makes calls to the MySQL database system. So far, all experience has been with versions of ETPRL. A design requirement is that the system be very simple and obvious to use, that is, that the affordances of the user interface be intuitive (Norman, 1990 and 1992). For students such clarity has been achieved. The major deficiency discovered was that each task required a separate set of directories and files for both the programs and uploaded files, making setup awkard as well as inefficient of disk space. This is being rectified by the author and a new, streamlined version is undergoing tests.

The CO4 collaborative web forum was programmed in Perl for a Windows web-server by a student, Lawrence Taylor, as a course assignment. Using a general set of requirements provided by the author, he did an outstanding implementation. CO4 allows a set of users to collaboratively build a web page by inserting, adding to or editing sections. There are facilities to insert images or more general file links. The file display is set up to display only a few sections at a time to reduce the time to load the page. CO4 proved quite easy to port to Linux, but so far is lacking in access control. We intend to re-implement in PHP for easier maintenance.

All these tools are implemented using server-side scripts and a single cookie. They are largely unaffected by the firewall protections that were increased after September 11, 2001, while systems relying on client-side scripts have been blocked. Such systems include the WebCT e-teaching system, as well as Hotmail and similar email hosts.

Image grab and send (ET-GRASED) is a tool needed to allow a student to communicate written or drawn material to the professor and the rest of the class. This tool has been developed to the stage of proving capability. The client program is for Microsoft Windows only and written in Visual BASIC, while the server software is a script in PHP for Linux-based servers.

PICKSEAT is already available as a project within the sourceforge system (sourceforge.org) , while FOTOHTML can be obtained via a link from www.nashinfo.com. Both are written in Pascal; while Turbo Pascal was used for development, we believe Gnu Pascal will compile and run these codes.

Future developments

We plan to use ETPRL and/or ETPHP in courses led by professors other than the author, so that reaction and ease-of-use for professors and teaching assistants can be verified and, if necessary, improved. We also hope to launch some trial applications of CO4. PICKSEAT and FOTOHTML are already available to others, but we have had very little reaction communicated to us yet.

We decided very early in the design to release the "products" of the work reported under either the Gnu Public License (www.gnu.org) or similar arrangement. This means that others may use and improve the software, with resulting improvements themselves being available to others. To alert others to this work, and also to learn what choices are being made elsewhere, the author has actively sought to meet workers with similar interests. These exchanges, carried out during personal or professional travel, as well as by telephone and e-mail, have proved very helpful in refining ideas and in gauging the value of design choices. Very recently (April 2002), it has been possible to let such colleagues actually test prototypes of some of the tools. For the most part, the reaction has been exceedingly positive, but it has also revealed some potential improvements and possible "glitches" related to as-yet-unresolved issues with particular Web browsers on particular operating systems.

Conclusions

The tools described above have largely met their design goals. For example, the assignment uploaders have proven very simple for students to use, to the extent that they are almost "invisible". They shorten the waiting time for the professor or marker to receive student work, offering opportunities for quicker correction and assessment that students appreciate. There is also a reduction in the clerical effort of the marker to organize and file papers, especially if students have omitted identification. All the tools are small and relatively simple in design and implementation. Improvements are clearly possible and desirable, but at present we perceive none that require major reworking of the programs.

Acknowledgements

A Teaching and Learning Grant from the Centre for University Teaching of the University of Ottawa paid for programming by Patrick Suwalski and Markus Svilans. Lawrence Taylor and the author also contributed code. Woody Suwalski supplied the Rebel Netwinder server used in initial experiments of ETPRL, while the School of Management has provided innovation funds for the courses.gestion.uottawa.ca server that will be hosting ongoing tests.

References

Leblanc, Karen (2001) *e-TUTOR*, University of Ottawa, Faculty of Administration, macnash.admin.uottawa.ca/~etutor/k_leblanc.pdf

Norman, Donald (1992) *Turn Signals are the Facial Expressions of Automobiles*, Reading MA: Addison-Wesley

Norman, Donald (1990) *The Design of Everyday Things*, New York: Doubleday

Faculty Institute: A Model For Online Success

Susan Moak Nealy
Carl [illegible]rkins Programs
Northwestern State University of Louisiana
United States of America
nealys@nsula.edu

Darlene Williams
Coordinator of Electronic Learning
Northwestern State University of Louisiana
United States of America
darlenc@nsula.edu

Kathy Autrey
Assistant Professor of Mathematics
Northwestern State University of Louisiana
United States of America
autrey@nsula.edu

Abstract: This project was developed to provide a roadmap for setting up online courses. A series of workshops was designed to help instructors improve upon and expand their use of technology as an instructional tool. Topics included pre-course development, interactivity, converting a traditional course to an online format, assessment, and using web-based materials to supplement a traditional course. Through the use of a web resource, material from these workshops is accessible to anyone interested in developing an online course or supplementing a traditional course with online materials. As a result of this project, 43 of the 47 participants surveyed were more likely to supplement their traditional courses with Blackboard and 42 were more likely to participate in the development of an online course.

Introduction

As the leader of Electronic Learning in the state, Northwestern State University of Louisiana encourages its instructors to make course offerings available online and to integrate technology into traditional classroom courses. The goal of this project was to provide face-to-face and online support for instructors whether they were already working with an online or hybrid course (traditional classroom with online supplements), or just starting to explore these instructional media. While technical aspects of the program were based on a Blackboard platform because it is the platform currently utilized by our university, much of the information can be used with any electronic learning platform.

The Program

A cohesive program of five broad topics was identified as essential to electronic instruction. Six experienced faculty members were identified to present workshops as part of a professional development series on integrating technology and education. These peer mentors were all seasoned veterans in the area of electronic learning, including online and hybrid courses. Faculty members developed a workshop on their assigned topic. Presentations were not limited to a presenter's specific discipline but were developed to be relevant to all participants. Workshops included presentation, group discussion, and small group discussions. Participants were allowed to register for one to six workshops, dependent upon their interest and schedule. Each workshop therefore had to be an independent session but still fit into the overall program. All workshops were presented in the university's compressed video classroom and broadcast via compressed video to two of the university's satellite campuses to allow for broader participation. Two workshops were held each month for three months and a practice course was set up in Blackboard during that time for participants to review examples and practice what they were learning.

Upon attendance at their first workshop, participants began to build their Online Faculty Resource Manual. The manual consisted of a program binder with in-house printed materials for each session, as well as additional relevant materials (tips, guidelines, etc.) to be placed in the appendix. The manual contained a section for participants to add their own materials as well, to customize the resource so that it was useful for them.

Because participants represented a variety of backgrounds and experience levels, we knew their reference needs might vary. In addition to the resource manual, participants were allowed to select materials through an online bookstore that would meet their own individual needs relating to the integration of technology and instruction. The amount of resources available to each participant was based on participation in the series, at a maximum of $250 per participant.

Through the University's web site, a web presence for the seminars was created. Web Developers were contracted to build the template that was used as an interface for this project, making this important information available to educators worldwide. At Perkins Presentations, visitors can review the handouts for a particular session, the computerized presentation (if applicable), or the actual presentation itself. Each session was also preserved on compact disc and video cassette tape with a copy placed at each campus's library, so that anyone on campus could review the material without accessing the web site.

Session I encompassed Pre-Course Development. Participants were provided with checklists for starting a new course and continuing to present that course in subsequent semesters. Sample letters and other relevant items were also provided. Session II was entitled Converting A Traditional Course To Online Part I. This session reviewed the theory or "thinking" part of converting a traditional face-to-face course to an online version. Participants brought in a syllabus for one of their own courses and completed some of the exercises necessary to complete this process. Session III, Converting A Traditional Course To Online Part II, dealt with the "buttonology" of converting a course. This session worked extensively with Blackboard, the university's platform for online learning. Its goal was to take participants through the process, step by step, of loading lectures, tests, announcements, etc. The subject for Session IV was Building Assessments. Participants discussed matters related to online testing and evaluation, including minimizing academic misconduct and importing test pools into the university platform. Course Facilitation was the topic for Session V. Various electronic methods for increasing student communication and interaction were discussed. Session VI, Using Blackboard as a Supplement, was chosen as the final workshop. Participants were able to draw on the technical information presented in the first five workshops and see how to use it in a more limited, supplemental fashion.

The Results

Participants evaluated each session individually as well as the program as a whole. Of the 48 respondents who completed the evaluation process, 76% had 5 or more years of traditional teaching experience; 17% had taught for 1 to 2 years and 7% had 3 to 5 years experience. Twenty-three of the participants (59%) had no prior online teaching experience and 36% had no experience using technology as a supplemental tool in a traditional classroom setting. The majority of the participants were from the main campus (60.4%) and 45.8% attended all six sessions.

Although 7% of the participants surveyed were undecided, the remaining participants indicated a willingness to supplement their traditional courses with technology (specifically Blackboard) and 92% expressed an increased likelihood of developing an online course in the future. The resource manuals as well as the web site were found to be extremely useful tools as well as the opportunity to interact with other professionals who had already designed online courses and supplemental materials. Forty percent of the participants indicated a preference for more "hands-on" type sessions with specific examples of ways to incorporate the technology into the classroom. According to one participant, " . . . I would actually like to sit down in a lab and design an online class or shell with assistance from the gurus. . ."

The ratings from the individual sessions mirrored the overall program ratings. Those sessions that incorporated more technological skill were more highly rated than those dealing with other areas. This finding is in keeping with the high percentage of participants who rated their skill at the level of novice. More experienced participants rated the sessions highly as well; however, their concerns were more related to issues of evaluation and assessment of current courses and conversion of traditional courses.

Conclusions

Given these findings, future plans include the development of workshops for both novice and experienced individuals. These will include more opportunities for "hands-on" experience as well as opportunities to discuss issues related to specific disciplines. The overall concept is one of an online institute in which individuals would be able to choose from a variety of offerings based upon their specific needs.

Acknowledgements

The Project, *Northwestern State University: A Model For Online Success* was funded through a Perkins III Postsecondary Leadership Grant awarded by the Louisiana Community and Technical College System. Additional assistance and support was provided through The President's Office, The Graduate School, and Barnes and Noble Bookstore at NSU.

THE ISSUES FACED BY TRADITIONAL CLASSROOM TEACHING STAFF WHEN CONVERTING COURSES FROM FACE TO FACE TO ONLINE.

Jenny Newby-Fraser, Manager, Centre for Learning Technologies, Waikato Institute of Technology, Hamilton, New Zealand jenny.newbyfraser@wintec.ac.nz

Introduction

Wintec, a traditional face to face teaching institution, identified a need to move into online teaching (OT) and learning. Wintec teaching staff have a lot on their plate and converting some of their courses to contain an online component causes anxiety for many. The Centre for Learning Technologies (CLT) was established to support the institute's OT initiative. Its role is to work with teaching staff, (the content experts and content developers), and support them with project management, instructional design, curriculum development, WebCT technical and design issues.

As Rogers (1983) predicts, Wintec has staff at the five stages of motivation: Innovators, Early Adopters, Early Majority, Late Majority and Laggards. Approximately 70% of Wintec staff are in the Early and Late Majority categories and these cohorts are more conservative and averse to risk. Most staff are in the Early Majority category however and all need support, reassurance, motivation and guidance (Newby-Fraser, 2000). There are many issues associated with the introduction of OT. A previous evaluation by the author found human concerns, rather than technical concerns, came through strongly. Boettcher and Conrad (1999) state that, *"Change is difficult. It takes time, energy, resources and altered attitudes"* (p.12). This paper concerns itself with how such changes affect teaching staff.

Methods

The study was both qualitative and quantitative and involved 17 staff completing questionnaires incorporating the following 12 statements:

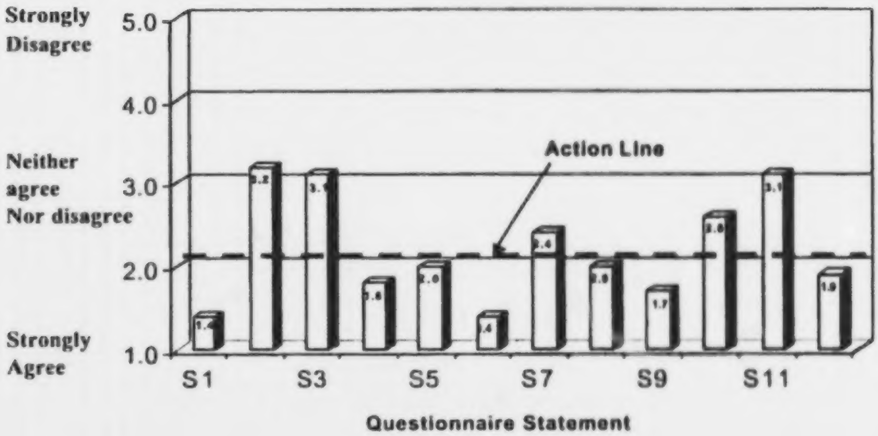
S1: I was given sufficient CLT support in the development of my online course.
S2: I was given sufficient time release to develop my online course.
S3: I did sufficient professional development to make me feel comfortable prior to starting OT course development.
S4: Converting my course to online has made me review my course content.
S5: Converting my course to online has made me review the content of my assessments.
S6: Establishing a sense of community within my online course is essential.
S7: Compared to face to face teaching my online teaching has been as effective.
S8: Taken overall I am satisfied with the online component of my course.
S9: I get a buzz from teaching online.
S10: Converting my course to online has affected my face to face teaching practice.
S11: After converting my course to online but before I actually taught it I felt comfortable about online teaching.
S12: After teaching my course online I felt comfortable about online teaching.

Each statement had a Likert scale (Strongly agree = 1 to Strongly disagree = 5) and provision for open comment and suggestions. Verification of the results of the questionnaire was obtained by asking a volunteer focus group outside the questionnaire group. Likert scales were analysed for their mean, median and mode. Those statements scoring above a mean of 2.0 were examined for future action.

Results

Of the 12 Statements regarding staff concerns during conversion of their courses to OT, the means of five statements (S2, S3, S7, S10, and S11) were above the 2.0 "Action Line" (Fig. 1).

Figure 1. Mean Likert Values of Evaluation Statements



In Statements 2 (release time) and 3 (professional development), a good proportion of staff did not agree. In Statement 7 (online teaching is as effective as FTF), although the mean was 2.4, the mode and median were both 2 and this indicates that scores were skewed below the mean. The mean may therefore be a slight overestimate of the average results. In Statement 10 (online has affected FTF), although the mean was 2.6, the mode and median were both 2 and indicates that scores were skewed below the mean. There appears to be a strong dichotomy of opinion among the staff on this statement as there is a gap between the majority of staff answers and the four staff who strongly disagreed. In Statement 11 (comfort prior to teaching online), both mean and median were 3.0 and the mode 2. This indicates that scores were fairly evenly distributed around the mean and the mean is a fair estimate of the average result.

Confirmatory Interviews

The three interviewees agreed in general with the questionnaire scores and comments. The only factor stressed more heavily by interviewees was the importance of course ownership.

Discussion

For change in delivery to be successful, the majority of staff must see some benefit from participating in a mixed mode delivery initiative, e.g. Release-time, technical and pedagogical support, professional development, promotion opportunities. (Newby-Fraser 2000).

Greater release time (a precious commodity) is a clear staff need. I agree with Oblinger (1999) that, a mixed mode initiative cannot be successful unless a substantial portion of mainstream staff buy into it. Without release time, they won't buy. Ideally, staff should have release time from some of their regular teaching commitments to work on their course redevelopment, or development, on negotiated allocated days in the CLT.

Then there is the issue regarding the time allocated for OT, although perhaps this is only an issue the first time it is taught, and perhaps it is highlighted if the course design is inappropriate.

"I did not realize the amount of time I would need, never having done this before. I did not allow time to learn about "how to manage" the course."

Staff do need to learn new skills to facilitate online teaching (Vardi & Bunker 2001).

Both the scores and comments in Statement 4 confirmed that much of the release time staff have been given for OT development is spent changing their content and updating their material. Although much of this work needs to be done for their FTF teaching, for a number of reasons it often does not get done. Staff comment on how much easier it is to "fly by the seat of your pants" in a FTF class than it is online. In the online world materials need to be prepared well beforehand. It is important for staff, and management, who

BEST COPY AVAILABLE

are planning on course delivery redevelopment to know that staff need time to do this. It will be interesting to see if these figures change over time as staff become more familiar with OT. One of the interviewees highlighted the formative assessment tools (eg. quizzes, matching exercises, cloze procedure) that are used increasingly by staff who teach the lower level courses. She commented, *"Self-marking more immediate."*

The results also clearly indicate that staff need more professional development in the online world. Successful online teaching and learning depends on teachers acquiring new competencies. Staff need to learn how to facilitate online, to learn new competencies in designing effective online learning environments and facilitating online (Palloff & Pratt, 2001) however many of the respondents would agree that many of these competencies are the same no matter what the mode of teaching.

The strategies and techniques staff use in their FTF teaching remain very relevant. *"Good teaching, is good teaching."* (Ragan, 1998,) Staff were asked to list the qualities of an effective online teacher and they provided a very long and comprehensive list. They believe that the requirements of an effective online teacher are actually a subset of effective and competent FTF teachers (Newby-Fraser, 2000). As one staff member commented, they were,

"*Willing to try a variety of delivery methods based on recognized teaching theories and practices.*"

Staff need to learn how to communicate and facilitate online. Students too need to learn how to communicate online, however they can be guided, facilitated, supported into this through thoughtful course design and teaching. We are mindful that student satisfaction depends more on the quality and effectiveness of the instructor and the instruction than on the technology (Johnson, Aargon, Shaik, & Palma-Rivas, 2000). One staff member who hadn't done any professional development commented,*"I did not know what I did not know!"* I think staff need to experience being an online student themselves. For a reflective practitioner this is a very valuable experience to have.

The results show staff are aware of the importance of a sense of belonging among the students in their course. *"Fruitful learning experiences don't happen by chance"* (Kimball, 1995) cited in Murphy & Cifuentes (2001, p.297). To build an online community, groups must share who they are *"as people...to build that container of trust"* (Pallof & Pratt 1999, p.7). On a sense of community some staff commented,

"Essential for student interaction and discussion. This is time consuming but very important".

The staffs' perception of the effectiveness of their OT in comparison to their FTF teaching (Statement 7) scored a mean of 2.4. Wolfe (2001), a Wintec midwifery online teacher, commented on the *change of roles* for her with OT. In the FTF classroom she is often the most "active participant" and enjoyed the various roles "teacher, director, organiser, actress". Online she found her students often interacted with each other, expanded on ideas, shared online resources and sometimes almost excluded her! Becoming an online teacher for many has been quite a learning curve. This is well documented in the literature.

"The role of the instructor is still key but changed." (Harasim et al, 1999, p.9).

Overall, staff were happy with their OT efforts and some wanted to take their OT to greater heights:

"It has been challenging but has reinforced the basics, especially of planning, of good teaching practice. The feedback from students confirms this."

Most staff got a buzz from OT. Harasim *et al*. (1997) agrees and says teaching staff should be motivated sufficiently to start online conversions and satisfied when they are finished. I was very interested in knowing if teachers who enjoyed being in the FTF classroom with their students still felt that same excitement when working online with them. Generally from these results there seems to be an energy, excitement, and motivation related to teaching online, even when staff are unhappy about release time (not enough of this) and professional development opportunities (not enough of these). It appears therefore that staff who enjoy traditional FTF classroom teaching also enjoy working in the online classroom. It is the challenge and also the opportunity to extend themselves into doing something different.

In FTF teaching we get our "buzz" from being in the classroom among students. As two staff members put it,

"I just love it!"

"Definitely gives a sense of satisfaction. Ability to quickly change online notes."

Although the scores of Statement 10 indicated a dichotomy among staff opinion on whether OT affected their FTF teaching, based on qualitative comments alone, I perceived staff strongly agreed that it did.

"*I have found that having to change material for online has made me look ahead in my face to face teaching - look at the effect of what I do.*"

"Positive spin-offs for your teaching generally."

Many staff definitely felt anxious before delivering their OT course. This was expected because the majority of staff participating were "first-timers" in converting courses to OT. Perhaps more professional development would help alleviate some of this anxiety although anxiety levels related to teaching online dropped markedly after staff had actually taught online. This is in line with what many experienced OT teachers say about OT, and indeed I would say about FTF classroom teaching. After we have taught a course once we are much more comfortable. One staff-member encapsulated it nicely:
"It is always stressful trying something new."

The study confirmed that: human aspects are the main concerns of Wintec staff; release time and staff professional development need further attention; and with knowledge of the specific causes, apprehension in teaching staff can be minimised. Technology issues take a back seat. I agree with Epper and Bates, (2001,) *"Probably the most important finding from the study is that best practice institutions keep their focus on teaching and learning issues and not on the technology itself" (p.144).*

References.

Boettcher, J.W., & Conrad, R. M. (1999). *Faculty Guide for Moving Teaching and Learning to the Web*. C.A: League for Innovation Community College.

Brandon, P.R. (1998). Stakeholder participation for the purpose of helping ensure evaluation Validity: Bridging the gap between collaborative and Non-collaborative Evaluations. *American Journal of Evaluation, 19*(3), 13.

Epper, R.M., & Bates, A. W. (2001) *Teaching Faculty How to Use Technology. Best Practices from Leading Institutions*. Westport CT: Oryx Press.

Harasim, L. Hiltz, S.T. Teles, L., & Turoff, M. (1997) ***Learning Networks. A Field Guide toTeaching and Learning Online.*** Cambridge Massachusetts. The MIT Press.

Harasim, L. (1999). What are we learning about teaching and learning online: An analysis of the virtual u field trials. Conference Proceedings. International Distance Education and Open Learning Conference.

Murphy K., & Cifuentes L. (2001). Using Web Tools, Collaborating, and Learning Online. Distance Education 2001, Vol. 22, No 2, pp. 285-305. ODLAA Inc

Newby, M., & Fisher, D. (1997). An instrument for assessing the learning environment of a computer laboratory. *Journal of educational Computing Research,* 16,179-190.

Newby-Fraser, J.B. (2000). A New Zealand Polytechnic's Implementation of New Learning Technologies: A Human Perspective. Paper presented at Learning Technologies 2000 Conference. Noosa, Queensland, Australia, 25-28 October 2000. http://www.videoling.qld.edu.au/

Palloff, R., & Pratt, K. (2001). *Online learning in the New Millenium. Lessons from the cyberspace classroom: Realities of online teaching*. Jossey-Bass. San Francisco.

Ragan, L.C. (1998) Good Teaching is Good Teaching: An Emerging Set of Guiding Principles and Practices for the Design and Development of Distance Education. DEOSNEWS Vol. 8. No 12. http://www.ed.psu.edu/ACSDE/

Rogers, E.M. (1983) *Diffusion of Innovations*. New York: The Free Press.

Vardi, I. and Bunker, A. (2001). The Relationship Between the Perceived Value of Supplementary Online Components, and Student Roles and Responsibilities. Conference Proceedings, ASCILITE 2001, Melbourne.

Wolfe, E. (2001). The Oldest Profession in the World – Online. Learning Technologies Conference. "Surviving the Odyssey". Noosa, October 2001.

Single–click Interactive Java Programming Tutorials on the Web

Jan Newmarch, School of Network Computing
Monash University, Australia, jan.newmarch@infotech.monash.edu.au

Abstract: Teaching programming is often best done by running and demonstrating programs, both by instructor and student. Programming environments are often very complex, and may hinder understanding of a lesson that does not involve the environment. This paper describes how the environment can be hidden, so that program compilation/execution is reduced to a single–click from a Web page. Programs can be modified within a Web page and re–executed again with a single–click, improving prospects for experimentation and student–centred learning.

Introduction

One of the major features of the Web is the ability to follow links to a wide variety of content using a single–click. This feature has proved so desirable that ecommerce models built on "single–click purchases" have even been patented.

The Web has been used for conveying teaching materials, and there is a huge literature on the courseware available on the Web (previous WebNet or any other Web conferences such as Asia–Pacific Web have conference sections devoted to the use of the Web for education). A large amount of this literature is concerned with techniques and application of learning models for structuring the courseware so that single–click navigation is profitable. Some literature uses plugins of various kinds (such as ShockWave) to deliver certain effects judged to be of educational value.

Computer programs are represented statically, but can only be understood by dynamic execution. Teaching programming is often regarded as a laboratory subject due to the need to run and to experiment with programs. Courseware on the Web (as with other media) is unable to aid directly in this, and there is often a means of accessing complete working programs, either by cut–and–paste or by FTP downloads.

An experienced programmer will not have difficulties in copying and pasting example programmers into their favourite programming environment, and will put up with various arcanities such as the Java main() method in order to play with new concepts.

The novice on the other hand faces a large number of difficulties just in dealing with any programming environment

- how does the editor work?
- how are individual programs or projects of many programs dealt with?
- how are programs compiled and linked?
- how are programs run?

It is common for the first few weeks of any introductory course to concentrate of getting students familiar with their local environment (such as an IDE or Unix command line tools). Educational systems such as BlueJ for Java (Barnes, 2002) are often used to try to remove as many enviromental issues as possible to allow concentration on pedagogical issues only.

This paper reports on a project to aid in learning Java by offering single–click compilation and execution of programs displayed in Web pages. The programs are given in TextArea's within browsers so that they can be displayed and edited (for experimentation). A single–click then delivers these to a server where they are compiled and the class files returned to the browser to be run as WebStart applications (webstart, 2001). The editing environment is familiar to users from previous experience with forms, while the compile and execution environments are hidden.

Previous work

In (Newmarch, 1996) we reported on a scheme to allow C programs to be displayed in a browser, edited and then compiled and run back on the browser side. There are many security and trust issues involved in this:

- If the browser can edit and send a file to a server, then the server will not want to perform any potentially dangerous operations such as executing code from an external source. Certain operations such as compilation may be safe, but execution may not be
- If the browser receives code from a server, then it must trust the server before it should execute it
- Any messages between internet nodes can be tampered with, so should be signed if there are possibilities that hostile code may be introduced by a third party

In addition, there are many environmental issues. Simply, C code is usually compiled to code native to a particular processor, and is not portable between either processors or operating systems. This generally means that compilation and execution must be done on the same machine. This machine would either be the server (too risky) or client.

The scheme used in Newmarch did solve the problem, using proxy servers running on each browser machine. It used a security exploit on the servers that made them execute code locally rather than transmitting it. This was extremely complex to set up, required administrator access to student machines, and was fragile in use. The scheme was used successfully for a few years, and then broke due to an unknown cause and could never be made to work again.

During the period in which it was working, both I in my lectures and students in labs used the mechanisms extensively. One click live demonstrations of programs proved very effective, especially when they could be edited in place to show variations, re–executed with just another click.

Requirements of single–click execution

A program needs to be displayed in a browser or plugin called from the browser and executed locally. Intermediate steps may involve compilation to executable or intermediate code, and may or may not involve round trips to a server.

Local execution means that the program must be run on the same machine as the browser, preferably in the same execution environment as the browser. It should be possible to interact with a program using keyboard and mouse. These rule out a number of possible technical solutions such as remote execution or using a proxy running as a different user.

Local compilation and execution may be preferable for client–side security. However, the variety of possible compile and execution environments makes this infeasible for all but the most common interpreted environments. Programs in a language such as C, with a multiplicity of compilers, need a high degree of local customisation. Languages with platform independent intermediate forms such as Java and Emacs Lisp can be compiled on servers and delivered to local platforms for execution (once the location of the local interpreter is known).

Execution of all but the most trivial programs will require access to local resources, and this may be problematic for security reasons. For example, a Java applet cannot be used to demonstrate file I/O using the standard applet sandbox security model since file I/O is disallowed under this model. There are weaker forms of the sandbox model that can be used in recent versions of Java. This requires trust in the executing code, and this trust must be present for all other possible solutions.

WebStart

The Java Network Launching Protocol (JNLP) is designed as a way to download and run Java applications by clicking on a particular kind of URL. URL's with extension .jnlp are associated in a browser to a helper application webstart. A JNLP file contains information about jar files and any other files (such as appropriate version of the Java runtime) required to run the application. The helper checks local system resources and downloads any required classes or resources before starting the application.

JNLP allows a one–click method of downloading software and running it locally. It takes care of ensuring that dependencies are met and a suitable runtime is present. It will download just the minimum to ensure this.

It has a security model that restricts code to a sandbox model unless the code is signed, in which case it may be allowed to run with no restrictions. This is a very coarse–grained security model, with far less options than are allowed with the Java 2 security model. The options are not appropriate for Jini code, for example, which should often run in a "sandbox with networking". Nevertheless, the all–permissions model does allow trusted code to run and do interesting things locally.

Interactive Web programs

By combining the ideas from our earlier work with WebStart, we can get a one–click interactive environment for demonstrating Java programs. The "compile once, run anywhere" property of Java means that most of the complications of languages that compile to native code can be avoided. The one–click environment is built from the following components

- A TextArea is used to display a Java program within an HTML Form. This can be edited to demonstrate variations, or submitted as is
- Form submission calls a CGI script/servlet/etc on the server which attempts to compile the program
- Errors are reported back in text/plain format
- A correct compile results in generation of a signed jar file containing the compiled classes
- A JNLP file is returned to the browser, which needs to be configured to hand this to a WebStart helper
- The WebStart helper uses the JNLP to download any needed files from the server
- The program which originated from the browser is then run in the browser's environment, allowing full user interaction

Engineering aspects

Lifetime

The Java source files are extracted from the Form data, compiled and used to create a jar file. Essentially, this is an atomic action, and after creation of the jar file the source and class files are no longer needed.

A response can then be sent as a JNLP file back to the browser, which references the jar file. The browser will call WebStart which will fetch the jar file after checks on the local system. After this, the jar file is no longer required on the server.

Managing this bumps into the standard web problem of stateful access in a stateless system. The response of a JNLP document ends a request session from the browser, and the interaction between WebStart and the server is a separate session. The current implementation handles these issues in the following manner

The "atomic" operation of creating the Java source files, compiling them, building the jar file and deleting the source and class files is protected by a file lock

The jar file is given a unique name for each session, and this jar file is stored persistently in the file system

After some "reasonable" time it can be assumed that WebStart has fetched what it needs of the jar file, and it can be deleted. This is similar to a cookie "timing out" and releasing a resource on the server

Visibility

To illustrate a programming concept it may not be necessary to show a full program. A couple of classes, or perhaps just some methods of a class might be enough. The current implementation uses the class as minimum unit. That is, one or more classes can be shown in TextArea's for editing. This may not be enough to actually run a program, and additional classes may be needed.

These may be included in two ways

- as hidden fields within the Form
- as references to jar files held on the server

Non-GUI programs

WebStart makes the assumption that downloaded programs use a GUI interface. This is not in the specification, and is just ignored as an issue. The Sun implementation of WebStart just discards I/O involving System.{in,out,err}. Other possibilities might have been a flag within the specification to include this environmental possibility, or to have an equivalent of the Netscape "Java Console" to handle this form of I/O.

There are many situations where one might want to avoid this assumption

- A lesson on a basic topic such as Vector would not want the complication of GUI code
- Some versions of Java – the J2ME restricted environments – do not even have the AWT or Swing classes
- Lessons on the JDK1.4 new I/O classes may not want GUI code complicating things

Objects such as System.in are declared final and so cannot be reassigned directly. However, there are methods such as System.setIn(...) that can be used to reassign these objects. Using these methods, it is not too hard to build a "GUI wrapper" that consists of a Text or JText with I/O linked to System.{in,out,err} by pipelines. The wrapper can be used as the main controller from a hidden field so that it need not be visible to the student.

Results

I currently teach a subject "Distributed Programming using Java". The Web lecture notes for this subject are being modified to allow one-click execution of programs (after WebStart has been installed). A sample lecture is at http://jan.netcomp.monash.edu.au/distjava/socket/lecture.html

Using this, it is straightforward to demonstrate even multithreaded and network programs using clients and servers, and modify the code in place. The subject will next be taught in August, and usage of this will be monitored throughout the teaching period.

Conclusions and future work

A system is running and is being used to modify existing teaching material of the author. Some parts of the online Java Tutorial are also being modified (in private copies) to demonstrate that this system is not tied to a particular teaching style.

There has been substantial work done on a teaching environment called BlueJ. This is a standalone system at present. Investigations are being made into integrating BlueJ and WebStart technologies to allow Java courseware on the Web to be imported into the BlueJ teaching environment.

References

Newmarch, J.D (1996) Client-Side Execution of Programs Proc AusWeb96, Southern Cross University

Barnes, D.J (2002) *Objects First with Java*, Prentice-Hall, 2002

WebStart (2001) Java WebStart, http://java.sun.com/products/javawebstart/

Building a Hybrid Learning Community

Submitted by Thanh Nguyen

As email, synchronous and asynchronous threaded discussion boards have increasingly become important communication tools for students and teachers, building a hybrid learning environment plays a critical role in enhancing student learning. "Hybrid" is the term commonly used nationwide to describe courses that combine face-to-face classroom with computer-based instruction. Activities in a hybrid course could be a mixture of Web-based and face-to-face discussions, or virtual classes where students could upload and share their works online before presenting theirs to others in the face-to-face learning environment. Also after their presentations, others could review their works for feedback. Because a hybrid learning environment allows students to have more time in giving their opinions, students could express their thinking and learning without being limited by their shyness or learning disabilities. For example, a near-blind student could take the time needed to read others' responses, or an English as a Second Language student could take time to understand other's writings.

Teaching with a hybrid format allow instructors not only having activities for usual face-to-face meetings, but also uploading a course syllabus, files, assignments, PowerPoint presentations with voice and sound recorded, streaming videos, posting grades and tracking student works. The instructors could make announcements or send messages to each or all students through the message board. Once class information was uploaded onto the class website, instructors would know for sure that students could get access to the information without worrying about student's losing their works or instructions. Using this hybrid format, students can take more responsibility in their own learning. For example, they can upload their assignments onto the course site, share their work with the class or with members of a work groups at their choice, or can search the web and email each other directly using clickable email aliases embedded in the course pages.

The threaded discussion forum allow instructors to check on students' knowledge through conversations exchanged on the forum or from topics covered through reading assignments. Best of all, the discussion forum allow students to share ideas with other students in class, extending the work during in-class discussions. Here is what students say:

- I enjoyed using the threaded discussion board for various reasons. It helped to create a thoughtful dialogue as each person carefully thinks over their answers. I enjoyed hearing from each of my classmates. My classmates writing often give me something to respond to in my writing. Sometimes I feel like it was kind of impersonal since I couldn't always connect the writing with the actual person in the room. Overall, however, I think it is a successful tool.

- I have really enjoyed having access to this online site where the class can find information, share ideas, contact our classmates etc. It is something new and I enjoy exploring its different features.
- I really like typing my responses and reading the comments of my classmates. First, I like that I don't have to do some extra journal before class. I like coming and applying what I read. It helps me see if I understood it after awhile and also serves as a refresher for the class discussion. I like reading everyone else's comments as well. They are written highly intelligently and sophisticated. I find I get more out of my classmates written and synthesized thoughts than if we just had an oral discussion. In an oral discussion, not many people talk and those that do always talk. It's nice to hear shy people's thoughts as well as boisterous ones, because they are all very important and have contributed significant insights to me.
- I think the threaded discussion board has worked fairly well -- it gives everyone in class the opportunity to express his/her opinion thoughtfully and everyone has a chance to be heard. Too often, one or two voices dominate class discussion but the online discussion eliminates that problem.
- I like this web-based environment as a tool for this class. It is convenient to get assignments online and respond to discussions online. As far as learning, I can't say that I've learned a completely new concept but it adds a new dimension to the course.

Technology Leadership Academy

The Technology Leadership Academy is a project funded by the U. S. Department of Education's *Preparing Tomorrow's Teachers to Use Technology* (PT3) Initiative. The mission of the Academy is to develop a collegial network for the infusion of technology into teacher preparation within the four-state area of Kansas, New Mexico, Oklahoma, and Texas. Academy partners include the higher education community, state agencies involved in teacher education, and the corporate sector. This presentation will showcase how the Academy has developed an online learning community for technology infusion and how faculty members can create this collaborative environment at their universities and in their regional areas to elevate faculty teaching and improve adult learning. Additionally, the Academy's online tutorials for faculty development will be highlighted.

The mission of the Technology Leadership Academy, a component of the Technology Leadership Institute, is to develop a learning community among teacher preparation programs. During the past three years it has grown from an abstract concept to an organization with around 450 members within the four-state area of Kansas, New Mexico, Oklahoma, and Texas. The Academy's membership throughout the world spans to 2,000 members. From the beginning, the goal was to build a collegial and collaborative organization to provide mutual support and sharing of resources in the challenging task of infusing technology into teacher preparation. The first organizational meeting, hosted by The University of Texas in January 2000, was attended by key officials from 85 universities and state educational agencies from the four states. Activities included: finalizing the Academy's organizational structure; establishing priorities; dividing into task groups (each concentrating on one aspect of the Academy's mission); nominating chairs of each Task Group (to serve on the Steering Committee and oversee the Task Group's functioning); and identifying a set of directives and recommendations for the Task Groups.

The Steering Committee, comprised of deans, faculty and technology directors, provides direction and oversight of the Academy's activities and meets several times a year to review progress and discuss future plans. There has been a shared responsibility in the development of the Academy, even though the distance across these institutions makes this task even more challenging (and yet so rewarding).

Each Task Group is chaired by a Steering Committee member and consists of volunteer faculty or staff from the member institutions and state educational agencies. Each Task Group is responsible for determining and coordinating its specific part of the Academy's functioning. Eight Task Groups emerged from the organizational meeting of the Academy. These included: Assessment and Planning, Academy Web Community, Consultants Database, Fall Institute, Policy and Leadership, Professional Development, Regional Conferences, and Technology Integration. Last year, the Academy formed a ninth committee, the Digital Equity Task Group, to ensure that the other eight Task Groups were addressing digital equity issues in their efforts.

The Academy facilitates an online tutorial process to provide on-going professional development opportunities. The Academy Web Community Task Group has developed a Faculty Mentor and Faculty Subject Area Mentor. These projects are unique resources that use a question and answer format to allow faculty members access to relevant online faculty technology professional development resources, models, and research. The Subject Area Mentor has four content area components: English-as-a-Second Language, Mathematics, Science, and Social Studies.

Academy members are represented on the Educational Technology Coordinating Council which developed the State of Texas Master Plan for Educational Technology 2000-2003. The mission of the ETCC is to ensure the cooperation and coordination of the state's efforts to implement education technology initiatives. The State of Texas Master Plan for Educational Technology is aimed at pre-service and in-service training in technology integration for teachers and librarians. The Master Plan includes eight goals and objectives which identify the organizational infrastructure and data requirements necessary to measure successful implementation. Included in the goal descriptions are definitions, levels of impact, lead agencies, participating agencies, objectives, limitations, and due dates. One of the most significant sections in the Master Plan recognizes 12 Recommendations which serve as an implementation plan for achieving statewide collaboration for educational technology.

Although competition within universities can be used in a positive manner, the focus of the Academy is to instill close, working relationships among and across institutions. The Fall Institute, the Academy's annual conference, is an activity used to accomplish this goal. Teams of 3-5 individuals from member institutions participate in a 3-day conference focused on infusing technology into teacher preparation programs. Academy members also participate in organizing Regional Conferences on member campuses to strengthen the face-to-face component of the continued attempted by the Academy to provide a structure that fosters community and resource sharing.

The Academy has devised a project to recognize outstanding faculty members who are effectively infusing technology into the curriculum. The purpose of the Consultants' Database is to develop a comprehensive listing of faculty with expertise in various areas who have agreed to be featured on the Academy website in a biweekly segment and to be part of a database of resources.

This session will be an interactive experience, whereby mutual benefit will exist between participants, between the participant and the presenter, and vice versa. The following objectives guide this session:

For participants to

1. Become familiar with the mission, goals and objectives, and components of the Technology Leadership Academy;
2. Participate in a discussion regarding issues involved in building an online learning community;
3. Learn about the process that the Academy took to develop this community (discuss benefits and challenges of certain strategies taken);
4. Contribute ideas on how the Academy can reach more faculty members.

Our overarching goal is for the participants to share ideas with the presenter on how to encourage more faculty members to become involved in the Academy and how to continue to meet our members' needs.

Please visit the Academy website at http://www.edb.utexas.edu/academy

Online Learning 'Assumes' Online Delivery Skills

John O'DONOGHUE – Senior Research Fellow

National ICT Research Centre for Education, Training and Employment
University of Wolverhampton.
Shropshire Campus
Telford TF2 9NT
UK

j.odonoghue@wlv.ac.uk
Voice: 01902 323854
Fax: 01902 322836

Abstract

Research suggests that education needs to embrace IT, use it to provide quality, flexible teaching and learning. In order to be competitive the organisational structures need to reflect the environment, this meansa change from the rigid, inflexible internal/stable structure. Findings suggest that, technological developments will change the role of the lecturer.

The expectations and learning styles of students and staff are increasingly diverse. Learning is regarded as a lifelong activity. Distance learning is becoming commonplace. Increasingly there is an emphasis on lifelong skills.

The solution is simple! Introduce technology, video conferencing, labs of PC's with powerful software. Significant investment has been made in technology within Education to enable students to use a very powerful computer to word process assignments and 'surf' the Net! Staff are little better, intrigued or disillusioned with video conferencing, seeing it as 'glossy' or at best futile in the context of learning delivery. This paper considers some of the issues raised and addressed by the development and implementation of our own in-house Virtual Learning Environment.

It is often said that we are entering or even part of the Information Age. This coming period could equally be called the Age of Learning: The sheer quantity of learning taking place in the world is already many times greater than in the past. For example, not very long ago, and in many parts of the world, young people would learn skills they could use in their work throughout life. Today, in industrial countries, most people are doing jobs that did not exist when they were born. The most important skill determining a person's life pattern has already become the ability to learn new skills, to take in new concepts, to assess new situations, to deal with the unexpected. The competitive ability is the ability to learn. Information technology, from television to computers, affords an opportunity to enhance the learning experience.

Children have seized this opportunity, they have entered a passionate and enduring love affair with the computer. What they do with computers is as varied as their activities. The greatest amount of time is devoted to playing games, with the result that names like Nintendo™ have become household words. They use computers to write, draw, to communicate, to obtain information. Some use computers as a means to establish social ties with other cultures, while others use them to isolate themselves.

However with all the technology and the ability to access it where or what has changed, in terms of a teaching and learning environment. If a party of time travellers from an earlier century descended on us what would they see. If they consisted of surgeons and teachers. The surgeons, irrespective of their competence, might recognise that some operation was taken place, but there would have no idea of the environment, or the technology or of the strange devices and tools which the present day surgeon would be employing. The rituals of antisepsis and anaesthesia, and even the bright lights, would be utterly unfamiliar to them. The teachers would respond very differently. They might be puzzled by a few strange objects, and there will be some debate about standard techniques which had changed, but would be reasonably comfortable with what was being attempted and may even be able to take over the class. This is particularly true of some of the more traditional subjects.

Why, through a period when so much human activity has been revolutionised, have we not seen comparable change in the way we help people learn?

To date, classroom enhancements have replaced traditional apparatus rather than the process or didactic model of teaching:

⇒ The chalkboard replaced the slate;
⇒ the whiteboard replaced the chalkboard;
⇒ the OHP replaced the whiteboard;
⇒ software (Microsoft PowerPoint™ et al) replaced the OHP

Teachers/ lecturers felt comfortable with these changes as they were replacing the quill with the keyboard, the delivery mechanism, process and interface was essentially the same. So how to progress, there is a need to enable staff to consider the pedagogic implication of the on-line learning environment rather than the content.

The Internet potentially provides an opportunity to change all this.

According to Graziadei et al (1998), in order to implement and sustain remote, distance based computer mediated courses with a high probability of success, the following should be considered as the critical areas:

- enhancing/extending autonomous learning and productivity in the face-to-face traditional classroom setting
- creating a Web-presence with easy access to 'basic' information about online courses and interactive learning materials
- discovering/developing tools and standards to support new learning environments
- advancing our understanding of the virtual and distance university
- increasing community/off-campus access to the teaching-learning community
- providing evidence of the viability of these concepts

Staff are currently being asked to develop material for on-line delivery. This is an anathema to them. Not because of any motive other than competence in the pedagogy, technology environment etc. They generally teach the way in which they have been taught. As tutors they feel in control of this environment of physically teaching students, they are 'happy' with the quality and control and standard of the 'interface'. To introduce another medium is quite threatening and may well affect the quality of the experience.

If I could elaborate. I personally feel that something such as video conferencing (VC) is not as successful as perhaps it ought to be due to the 'tablet looking for something to cure..' syndrome. Have we developed a real use for VC? I would suggest not, so we create environments where VC can be used. This is surely not the thing to do. From my own experience setting up e/mail in schools for pen pal use failed miserably. This was because I introduced e/mail and then something to do on it...However I rapidly learnt a lesson. In a number of other schools I introduced the staff to e/mail and provided an opportunity for them to exchange pictures/ letters/ curriculum ideas and projects. These were via e/mail and more traditional means of communication. These teachers then developed local, regional, national and international databases and information exchange systems, the important fact being that *they* exchanged, *they* decided, *they* owned, developed and delivered. I provided and enabled a platform for them. The issues are about how teaching and learning are perceived within the organisation.

However we must maintain quality within our content and delivery. According to the literature, quality is concerned with meeting a defined specification(s). Clearly then, for learning to be considered as quality learning, it must also meet prescribed and accepted criteria. Nightingale and O'Neil (1994: p. 54), suggest that the indicators of high quality learning having taken place are:-

- being able to discover knowledge for oneself
- long term retention of knowledge (implying that there is understanding)
- being able to perceive relations between old and new knowledge

- being able to create new knowledge
- being able to apply knowledge to solving problems
- being able to communicate one's knowledge to others
- wanting to know more

But, they add the caveat that it is only possible to achieve this specification where certain pre-requisites for quality in learning are in existence:-

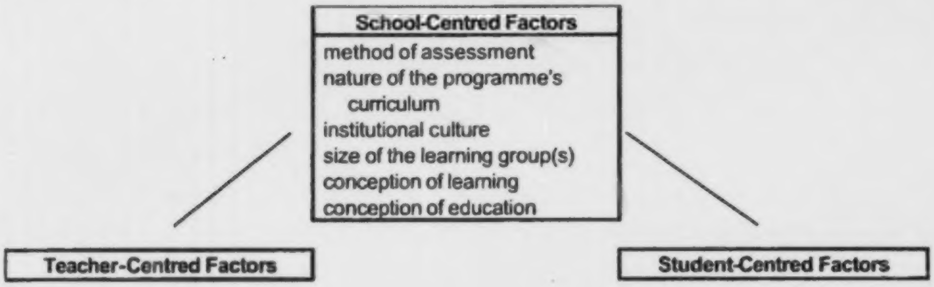
- the learner is ready to meet the demands of the learning task(s)
- there is a reason for learning (acceptable reason, to the student)
- the learner is active during learning
- adequate support is provided by the environment in which that learning occurs

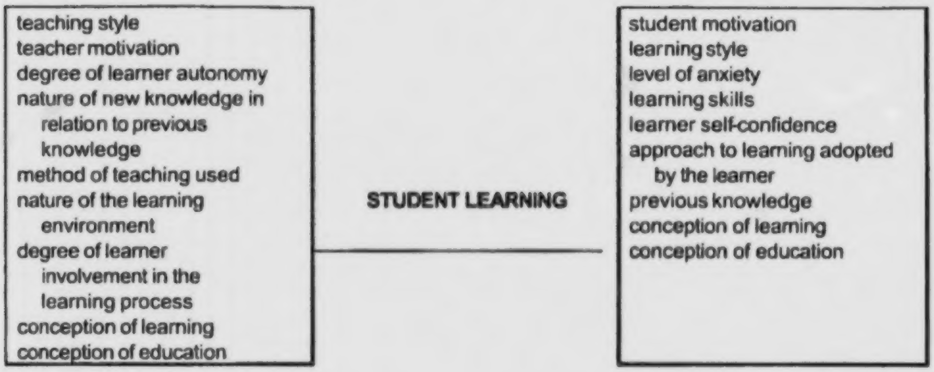
The adoption and implementation of such a model by staff in developing for an on-line delivery platform or for an on-line supported delivery platform will require a greater understanding of both the learning process itself, and also the most appropriate means to facilitate that process (O'Donoghue et al, 2001). This understanding is a pre-requisite for effective course design. But, I would suggest that at present, part of the problem is the differing conceptions held by academic staff as to exactly what; a) learning is, and b) what on-line facilitated learning is. But perhaps more importantly, future developments in course design, structure and delivery will continue to be at best misguided, and at worst potentially damaging to the quality of the learning experiences that are offered.

The challenge is to develop a curriculum which can emphasise interconnections between learning pathways, the practical application of knowledge in a variety of contexts and flexible relationships between core and specialist knowledge. It must be based on sound pedagogy. The focus on tutors is not on the training but on the facilitation of central processes of learning which too often is interpreted as something which is transmitted to people rather than an activity for which they themselves have responsibility. The teachers of tomorrow must have some involvement, experience and opinion of 'student-centred learning', 'flexible learning', 'open learning', 'active learning', 'on-line learning' etc.

Effective learning within this environment is:-

1) a function of the interaction between, *and* the interdependence of, 3 groups of factors
2) and a cause of that interaction




teaching style
teacher motivation
degree of learner autonomy
nature of new knowledge in relation to previous knowledge
method of teaching used
nature of the learning environment
degree of learner involvement in the learning process
conception of learning
conception of education
STUDENT LEARNING
student motivation
learning style
level of anxiety
learning skills
learner self-confidence
approach to learning adopted by the learner
previous knowledge
conception of learning
conception of education

Robotham, 1996

The approach of the tutors in allowing cross fertilisation and conceptual development of the student and tutor and technology must be fostered. It must allow various "partnerships" into which students will enter. Successful learning depends on success in establishing and developing such partnerships - with tutors and with collaborators.

However, such an attitude is not free of complication. It may be argued that one important goal of formal education is to cultivate a capacity to learn independently; in a sense to find some release from learning - as - partnership. Now, claims of this sort introduce an element of tension: we wish to develop partnerships for purposes of socially mediated learning, but we also wish to cultivate in the learner a certain autonomy. Tension of aims need not imply conflict of aims. Indeed, far from being in conflict there may be necessary developmental relationships between socially organised cognitive functioning and that which is 'private' or autonomous to the individual (Vygotsky, 1978). Nevertheless, at a practical level of formulating strategies for teaching, there does remain a tension to be handled. Thus, in practice, one thing teachers must surely consider is how they should manage the learning process in terms of a balance of emphasis between pupil autonomy and interpersonal exchange.

References

Graziadei, W., Gallagher, S., Brown, R., & Sasiadek, J. Building Asynchronous and Synchronous Teaching-Learning Environments: Exploring a Course/Classroom Management System Solution. http://horizon.unc.edu/projects/monograph/CD/Technological_Tools/Graziadei.asp. Accessed July 2002.

Nightingale, P., & O'Neil, M. (1994). Achieving quality learning in higher education. London: Kogan Page.

O'Donoghue, J., Singh, G., Caswell, S. & Molyneux, S. (2001). Pedagogy vs. Technocentrism in Virtual Universities. Journal of Computing in Higher Education. Volume 13, Number 1. October, 200.

Robotham, D.(1996). Effectiveness of self directed learning (Thesis).

Vygotsky, L. S. (1978). Mind in society : The development of higher psychological processes. Cambridge. Massachusetts. Harvard University Press.

A Model for an Open, Flexible Website to Aid Classes at University: the Student Interface.*

Lia Raquel Oliveira & Elías Blanco
Curriculum and Educational Technology Dept.
University of Minho
Portugal
lia@iep.uminho.pt & eblanco@iep.uminho.pt

Abstract: In the context of a research-development study in progress, a website prototype was created (dynamic, interactive and multimedia data base) with the purpose of providing support to any subject-matter in teaching and learning at university. The aim is to make classes more flexible in the terms of space and time, providing a classroom virtual environment, based on "good pedagogical practices" of sharing and cooperative construction of knowledge. The model is briefly presented and the interface to be used by students is discussed.

Introduction

The new technologies of information and communication, and more specifically the Internet, have radically transformed the ways in which information is accessed and produced, as well as the scale of its diffusion. At the same time, forms of communication have changed, too. Universities, as generators of knowledge and agents of human resources development, are not dissociated from these phenomena and play a determining role within them. Both society and available knowledge are experiencing change and, consequently, workplaces demand flexible professionals with autonomous learning skills, ability to adapt and a cooperative enterprising capacity. In this context, the university needs to reflect upon the kind of education and the forms of learning it provides. Thus, we believe it has to undertake some changes in its pedagogical practices. One of these changes includes the effective use of the web as a didactic device for teaching activities. This implies not only transposing study material into the web, but also, and above all, creating and developing environments which aid methodologies and strategies so as to improve meaningful learning. We are not dealing with the issue of long-distance teaching but rather with the reconceptualisation of formal education through the use of technology at hand and its potential for communication and distribution. In fact, it is precisely due to this technology that we have witnessed a steadily increasing convergence between the two forms of teaching, which tend to complement each other both in education and training.

Intention and Objectives

The context of this project is a research-development study in progress, whose primary objective is to discuss and understand the process of conceiving and implementing a device for education/training. This objective distinguishes the project from other similar undertakings, which may concurrently occur over time. The purpose it to provide a working tool which will allow an essentially pedagogical and didactic reflection on the use of this technology in this context, in addition to a reflection on the technical, administrative and logistic aspects of the prototype.

A website was designed, aimed at providing support for any subject-matter related to learning at university. This prototype is to be used outside the classroom and/or in the classroom and provides support, both as a model and an example, for the subject of Educational Technology (3rd year of training for prospective secondary school teachers), which is taught in a laboratory regime, with special emphasis placed on project methodology and portfolio assessment.

The purpose of the website is to make attended classes more flexible, in terms of time and space management, by creating a virtual environment based on "good pedagogical practices" which can be translated into the notion of community (group, the feeling of belonging), sharing and the cooperative construction of knowledge. Flexibility will allow students to possess greater autonomy in their learning process because, during their training period, they have access to an interactive reference online regarding the subject and may use it in accordance with their personal characteristics (learning styles and pace).

More concrete objectives include the way in which access to relevant information is facilitated, making thematic communication more dynamic (students-students and students-teachers), promoting the development of information literacy skills, and simplifying some of the teacher's administrative and organizational tasks, thus contributing to improved quality in learning.

The Process of Creating the Device

The process of creating the device was undertaken in three phases: conception, development and implementation (analysis and assessment are currently under way).

The conception phase started with a literature review on the subject and a search on the web for related undertakings. From the analysis of available platforms (paid or gratuitous) for "virtual lessons", we concluded that they were either too complex for what was required (although some were extremely interesting) or excessively directed towards distance-learning. However, we found various specific undertakings which closely matched our intentions. We proceeded with some preliminary research on the existence of sites possessing these features, at Portuguese state universities, for the teaching of the subject under study (Educational Technology or other related subjects) (Oliveira & Blanco, 2001).

We then made decisions about specific objectives, the contents to be made available and the formats to use, the approach to communication/aesthetics, and the types of communication and interaction. The idea of "good pedagogical practices" previously mentioned was turned into a metaphor inspired by the categories of narratives (since Man is a consumer/producer of stories): elaboration of a story (i.e. construction of knowledge) in a specific dimension of time and space, by someone who makes something, using the resources required to meet common objectives and depending on some conditioning factors (Laurel, 1991, Depover et al, 1998). The communication/aesthetic options were as minimalist as possible, respecting the criteria of simplicity, easy use, clarity, consistency and induced credibility. The architecture of the final information was managed by resorting to the "post-it" technique (Boling & Frick, 1997) and the result is presented in the following flowchart (Fig.1).

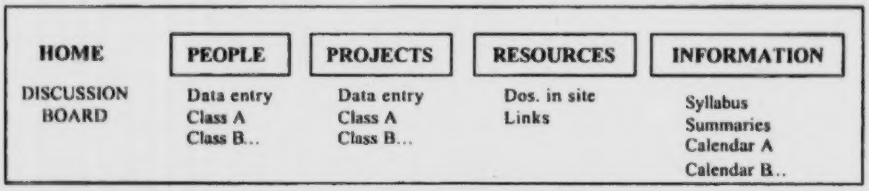


Figure 1 - Flowchart of the student interface.

The development phase - the technical execution of the site itself - counted on the collaboration of professionals from the areas of Systems Engineering and Communication Design (programming and surface structure). After elementary testing and site installment, we undertook usability tests not referred to at length here, which were fundamentally based on the analysis of "think aloud" individual protocols registered on video (Schriver, 1997), involving five participants representative of the intended users (Nielsen & Landauer, 1993, Reeves & Carter, 2001). Some changes were made as a result of these tests.

The website was implemented for a semester (2002) and was used by approximately seventy students from teaching degrees (languages and science). At present, we are analysing opinions gathered from these users (through questionnaires and interviews) and we expect to make the results available soon, especially those relating to the pedagogical interest of using the model in the given situation.

As for the system, the site has two interfaces: the student interface, that is, the shared environment (students and teacher) and the administrator interface (teacher) for updating and managing the information on the site. To make this possible, the online content is dynamic and is fed by an information system created by Microsoft Access (using Dreamweaver, Ultradev, HTML, ASP and Java Script). We are, therefore, dealing with a data base whose interfaces allow data uploading without authorized access to the server. We consider this aspect to be important for real interactivity at the level of both interfaces, so that the platform is not reduced to unidirectional communication (teacher-students) and directive discourse. Access to any of the interfaces requires login and a password.

The student interface is made up of five sections: Home, People, Projects, Resources and Information. These sections aim to reflect the adopted metaphor.

The Home section (Fig.2), presented as the site map (deeper information is accessed after a maximum of three clicks, due to the use of pop-down menus) proposes a type of simplified forum - a discussion board. A statement is under discussion (weekly suggested by the teacher) and the comments introduced are automatically inserted using a click (bypassing identification). These comments may be used to start a discussion at the beginning of a class. The principles underlying this option are reflectivity and voluntary participation. Thus, the Home is supposed to generate interactivity and participation.

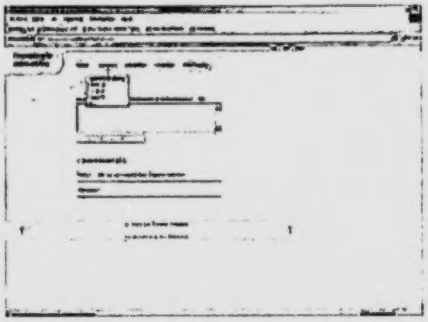


Figure 2 - Home and navigation menu.

The People section allows four entries: data entry and three classes.

In the data entry, students will find a form where they fill in personal data (photography included) which become available on a personal page made accessible via the course page. The teacher is part of the page since she/he integrates the group/community, although she/he obviously has different objectives from those of the students.

The Project section also allows four entries: data entry and three courses.

The data entry is also a form where students are asked to fill in synopses of the work projects in which they are involved. Their names (nicknames identifying them in the group) are connected with their personal page.

The Resources section allows two entries: resources on the site and external resources. The latter are traditional *links* of interest, which are progressively updated by students' contributions (the *links* are inserted by the teacher). At present, these are grouped as national and international.

The resources on the site are grouped according to the type of document: written texts (.doc), powerpoint presentations (.ppt), video extracts (.mpeg), still pictures (.jpg and .gif) and exercises (various formats). At present, these are presented on run-on pages (with *links* for the top of the screen and for the category) since it is difficult to predict the number of documents which can be inserted.

Various reference texts were made available, also powerpoint versions of some of them, assessment grids for projects to be undertaken as well as for various types of performance (student participation, teacher's activity), autonomous presentations in powerpoint, video extracts of documents seen in class, a set of images and a few exercises on computing tools. This possibility of insertion and the availability of multimedia documents constitutes an inevitable requirement due to the obvious advantages, for the process of learning, of using diverse symbolic systems to represent information (Depover et al, 1998).

All the documents are posted on a new window on the *browser* so that they can be seen immediately and may be recorded at the source of application.

The links to other sites use the same process of posting a new window on the *browser*, avoiding, on the one hand, an involuntary exit from this site (due to URL change) and, on the other, preserving their authorship (one of the many reasons why frames are not used).

The Information section summarizes institutional and administrative aspects: the formal course syllabus, summaries and calendar (for each course).

The syllabus page occupies one screen (containing a summary of it) and one can *download* from the respective file (.doc) as well as from a specific file concerning assessment norms, criteria and methods.

The Summary page is similar and allows one to download from the respective file.

The Calendar, as the name indicates, schedules the activities over the time-period estimated for attendance of the course. It is divided into months and days (on a run-on page) and presents a guiding summary for the activities to be developed.

As for possible forms of communication, apart from the initial discussion board which can be used in an asynchronous or synchronous manner, priority is given to the use of electronic mail. All the members of the class-community introduce their electronic mail address on their personal pages, which then becomes available for communication from this interface.

BEST COPY AVAILABLE

Electronic mail, as we know, allows private communication from one person to another but also from one to various people (e.g. mailing lists). It also allows one to send attached files in various formats. On the other hand, e-mail applications allow one to establish rules for message reception and dispatch (e.g. various filters) as well as to file, register and confirm reception. Thus, we believe that this mode of communication is the most suitable in this kind of situation, ensuring the privacy, speed and general efficiency required in the exchange of messages. Furthermore, it is via electronic mail that the transmission of assessment results takes place (formative and summative) both by the teacher and the students, through the use of selective mailing lists (individual, small group or course groups). This option is based on the fact that we consider evaluation, in any of its forms, to be a context-sensitive process which concerns the people involved and that, therefore, a certain degree of discretion and privacy must be ensured. This, in fact, occurs in the traditional academic context of publicizing results (posting marksheets). It is our belief that using electronic mail for this purpose over the learning period contributes to higher degrees of personalization, transparency and fairness in the assessment process.

Final remarks

No technology can be educational on its own. To understand this, you need only to use it (Jacquinot-Delaunay, 2001). The conception, development, implementation and evaluation of educational and training devices for the web necessarily demands deep reflection and discussion, not only regarding the computer software and communication aspects of operating those devices, but also and above all, concerning the pedagogical, didactic and curricular purposes and intentions which support them. With this text, we hope to contribute to this discussion and promote the transdisciplinary approach that this medium of communication requires.

References

Boling, E. & Frick, T. W. (1997) "Holistic Rapid Prototyping for Web Design: Early Usability Testing Is Essential". In, Khan, B. H. (Ed.), *Web-Based Instruction* (pp. 319-328). Englewood Cliffs, NJ: Educational Technology Publications.

Depover, C., Giardina, M & Marton, P. (1998), *Les Environnements d'Apprentissage Multimédia. Analyse et Conception*. Paris: L'Harmattan.

Jacquinot-Delaunay, G. (2001) "Avec Internet, finies les télévisions éducatives?" (pp. 72-73). In *MédiaMorphoses*, 1, Janvier. Bry-Sur-Marne. INA.

Laurel, B. (1991) *Computers as theaters*. Reading: Addison-Wesley.

Nielsen, J. & Landauer, T. K. (1993) "A mathematical model of the finding of usability problems" (pp. 206-213). In Proceedings of ACM INTERCHI'93, Amsterdam, The Netherlands, 24-29 April.

Oliveira, L.R. & Blanco, E. (2001) "Apresentação de informação educativa na *Web*, no contexto universitário português: análise de disciplinas *online* de suporte à lecionação" (pp. 421-429). In Silva, B. D. & Almeida, L. (Eds.) *Actas do VI Congresso Galaico-Português de Psicopedagogia*. Braga, Portugal: CEEP.

Reeves, T. C. & Carter, B. J. (2001) "Usability Testing and Return-on-Investment Studies: Key Evaluation Strategies for Web-Based Training"(pp. 547-557). In Khan, B. H. (Ed.) *Web-Based Training*. Englewood Cliffs, NJ: Educational Technology Publications.

Schriver, K. A. (1997) *Dynamics in Document Design*. USA: John Wiley & Sons, Inc.

*This work is financed by the portuguese Foundation for Science and Technology (FCT) with the reference SFRH/BD/1297/2000.

WHAT ARE FACULTY'S THOUGHTS ON ASYNCRONOUS TEACHING? A CASE STUDY OF ONE COMMUNITY COLLEGE IN UPSTATE, NEW YORK.

Carol Oliver, MA
The Graduate School, The City University of New York
Environmental Psychology, Sub-Program in Psychology
New York, New York, USA
oliverc126@aol.com

Abstract - This research paper critically looks at professors' everyday work experiences teaching courses online, their work responsibilities as faculty within the larger university system and the issues that affect these faculty members. The paper illustrates how their experiences with asynchronous teaching have an affect on their professional and personal work experiences. The methods used for this study primarily involved qualitative research design and some quantitative analyses. Surveys and one-on-one interviewing were used for the collection of data. This paper is only a preliminary introduction to some of the data analyzed from interviews conducted with faculty.[1]

Introduction

The academic profession operates as a mentoring-training ground for professions, which include, doctors, lawyers, architects, engineers, and representatives of other advanced crafts or non-professional training (Clark, 1987). The academic profession involves varying dimensions of academic work, such as teaching, research, mentoring, evaluation of students' work, supervision and evaluation of dissertation work, administration and public policy work (Cahn, 1994; Clark, 1987; Markie, 1994; McKeachie, 1994). The question "*what do academics do*" is difficult to answer because it varies by discipline, institution, professional seniority, teaching styles and by personality traits, like temperament. The work of the professor involves teaching, mentoring, administration, and research, but these tasks vary greatly by person, institution, and seniority. Research and publishing serve as the primary basis for prestige in many disciplines and in the profession as a whole, and it is bound to play a substantial role in major universities (Clark, 1987, p.70). In addition, professors spread themselves beyond these two major tasks; some formally counsel students, some work in administration, some are heads of departments and others are active members in committees where they can vote on university policies and procedures (Cahn, 1994; Clark, 1987; McKeachie, 1994). Despite this range of activities, the workload of academics is usually defined by "teaching load" (Clark, 1987). In some cases, the workload may include supervision of students (both in the professor's research and in activities such as mentoring, studio work, dissertation work etc.) but teaching remains the institutional obligation for which hours can be specified. In graduate schools dissertation supervision is also considered part of the faculty workload and "research load" (for which one can get "released time" from teaching) is often assessed as a formal duty that is required for retention and promotion.

A review of the literature on the academic profession looks at "workload" in terms of "productivity,"(Green & Gilbert, 1995; Massy & Wilger, 1995; Robinson, 1997; Wulf, 1995). With the evolving use of information technology in academia, the work of professors is being measured by how much is produced within a specified time. Since information technology is allowing professors to do their work, including teaching, at a distance, the question of productivity has taken on new dimensions and in some learning institutions has become a concern. With email, distance learning, Internet technologies and fax, the method of delivering "*teaching*" or "*what professors will be doing*," will change as information technologies change the environment of professors' "work" and their access to students. While the research on distance learning continues to grow many programs and universities are continuing to develop this medium to 'deliver' educational courses (Blumenstyk, 1997; Curtis , 2001; Frenette, L. 1997; Jaffe, 1998; Jellinek, 1988; Luke, 1997; Maurizio, 1997; Margolis, 1998; Noble, 1997; Novek, 1998;).

---

[1] *The data for this paper is part of a larger data set that is currently being analyzed by the author for the completion of the dissertation.*

Technological advances in education are still met with skepticism by both educators and higher education administrators and teacher unions, (as reviewed in PSCcuny Clarion, 2000 Vol 29(6):5 -article entitled *"CUNY is not ready for distance learning"*). However, some academics and higher education administrators feel that distance education is a wonderful new teaching tool for learning because it offers flexibility of time and space and students can have access to professors by email and other online methods. In addition, distance learning education, can be attractive to the non-traditional learner (Ben-Jacob, et al., 2000). According to the article, *The Learning Environment of the 21st Century (Ben-Jacob. et al, 2000),* "the typical 21st century student will be an adult learner who is mature, more likely to be financially secure and more serious academically than today's student. A great number of these students will be employed full time and will pursue further education as a requirement of employment or for career advancement" (Ben-Jacob et al., 2000, p 8.). Distance learning will capture the interests of these different types of students because it provides flexible arrangements responsive to their time constraints (Ben-Jacob.et al, 2000, Berg, 2000). Conversely, some faculty members feel that distance learning is not "*a real education*" because students need to have face-to-face contact with educators. They view the online courses as inferior to the traditional classroom lecture, because they assume that distance courses cannot be rigorous enough to be academic (Ben-Jacob, et al., 2000). Faculty are concerned with *workplace* issues, such as the time that they spend designing their traditional courses online and how they will be compensated for the time they spend preparing a course. They are concerned with issues regarding evaluation for tenure and being retrenched by these new methods of teaching along with issues like publishing online, proprietary work and mentoring. Other ethical issues, such as universities becoming diploma mills, have become major concerns in the academic community ("An on-line experience," 1995; Curtis, 2001; Guernsey, 1997; Novek, 1996; Robinson, 1997; Young, 1997).

Currently, distance learning technologies are being used by professors as another teaching tool and not as a replacement to their practice of teaching. Questions of how professors use distance learning technologies in their work, if in fact, these technologies alter their teaching practices, and how teaching online may differ from teaching in the classroom, are important in looking at the profession in the context of professors' work lives when they use information technology. While some empirical studies on these questions have been done, studies have not looked at the teaching strategies that professors use when teaching online, nor has further consideration been given to issues of the professors' work environment. This research will examine these issues and will critically evaluate all aspects of the work lives of faculty that teach in online learning environments.

The Study

This paper is a result of one-on-one interviews that were done with faculty from a community college in Upstate New York. The faculty members at this community college were interviewed on issues relating to their online teaching *work* and *personal space issues* when teaching at a distance. This research was based on a larger data set, where 299 surveys where sent to faculty's homes asking about their experiences with computers and questions about online teaching. From the 299 surveys sent, 112 responded and 20 faculty members returned a postage-paid postcard that was attached to the survey, indicating that they would participate in the one-on-one personal interviews. The faculty members were contacted by email and given two weeks to respond to a date and time for the interview. Seventeen out of 20 professors responded and were interviewed. The interviews were taped and transcribed. The preliminary results that follow come from the interview data.

Preliminary Findings

The following is a grouping of preliminary findings that are currently being further analyzed.

What faculty favored about asynchronous teaching:

- Faculty members (n=17), in general were happy with the work they were doing using distance learning technology to teach. They enjoyed teaching online and felt that they had close-knit relationships with their students.
- Faculty expressed that they knew their students far better than they knew their face-to-face students. They had a stronger one-on-one relationship with their students because of the increased interaction they had with them online.
- Faculty stated that this was due to the more time they were spending evaluating individual student's work. They had to answer enormous amounts of email and discussion questions with each individual student.
- Despite the fact that the literature, and many non-distance learning teachers say that they do not teach online because they need the face-to-face interaction, these teachers felt that they knew their students far better than their traditional classroom students. They felt a special bond with the students and there was a *special* "virtual" communication that happened online between the student and the instructor.
- Faculty stated that students who took online courses were more reflective with their answers and homework assignments. Their writing was far better and they took more time to give well, researched answers.

What faculty concerns are regarding asynchronous teaching:

- All 17-faculty members stated that the number of students enrolled in their classes was *too* many. Student enrollment for an online class was the same as in a face-to-face class in this community college. For example, if a psychology class has a 30-student enrollment, then the department expected that the online class should have the same number of enrollments as well. All faculty (n=17) expressed that if enrollment was capped at an average of 15-20 students, it would be more manageable and less time consuming. Currently the community college has about 30-35 students enrolled in online classes at the time of registration, by the first weeks of class students enrollment drop to approximately 20 -25 students. *Faculty stated that the number of students made a major difference in the amount of hours they spent online!*
- One faculty member compared the amount of time and work in an online class with the classroom in a ratio of 4:1. The instructor said, *"For every hour I spend in the classroom, I spend four hours online."*
- Three faculty members reported ergonomic issues e.g. carpal tunnel syndrome; back pain; neck pain.
- Faculty stated that students who were not successful online were students who needed discipline, maturity and students who needed to be organized and structured in order to make their online experience rewarding and successful.
- Faulty reported that students, who dropped out during the first three weeks of class, needed more hands-on training as to the mechanical aspects of online course. They stated that they hope that the administration and the technology people could work together to give students more tutorial experiences.
- Two faculty members admitted that they were not happy with their dl experience because they were not utilizing the technical support adequately (by choice). These two faculty members reported that they were meeting with students online once or twice a week and giving them test --- they had no discussions with students online nor did they develop and online dialogue.
- Faculty stated that getting release time for teaching online or getting extra compensation for designing, preparing, or upgrading a course was optimal.
- Faculty stated that it was important to get more compensation because of the endless amounts of time they spent online evaluating student's work, participating in threaded discussions and answering large amounts of email messages.
- Two faculty members suggested that the university should be able to provide for the paid-Internet service at home, since they did all of their online teaching at home.

References

An "online" experience. Discussion group debates why faculty use or resist technology. (1995). In, *Change* Vol. (27)2 March/April

Ben-Jacob, M.G., Levin, D. S., and Ben-Jacob, T. K. (2000). The learning environment of the 21st century. *Educational Technology Review*. Spring/ Summer 2000, No.13, P.p. 8 –12.

Berg, G. A. (2000). Distance learning in the middle of trends in higher education. *WebNet Journal. Internet Technologies, Applications & Issues*. April-June 2000, Vol. 2(2), P.p. 5-6.

Blumenstyk, G. (1997). Some elite universities get serious about distance learning. In, *The Chronicle of Higher Education*. June 20, 1997. Pp. A23.

Cahn, S. M. (1994) *Saints and scamps. Ethics in academia.* The Graduate Center. The City University of New York. Maryland: Rowman & Littlefield Publishers, Inc.

Clark, B. R. (1987). *The academic life. Small worlds, different words.* The Carnegie Foundation for the Advancement of Teaching. Princeton, NJ: Princeton University Press.

CUNY is not ready for distance learning. (2000). PSCcuny Clarion. Vol 29 (6), p5.

Curtis, M.P. (2001) *Incentives and obstacles for nursing faculty in choosing to teach via distance.* Dissertation. The Graduate School of Saint Louis University.

Frenette, L. (1998). Distance learning takes off at SUNY. In, *The Voice*, Vol. (25) 5. Pp. 11-12.

Green, K. C., and Gilbert, S. W. (1995) Great expectations. Content, communication, productivity and the role of information technology in higher education. In, *Change* Vol. (27) 2 March/ April, p8.

Jaffe, D. (1998). The opportunities of anytime/anywhere learning. In, *Aft On Campus*, February 1998, Pp. 9.

Jellinek, D. (1998). Distance Learning/Digital Degrees, *The Guardian Weekly*, Vol (Pp.21).

Luke, T. W. (1997). The culture of cyber schooling: Information technology, digital discourse, and the political economy of university restructuring. *Presented at the Annual Meeting of Anthropological Association, November 19-23, 1997.*

Margolis, M. (1998) Brave new universities. (The future of the academy?). *First Monday*, Vol 3 (May 4, 1998) Issue 5. Also, [On-line] http:/www.firstmonday.dk/issues/issue3_5/index.html.

Markie, P.J. (1994). *Professor's duties. Ethical issues in college teaching.* Maryland: Rowman & Littlfield Publishers, Inc.

Massy, W. F. and Wigler, A. K. (1995). Improving productivity. What faculty think about it-And it's effect on quality, in *Change,* Vol (27)4 July/August p 10-20.

McKeachie, W.J. (1994). *Teaching tips. Strategies, research and theory for college and university teachers.* (Ninth Ed). Massachusetts: D.C. Health and Company.

Noble, D. F. (1997). Digital diploma mills: The automation of higher education. (http:/www.hronline.com/forums/labour/9711/0271.html).

Novek, E, M. (1996) Do professors dream of electronic sheep? Academic anxiety about the information age. Paper presented at the *79th Annual Meeting of the Association for Education in Journalism and Mass Communication, Anaheim, CA. August 10-13, 1996.*

Robinson, P. (1997) Awash in technology. Will the rising tide lift all boats? in *Aft on Campus*, Vol (17) 3. November 1997. P.6-8.

Thompson, H., (1999). The impact of technology and distance education: A classical earning theory viewpoint.
Wulf, W. A. (1995). Warning: information technology will transform the university.[On-line journal] *Technology*, Vol (2) 53, p15-52. SIRS Researcher

Young, J. R. (1997). Rethinking the role of the professor in the age of high-tech tools. In, *The Chronicle of Higher Education*, October 3, 1997, Pp. A26-A28.

Doctorate at a Distance (D@D): In Search of Serendipity

Nadine Ozkan, Jacqueline Bourdeau and France Henri
Télé-Université, LICEF
4750 Henri-Julien, #100
Montreal, QC.
Canada H2T 3E4
Ph. : (1 514) 843-2015
Fax: (1 514) 843-2151
nozkan@licef.teluq.uquebec.ca , bourdeau@licef.teluq.uquebec.ca , fhenri@licef.teluq.uquebec.ca

Abstract: Distance higher education is a rapidly growing and evolving phenomena, which is actively promoted in many countries. Despite this, there is a relatively small proportion of this effort devoted to the distance PhD: distance PhDs programs are relatively new and experiences are scarce, specific, and hard to generalize. How, then, can we approach the design of a distance PhD program? This is the focus of the paper. Issues addressed include the following:

What are the pedagogical motivators of distance PhD programs? Here, we attempt to understand the benefits of such programs in terms of learning outcomes and of target population.

What are the specific challenges linked to distance PhD programs (as compared to other distance university degrees), and how can we attempt to address them?

What methods should be explored in order to ensure quality of learning but still favor autonomy and creativity?

Introduction

We are concerned with the design of distance PhD programs. Within PhD programs, we can distinguish those aimed at training highly skilled specialists, and those aimed at training researchers. Our focus is with the latter: the PhD process as research training.

The doctorate at a distance (or D@D) is a topical area, which currently fuels much interest from governments and universities (Averous and Touzot, 2002) (FU.NT Expert Work group, 2002) (National Science Board, 2002). Benefits sought include:

- An increased accessibility for potential students, which is a motivator for distance education in general, but which is specially relevant at the PhD level, in the context of "knowledge economies";
- The merging of PhD programs which, individually, may have a small number of students, but which attain critical mass when merged;
- The promotion of distributed research, which is actively encouraged and rewarded by research funding organizations. Distance PhD programs can help introduce a new generation of researchers to the practice, tools and methods of distributed research.

Despite this interest, there is currently little work in this area, either theoretical or in terms of best practices from the field. Indeed, work in distance university training focuses on *professional* training rather than on *research* training, and work in such areas as virtual research communities focuses on the *practice* of research rather than on the *training* of researchers. As to actual experiences, there are some existing distance PhD programs, but no synthesis – guidelines or principles – that might help guide the design of such programs. A reflection on distance research training remains to be done, and we hope that this paper constitutes an initial contribution.

Initial Reflections On the Nature of Research Training

In this section, we attempt to understand the nature of training for research, in order to assess whether a systematic approach to instruction design for the D@D is possible.

At a high level of abstraction, we consider the objective of research training to be the development of the capacity to contribute to the advancement of knowledge in a given area (which may be multidisciplinary), according to the norms defined by the research community. These norms, which are defined in a collective and consensual way, must thus be known and applied to the advancement of knowledge.

We consider the advancement of knowledge to be manifested in two ways: by conducting research projects that respect these norms, and also by the critical application of these norms to research projects conducted by others. In the first case, the contribution of the researcher is direct and active, and must be submitted to peer assessment. We qualify this as the *active* role of the researcher. In the second case, the researcher must apply meta-knowledge: the quality norms of research must be sufficiently understood and mastered to allow the constructive appreciation assessment of research projects. We qualify this as the *assessor* role of the researcher.

In the active role, in order to carry out a research project, the researcher must first conceive a research problem, which means identifying and stating a problem which is new, for which there is no obvious solution, which can be investigated using a scientific method, whose relevance can be convincingly argued and which builds upon existing scientific knowledge. The next step is to plan and execute the research project: design ways to approach the problem, choose one or several appropriate methodology/ies, execute the plan in a correct and ethical fashion, interpret results and draw conclusions. The last step consists in communicating research results in the appropriate channels, using the format of scientific communications.

In the assessor role, the researcher must be able to apply the norms of the scientific community to the activities that pertain to the carrying out of research projects (as described above), and to communicate the assessment (in order to advance the community).

In addition to these basic research skills, the doctorate student must also be trained in skills that are required from the context in which research will be undertaken in their professional life. Here, we can distinguish academic careers from organizational - industrial or public (governmental) - careers. Future academics should be trained in pedagogical skills and in raising grant funding. Future industrial researchers should be trained in issues pertaining to the commercialization of research results, including the protection of intellectual property, and in the management of research teams.

Finally, researchers should also have a deep knowledge of their domain area, of its concepts, theories and state of the art, and of that of the sub-domains that constitute it.

We have found that these reflections on the role, nature and activities of research lend themselves very well to their encapsulation in a hierarchical competency profile. We are currently developing such a profile, developing and building upon the initial reflections we have exposed here[1]. To our knowledge, there is currently no competency profile for researchers. Our undertaking, presented partially in this section, is the result of a synthesis of the following sources:

- general objectives for doctoral training (Prégent, 2002),
- requirements for admission into post-doctoral training, and criteria for the granting of post-graduate grants and scholarships (Economic and Social Research Council, 2001), and
- the definition of training objectives for some PhD programs (e.g., Missouri University, 2002).

Further Challenges

In addition to training of the specific competencies that researchers must demonstrate, as sketched in the previous section, PhD training displays specific features that distinguish it from other types of training, and that should have consequences for the design of distance PhD programs. We review them here.

- PhD programs aim at training self-directed, autonomous workers, who can demonstrate leadership. Indeed, PhD graduates are often required to supervise or guide undergraduate or master students. PhD training should include components specifically linked to the development of autonomy and leadership.

---

[1] Lack of space prevent us from showing an extract of our competency profile, but this will be shown in the presentation at the conference.

- The interaction between PhD students and their research environment (peers, researchers, seminars, facilities, etc.) is an essential aspect of the training. In a distance mode, tools and facilities that support the emergence and maintenance of communities of practice and of communities of learners should be investigated.
- Another essential aspect is their interaction with their research supervisor and with their mentor (who may not be the same person. In fact, studies suggest that these interactions are more effective when mentor and supervisor are indeed not the same person (McCall and al., 2000). Studies show that the reactivity, relevance and regularity of these interactions are factors that can influence the success or failure of PhD studies (Muirhead, 1999), (Council of Graduate Schools, 1998) (Walker, 1998). Studies also show the importance of establishing trust early in the process ("swift trust" – (see Hiltz and al., 2002).
- The writing of the thesis is a critical stage in PhD studies. Indeed, it is at this stage that most of the "drop-outs" occur (National Science Board, 2002). The writing stage should be a time for monitoring and encouragement, notwithstanding the next point.
- PhD training requires "mental space" for the elaboration and maturing of ideas. A training environment where student progression is monitored too closely is not conducive to research training objectives, and can be a de-motivation factor for adult and autonomous students.
- The undertaking of a PhD program is a process that is deeply personal and meaningful, and that requires a high level of commitment (Prégent, 2002). The aims, activities and resulting career paths of PhD programs should be strongly coherent with the personal project of the PhD student.

These specificities all point to the fact that vital to successful PhD studies are a sustained contact with a stimulating research community, peer interaction, mentoring and the guidance provided by the supervisor. Learning outcomes should emerge naturally from these contacts, interactions and supportive relationships within the PhD environment, in a process that we qualify as *serendipitous.* The challenge in the design of distance PhD programs will be in the delicate balance between *engineering* learning outcomes, which is a proven way to ensure quality, and making room for *serendipity*, required at the PhD level.

Conclusion

This paper points to the need to assess the scope of applicability of an instructional design approach to the design of distance PhD programs. We have argued that an instructional design approach can be possible and beneficial, provided that it makes room for serendipitous creativity, which is the essence of research apprenticeship.

References

Averous, M. and Touzot, G. (sous la direction de). (2002). *Campus Numériques. Enjeux et perspectives pour la formation ouverte et à distance*. Rapport de Mission sous la direction de, à l'attention du Ministère de l'Éducation Nationale, du Ministère de la Recherche et de la Délégation à l'Aménagement du Territoire et de l'Action Régionale. Avril 2002. France. www.education.gouv.fr/rapport/foadenjeux.pdf

Council of Graduate Schools, Task Force on Distance Graduate Education. (1998). *Distance Graduate Education : Opportunities and Challenges for the 21st Century*. Washington. Sept. www.cgsnet.org

Economic and Social Research Council. (2001). *Postgraduate Training Guidelines*. Third Edition.. Jan. http://www.esrc.ac.uk/esrccontent/downloaddocs/sectionae.pdf

FU.NT Expert Work group (Formation Universitaire et Nouvelles Technologies). (2002).*Création d'un campus virtuel suisse*. Suisse. http://www.edutech.ch/edutech/publications/rapport_final_f_f.asp

Hiltz, S.R., et Turoff, M. (2002). What Makes Learning Networks Effective? *Communications of the ACM*, april, vol. 45, no. 4, pp. 56-59.

Institute for Higher Education Policy, National Education Association. (2000). *Quality On the Line: Benchmarks for Success in Internet-Based Distance Education*. US, April. www.ihep.com/Pubs/PDF/Quality .pdf

McCall, L., Schattner, P. et Piterman, L. (2000). *Supervision of research by distance methods. Department of Community Medicine and General Practice*, Monash University, Australia.
http://www.com.unisa.edu.au/cccc/papers/non_refereed/mccall.htm#Abstract

Missouri University. (2002). *Doctorate in Information Science and Learning Technologies (PhD) Competencies and Products*.. www.coe.missouri.edu/~sislt/programs/phd_comp_chart.html
http://www.coe.missouri.edu/~sislt/phd/research.html

Muirhead, B. (1999). *Attitudes Toward Interactivity in a Graduate Distance Education Program: A Qualitative Analysis*. PhD dissertation, Capella University, April 13th, Dissertation.Com Publishers.
http://www.dissertation.com/library/1120710a.htm

National Science Board. (2002). *Science and Engineering Indicators 2002*.
http://www.nsf.gov/sbe/srs/seind02/pdfstart.htm

Prégent, Richard. (2001). *L'encadrement des travaux de mémoire et de thèse*. Presses Internationales Polytechnique, Montréal, Canada.

Walker, R. (1998). Experiments in Virtual Supervision. *ED-MEDIA/ED-TELECOM 98* World Conference on Educational Multimedia and Hypermedia & World Conference on Educational Telecommunications Proceedings, Freiburg, Germany, June 20-25.

A Model LAN to Mimic the Networking Environment in Hong Kong Primary and Secondary Schools for Teaching and Learning

Ka-man Pang and Simon So
Department of Information and Applied Technology
Hong Kong Institute of Education
10 Lo Ping Road, Tai Po, N.T.
Hong Kong SAR, China
E-mail: {kmpang | swwso}@ied.edu.hk

Abstract: With the surging demands for the use of network-based learning environment in primary and secondary schools, the knowledge and practical skills on school LAN management is increasingly critical for our pre-service and in-service IT teachers. Many of our IT graduates will assume the role of IT coordinators in their employed schools on top of their regular teaching duties. Training on network concepts and hands-on communication skills are essential to them. As the prime business of our Institute is teacher training, it is impractical to provide the students with the comprehensive network training similar to network engineers, We should focus on the training to the prescribed network infrastructure in our government-funded schools. In this paper, we describe our model LAN project for teaching and learning. The model LAN stimulates a school's networking environment so that our student teachers can acquire the relevant knowledge and practical skills very close to the real school networking environment.

Introduction

Under the Hong Kong Government's five-year strategy for IT in education to promote the use of IT for the enhancement of learning and teaching (Education and Manpower Bureau HKSAR, 1998), the majority of primary and secondary schools in Hong Kong have well-established and fairly standardized network infrastructures. The networked areas include 1) Staff Room (limited to two only), 2) Computer Room, 3) Library, and 4) Multimedia Learning Centre (MMLC) if available. Some schools may have multiple access points installed in their classrooms. The computing facilities are predominately PC-based. Microsoft Windows NT Servers or 2000 Advanced Servers are used to support the client-server environment. The configuration and the cabling system for a school (Education Department HKSAR, 2002) is specified by the Education Department as illustrated in Figure 1.

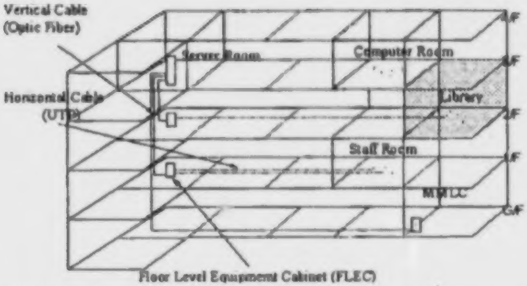


Figure 1. The Configuration and Cable Infrastructure for a school in Hong Kong (Education Department, HKSAR)

Given the unique characteristics for the school network requirement, the Hong Kong Institute of Education (HKIEd) offers a number of modules for our IT students in the areas of School LAN Management and Network-supported Learning Environment. Students are exposed to network theories, network configuration, operating system setup, web-based learning sites and a range of intra- and inter-networking concept and knowledge relevant to the school environment.

In the 2001-2002 academic year, we taught these modules and students' feedback are highlighted in Table 1. Students (over 80%) indicate that they want to practice their knowledge in a real school network which is not feasible at present. This reveals a pressing need from us to provide an authentic learning environment and, hence, the idea of a model LAN to mimic the real school environment is formulated. We proposed to the Institute for a model LAN establishment and the project has been accepted and funded.

Questionnaire(Further Comments)	Responses
The most useful aspects of this module were:	Recognize the essential network knowledge and principle
Why are they useful?	Help me understand the school network, how to setup a network-based learning environment, more confidence in teaching computing related subjects such as IT and very helpful on future self-development.
What can be changed to help students learn better:	More lectures and workshops. Doing more practice in a real network environment. Organize visit to HK school to get more exposure on a real school network. Provide a better workshop environment.
Why are these changes would help?	Practice can enhance the learnt knowledge and skill. Can understand better if learning in a real school network environment rather than from books and Internet.

Table 1. Highlight from 50 Students' Feedback

In this paper, we provide the overall design, the configuration and the salient features of our model LAN. The chief objective for this project is to foster an authentic teaching and learning environment for our

BEST COPY AVAILABLE

students. The design is also flexible enough to allow us to explore, reconfigure and extend beyond the current school networking environment.

Overview of the School Networking Environment Model (Model LAN)

In order to design an environment suitable for teaching and learning and, at the same time, provide an experience for our students close to a real school, we started with the recommendation found in the Procurement Guidelines from Education Department HKSAR (1999) as well as our experience on students' teaching practices in schools. We come up with the design topology of the school model LAN as illustrated in Figure 2. The model LAN stimulates the typical architectural design of a school in a laboratory. Four computers are grouped together in a subnet of a star topology to imitate an individual floor of a school. Each subnet is connected to the backbone switch using optical cables to mimic the vertical cabling of a school. This forms a star-to-star topology for the entire school.

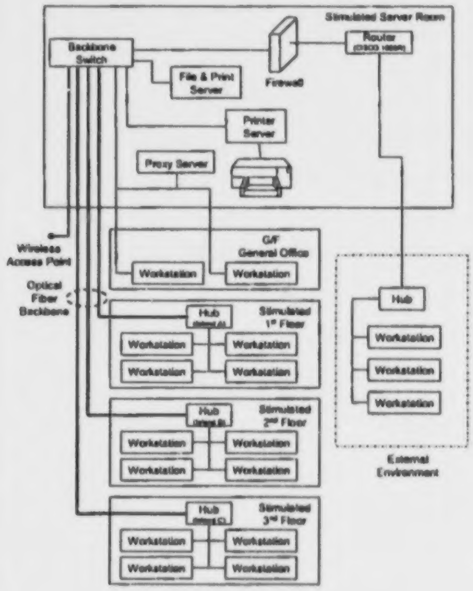

Stimulated Server Room
Backbone Switch
File & Print Server
Firewall
Router
Printer Server
Proxy Server
Wireless Access Point
Optical Fiber Backbone
G/F General Office
Workstation
Workstation
Hub
Stimulated 1st Floor
Workstation
Workstation
Workstation
Workstation
Hub
Stimulated 2nd Floor
Workstation
Workstation
Workstation
Workstation
Hub
Stimulated 3rd Floor
Workstation
Workstation
Workstation
Workstation
Hub
Workstation
Workstation
Workstation
External Environment

Figure 2. The Topology of Model School LAN Project

Since this is a teaching and learning LAN model, consideration must be given to the students on what the daily operations can likely be occurred in schools. Therefore, the salient features of our design include the following:

1. External access: We need to stimulate the external environment on accessing the network. Therefore, a stimulated external subnet through a router is protected by a firewall. All the traffic

BEST COPY AVAILABLE

from the simulated external subnet will be monitored by the firewall. Students will learn the important concept of security and the firewall setup activities.

2. Flexible configuration: We need to demonstrate to the students that it is possible to detach the three individual star networks / floors from the backbone switch. This is a very likely scenario in a large network when some segments are failed. Students can learn how to keep the network alive. Furthermore, by separating these star networks, we can support three small group workshops on the client-server networking model simultaneously.
3. Expandable features: We need to accommodate the latest development in schools. Campus-wide wireless communication is getting popular in schools. Therefore, the provision of wireless access point connected to the backbone switch allows the students to learn the configuration and setup of accessing the servers through wireless notebook within an accessible range. Traffic from this access point is monitored and coordinated by the proxy server. The concept of setting up a web-based portal in relation to the proxy server can also be learned in this configuration.

Conclusion and Future Work

This paper describes the model LAN project is currently undertaking in HKIEd. We are confident that this project can enhance the learning of our students on school LAN management. The model LAN will be used in the 2002-2003 academic year. By then, we can assess the learning outcome of this project.

The School Administration and Management System (SAMS) developed by the Government forms an integral part of the daily operations for teachers in schools. In the future, we need to enhance our model LAN by attaching another Virtual LAN to our model LAN to facilitate this type of networking facilities.

Acknowledgement

The authors would like to thank Stephen Ho for his technical support to this project and the IT Strategy Committee, Dr. Kar Tin Lee (ITADC), for the approval of this project.

References

CISCO (2001). Writing the Classroom Rules: An End-to-End Network for Delivering Broadband in Primary and Secondary Environments. Retrieved on 5th July 2002, from http://www.cisco.com/warp/public/cc/pd/si/casi/ca3550/prodlit/sndsy_dg.htm

Education Manpower Bureau HKSAR (1998). *Information Technology for Learning in a new Era Five-year Strategy 1998/99 to 2002/03*. Hong Kong: HKSAR.

Education Manpower Bureau HKSAR (1999). *Technical Guidelines for School LAN Implementation under the Information Technology in Education Project.*. Hong Kong: HKSAR.

Education Department HKSAR (2002). Retrieved on 4th July 2002, from http://www.ited.ed.gov.hk/English/ITinschool/Site_preparation/work_sitepreparation2_english.htm

Adaptation Architecture for Adaptive Educational Hypermedia Systems

José M Parente de Oliveira
Clovis Torres Fernandes
Computer Science Division, Technological Institute of Aeronautics
Brazil
{parente, clovis}@comp.ita.br

Abstract: Several Adaptive Educational Hypermedia Systems (AEHSs) have been described in the literature. In general, the adaptation mechanisms are presented but the architecture of these systems do not clearly separates the several components involved. As a consequence, these architectures neither facilitate the understanding and reproduction aiming at implementing new models of AEHSs nor offer a frame of reference for comparison and analysis. This paper presents a proposal for a generic architecture for AEHSs. On the basis of the analysis of AEHSs using the proposed architecture, it is expected that the architecture be a safety reference for the analysis and implementation of new AEHSs.

1 Introduction

Nowadays there are several Adaptive Educational Hypermedia Systems (AEHSs) available. The literature present them with their respective adaptation mechanisms [Brusilovsky et al., 1996; Fernández, 2000; Henze, 2000; De Bra and Calvi, 1998; Barbeiro, 2001; Weber et al., 2001]. In general, the architecture of these systems do not clearly separates the several components involved. As a consequence these architectures neither facilitate the understanding and reproduction aiming at implementing new models of AEHSs nor offer a referential for comparison and analysis. The main focus of this paper is to present a proposal of a high level architecture for AEHSs.

The paper is organized in the following way. Section 2 presents the proposed architecture. Section 3 presents some preliminary findings from the analysis of some AEHS using the architecture. Finally, Section 4 presents some concluding remarks.

2. Proposed Architecture for AEHS

To incorporate several adaptation aspects, the architecture of the AEHSs have to clearly separate the roles of the involved components. Adaptation includes aspects of adaptivity and adaptability [Opperman 1994; Opperman et al. 1997]. Adaptive systems have the capacity of automatically modifying their own characteristics with base on their perception of the user's necessities and personal characteristics. Adaptable systems offer tools that allow the user to explicitly set certain system characteristics in order to adapt the system to user's behavior.

Figure 1 shows the proposed high level architecture for AEHSs. Such an architecture is the result of the analysis of the architecture of AEHSs and adaptive systems described in the literature [Brusilovsky et al., 1996; Fernández, 2000; Henze, 2000; De Bra and Calvi, 1998; Barbeiro, 2001; Weber et al., 2001; Opperman, 1994; Opperman et al., 1997; Karagiannidis et al., 2001]. The explanation of the Interface Component is out of scope of this paper. The architecture's components are described next.

Interaction Analyzer

The Interaction Analyzer has two main functions [Karagiannidis et al. 2001]:

- To monitor learner-system interaction in order to get information on links that have been followed, selected tools, etc.

- To infer relevant conclusions on the learner's behavior, as for example if the learner wants to relate a giving concept with another one, wants more details, etc. Depending on the learner's actions the Interaction Analyzer draws conclusions that can be of adaptativity or adaptability types.

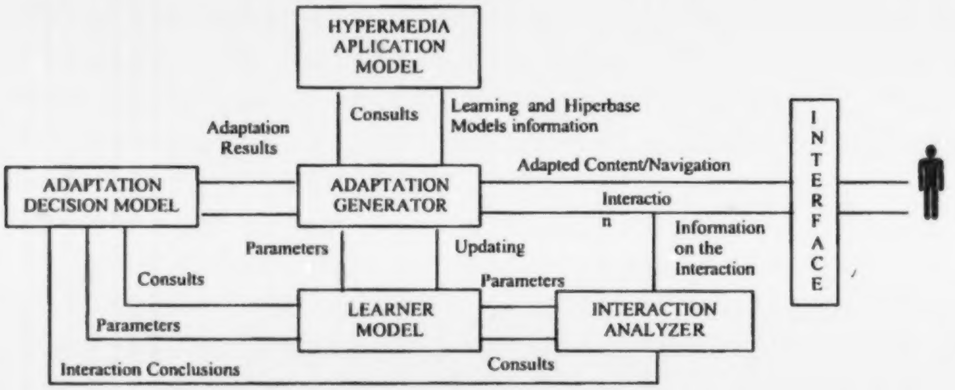

HYPERMEDIA APLICATION MODEL
Consults
Learning and Hiperbase Models information
Adaptation Results
ADAPTATION DECISION MODEL
ADAPTATION GENERATOR
Adapted Content/Navigation
Interactio n
I N T E R F A C E
Information on the Interaction
Parameters
Updating
Consults
Parameters
LEARNER MODEL
INTERACTION ANALYZER
Parameters
Interaction Conclusions
Consults

Figure 1: Proposed Architecture for AEHS.

Adaptation Decision Model

The Adaptation Decision Model is responsible for deciding *what* the system should do and *how to do* it. These decisions are based on the conclusions draw by the Interaction Analyzer. Examples of what to do are to present more details, related concepts, etc. The *how to do* part includes the selection and the activation of the corresponding adaptation mechanisms. Among these mechanisms are the two main adaptation types identified in Brusilovsky [1996, 1998]: adaptive presentation and adaptive navigation. The function of the adaptive presentation is to adapt the content of an information node of the application domain to the current knowledge level, goals and other characteristics of the learner. The function of the adaptive navigation is to help the learners to find their navigation routes throughout the information hyperbase. The system provides this last adaptation type by presenting the links for the goals, knowledge level and other characteristics of the learner.

As to adaptability, the Adaptation Decision Model simply carry out the action requested by the learner. Adaptability includes the several tools the systems offers to the learner with respect to interface, content and navigation adaptation, as well as to inspection of the learner model.

Learner Model

The Learner Model is the structure that contains the information on the learner's characteristics during the interaction with the AEHS, that allows the system to adapt to these characteristics. Among the main learners' characteristics to be considered for adaptation are knowledge level, goals, previous knowledge, experience and preferences [Brusilovsky, 1996]. Another aspect that can be added to this list are the personal characteristics that define a learner as an individual, as for example personality factors, cognitive factors and learning styles [Brusilovsky, 2001].

Hypermedia Application Model

The Hypermedia Application Model comprises two submodels: Hyperbase and Learning Submodels. The Hyperbase Submodel includes aspects related to domain modeling, metainformation on the domain and the way information is internally represented. The stored information include the concepts to be learnt, examples, exercises and distinct ways of learning evaluation. The Learning Submodel includes pedagogical aspects, guided and unguided presentation, etc. This submodel represents the type and the way the learning activities should be realized, which actually determine the learners's behavior during the activities.

Adaptation Generator

The Adaptation Generator is responsible for generating what will be presented to the learner as a result of processing the information received from the Interaction Analyzer, Adaptation Decision Model, Learner Model, and Application Model.

3 Analysis of Adaptation in AEHSs

Besides being useful for the implementation of AEHSs, the architecture presented in Figure 1 also provides subsidies for the analysis of the adaptation in AEHSs. As an example, Figure 2 presents the result of an analysis of the architecture of the AEHS ELM-ART, according to the proposed architecture.

ELM-ART, an acronym for *Episodic Learner Model – Adaptive Remote Tutor* [Brusilovsky et al., 1996], is an adaptive system for supporting learning programming in Lisp. Even though ELM-ART be considered an AEHS in this work, Brusilovsky et al. [1996] refer to it as an Intelligent Tutoring System for the WWW.

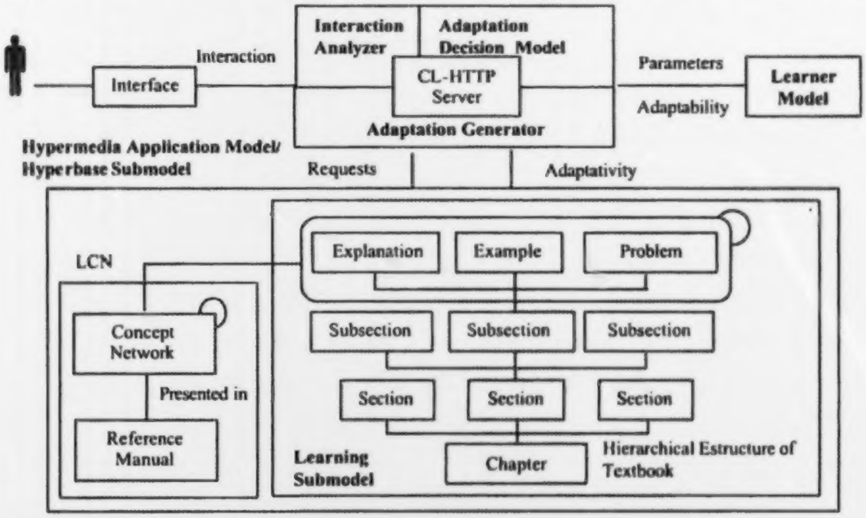

Interaction
Interface
Interaction Analyzer
Adaptation Decision Model
CL-HTTP Server
Adaptation Generator
Parameters
Adaptability
Learner Model
Hypermedia Application Model/ Hyperbase Submodel
Requests
Adaptativity
LCN
Concept Network
Presented in
Reference Manual
Explanation
Example
Problem
Subsection
Subsection
Subsection
Section
Section
Section
Learning Submodel
Chapter
Hierarchical Estructure of Textbook

Figure 2: A possible structuring of ELM-ART's architecture according to the proposed architecture.

In Figure 2, the Hypermedia Application Model comprises the Hyperbase Submodel and the Learning Submodel, but in fact the Hyperbase Submodel corresponds to the whole Hypermedia Application Model. The Hyperbase Submodel consists of two main components: The Lisp Concept Network (LCN) and the Learning Submodel called also the Hierarchical Structure of Textbook. The LCN represents all the concepts used in the course, as well as the relations among them. Every concept in LCN corresponds to a page in the reference manual. In the textbook, each terminal unit, defined as Explanation, Example and Problem, treats the concepts of the textbook sections. In addition, each textbook section is indexed by the concepts of the LCN.

Since the Learning Submodel is entirely integrated to the Hyperbase Submodel, any change in the Learning Submodel in fact entails changes to the Hyperbase Submodel.

The CL-HTTP Server performs all the functions proposed in the Interaction Analyzer, Adaptation Decision Model and Adaptation Generator. Such a integration may cause some problems for carrying out system maintenance and improvements.

Besides ELM-ART, the following systems have been analyzed [Oliveira, 2002]: HEZINET [Fernández, 2000], KBS Hyperbook [Henze, 2000], AHA [De Bra and Calvi, 1998], CHA [Barbeiro, 2001] and NetCoach [Weber, 2001]. The analysis presented in Oliveira [2002] includes possible structuring of these systems using the proposed architecture, similar to the one showed in Figure 2. The following recurrent problems were noticed:

- There are no clear separation between the hyperbase submodel and the learning submodel. To some extent these two submodels are put together in a single one.
- Personal characteristics that define a learner as an individual, as previously mentioned, are not explored in these systems.
- Adaptability aspects are poorly explored. Basically they are limited to allowing the learner to define personal preferences in terms of information media and to change some aspects of the learner model related to the learner's perception of the concept mastery level.

4 Conclusion

Besides being a useful model for the implementation of new AEHS, the proposed architecture can be considered as a high level framework for the analysis of the adaptation in AEHSs. The proposed architecture fulfills the lack of a common frame of reference to such an analysis. Though the proposed architecture can drive the analysis work, it is still difficult to analyze AEHSs because of the poor system descriptions available in the literature.

The adaptation concept for AEHSs maybe could be more explored on the basis of the Hyperbase Submodel, Learning Submodel, Adaptation Decision Model, Adaptation Generator, Learner Model and Interaction Analyzer, at least to improve the systems descriptions. Maybe this can open up space to explore different levels of adaptation between the concepts of adaptativity and adaptability.

References

Barbeiro, Raul S. G. (2001). Characterizing and Modeling of Adaptive Hypermedia Courses. National Spatial Researching Institute (INPE), Master Degree Dissertation. (Available in Portuguese).

Brusilovsky, Peter (1996). Methods and Techniques of Adaptive Hypermedia. *User Modeling and User Adapted Interaction*, v.6, n 2-3, p 87-129.

Brusilovsky, Peter (1998). Adaptive Educational Systems on the World-Wide-Web: A Review of Available Technologies. *Proceedings of Workshop "WWW-Based Tutoring" at the 4th International Conference on Intelligent Tutoring Systems* (ITS'98), San Antonio, TX, August 16-19, 1998.

Brusilovsky, Peter (2001). Adaptive Hypermedia. *User Modeling and User Adapted Interaction*. Kluwer Academic Publishers, v.11, pp. 87-110.

Brusilovsky, Peter; Schwarz, Elmar; Weber, Gerhard (1996). ELM-ART: An intelligent tutoring system on World Wide Web. In C. Frasson, G. Gauthier, & A. Lesgold (Eds.), *Third International Conference on Intelligent Tutoring Systems, ITS-96* (LNCS, Vol. 1086). Berlin: Springer-Verlag, p 261-269.

De Bra, Paul; Calvi, Licia (1998). *AHA! An Open Adaptive Hypermedia Architecture*. The New Review of Hypermedia and Multimedia. Taylor Graham Publishers, v. 4, p 115-139.

Fernández, Tomás A. Pérez (2000). *Un Hiperentorno Adaptativo para el Aprendizaje Instructivo/Constructivo*. Universidad del País Vasco, Departamento de Lenguajes y Sistemas Informático, Memoria para el Grado de Doctor en Informática.

Henze, Nicola (2000). *Adaptive Hyperbooks: Adaptation for Project-Based Learning Resources*. University of Hanover, Department of Mathematics and Informatic, Doctoral Dissertation.

Karagiannidis, C; Sampson, Demetrios; Brusilovsky, P. (2001). Layered Evaluation of Adaptive and Personalized Educational Applications and Services. *AI-ED 2001*, Workshop on Assessment Methods in Web-Based Learning Environments & Adaptive Hypermedia, May 19, 2001, p 21-29.

Oliveira, José M. P. (2002). Adaptation Model for Adaptive Educational Hypermedia Systems. Technological Institute of Aeronautics (ITA), Computer Science Division. Doctoral Thesis Proposal.

Opperman, Reinhard (1994). Adaptively Supported Adaptability. *International Journal of Human-Computer Studies*, 40, 544-472.

Opperman, Reinhard; Rashev, Rossen; Kinshunk (1997). Adaptability and Adaptivity in Learning Systems. *Knowledge Transfer*, vII, p173-179.

Weber, Gerhard; Kuhl, Hans-Christian; Weibelzahl, Stephan (2001). Developing Adaptive Internet Based Courses with the Authoring System NetCoach. *Twelfth ACM Conference on Hypertext and Hypermedia – Hypertext' 01*. Arhus, Denmark, August 14-18.

Every Word a Click: The Hypertext Being Smart

Young Park (yp85@columbia.edu),
Instructional Technology & Media, Teachers College, Columbia University

Abstract: Hypertext, one of representatives of Internet is well known for its unique features for knowledge generating activities. Now, the new types' smart hypertext is appearing to overcome current hypertext's limitations. They seem to be promising since they start developing recognizing the current Internet users' needs. The study's purpose is to investigate the new hypertext's meaningfulness on knowledge activities and to propose hypertext's future direction. And it calls researchers' attentions by asking its interrelationship with cognitive development.

The Problems

The hypertext is well known as a tool to represent rich semantic relationships. A learner builds up her memory structure by adding a new object to existing memory structure. So some factors such as proper visual association, meaningful relationships or appropriate category are very significant to enhance learning. For this reason, hypertext is very suitable to support knowledge activities.

The current hypertext is built up only by links created by a web author. It is incomplete in terms of user-centered information environment with the following reasons. Very often a web page's information can be interpreted as very different anchors from information author's original intention. It could mean that it does not provide the right response or feedback according to users' inquiry. Immediate response is one of very important factors in knowledge activities because otherwise, a user might lose her curiosity or even forget soon what she would look for. Thus, with some kinds of aids, if a user is able to construct her own hypertext-links for herself, presumably, she is able to follow her own curiosity and to facilitate knowledge activities. It could also encourage a user's flexible and creative thinking process. On the basis of such a point, I propose that the current hypertext should be more developed to be more user-centered, context-oriented and learning-focused. On the basis of this perspective, I searched the Internet and found out three new types' hypertext applications, Atomica (www.atomica.com), Flyswat (www.flyswat.com) and Microcosm (www.microcosm.com) reflecting my perspective.

The Example

Among them, Atomica, a free shareware is an exemplary one to demonstrate the above perspective. Its key point is the simple human computer interaction, which is that one just clicks on the word you want defined or explained. When a user clicks a word on where it is available, whether you're using, for example, an e-mail client, a word processor or a spreadsheet as well as Web, Atomica automatically searches its relevant information as well as definition and then opens a small window to show the list.

There is an example for understanding its features. Suppose that a user was reading an article on the Web, or an e-mail and she came across this sentence: "The abstemious people from Woonsocket invested aggressively in companies like Tecumseh Products, hoping to become as rich as their idol, John Kluge." And suppose she had no idea what "abstemious" meant, where Woonsocket was, what Tecumseh Products did, or who Mr. Kluge was. To find them out quickly using the Internet, she needs to look up each term individually, which requires her to leave the document that she was reading and laboriously type in each term for multiple searches, probably at multiple sites. Instead, she could use Atomica that fetches such answers from the Internet, without leaving the text she was reading. Also, Atomica combines the ability to search multiple information sources simultaneously with a natural intelligence that helps to ensure targeted results. Users don't have to memorize Boolean logic or even construct an English language query. For the kinds of information Atomica is designed to parse-word definitions, language translations and company profiles-it works well.

Finally, one of the most distinguishable elements of Atomica is trying and guessing the entire phrase or context of a word that a user clicks on although it is still very limited. If, for example, a user clicks on either word in the phrase "Supreme Court," the program pops up with an answer about the highest court in the U.S., not a definition of either word on its own. And it pays attention to capitalization. It knows that the word "polish" is something a user does to furniture, but Polish is a language and culture (Wall Street Journal, 2000).

However, the service is still a work in progress. First, it doesn't work with text inside an image. Second, it is not able to search multimedia-based information such as mp3 files or quicktime movie files. Third, while it draws on a host of reference works and Web databases, it doesn't use premiere sources, such as the Encyclopedia Britannica and major newspapers. It tends to rely on almanacs, single-volume encyclopedias and little-known reference sites, though it does use major dictionaries (Wall Street Journal, 2000).

The Suggestions and Discussion

I conducted the small pilot study with five graduate students in Teachers College, Columbia University in order to explore for the new hypertext's future direction. Based on Atomica's functions and the results of the pilot study, I propose the following directions.

First, hypertext is merging with a search engine. With it, hypertext is becoming more effective and is able to reduce users' information seeking efforts considerably.

Second, the future hypertext's success empowered by a search engine depends on, I believe, how much it understands users' intention. Namely, they should be smart enough to understand not only what a user is looking for but also the whole context where a user is. The findings of a pilot study support it. Its subjects merely used very simple search formulations. What they wanted to obtain was simply the quick and effective search results and not-so-complicated human-computer interaction. Hence, the concept of 'agent software' is inevitable one so that it can play a role like a secretary or a task manager reducing human users' cognitive overload to a certain degree that they feel comfortable. At the same time, such agents will restrain information overload by filtering and analyzing information on web pages.

Third, when the smart agent, hypertext provides advice or a hint to users by being modeling and doing scaffolding exactly like a teacher in a classroom, I assume that it could reduce users' unnecessary search behaviors and assist developing their' meta-cognitive process. Atomica's 'did you mean?' description or its additional key words' list can be exemplary.

Finally, while more successful information seekers seem to be able to initiate their search behaviors on their own, less successful ones need a structure to help them search and do knowledge activities. Hence, it will be worth to consider if hypertext can provide different levels' gateway or interface design according to information seeker's search capability consisted of novice, intermediate and expert.

Such a new hypertext seems to be worthy for further consideration to influence users' information search behavior. Although I have explored mostly the positive impacts of it but there should be negative impacts such as users' dependence on its smart functions. Thus, it should be pondered critically to what degree and in what ways it would support human beings' Internet search. That is, we should investigate its multi-dimensional aspects carefully. I hope that this study could draw educational researchers' attention to explore its roles and potential to build up the enhanced learning environments.

References

Choo, C. W., Detlor, B. & Turnbull, D. (1999). Information Seeking on the Web – An Integrated Model of Browsing and Searching, 1999 ASIS Annual Meeting contributed Paper.

Mossberg, W. (10/05/2000). No Need to Leave the Page As Atomica Fetches Answers, *Wall Street Journal.*

Unz, D. C. & Hesse, F. W. (1999). The Use of Hypertext For Learning *Journal of Educational Computing Research*, v20, n3, 279-295.

Generic simulator model

for training and learning in virtual laboratory environments

Pierric PERMEZEL [1], Olivier MARCOUX [1],
Hamadou SALIAH-HASSANE [2], Maarouf SAAD [3], Chahe NERGUIZIAN [4]

[1] ENSEITH, pierric.permezel@free.fr
[2] Télé-université & LICEF/CIRTA Research Center, saliah@teluq.uquebec.ca
[3] École de Technologie Supérieure, msaad@ele.etsmtl.ca
[4] École Polytechnique de Montréal, Chahe.Nerguizian@mail.polymtl.ca

Abstract : Designing and developing simulators as a learning tool is an essential aspect of computerized learning systems. Yet such computerization must be well thought out and simulators designed for this purpose must be a useful and effective alternative to using the real systems they simulate. We therefore propose a simulator design method based on a simple, modular and above all generic and reusable architecture. This design method can therefore be applied to a broad range of fields and offers an efficient solution to various problems such as 1) economic factors, since a simulator is often less expensive than the system it simulates; 2) geographic constraints, since it can be utilized almost anywhere; 2) grasping certain concepts, since it can focus on interesting aspects and results by getting rid of numerous technical problems; 3) lastly, it lightens the educator's workload by assisting the student using the system. As well, the widespread use of *Java* allows for a quick, simple and efficient implementation of such simulators, especially due to its multi-platform properties, the modular nature of its *JavaBeans*, the ease with which the encapsulation of variables is executed and the inherent self-analysis possibilities of this language. Yet it should be pointed out that *Java* still exhibits problems, especially in regard to sluggish execution speed and insufficient security management.

Introduction

Over the last few years, there has been an explosion and widespread use of communication technologies, and of the Internet in particular. Thus there is an easier access to these new technologies, from an intellectual and an economic point of view. Educational and teaching institutions have welcomed this electronic revolution, since some educators have long dreamed of the benefits of computerizing learning systems (Paquette et al, 1996). In fact, they have in many cases already explored this approach, and have encountered numerous problems: an inadequate and heterogeneous infrastructure of materials and software, insufficient processing capabilities and above all, insufficient design and development tools. As a result, numerous specific learning objects have been created independently: on-line courses, student evaluation tools, interactive tutorials or virtual laboratories systems often based on simulations or remote access to real apparatus (Saliah et al, 1999). Let's recall that a virtual laboratory is a space where several people can run experiments based on real or simulated data and materials, while being totally free of geographic constraints This paper will deal with the latter type of computerized learning system. Developing reusable pedagogical and modular software simulators of real systems offers several advantages: 1) It helps students grasp the fundamental concepts of a system by getting rid of material problems such as bad contacts in electronic circuitry, handling hazardous products, lengthy and laborious handling of material; 2) It offers automatic assistance during the learning process by providing students with advice and relevant information at the appropriate moment; 3) Lastly, it resolves economic or physical problems involved in accessing to costly materials, by simulating and integrating real materials within the context of *virtual laboratories*.

Software solutions have been available for some time and propose remote access to various devices (National Instruments, 1998) and (Sigmon and Davis, 2001), yet they incur numerous problems: utilization limited to a specific field, complicated utilization, difficult integration with a computer-assisted learning system (CAL) (Saad et al, 2001). As a solution to these problems and requirements, in this paper, we are proposing a generic simulator model for training and learning within virtual laboratory environments based on reusable Java components (Matena et al, 2001). In the following sections we will describe the architecture of the proposed modular and generic simulator model.

A Simple Case Study: An Helicopter Altitude Control System Simulator

Requirements

In order to clearly describe the basic components and advantages of our model, we propose designing an helicopter control system simulator. We wish to develop a Distributed Computer Aided Learning application that copes with the specification described in table 1. These specifications let us henceforth predict the functions that should exist in our simulation application.

Table 1: Specifications and Functions Sought

Specifications	Functions Sought
To simulate an helicopter altitude control system	• simulation functions of the system based on mathematical algorithms and equations modeling the proposed filters. • set of variables representing the simulated system state
Lets the user interact with the system parameters during the simulation	• user interface reacting at any time during the simulation • immediate feedback of any modification • control of transition states from setting to setting, as required
lets the simulation be conducted automatically according to a pre-established scenario	• scenario manager
can run this simulation in real time by means of a real data acquisition system; Data can be acquired from a remotely located site through computer networks can export simulation results to an external software.	• input/output control • capability of importing signals, doing calculations and exporting results in real time; and configurable data acquisition system

Generic Model Proposed

The generic interface has three windows (Figure 1). The first allows the input of the physical model's parameters. All the controller parameters are defined in this window and they can be changed during the simulation. The second window is designed to animate the physical representation of the system. For example, figures 2, 3 and 4 shows respectively simulators of a tank, a submarin and an helicopter control system within the same interface framework. Finally, the third window gives a brief explanation of the theory related to the system, the diagram bloc and the time domain results. The diagram bloc illustrates the control loop. In the case of the helicopter altitude control simulator (Figure 4), R(z) is the set point signal, E(z) represents the error between the set point and the measured output Y(z). The error is then applied to the controller to compute the control to be applied to the system. In the case illustrated above, the controller structure is a PD type controller with the following transfer function $G_c(z)$ in the z-domain:

$$G_c(z) = K_P + \frac{K_D}{T}\frac{z-1}{z}$$

where K_p and K_D are the proportional and derivative controller gains and T the sampling period.
The output Y(z) is related to the control U(z) by the following relation

$$\frac{Y(z)}{U(z)} = K\left[\frac{T}{z-1} - \tau\frac{(1-e^{-\frac{T}{\tau}})}{z-e^{-\frac{T}{\tau}}}\right]$$

This architecture is comprised of the following five main modules:

The System State Module

The *State variables* contain the information representing the simulated system state. These values are memory-resident and can be consulted and modified via the *Simulator, Input-Output, GUI* and *Scenario*

BEST COPY AVAILABLE

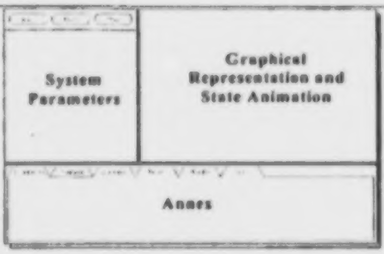


Figure 1 The Generic Interface Model

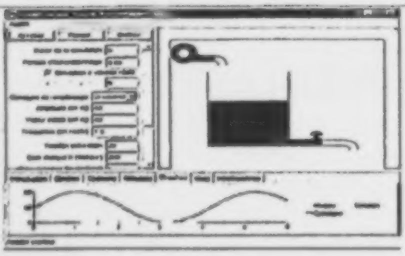


Figure 2 A Tank Simulation Interface

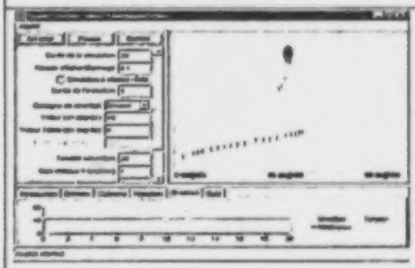


Figure 3 A Submarin Simulator Interface

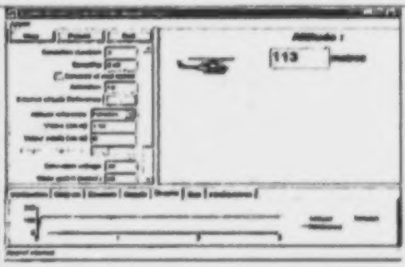


Figure 4 An Helicopter Simulation Model

Manager modules. In the highly unlikely event that a state variable might be simultaneously modified by two modules, protecting concurrent access to the variable by means of mutual automatic exclusion would be advisable. The *write controller* sends events to other modules when the value of a variable being utilized has been modified

The Simulator Module

How this module works can be clarified in figure 7. The *simulation model*, specific to each application, contains the code needed for the simulation itself. This simulation will generally be based on a set of mathematical formulas and other constants. The *GUI pilot*, also specific to each application, gives a graphical rendering of the simulated system state by driving the *GUI*.

The Graphical User Interface

The *GUI construction module* represented in figure 8 utilizes set data to define all components to be loaded on starting the application. It creates the startup screen and all windows or components that could be utilized during the simulation. The *standard and intelligent component library* provides various types of visual or non-visual components. Each component will possess some input data (title, style, etc...) and output data (values). Interacting with these components (click, value modification or entry) will automatically generate a *system state* modification, according to the new state of this component.

The Input/Output Module

The *exported data management* module exports data generated by the simulator. It controls the entire process such as the connection with external applications, the accessibility, data transfer (sending) and traffic flow security. The *imported data management* module, on the other side imports data generated from external sources and useful to the simulator. It also controls the entire process but deals with the received data instead.

The Scenario Manager Module

The scenario manager's role is to drive the simulator according to a pre-established scenario or according to a user-generated scenario. Here, the Graphical User Interface (GUI) Pilot is a set of functions allowing the user to edit scenarios and control their execution.

BEST COPY AVAILABLE

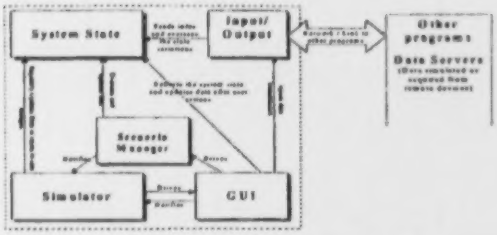

System State
Input/
Output
Other
programs
Data Servers
Scenario
Manager
Simulator
GUI

Figure 5 The Simulator System Architecture

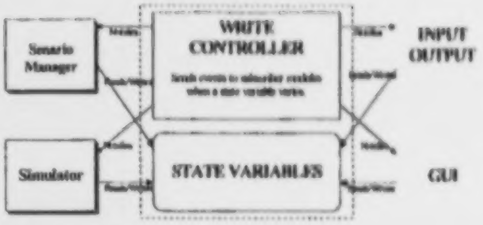

Senario
Manager
WRITE
CONTROLLER
Simulator
STATE VARIABLES
INPUT
OUTPUT
GUI

Figure 6 The System State Module

Conclusion

Computer Aided Learning applications are fast becoming an essential learning tool. Simple, modular and generic simulators represent a solution for various problems: economic factors, geographic constraints, grasp of certain concepts (understanding the fundamental notions involved), avoidance of having to deal with real equipment, efficient follow-up of student progress. We have used JAVA, a computer language, to demonstrate our concept of generic control system simulator. The model can be used for applications other than learning. This design method is not limited to the teaching area and can very well be utilized in developing all types of simulators, be they stand-alone or part and parcel of a virtual laboratory.

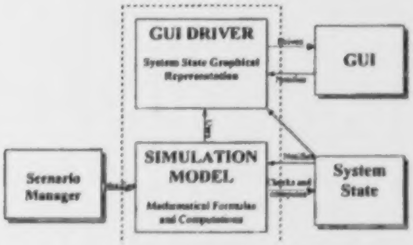

GUI DRIVER
System State Graphical
Representation
GUI
SIMULATION
MODEL
Mathematical Formulas
and Computations
Scenario
Manager
System
State

Figure 7 The Simulator Module

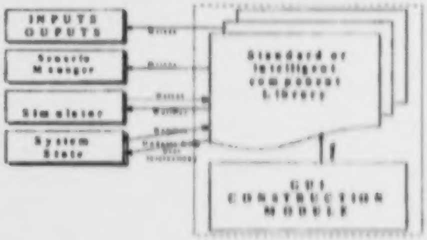

INPUTS
OUPUTS
Scenario
Manager
Simulator
System
State
Standard or
intelligent
component
Library
GUI
CONSTRUCTION
MODULE

Figure 8 Graphical User Interface

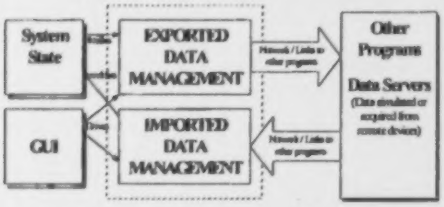

System
State
GUI
EXPORTED
DATA
MANAGEMENT
IMPORTED
DATA
MANAGEMENT
Other
Programs
Data Servers
(Data simulated or
acquired from
remote devices)

Figure 9 The Input/Output Module

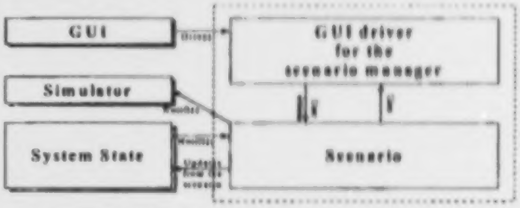

GUI
Simulator
System State
GUI driver
for the
scenario manager
Scenario

Figure 10 The Scenario Manager Module

References

Paquette, G., Ricciardi-Rigault, C., Paquin, P., Liégeois, S., Bleicher, E., (1996), *Developing the Virtual Campus Environment, Proceedings of Ed-Media 96 World Conference on Educational Telecommunication*, (pp. 244-249), Boston, USA.

Saliah, H. H., Abecassis, A., Nurse, E., (1999), *Design of a Generic, Interactive, Virtual and Remote Electrical Engineering Laboratory, Frontier in Education Conference 99: Designing the Future of Science and Engineering Education*, San Juan Puerto Rico.

National Instrument, (1998), *LabVIEW Basics I Hands-on Course*, National Instruments, Austin.

Sigmon K, and Davis K., (2001), *Matlab Primer - 6th Edition*, Chapman and Hall/CRC Press

Saad, M., Saliah, H. H., Hassan, H., El-Guetioui, Z., Cheriet, M., (2001) *Synchromous remote accessing control laboratory, 2001 International Conference on Engineering Education; Interfacing the World, Oslo/Burgen, Norway.*

Matena, V., Stearns, B., (2001) *Applying Enterprise JavaBeans: Component-Based Development for the J2EE Platform, The Java Series, Sun Microsystems, Inc.*

BEST COPY AVAILABLE

E-LEARN 2002 CONFERENCE
BRIEF PAPER ABSTRACT

Title: A District in Transition: Information and Decision-Making in a California Community College

Authors: Dr. Lisa Petrides and Sara McClelland, Teachers College, Columbia University
Email: lap52@columbia.edu

BACKGROUND

Information systems play a critical role in assessment and accountability. In order for educational institutions to develop effective methods to evaluate strategies that improve student outcomes, a reliable and accurate system must be in place for collecting and disseminating data. These data, in turn, must be readily accessible and put into formats that are easily understood and used. Finally, staff must be willing and able to use data and have the ability to inform and modify policy and practice accordingly. Unfortunately, most community college districts have no reliable methodology to evaluate the effectiveness of resource allocation in improving student learning. However, state and national trends are clearly moving in that direction—improvement of assessment and accountability research.

This study examines the ways in which faculty and staff within a community college district interacted with student information in making day-to-day decisions and engaging in long-term planning. The goal of the research was to better understand the intersection of cultural, political and technological forces within the district as they faced an increased demand to use data, information, and knowledge to account for monies spent and decisions made. Current organizational change research shows that effective use of data and information can raise performance, productivity, and outcomes at all levels – for students, faculty, administration, and governance. Therefore, an institution that collects and uses data on student performance can proactively make decisions about investments in programs and services, target remedial assistance, eliminate duplication in programs, and ensure higher rates of student success.

METHODOLOGY

Due to the increase in state-mandated accountability measures and the desire for internal research, this study examined the use of data to inform decision-making in one California community college district. We were interested in identifying the issues that arose out of the desire to use information about students to inform decision-making; specifically, the types of student information that were required, how information was produced or accessed, the quality or usability of the information, and how the information was used once it was received.

The research team conducted 49 in-depth interviews with administrators, faculty, and staff at one community college district. We used the critical incident technique that allowed us to elicit examples and outcomes by gathering information about actual behavior that relied upon specific recall, thereby bypassing opinions and hypothetical situations. By asking people to recall specific incidents, gathering information about the context of those incidents and asking whether the incident had a successful or unsuccessful outcome, we were able to take a snapshot of what types of information had been requested over the past year and to identify the processes undertaken by information seekers to get information on students. We selected our interveiw samples based on a cross section of administrators, faculty, and staff members who were chosen because of their involvement in decision making processes. The critical incident methodology allowed us to examine: 1) the beginning and ending of a critical incident; 2) a task or goal of a user just before critical incident occurred; 3) expectations of user just before critical incident occurred; 4) a detailed description of critical incident (what exactly happened, what caused it); and 5) the severity and frequency of the critical incident

We employed a non-random selection process that included:

1. Administrators: The high level officials who oversee the management of the campuses
2. Faculty: The teachers who are also involved in decision making bodies on the campus such as deans and program coordinators
3. Staff: The assistants and aides who support the faculty and administrators and therefore are often the ones who do the legwork to find out student information

FINDINGS

The first theme that we found was the presence of a very strong research culture within the district. Individuals have a strong desire to find out how they can help students and a highly developed ability to craft insightful and focused inquiries. However, historically necessary data and resources have not been readily available. As a result, this desire to improve outcomes has often been hindered as faculty, staff and administrators struggle to find data that can be used to make informed decisions concerning students. Said one participant:

> *I can't even tell you how many students survive a class here. I have no idea. Does this make me feel good as a manager? Absolutely not. I feel like I'm trying to manage in one of those black hoods where you're just kind of feeling - is this an elephant? Is this a giraffe? What do I have a hold of? And I'm trying to do my best guess.*

Instructors and administrators alike have a strong desire to acquire meaningful data to become more effective in their jobs, yet this desire has not been appropriately supported or aided by the existing student information systems. More often than not, data are fragmented, scattered, and incomplete. One participant commented:

> *[T]here's more than one system tracking student data and they don't -- they're not the same. They don't yield the same data. So is it valid? Is it reliable? Can you count on it? Can you do projections? Can you do reports accurately? Probably not.*

Additionally, access to and flow of information remains inconsistent across departments. Technology infrastructure and capabilities are insufficient to support the increasingly complex needs for meaningful information. As a result, existing data fails to inform its users in ways that enable them to decide where to invest resources and which programs need to be improved. Most are forced to rely on hunches about student performance rather than rely on multi-variable student data that are continuously collected and analyzed. This translates to lost opportunities on each campus—lost time and energy having to create smaller but more accurate systems, lack of long-term planning data, difficulty with enrollment management, problems in assessing student outcomes and establishing benchmarks for comparison, and an inconsistent ability to substantiate needs for further funding. This ultimately impedes progress in the development of appropriate learning environments or interventions for students.

This culture of inquiry has been historically hindered by the lack of available data resources. In the face of this deficiency, many individuals have developed ways of working around this problem and have created their own data, in the form of separate databases, internal student data, and sometimes resorting to methods such as hand counting students in classrooms because they believe an accurate and timely count could not be retrieved using the existing technology.

> *Well, we all use Excel. We all use our own spreadsheets. We do all that. I mean, that's what we do.*

Although this means there is a strong desire to acquire meaningful data in order to be effective educators and administrators, this desire has not been appropriately supported or aided by the existing student information systems. This translates to lost opportunities on each campus—lost time and energy having to create smaller but more accurate systems, lack of long-term planning data, difficulty with enrollment management, and an inconsistent ability to substantiate needs for further funding. This ultimately impedes the district's progress in the development of appropriate learning environments or interventions for their students. They are forced to rely on hunches about student performance rather than rely on multi-variable student data that is continuously collected and analyzed.

> *Interviewer: How are you able to, I mean, what are examples of situations in which you find yourself needing to make a decision, needing data, and what mechanisms do you devise in order to do that?*
> *Participant: Shoe leather, conversation, and just my best guess. That's all I've got.*

All of these factors impact this community in a number of important ways. First, students are not served to the fullest. Second, this district is not spending its limited resources effectively. If staff are forced to hand count students, this is time and energy that is taken away from many other important tasks. Third, they cannot plan for the future when they are not sure what has worked in the past. They cannot develop new strategies for growth and change with the times when they do not know what programs are shown to positively impact student success. They simply do not have enough information to know what works and what does not.

> *Interviewer: And are you able to notice any distinguishing characteristics among those students who are failing? Is that kind of information-- Participant: That's the information that we're not getting. We're not breaking it out. We're not breaking it out by ethnicity, or by course, or by gender, or any of those kinds of things. That would be helpful information to know how to target what to look at, are there special populations that are encountering these kinds of issues. And if so, then you identify the population and look at that population and say, 'Well, what are the barriers? What can we do to create interventions?' But we're not getting to that depth utilizing the research information to get to that depth to problem solve.*

CONCLUSION

We believe that the ability of administrators, staff, and faculty to obtain the information they need to make informed decisions about their academic programs and services is criticial to student success. As researchers, we started with a basic assumption that the accumulation of data is influenced by the core values of the organization, and that these data, through human interaction, take on significance as information. Our findings indicate the importance of research in the field of education that can help us understand how and if data are transformed into information and then knowledge, and finally, how this process informs decisions that contributed to positive student learning outcomes.

Research concerning how groups manage data and information in order to make decisions has long been popular in other contexts, outside of higher education. There has been a great deal of recognition in the business world, for example, that information and knowledge management can be vital tools in organizations. However, it is only recently that institutions of higher education have begun to look at how they might more effectively use information systems for better management practices, as well as in teaching and learning environments. Because much of the literature on knowledge management in business is focused on economic utility and consumerism, studies that focus on the field of education are important in order to ensure that issues of student success in terms of democracy (such as information sharing) and social justice (such as access and equity) are kept in the forefront.

CORE SOLUTIONS: A TRIFECTA FOR EDUCATION

Jennifer Platt
University of Central Florida/Orlando
College of Education
4000 Central Florida Blvd.
Orlando, Florida 32816 USA
platt@mail.ucf.edu

Mem Stahley
University of Central Florida
Brevard Campus
1519 Clearlake Road
Cocoa, Florida 32922 USA
mstahley@mail.ucf.edu

Abstract: In the central Florida area, the School District of Osceola County, the Valencia Community College and the University of Central Florida have designed a partnership program to give employees of the school district the opportunity to complete a baccalaureate degree. This paper addresses the current shortage of qualified teachers, the need to recruit and retain teacher education candidates through a mutual effort by universities, community colleges, and school districts, and the need to attract a more demographically representative minority population to teaching. The paper also presents the existing connectivity and technological tools that support and enrich the academic experience. The program, named CORE (Creating Opportunities and Resources for Educators) is described. The presentation will include a live demonstration of the technological infrastructure affording access to library and Internet resources for all CORE students and faculty.

The CORE Program

Osceola County has a reported population of 172,493 residents. The School District of Osceola County has a population of 37,774 students in K-12 with a growth rate of 12% annually. Of these students, 35% are Hispanic and about 22% have language problems. The school district identified as one of its highest priorities the recruitment of a diverse pool of teachers to meet the needs of a diverse group of students. To accomplish this, the Superintendent of the School District of Osceola County and the President and Provost of Valencia Community College contacted the Dean and Associate Dean of Education at the University of Central Florida to form a partnership that would give employees of the school district (non-instructional personnel) the opportunity to complete a baccalaureate degree in Education.

The CORE Program (Creating Opportunities and Resources for Educators) is a collaborative partnership formed by a metropolitan, research university, a community college (a Hispanic serving institution), and a school district with a Hispanic population of 35% that is experiencing a critical shortage of teachers. The purpose of the CORE Program is to address the critical shortage of qualified teachers by assisting non-instructional personnel in the district to pursue a degree in teaching. It is based on the premise that the accountability for solid educator preparation relies on the mutual efforts of university, community college, and school district faculty and administrators; business leaders; legislators; members of the media; private foundations; counselors; advisors; and financial aid officers. The purpose and outcomes of CORE underscore the need for collaborative efforts among diverse partners to address the national shortage of qualified teachers. The CORE Program has promoted the success of all its students by assisting them to overcome the obstacles of distance and time, learning in isolation, problems accessing technology, and difficulty with paying tuition.

CORE participants who live and work in the county have excellent access to lower division college classes at the local community college. The community college campus is located in the heart of the county's most populous area. The CORE Program offers a class schedule that accommodates the needs of the participants who are faced with the difficulties of working full-time, meeting their family commitments, and taking classes. CORE participants also have access to specially designed online classes that facilitate flexible time scheduling. For many potential teachers, the prospect of completing their studies at a senior institution is complicated by the fact that the local university is over 40 miles away. For CORE participants, the university offers the baccalaureate degree right on the community college campus with selected courses provided through distance education. In addition, CORE participants complete required field experiences and internships in their own school district.

One of the greatest challenges non-traditional students face is the fact that they have to fight the uphill battle of getting an education without an extensive support network. The CORE Program has created a community of learners by giving every participant a mentor, a teacher or administrator who works in the same school. CORE participants stay connected with others through their own dedicated web page (http://faculty.valencia.cc.fl.us/CORE), which contains a discussion board for their exclusive use. In addition, a community college member stays in contact with each of the students each semester to make sure that everything is going smoothly and the university sends professional advisors to the community college campus to provide advisement. CORE participants complete the program as members of a cohort making it possible for the participants to form study and support groups.

Students cannot take advantage of web pages, online classes, or the riches of the Internet if they do not have computers. Every CORE student who needs one is able to have a computer at home. The community college provides the computer and the school district equips the computers with modems, thus helping to close the digital divide between the technology haves and have-nots.

Since time is critical for CORE students, it is essential to provide them with a fully articulated curriculum. The CORE program provides participants with the opportunity to earn an Associate of Arts degree, thus guaranteeing them junior status at the university. Furthermore, this curriculum meets every transfer requirement for the university's Bachelor of Science degree in Elementary and Exceptional Education. The CORE Program guarantees a seamless transition between the two academic institutions.

Closing the Digital Divide

Convenient efficient program models, realistic course loads, mentoring, and schedules tailored to meet the needs of working adults are essential to student success. Academic information, i.e., electronic access to student services and to academic and library resources, is also crucial. Particularly in the CORE program, many of our students reside outside the metropolitan area in communities where they maintain employment and families. A large part of our commitment to high quality education rests on developing technological tools and staff training to provide convenient remote access to multiple information services. In an earlier work the authors discussed access to admission, class schedules and registration (Stahley and Platt, 2001), the following portion of this presentation will examine live, online information access strategies in place at the community college and the university to afford access to proprietary educational resources, library catalogs, and help services.

As CORE students begin their coursework in pursuit of the associate's degree in education, their best option for electronic research access is Valencia Online (VO), http://west.valencia.cc.fl.us/distance/lrc.html, a site brimming with useful information including bookmarks for style guides, and full-text and citations databases accessible to any user equipped with an Internet Service Provider (ISP). Valencia Online was designed for distance learners. The site, however, and supporting links present not only LRC catalogs and proprietary database gateways, there are also countless tutorials and guidance services tailored to meet any research need. As such, VO is an invaluable asset for meeting the needs of all VCC students and faculty.

For example, the VO page includes a hierarchical menu of resources beginning with the Library Card link. Here is found is information about the 14-digit number required for access to licensed databases, as well as a listing of the other services and resources that require a library card. Next is a search guidance hyperlink to the community college catalog. The Online resources link leads to research bookmarks and electronic databases chart. Research Bookmarks presents a tabular list of indispensable reference works for the student researcher ranging from APA and MLA style guides, to full-text encyclopedias, to a multimedia archive of photos, audio clips, and graphs dating back to the 1920s. The electronic databases link is the gateway to a matrix listing of databases, complete with subject coverage, information type, update frequency, format, and a hot link to the database. One of the most valuable links at the Distance Learning site is to be found at the Internet Resources page. After a succinct caveat related to evaluating Internet information, the list begins with an 4part information literacy tutorial on selecting a topic, searching for information, and evaluating and documenting resources. Several other useful and relevant links are on the list, including a step-by-step research guide, a search engine strategies chart, and a guide for citing electronic resources. Last, the Distance Leaning page describes "bread and butter" services, such as document delivery services, and descriptions of each Valencia Campus Learning Resources Center Collection, with areas of subject emphasis to give students and faculty an idea of "what is available and where."

Once students make the seamless transition to their upper division CORE studies, the knowledge, skills and experience acquired from Valencia Online provides the foundation for utilizing the University of Central Florida library and information services. The countless resources of UCF libraries are accessible via the Internet. The size and complexity of the available databases makes them slightly less intuitive and user-friendly than Valencia Online. Still search guides and user assistance are generously sprinkled throughout the system. In addition, like the VCC system, UCF licensed information is protected and accessible only by students, faculty, and staff. Several levels of system entry are available, ranging from baseline ISP access, for book catalogs and non-proprietary databases, such as ERIC, to proxy access to most information and services, to full-blown, comprehensive access to every database and service via the University's network, Pegasus server.

For CORE students, the University Libraries homepage, http://library.ucf.edu/, is the starting point for education resources access. Corresponding to VCC's resources pages, the UCF library's page lists a hierarchical index of resources beginning with book catalogs and WebLUIS services. Following is a link to journal articles and other resources. Clicking the articles and other resources link takes the researcher to a tabbed listing of 18 subject-specific resources links beginning with popular databases and ending with social sciences databases. Clicking on the education subject tab takes the researcher to a hot-linked listing of full-text and citation databases designed to fill the research needs of students and educators. In the Education page header is a link to a dozen user guides for education classes. Some of the most useful educational resources links are the six areas mentioned in the table below below. All of the guides are worth examining.

UCF Online Education Resources

Link Title	Access To	Comments	Hyperlink to Resource
Education and Elementary Education Resources	Book catalog by classification range and subject databases and indexes for education topics.	Includes description and access needs.	http://library.ucf.edu/Instruct/Education/UserGuides.htm
Education Webliography	Comprehensive access listing of 28 education-oriented sites, including curriculum and instruction, elementary education and middle school, technology in K-12, mathematics and science, and multicultural education.	Most sites include annotation.	http://library.ucf.edu/Instruct/Education/eduwebsites/education_webliography.htm
Internet Tools	Hot linked listing to research resources for searching and evaluation of Internet sites, and an annotated list of popular and meta, image, and education search engines. Also includes children's search engines and a site for search engine comparison and evaluation.	An irresistible gateway to everything you always wanted to know about Internet searching but did not know how to ask.	http://library.ucf.edu/Instruct/Education/EDF6481/internet_tools.htm
Music Webliography	Comprehensive access listing of 25 music education-related sites, including church music, American music, composers, ethnomusicology and world music.	Many sites are annotated. Also include sites for lyrics and public domain music. Note: ".com" usually designates a pay-for-access commercial site. Look for ".edu," ".gov," or ".org" sites.	http://library.ucf.edu/Instruct/Education/musicwebliography.htm
Psychology Subject Guide	Comprehensive listing of 13 psychology guides, including access to online journals, texts, APA resources, directories and associations.	Many sites are annotated and include resources at other universities.	http://library.ucf.edu/Instruct/Education/psychology_subject_guide.htm

Table I: Illustrates online education resources available from the UCF Library Homepage.

Conclusion

CORE is a program that exemplifies the role of shared accountability in education implemented by university, community college, and school district partners in central Florida as they identify potential teacher candidates and shepherd them to successful completion of a collaborative teacher preparation program. The CORE Program is dedicated to the mission of finding potential teacher candidates and helping them become successful, while at the same time relieving the shortage of qualified teachers that exists in the community. To ensure that CORE students have optimal access to resources, and ultimate success in their educational pursuits, VCC and UCF have designed and engaged a system of electronic and Internet access and resources tailored to suit education-specific lower and upper division coursework.

Handouts will include the presentation slides and a list of partnership, and education resources web sites.

References

Anderson, B. T., & Goertz, M.E. (1995). Creating a path between two and four year colleges. *In Teaching for diversity: Models for expanding the supply of minority teachers* (pp. 48-71). Princeton, NJ: Educational Testing Service.

Brennan, S., & Bliss, T. (1998). Increasing minority representation in the teaching profession through alternative certification: A case study. *The Teacher Educator.* 34(1), 1-11.

Chambless, J.R, Sweeney, M.V., & Thompson, W.D. (1999). *The Mississippi teacher fellowship program: A state-based initiative for the recruitment and retention of teachers in critical shortage districts.* (ERIC Document Reproduction Service No. ED 437348)

Darling-Hammond, L. (1998). *How can we ensure a caring, competent, qualified teacher for every child? Strategies for solving the dilemmas of teacher supply, demand, and standards.* Presentation to Shaping the Profession that Shapes the Future: An AFT/NEA Conference on Teacher Quality, Washington, DC.

Dilworth, M.E. (1990). *Reading between the lines: Teachers and their racial/ethnic cultures.* Teacher education monograph: No.11, Washington DC: ERIC Clearinghouse on Teacher Education and American Association of Colleges for Teacher Education.

Gonzalez, H. (1999, October). *The teacher shortage in Texas: How are school districts coping?* Paper presented at the annual conference on School University Partnerships, San Antonio, TX. (ERIC Document Reproduction Service No. ED 434 113)

Haselkorn, D., & Fideler, E. (1996). *Breaking the class ceiling!: Paraeducator pathways to teaching.* Belmont, MA: Recruiting New Teachers, Inc.

Stahley, M. and Platt, J., "Knowledge Management and Access in a Multi-Campus System: Collaboration, Communication, and Innovation," a professional paper for presentation at the Webnet 2001 World Conference, Orlando, FL, October 23-27, 2001.

Stewart, D. (1999). 10 Ways to recruit teachers. *Techniques: Making Education and Career Connections. 74, 20-22.*

Villegas, A.M., & Clewell B.C. (1998). Increasing teacher diversity by tapping the paraprofessional pool. *Theory into Practice.* 37(2) 121-130.

Yeager, M. (1999). Better pay, benefits would help fix shortage. Globe News [On-line]. Available: http://www.amarillonet.com/stories/090198/new_134-2038.002.shtml

Online Learning Forum:
An RPInteractive Professional Development Model

Linda Polhemus
Center for Initiatives in Pre-College Education (CIPCE)
Rensselaer Polytechnic Institute

Karen Swan
University at Albany

Michael Danchak
Computer Science
Rensselaer Polytechnic Institute

Lester Rubenfeld
Center for Initiatives in Pre-College Education (CIPCE)
Rensselaer Polytechnic Institute

Abstract: This paper will describe the Online Learning Forum (OLF), a k-12 professional development program. This RPInteractive professional development model provides teachers with the opportunity to learn new technologies, work collaboratively, communicate with their peers, and develop projects for their classrooms. With the advent of distance learning, online teaching and learning allows educators to participate in such experiences at their own pace, in their own environments, on their own time. This model has been developed to facilitate a community of learners, where the transfer of existing technologies and the development of new technologies are integrated into an RPInteractive experience unlike any other.

Background

This model of online professional development is a work in progress, where new technologies and new approaches to online teaching and learning inspire new pedagogies. The Capital Area Technology and Inquiry in Education (CATIE) mentoring program, also developed by CIPCE, provides a basis for the online learning forum. The CATIE model situates educational technology experts in schools and classrooms to work directly with teachers (Swan et. al., 2002). The situated professional development model is based on a constructivist approach to technology integration, in which educational technology mentors work jointly with teachers to design computer-supported lessons that incorporate technology into existing classroom curricula.

We are adapting this model into the online environment. However, the Internet's current limitations as a medium of instruction, including its reliance on text and still graphics or low-quality audio and video would seem to restrict instructors' abilities to form motivational relationships with their students (LaRose and Whitten, 2000). Research on classroom teaching in higher education found that *teacher immediacy* behaviors that increase the perception of closeness between instructors and students can increase affective learning, which in turn increases cognitive learning (Rodriguez, Plax & Kearney, 1996). Mediated instruction can also evoke teacher immediacy, but only live interactive video (Hackman & Walker, 1990) and videotape recordings have been (Guerrero & Miller, 1998) proven effective. Research on computer mediated communication (Walther, 1996; Lombard & Ditton, 1997) calls our attention to the socio-emotional deficits imposed by mediated instruction.

Although there are deficits imposed by mediated instruction, the development of new technologies and approaches to online instruction challenge us to create better web courses. To improve the 'behavior' of the computer, RPInteractive presents a new approach to online course development.

RPInteractive is an approach to e-learning being developed at Rensselaer that seeks to enhance learner-content, learner-instructor, and learner-learner interactivity for distance students (see Danchak paper submission to ELearn). As a natural extension of the Studio model (Wilson, 1994) of instruction in the face-to-face science and engineering classroom integrates mini-lectures, collaborative learning, inquiry and direct experience, reflection, and_conceptualization, in a sequence not unlike the Kolb Learning Cycle, RPInteractive transfers these techniques, as well as existing and new technologies into the online environment. The role of the instructor/coach in this model is to gauge students' understanding, listening and questioning them to develop desired knowledge_(Cupp, et al, 2001). In the online learning forum, a course Mentor guides students through an experience and models an interactive, student-centered approach to instruction.

Our Unique & Innovative Style

Integrating tools with content is the pedagogical foundation of everything that the Online Learning Forum attempts to achieve. The components described in Table 1 are integrated into the context of a topic(s) and/or a software application to meet course objectives, where communication, collaboration, and activity-based learning are facilitated.

Component	**Description**	**RPInteractive Element**
QuikQuiz©	This tool, unique to the Online Learning Forum, addresses the issue of immediacy behaviors, where the Mentor poses a question regarding a given topic, and students are to respond, after which they are immediately able to view the responses of their fellow participants. The course mentor can then view which participants are on task, and make necessary adjustments.	Communication Collaboration
Interactive animation	Another unique component of the Online Learning Forum that permits participants to follow along as the animation proceeds to sequentially access commands in the computer application being taught online.	Activity-Based Learning
Video	Camtasia is also integrated into the online learning forum experience. This allows participants to watch a demonstration of a specific objective in short clips.	Activity-Based Learning
Problem solving	These scenarios are integrated into the context of a learning activity. Project development is supported by the integration of problem-solving situations where the participants are required to analyze and critique situations.	Activity-Based Learning
Threaded discussion	This communication tool permits participants to interact with the course Mentor and course participants to share, discuss and reflect on teaching and learning with technology. Participants have the ability to access these discussions and a tree-like structure will permit them to respond to any of the comments.	Communication Collaboration
Technical orientation	This prerequisite may be completed online or in-person with a course mentor. This orients participants to the online environment and provides them with all plug-ins and downloads necessary for a successful OLF experience. Teacher attitudes and beliefs, which may affect their confidence in dealing with advances in technology and their perception of change, are also addressed.	Activity-Based Learning

Capstone project	Participants complete a project that can be integrated and implemented into their classroom and/or school environments.	Situated Learning

Table 1: Online Learning Forum Interactive Components and Descriptions.

Findings

The online, asynchronous six week experience aims to provide a forum for interaction between educators where they are able to reflect individually and as a group on technology integration, to build a network of fellow educators to develop and disseminate technology-rich resources, to share new learning and to provide hands-on experience with software applications. During the Spring 2002 semester, 27 area educators enrolled in two different online courses. An end of session online survey was distributed to course participants to determine their perceptions of the course's structure, format, content, and design.

Participants in the Online Learning Forum courses were satisfied with the course objectives, structure and course mentor. All of the participants indicated that the components provided them with the opportunity to interact with the course content at a level comparable or higher than a traditional workshop setting.

Feelings about learning online when you enrolled in the course were first captured. All participants reported reluctance, as well as excitement. Comments included:

> *"…. anticipated it would be a great way to learn at my own pace at home!"*
>
> *" I was excited about learning how to do this work."*
>
> *" I was excited by its flexibility and wanted to try it!"*
>
> *" I was nervous at first. I thought that it would be confusing."*
>
> *" I was very curious as to how the lessons would be taught and how much I would be able to do."*

As a result of the online courses, students also reported the ways their feelings changed, or remained the same, as a result of taking this course. Comments included:

> *"I still think it has the advantage of being able to work at your won convenience but there is also a matter of self-discipline creating the time."*
>
> *"I am more confident in taking another course online. Even though I did miss people direct contact."*
>
> *"I am pleased with what I have learned and the experience of it via distance learning."*
>
> *"I am amazed at how informative the course was! The examples were very clearly portrayed. I was able to apply them right away!"*

In addition, participants revealed that having an initial face-to-face orientation to the online environment course would have enhanced their experience. For these participants who have not taken online courses before, this would alleviate any initial hesitation and frustration. Participants stressed the importance of problem solving scenarios and examples. In future and existing courses, revisions will be made to include more interactive, problem solving scenarios as well as an integration of more examples of how to apply give software programs.

Conclusion

Most of the participants in the online learning forum have never taken an online course prior to this experience. Although the online learning forum allows educators to engage in technology-rich activities to enhance their face-to-face instruction, some teachers are skeptical as to whether an online experience is for them. Learning new technologies in an online environment requires that participants not only learn given content, but also become familiar and comfortable with the course design. Future efforts will be given to finding solutions to issues such as these, in addition to a continued pursuit to integrate new technologies that will improve online professional development.

References

Cupp, E., Danchak, M., Foster, K., and Sarlin, D. (2001). "The RSVP Unibrowser: Bringing Interactivity to e-Learning", Intenational Conference on Advanced Learning Technologies, Madison, WI, Aug., 2001.

Guerrero, L.K & Miller, T.A. (1998). Associations between nonverbal behaviors and initial impressions of instructor competence and course content in videotaped distance education courses. Communication Education. 47(1), 30-42.

Hackman, M.Z. & Walker, K.B. (1990). Instructional communication in the televised classroom: the effects of system design and teacher immediacy on student learning and satisfaction. Communication Education 39 (July), 196-206.

LaRose, R. and Whitten, P. (2000). "Rethinking Instructional Immediacy for Web Courses: A Social Cognitive Exploration" , Communication Education, 49 (4), pp. 320-338.

Lombard, M. Ditton, T. (1997) At the heart of it all: The concept of presence. Journal of Computer Mediated Communication. 3(2).

Rodriguez, J.I, Plax, T.G. & Kearney, P. (1996). Clarifying the relationship between teacher nonverbal immediacy and student cognitive learning: Affective learning as the central causal mediator. Communication Education 45(4), 293-305.

Swan, K.,Holmes, A., Vargas, J., Jennings, S., Meier, E., & Rubenfeld, L. (2002). Situated Professional Development and Technology Integration: The Capital Area Technology and Inquiry in Education (CATIE) Mentoring Program. Journal of Technology and Teacher Education. 10 (2), 169-190.

Walther, J.B. (1996). Computer-Mediated Communication. Communication Research. 23(1), 3-43.

Wilson J.M (1994) The CUPLE Physics Studio. The Physics Teacher, 32, 518-523

Student Roles in Online Learning Communities: Navigating Threaded Discussions

Linda Polhemus & Karen Swan
University at Albany

Abstract: This paper discusses navigation strategies affecting the interactivity of a graduate level course's asynchronous online discussion with a focus on the development of a learning community and knowledge building. This qualitative analysis reports on an exploratory investigation of student interviews and observations while interacting with the online discussion board. Observations of graduate level students in education courses from the State University of New York Learning Network (SLN) in the 2001-02 academic year revealed that students were interacting with the content vicariously and that the integration of multiple perspectives facilitated the construction of knowledge both individually and communally. Routines for reading and responding to discussion board messages also suggest that first students negotiate through the threads created, then based on personal criteria interact directly or vicariously with the content of messages.

Purpose

Quantitative research provides valuable information for online teaching and learning, however, the emphasis on grade/test score improvement does not really explore what is really going on in an online learning environment. How can we identify factors that increase participation and the quality of an online discussion? How can we evaluate the navigation patterns and their influence on the dynamics of the online community only assumed in an online discussion? This study presents the development and implementation of a research and evaluation protocol that analyzes online course participation for community building indicators and perceptions of learning. Specifically, it examines the way in which a user navigates the online discussion board interface, uses 'dialogue' to compose messages and construct and develops a perception of community online.

Literature

Many believe that the defining characteristic of the computing medium, if one can think of the computer as a single medium at all, is its interactivity (Bolter, 1991; Landow, 1992; Murray, 1997; Turkle, 1997). Recent research has focused on the general topic of student interaction within four defined categories: (a) learner-content, (b) learner-instructor, (c) learner-learner, (d) learner-interface (Hillman, Willis, and Gunawardena, 1994; Moore, 1989). When at least one of these forms of interaction is incorporated into teaching, student achievement and satisfaction are enhanced (DeVries, 1996; Fulford & Zhang, 1993). a fifth interaction, that of (e) 'vicarious' interaction (Sutton, 2001) whereby students do not interact directly at all, but observe and process both sides of direct interaction between two other students or between another student and the instructor has also been suggested.

Research focusing on community describes 'legitimate peripheral participation' as a means for knowledge building (Wenger, 1998). Although peripheral participation is assumed as a result of online communication, evidence for this assumption have not been determined. In addition, working together in an online discussion is also facilitated. Students are required to respond to each other to reach course goals. This produces the externalization of the thought processes, the comparison of alternative perspectives, social facilitation, better learning, high self-esteem and more positive attitudes toward the learning experience (Salomon & Globerson, 1989).

Method

The students who volunteered to participate in this exploratory study were enrolled in graduate level courses. Over the course of two semesters, different students from different courses discussed and participated in their online courses as they 'normally' would. Our protocol involved first students responding to questions regarding discussion board participation and online community. Second, students were asked to 'think aloud' while reading and responding to required discussion for that particular module or week. Third, students were asked follow-up questions regarding their interactions with the discussion messages, why they made such decisions and what they think about the community.

Instructor expectations for threaded discussion integration into asynchronous courses are as follows:

- To make thought visible
- Negotiate meanings around content
- Exposure to multiple perspectives
- Articulate positions
- Elicit reactions
- Critically analyze content, experiences and beliefs

To determine a student's level of participation in terms of 'learning,' we analyze not only the content of their messages, but also their reaction and interpretation of the messages of others. Examples of knowledge building in online threaded discussion is dependent upon the triangulation of community development (social presence), multiple perspectives, and routines for navigation.

Community Development	Multiple perspectives	Routines for Navigation
"I feel a part of the online community of all people who've taken online courses and also a part of the smaller community that is my online course I'm taking now."	"I am excited that the information in this module correlates with an ETAP course I took last summer! I have the opportunity to draw on prior knowledge."	"First I check to see if anyone has responded to any postings I have made. Then I check out new postings. I respond to several postings, sometimes I do this randomly as to not respond to the same person all the time."

Table 1: Examples of Knowledge Building in Online Threaded Discussion

In the observations, student interactions with the structure of the discussion board, the content, their peers and the instructor were found to reflect the learning community's dynamics. In a traditional classroom setting, students are integrated with all discussions (by listening), however, their engagement with those discussions are unknown and perhaps limited. On the other hand an online discussion provides students with the opportunity to experience the interactions of others based on their own personal interests and goals. In a traditional classroom, time may not permit all students to actively participate in these experiences, nor may students be attending to what others have to say even when they are present in the classroom environment. In the online interactions we observed, when a student clicked on (and read) another's message, he or she was then either motivated to respond or not. Observations and interviews indicated that students were more motivated to read and respond to a message with which they identified culturally, professionally, or personally; to meet course requirements; to make others feel a part of the course; to anyone who responded to them; to those messages that integrated multiple perspectives.

Similar to Salomon & Globerson (1989) students reported that learning took place in the comparison of alternative perspectives. Also, as indicated by Gunawardena & Zittle (1997) and others, students were aware of other student's social presence based on immediacy behaviors. During observations, students made mention of other's negotiation patterns (such as how, where, when and to whom they posted), experiences and cultural backgrounds. In addition, students used the discussion board to 'prime' their thought processes when composing messages to others.

Video-taped sessions of students 'thinking aloud' provide evidence for the following:

1. Setting for diverse thought
2. Navigation: reading other reactions, then forming own
3. Social presence evident in posting patterns
4. Priming: reading other messages, composing, then thinking of a new response to a previous message
5. Affect: laughing out loud at the message

Follow-up interviews revealed that students feel a part of their course's learning community, as well as, part of the community of all online learners.

Discussion

When students were navigating through the discussion, they were making decisions. First, they were making decisions about which messages to read. When students entered the discussion, they first interacted with the interface of the threaded discussion. Most students re-read the instructor's question, and then scrolled through the discussion. Students interacted with those messages from students with whom they could identify. Over time students who integrated themselves at a high level were able to make predictions of the nature of another's message. These students described the posting habits of other students, as well as made assumptions about the contents of their messages. As a result, during the semester, an online learning community was built. An integrated role in the online community is supported by student navigation patterns when students are able to acknowledge another's tone in dialogue (e.g. social presence), and identify with another student culturally. When students navigated the discussion board, the above characteristics are what influenced their feeling of a learning community in that they could connect with another student.

Disagreements also influenced student interactivity and student roles. When controversy took place online, disagreement between learners created an opportunity for others to mediate or oppose another's view. As a result, students were more likely to read and respond, thereby increasing interactivity. However, in the online discussion board, unlike a traditional classroom, not all students witness an argument or disagreement. One student we interviewed, who was segregated in the online discussion, was not aware of the argument. She did not read and respond to many messages, only to a limited few.

The roles that are taken in an online discussion vary. In an online course students are given the opportunity to participate in many threads of the discussion for a broad perspective (integrate themselves), or participate in only a small amount for deeper engagement (segregate). The two experiences are not necessarily mutually exclusive, however, student roles and expectations may facilitate one experience over another.

Students did not respond to all messages that they read. Also known as, 'lurking,' this vicarious interactivity (Sutton, 2001) also supported knowledge building. Those students who identified other student's as 'higher-level' participants, often read those messages to interact with the content. Although students did not always respond in written form, they sometimes printed these messages for future reference.

Finally, all students perceived they learned about diversity and multiple perspectives from the online discussion. Students reported that diversity and multiple perspectives provided the most evidence for learning, which was delivered in the form of feedback in the online discussion.

Conclusion

Bangert-Drowns & Pyke (2001) define learning engagement as the strategic mobilization of cognitive, volition and affective processes to foster personal meaning-making. We will continue to conduct more interviews and observations to investigate the possibilities of cognitive processes (and knowledge building) in terms of message content, volition (decision-making, the student's rationale for reading and responding or not), and affect (the integration of social presence). Some limitations to this particular study include the 'think aloud' process and the protocol for interviewing and observing student participation. Time, as well as other variables, limits the validity of the observation and interview process. However, the observations and interviews also provide insight into online communication for further research with a broader range of disciplines and a revised protocol.

References

Bangert-Drowns, R. L., & Pyke, C. (2001) *A taxonomy of student engagement with educational software: An exploration of literate thinking with electronic text.* Journal of Educational Computing Research, 24 (3), pp. 213-234.

Bolter, J. D. (1991) *The Writing Space: The Computer, Hypertext and the History of Writing.* Chapel Hill, NC: University of North Carolina Press.

Fulford, C. P., & Zhang, S. (1993). *Perceptions of interaction: The critical predictor in distance education.* The American Journal of Distance Education, 7(3), pp. 8-21.

Gunawardena, C. & Zittle, F. (1997) *Social presence as a predictor of satisfaction within a computer mediated conferencing environment.* American Journal of Distance Education, 11 (3), 8-26.

Hillman, D. C., D. J. Willis., and C. N. Gunawardena. (1994). *Learner interface interaction in distance education. An extension of contemporary models and strategies for practitioners*. The American Journal of Distance Education 8 (2): 30-42.

Landow, G. P. (1992) *Hypertext: The Convergence of Contemporary Critical Theory and Technology*. Baltimore, MD: Johns Hopkins University Press.

LaRose, R. & Whitten, P. (2000) *Re-thinking instructional immediacy for web courses: a social cognitive exploration*. Communication Education, 49, 320-338.

Moore, M.G. (1989). *Three types of interaction*. American Journal of Distance Education, 3 (2), 1-6.

Murray, J. H. (1997) *Hamlet on the Holodeck: The Future of Narrative in Cyberspace*. New York: The Free Press.

Richardson, J. & Swan, K. (2001) *An examination of social presence in online learning: students' perceived learning and satisfaction*. Seattle, WA: Paper presented at the annual meeting of the American Educational Research Association.

Rourke, L., Anderson, T., Garrison, D. R. & Archer, W. (2001) *Assessing social presence in asynchronous text-based computer conferencing*. Journal of Distance Education, 14 (2).

Salomon, G., Globerson, T. & Guterman, E. (1989). *The computer as a zone of proximal development: Internalizing reading-related metacognitions from a reading partner*. Journal of Education Psychology, 89,620-627.

Sutton, L., (2001) *The Principle of Vicarious Interaction in Computer-Mediated Communications*. International Journal of Educational Telecommunications, 7(3), 223 – 242.

Turkle, S. (1997) *Life on the Screen: Identity in the Age of the Internet*. New York: Simon & Schuster.

Community and Constructivism: Implicit Pedagogical Models in Virtual Learning

Richard Pountney, School of Education, Sheffield Hallam University, UK
r.p.pountney@shu.ac.uk

Liz Aspden, Learning & Teaching Institute, Sheffield Hallam University, UK
e.j.aspden@shu.ac.uk

Abstract: Communal constructivism attempts to move beyond social constructivism and capture specific elements of the additional value that ICT applications bring to the learning and teaching environment. Case studies of elearning implementations at Sheffield Hallam University are used to examine whether the advent of new educational technologies such as virtual learning environments warrants a new kind of educational theory, or whether they perhaps lure teachers into affordance (Tolmie and Boyle 2000). Properties of one VLE, *Blackboard*, which allow certain actions to be performed and which encourage specific types of behaviour, are examined and the attributes of effective models of online communities of learners are considered.

Introduction

Recent approaches towards teaching practices have seen a shift towards an acceptance of constructivist principles (Dalgarno, 2001). Although constructivism does not represent a single outlook, and is better understood as a continuum (Doolittle, 1999), the various different viewpoints unite around central core beliefs, and stand in stark contrast to behaviourist thinking. Whereas behavioural psychology is associated with an objectivist epistemology, where reliable knowledge about the world exists and can be transmitted from teacher to (passive) learner, constructivists acknowledge the active role of the learner in creating knowledge. So, for example, although cognitive constructivism does believe in the existence of an external reality, it is concerned with the construction of mental structures about this reality, rather than merely a passive assimilation of facts.

Of the different types of constructivism, social constructivism is often perceived as the more holistic viewpoint and, as the name suggests, its epistemological underpinnings emphasise the importance of social context, interaction, and dialogue in knowledge construction. It is these beliefs that Holmes et al have suggested need updating in order to account for the "synergy between more recent advances in information technology...and advances in virtual learning environments" (2001). What they propose is communal constructivism, where students create knowledge not only for themselves, but also for others who are not involved in the initial knowledge construction process. It is suggested that it is the particular attributes of ICTs and VLEs (such as the increased potential for communication, and storage of a variety of data types) that allow this to occur. Rather than passing through the educational system and leaving no trace, students' learning processes and products are available to learners in subsequent years, and potentially to the wider learning community (ie: those not involved in the initial knowledge construction).

Communal constructivism doesn't represent a radical departure from social constructivism in that many of the teaching practices advocated are precisely those that would be used in social constructivist environments. However, where the two do seem to differ is in the scope of influence that students are allowed, and it is suggested that the main interest is in the ways in which "ICTs can be creatively used to bring new life into...diverse ideas" (Holmes et al, 2001). By examining some of the activities taking place across Sheffield Hallam University (SHU), this paper aims to assess the strength of communal constructivism as a theory, as well as asking whether some of the developments could, potentially, be understood in terms of technical affordance.

Technical affordance

The term affordance was coined by J J Gibson (1979/1986), and is a central concept in the approach to perception and action within ecological psychology (Stoffregen, 2000). Behaviour is afforded by the environment, and affordance can be defined as the "properties of the environment of an animal that have consequence for the animal's behaviour" (Stoffregen, 2000). Affordances can be positive or negative and are effected by their context (Barnes, 2000); they are not necessarily deterministic - rather, they are opportunities (Barab et al, 1999, cited in Barnes, 2000) which guide behaviour. In her discussion of affordance of electronic conferencing in relation to distance education, Barnes uses the analogy of a path in the woods to illustrate this - the existence of a path "does not imply that this is the only place we can walk. However, it does provide an easy place to walk as well as providing a direction to walk in" (2000).

This clearly illustrates both the negative and positive aspects of affordance: the path allows the walker to travel more easily through the wood (positive), but may not lead the walker in the direction he wishes to go (negative). It is in this context that we talk about teachers being 'lured' into affordance by the particular attributes of a system: VLEs and ICTs have their own attributes that act in the same way as paths in woods. Email, for example, affords asynchronous communication (one-to-one; one-to-many); the use of electronic conferencing affords closed group discussions to take place online, either asynchronously or synchronously.

In their examination of two contrasting case studies, where CMC has been used to supplement campus based study, Light et al state that the introduction of computer mediated communication "can encourage both tutors and students to examine their existing roles and practices" (2000). In their conclusion, they agree that "As Harasim et al (1995) put it, CMC offers a *customisable* networked learning environment, *tailorable* to a wide range of purposes...even in this medium (and even when they are trying not to) tutors still have a critical role in shaping student learning experiences" (Light et al, 2000). What this paper aims to assess is how much influence the structure of the VLE could have over the individual decisions made by the tutors.

Case study background

As part of ongoing research at Sheffield Hallam University, members of staff who have been using the VLE *Blackboard* have been asked to contribute case studies outlining their use of the available technology, and their motivation behind this. Course tutors were asked to 'self-identify' how the VLE had been used to supplement teaching and learning activities by indicating which of a series of modes of usage could be applied to their course. At one end of the scale are purely content driven sites (or 'support' modes), where the site is used to display copies of essential documents, important dates, contact details for unit leaders, etc. More interactive sites introduce elements of communication (synchronous or asynchronous; one-, two-, or multi-way), assessment (formative or summative; single or multiple attempt), and resource provision, combining these with face-to-face teaching to a lesser or greater degree. The findings from the first phase of case study collection (total of 20 cases collected) have been used to support the conclusions of this paper in relation to the relevance of affordance and communal constructivism, and also to begin identifying attributes of effective online communities.

General findings

Both communal constructivism and technical affordance acknowledge that the availability of ICTs have a profound impact on teaching and learning. For Holmes et al, the emergence of new technologies "force the teacher to undertake a radical reassessment of the way in which they teach" due to the "enormous flexibility" offered (Holmes et al, 2000). This places the emphasis on the decisions made by individuals. The affordance theory, on the other hand, would assume that the availability and adoption of a VLE would guide tutors towards a particular style of teaching. So, the available features would "push behaviour in certain directions" (Tolmie & Boyle, 2000). At a general level, there is little to suggest from the collected case studies that the affordances of the VLE are guiding tutors to adopt practices that they would not necessarily wish to use. In fact, there was a strong sense of variety, with tutors choosing to adopt styles of site organisation that fitted in to their personal view of teaching and learning: there was no wholesale, widespread adoption of a particular feature, or set of features. Additionally, there are instances of tutors actively reassessing the practices they have adopted, rather than continuing in any particular way. These findings seem to assert the strength of the individual in the decision making process, and the following section outlines some general observations that support this, as well as providing a more in depth look at three undergraduate units.

Discussion

Barnes suggests that "The main issue concerning affordances of ICT and education is how and when ICT is an appropriate medium that enhances the learning process or learning outcomes" (2000). Comments from tutors at SHU such as "ICT is used alongside teaching, rather than being the driving force" were common, showing that they were interested in using particular functions to support their own aims. Appropriate use of the features of the VLE, and awareness of the need for this, has been highlighted throughout the case studies with tutors actively selecting - and amending their use of - particular features. So, for example, we can examine one affordance of the VLE - the potential for multi-way communication to occur - and compare three different units, all of which have tried to introduce some element of this. In the first case, the synchronous discussions proved extremely successful, leading to the conclusion that online communal learning has the potential to work well at undergraduate level. In the second case, the synchronous communication was not used ("if the students are on campus at the same time anyway, it makes more sense for them to be together in a 'physical' environment"; quote taken from case study), but the asynchronous discussion area has been used extremely effectively. This has been done to the extent that it has fostered a sense of community, with students happy to share thoughts and ideas in this environment. In the third case however, where the students were all professionals in full time work, the use of secure Discussion Boards for asynchronous communication is being discontinued. It is felt that "the commitments of a full time job and study leave little time for engaging in what is perceived as non-essential dialogue" (quote taken from case study). This pattern suggests that, even if tutors are being led down a particular path by the availability of certain functions, they are tailoring their use of the VLE to their own ideas, and the needs of the students: it supports the assertion of Light et al (2000) that "there is not *one* way, or even perhaps a *best* way of using CMC to support student learning".

We will now turn to a more descriptive look at three undergraduate case studies. The first of these - *ICT in an Educational Context* - is a specialist, level 3 unit taught over 7 weeks. In a previous paper (Pountney et al 2002), the manifestation of the nine critical elements of situated learning contexts as identified by Herrington & Oliver (see Herrington & Oliver, 2000) was examined, with the conclusion that it provided a highly effective environment for social constructivist learning activities: It provided authentic contexts and activities, alongside access to expert thinking and different perspectives; the environment allowed students to collaborate in knowledge construction, to reflect on their work, and to articulate their beliefs; it allowed for the integration of authentic assessment, and for the teacher to provide scaffolding at critical times. In looking at whether it could be re-described in terms of communal constructivism, the authors remained sceptical, and whilst acknowledging that communal constructivism does provide a useful framework for ensuring that networked learning is appropriately employed, they felt that it did not depart radically enough from social constructivism to warrant being a new educational theory (Pountney et al, 2002).

One of the fundamental tenets of communal constructivism is students developing a body of knowledge that will potentially benefit other learners, and teachers, thereby allowing the students to leave their mark on the course. By examining a second case study, where undergraduate students are involved in collecting fieldwork relating to tourism in the City of Sheffield, we can find support for the Holmes et al's belief that "the synergy between the more recent advances in information technology...and advances in virtual learning environments" (Holmes et al, 2001) does allow new educational opportunities. The information collected by the students in one year is stored in a hierarchical database, which has been packaged within *Blackboard*. This allows students in subsequent years to access and use this data alongside their own to map longitudinal changes in tourism provision. So alongside the authentic contexts already provided by the unit (eg: use of fieldwork, and collection of data reflecting how information is used in real life), it could be argued that the particular use of ICTs in this unit enable an additional layer of authenticity to be added to the learning process, as students can see how knowledge created at one point in time can be used in the long term, by others, as it would be in industry, for example.

Communal constructivism also argues that students can be "actively involved in creating knowledge that will benefit other students" (Holmes et al, 2001), an idea that is echoed in the development of a body of knowledge to be used over time. In our final case study we look at an instance that supports the idea of students collaborating, and creating knowledge for themselves and others, in a way supported specifically by the use of the VLE. Second year undergraduate students have been demonstrating high levels of engagement with the networked learning opportunities afforded by the *Blackboard*. This has been particularly well demonstrated in the use of the Discussion Board, where they have regularly been posting thoughtful messages, including suggestions for useful resources that they have found outside of the scope of those suggested. One point is particularly relevant here in relation to communal constructivism: although students could just as easily communicate, collaborate and pass on information on a one-to-one basis, or within controlled groups, the exchanges and processes could potentially remain invisible to the tutor. However, within the secure environment offered by the VLE, the students feel comfortable sharing their ideas within the whole group, and the elements of the collaboration are made visible to the tutor as well as to other students who may potentially have been excluded from individual exchanges. Thus, it could be argued that the particular features of the VLE allow these exchanges to be made available to a wider community.

The above three case studies illustrate units where the pedagogic strategies employed have created effective online communities of learners. A possible interpretation of this is that the particular features of the VLE have encouraged particular types of behaviour. The availability of multi-way communication, and the ability to store data, might have prompted tutors to use these facilities to supplement their learning and teaching strategies simply because they were there: they might have provided a particular path through the woods. Where the affordances have proved successful, they have been developed and integrated to supplement the teaching in effective ways. However, as in the instance mentioned briefly above, wh ere they have been felt to be negative or unnecessary, they have been reassessed and their use discontinued.

Conclusion

It is apparent that the opportunities offered by ICTs do provide the opportunity for tutors to actively reassess their teaching practices, and it could equally be suggested that the availability of certain features do suggest particular strategies. However, to argue that it is the facilities themselves that push behaviour in certain directions is to ignore the role of the tutor - and the students - in the process of developing the course. In the cases collected at SHU the positive (or not) engagement of students and tutors with the technology has as strong an influence over the development of the course as does the availability of certain features. Tutors are actively involved in the decisions made about the course, rather than being just passively guided by the opportunities offered by the technology.

References

Barnes, S. (2000) What does electronic conferencing afford distance education? In *Distance Education*. Vol. 21, No. 2.

Barab, S. A., Chekes-Julkowski, M., Swenson, R., Garrett, S., Shaw, R.E. & Young, M. (1999). Principles of self-organization: Learning as participation in autocatakinetic systems. In *The Journal of the Learnin g Sciences*, Vol. 8., Nos. 3-4.

Dalgarno, B. (2001) Interpretations of constructivism and consequences for Computer Assisted Learning. In *British Journal of Educational Technology*, Vol. 32, No. 2.

Doolittle, P (1999). Constructivism and Online Education. 1999 Online Conference on Teaching Online in Higher Education. Available at http://edpsychserver.ed.vt.edu/workshops/tohe1999/text/doo2.pdf

Gibson, J. J. (1986) The ecological approach to visual perception. Hillsdale, NJ: Lawrence Erlbaum Associates, Inc. (original work published 1979)

Harasim, L., Hiltz, S. R., Teles, L. & Turoff, M. (1995) *Learning Networks: a field guide to teaching and learning online.* Cambridge, MA: MIT Press.

Herrington, J. and Oliver, R. (2000). An Instructional Design Framework for Authentic Learning Environments. In *Educational Technology, Research and Development*, Vol. 48, No. 3, pp23-47.

Holmes, B., Tangney, B., FitzGibbon, A., Savage, T., and Mehan, S. (2001). Communal Constructivism: Students constructing learning *for* as well as *with* others. Proceedings of SITE 2001, Florida.

Light, P., Nesbitt, E., Light, V., and White, S. (2000). Variety is the spice of life: student use of CMC in the context of campus based study. In *Computers & Education*. Vol. 34, Nos. 3-4.

Pountney, R., Parr, S. and Whittaker, V. (2002) Communal Constructivism and Networked Learning: Reflections on a case study. In Banks, S., Goodyear, P., Hodgson, V. and McConnell, D. (eds) Proceedings of the Third International Conference Networked Learning 2002, pp497-506. Sheffield University, England.

Stoffregen, T. A. (2000) Affordances and Events. In *Ecological Psychology*. Vol.12, No. 1.

Tolmie, A. and Boyle, J. (2000) Factors influencing the success of computer mediated communication (CMC) environments in university teaching: a review and case study. In *Computers & Education*. Vol. 34, No. 2.

Williams, C. (2002) Learning On-line: a review of recent literature in a rapidly expanding field. In *Journal of Further and Higher Education*. Vol. 26, No. 3.

An Efficiency Improvement Scheme for Content-Based Image Retrieval Systems

Wichian Premchaiswadi*, Nucharee Premchaiswadi**, Sutasinee Chimlek*,
Wichai Premchaiswadi***, Seinosuke Narita****
*Faculty of Information Technology, King Mongkut's Institute of Technology Ladkrabang,
Bangkok, 10520, Thailand
**Faculty of Information Technology, Dhurakijpundit University, Bangkok, 10210, Thailand
***Faculty of Engineering, Khon Kaen University, Khon Kaen, Thailand
***School of Science and Engineering, Waseda University, Tokyo, Japan

Abstract: This paper presents a scheme for improving an efficiency of image retrieval systems. The image indexing and retrieval technique based on the combination of the autocorrelogram method and color difference correlograms method is proposed. Color filtering technique is used for quantization of the RGB colorspace into 64 colors to reduce the complexity and calculation time. Then, both color and spatial information are employed to build the index of each image by using autocorrelgram and color difference correlogram. The distance measure technique is used to retrieve target images from the database. Experimental results suggest that this method can index and retrieve images which different views of the same scene, large changes in appearance. The performance of the image retrieval system is also improved significantly when compared with both color histogram and color correlogram method.

Introduction

Content-based image retrieval system is one of the popular techniques for retrieving image from image databases. There are two steps that are common used in most image database information retrieval systems as followings: indexing and searching (Huang et al., 1997). In indexing process, each image in a database, a feature vector capturing certain essential properties of the image is computed and stored in a feature-base. Then, in searching process, given a query image, its feature vector is computed, compared to the feature vectors in the feature-base, and images most similar to the query image are returned to the user. In a content-based image retrieval system, color (John et al. 1995, Swain 1991), the most recognizable element among image contents, is usually used for various image database applications. Color histogram, however, does not provide enough spatial information such that different images may have similar color histogram. To handle the weakness of color histograms several new features that strive to integrate both color and spatial information have been proposed (Huang et al., Pass et al., Markus et al., Hsu et al.)

This paper proposes a scheme that makes use of both color and spatial information for the image indexing and retrieval system. The effectiveness of the proposed scheme is confirmed by the experimental results and compared with both color histogram and color correlogram method.

Image Indexing Scheme

The process consists of three steps namely: color filtering, autocorrelogram (AC) and Color different correlogram (CDC).

1. Color Filtering

The process is used for quantization of the RGB colorspace of each image into 64 colors to reduce the complexity and calculation time in the following processes.

2. Autocorrelogram

A color correlogram expresses how the spatial correlation of color changes with distance [1] and is defined by the formula shown in Eq. 1 and Eq. 2.

Let I be an $n \times n$ image. The colors in I are quantized into m colors $c_1, \ldots, c_m$. $H_c(I)$ is number of pixels of color c_i in I. For a pixel $p = (x,y) \in I$, let $C(p)$ denote its color. Lets $I_c = \{p \mid C(p) = c\}$.The distance between 2 pixels, i.e., for pixels $p_1 = (x_1, y_1)$, $p_2 = (x_2, y_2)$, defined $|p_1 - p_2| = max\{|x_1 - x_2|, |y_1 - y_2|\}$, let [n] denote the set {1, 2, ..., n}. Let a distance d ∈ [n] be fixed a priori. i,j ∈ [m], and k ∈ [d].

$$\gamma^{(k)}_{c_i,c_j}(I) \cong \Pr_{p_1 \in I_{c_i}, p_2 \in I}[p_2 \in I_{c_j} \,\|\, p_1 - p_2| = k] \quad (1)$$

$$\gamma^{(k)}_{c_i,c_j}(I) \cong \frac{\Gamma^{(k)}_{c_i,c_j}(I)}{H_{c_i} x\, 8k} \quad (2)$$

The autocorrelogram captures spatial correlation between identical colors only and defined by Eq. 3.

$$\alpha^{(k)}_{c_i}(I) \cong \gamma^{(k)}_{c,c}(I) \quad (3)$$

3. *Color Difference Correlogram*

Color difference correlogram (CDC) is the scheme that is modified from the texture description technique (Robert et al., Manjunath et al., Randy, Nepal et al.). Color difference correlogram of an image is graph or table that indexed by color difference value, where the k-th entry for $Diff_i$ specifies the probability of finding color difference value $Diff_i$ of pixels at distance k from any pixels in image. The color difference value between two pixels having distance equal to k is defined by Eq. 4.

$$Diff_i = |\, C(p1) - C(p2) \,| \qquad \text{where } |\, p_1 - p_2 \,| = k \quad (4)$$

The color difference correlogram is calculated by the formula in Eq. 5.

$$Cdf^{k}_{diff_i}(I) \cong \Pr_{p_1,p_2 \in I}[\,|\, C(p_1) - C(p_2) \,| = diff_i \,\|\, p_1 - p_2 \,| = k\,] \quad (5)$$

$$Cdf^{k}_{diff_i}(I) = \frac{\beta^{k}_{diff_i}(I)}{n_1 x n_2 x\, 8k}$$

Image Retrieval Scheme

The process is used to retrieve images from the image database. The technique of distance measure (Huang et al., 1997) is employed in the process. This paper use d_1 distance measure for comparing histogram, autocorrelogram, color difference correlogram, and AC/CDC because it is "relative" measure of distance.

d_1 distance measure for histogram, autocorrelogram, color difference correlogram and AC/CDC is defined by Eq. 6 to 9.

$$d_1(h) = |\, I - I' \,|_{h,d_1} \cong \sum_{i \in [m]} \frac{|\, h_{c_i}(I) - h_{c_i}(I') \,|}{1 + h_{c_i}(I) + h_{c_i}(I')} \quad (6)$$

$$d_1(\gamma) = |\, I - I' \,|_{\gamma,d_1} \cong \sum_{i,j \in [m], k \in [d]} \frac{|\, h_{c_i}(I) - h_{c_i}(I') \,|}{1 + h_{c_i}(I) + h_{c_i}(I')} \quad (7)$$

$$d_1(CDC) = |\, I - I' \,|_{CDC,d_1} \cong \sum_{diff_i \in [diff], k \in [d]} \frac{|\, CDC^{k}_{diff_i}(I) - CDC^{k}_{diff_i}(I') \,|}{1 + CDC^{k}_{diff_i}(I) + CDC^{k}_{diff_i}(I')} \quad (8)$$

$$d_1(\gamma, CDC) = d_1(\gamma) + d_1(CDC) \quad (9)$$

Performance Measures

The performance of the scheme is measured by using the parameters the same as described in (Huang et al.,

1997) as follows.

$$r-measure = \sum_{i=1}^{q} rank(Q_i') \tag{10}$$

$$Avg\ \text{r - measure} = \frac{\text{r - measure}}{q} \tag{11}$$

$$p_1-measure = \frac{1}{\sum_{i=1}^{q} rank(Q_i')} \tag{12}$$

$$Avg\ \text{p}_1\text{ - measure} = \frac{\text{p}_1\text{ - measure}}{q} \tag{13}$$

Experiment Results and Conclusion

The proposed scheme is implemented by using Visual Basic version 6.0 and Microsoft Access Database. The experimental image database is a heterogeneous image database. It consists of 10,204 images in varieties formats such as JPEG, BMP and GIF and varieties sizes. The number of color in each image is quantized into 64 colors. Thus, color difference of 64 values are computed, set {0, 1, ..., 63}. The distance measure is performed by d={1}, d={1,3}, d={1,3,5}, ..., d = {1, 3, 5, 7, 9, 11, 13, 15, 17, 19}.

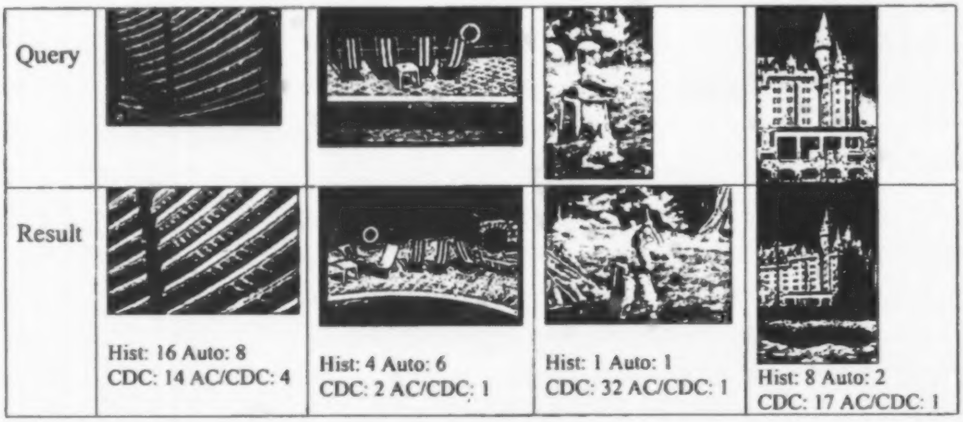


Figure 1. Sample queries and answers.

For the performance evaluation, one hundred queries, each with a unique correct answer, are used in the experiment. Figure 1 shows sample of some queries, query results and ranking of the result in various method namely: color histogram (Hist), autocorrelogram (Auto), color difference correlogram (CDC) and autocorrelogram and color difference correlogram (AC/CDC) methods. It can be seen that the AC/CDC scheme performs better performance than the other compared schemes. The scheme can also retrieve images with different views of the same scene, large changes in appearance.

The performance of the proposed scheme is also compared with other methods, color histogram, autocorrelogram and color difference correlogram. The comparison of average r-measure values and average p1-measure for each method are shown in Figure 2 and 3, respectively. From the experimental results, it could be concluded that the use of autocorrelogram and color difference correlogram for indexing and image retrieval that could improve the performance of the image retrieval system.

BEST COPY AVAILABLE

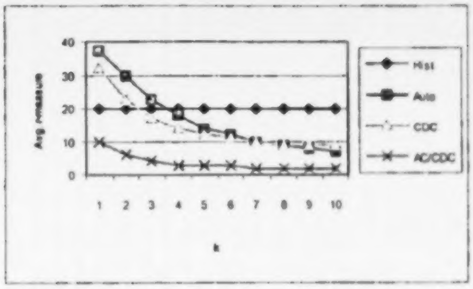


Fig. 2. Average r-measure.

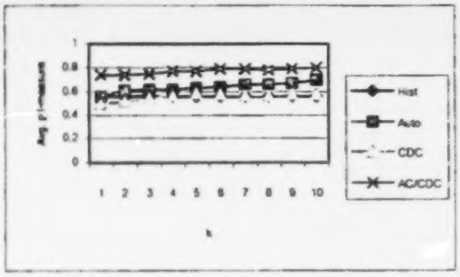


Fig. 3. Average p1-measure.

References

Huang J., S. Kumar, M. Mitra, W.J.Zhu, and R. Zabih (1997). Image indexing using color correlogram. Proc. of IEEE Conf. on Computer Vision and Pattern Recognition, pp.762-768.

John R. Smith and Shih-Fu Chang (1995). Single color extraction and image query. Proc. IEEE Int. Conf. on Image Proc., pp.528-531.

Michael Swain and Dana Ballard (1991). Color indexing. International Journal of Computer Vision, 7(1), pp.11-32.

Robert M. Haralick, K. Shanmugam, and Its'hak Dinstein (1973). Texture feature for image classification. IEEE Trans. on Sys, Man, and Cyb, SMC-3(6), pp. 610-621.

Manjunath B. and W. Ma (1996). Texture feature for browsing and retrieval of image data. IEEE Transaction on Pattern Analysis and Machine Intelligence, 18(8).

Randy Crane (1997). A simplified approach to Image Processing. New Jersey, Prentice-Hall.

Pitas I. (2000). Digital Image Processing Algorithms and Applications. New York: WILEY INTERSCIENCE.

Nepal S., M V. Ramakrishna, J A. Thom (1997). Image Retrieval Using Pixel Descriptor and its Applications to Region Extraction. Technical report, Royal Melbourne Institute of Technology.

Stephan Bres and Jean-Michel Jolion (1999). Detection of interest points for image indexing. 3rd Int. Conf. on Visual Information Systems, Visual 99, Springer, Lecture Notes in Computer Science, 1614, pp.427-434.

Greg Pass, Ramin Zabih, and Justin Miller (1996). Comparing images using color coherence vectors. In Proceedings of ACM Multimedia 96, Boston MA USA, pp. 65-73.

Greg Pass and Ramin Zabih (1996). Histogram Refinement for Content-Based Image Retrieval. Workshop on Applications of Computer Vision.

Markus Stricker and Alexander Dimai (1996). "Color Indexing with Weak Spatial Constraints. SPIE Conference, San Jose, CA.

W.Hsu, T.S.Chua and H.K.Pung (1995). An Integrated Color-spatial Approach to Content-based Image Retrieval. The ACM Multimedia Conference, pp. 305-313.

Selecting a Course Authoring System

Dr. Robert V. Price, College of Education, Texas Tech University
Bob.Price@ttu.edu

Abstract

Selecting a Course Authoring Tool (such as WebCT or Blackboard) that best meets the needs of the course author or instructor is an important consideration in creating quality online instruction. This paper reviews the features and considerations which course authors and instructors should consider when selecting a course authoring tool. An evaluation rubric is presented which those evaluating course authoring tools may use to guide them in their selection of the most appropriate system for the intended use. The rubric includes features common to course authoring tools, a rating scale of their ease of use, and a rating scale for the relative importance of each feature to the course author.

Providing course materials and information through the Web is a new frontier for many educators. *Course authoring tools* (CATs) are vital for the development and maintenance of course Web sites. A CAT is a computer program that is used by a course developer to design, develop, and maintain learner based web sites. Course authoring tools such as *WebCT* and *Blackboard* provide designers the means to distribute course materials, content, and tests to learners through the Internet. These tools use program components that allow course designers to design and deliver courses online, provide course material updates, and effectively deliver instructional modules to learners through standard web browsers.

The use of course authoring software for developing and maintaining courses has become a necessity. Course issues are important because they determine which course authoring tool is best suited for the job at hand. Selection of an authoring tool will have a direct affect on course development and the achievement of program goals.

Features of Course Authoring Tools

The selection of a course authoring software program is simplified if the user is aware of the features needed for course development. The software features considered here include course development, course collaboration, and course management (Gray, 1998). These software feature categories stem from typical activities that occur in the instructional environment and are shown in Figure1.

Course Development	Course Collaboration	Course Management
Content: lectures, materials and homework are developed for delivery through the web. Delivery: course development is conducted to include content. Forms of delivery include text, HTML, video, animation, and audio.	Access: course materials are accessed through learners' Internet service providers. Interaction: learners interact using own Web browsers. Support for e-mail, document sharing, learner homepages, discussions, etc.	Assessment/Feedback/ Administrative: grade books, quizzes, exams, course related reports, course security, and software support.

Figure 1: Class activities that fall under software tool features (Aggarwal, 2000)

Tools for Course Development

Some features to consider for course design include:

- Site search tools,
- Course participant homepages, and
- Course development (templates).

Search tools help learners find useful information they need. Search tools can be invaluable for prospective learners who may be interested in online course offerings. *Learner homepages* are one way to help learners get to know each other. Learner home pages help because they allow the participants a chance to share personal information and interests. They provide learners with opportunities to help reduce the psychological effects produced by the distance between them.

A *course-authoring template* allows the developer to construct an online course using a pre-designed format. Templates are easy to apply to specific course development applications and adapt to changing situations. Templates help a designer get a new course up and running in the shortest amount of time possible. When a designer has a custom course template, it can be shared among divisions or departments to provide standard course interfaces and visual consistencies. The ability to develop and distribute a custom template design will help an organization accomplish this task.

Tools for Course Collaboration

Some of the main tools provided for course collaboration are:

- Chat rooms,
- Message boards,
- E-mail for course participants,
- Whiteboards support, and
- Special workgroup features.

Course discussions may be conducted either asynchronously or synchronously. Asynchronous discussions are usually threaded and allow learners to respond when it is convenient. This type of discussion typically takes place over several days, or longer, for each topic. Synchronous, or real-time discussions, allow learners to participate in a virtual classroom session and communicate to others who are logged on at the same time. Instructors can designate a specific time for discussions or workgroup activities.

Electronic bulletin boards allow course instructors to post announcements related to the course that learners can visit periodically to check for new information. E-mail provided through course management programs gives learners private e-mail accounts that are specific only to the courses for which they are enrolled. E-mail is very useful for receiving course assignments and corresponding with learners on an individual basis. Some instructors prefer web based private mail to regular email because it eliminates the need to maintain a class email list, and the problems that may be associated with learners working from a variety of ISPs.

Whiteboards allow the instructor to provide course participants with visual information (i.e., computer graphics) from the computer or a physical whiteboard (i.e., drawings). Instructors can use whiteboards to enhance synchronous discussions.

Finally, web-based *workgroup features* can help provide collaborative elements to learners. This is done through a special workgroup option that provides group members with web-based resources that might include a workgroup homepage, a private discussion area, or file transfer options for the workgroup.

Tools for Course Management

Some features to consider for managing a course include:

- Course grade books,
- Assessment tools (such as quizzes and exams),
- Course access control,
- Software support, and
- Course related reports.

Web-based course *grade books* provide a means for grading and tracking learner progress. Some course authoring tools provide tests, grade books, and other data handling options. Assessment tools provide a variety of options to the course instructor, such as, the ability to generate standard or random tests and quizzes for online assessment. Grading and other forms of feedback can be provided immediately to learners, if desired.

Course access control provides a means to secure course sites and learner access. Course authoring software should provide for course sites that are easy to access by authorized users, yet guard against unauthorized use. The most common methods of access control are user names and passwords.

Learner tracking features provide the ability to generate various reports concerning learner activities in a course and the use of online course resources. Such reports help instructors and designers evaluate the effectiveness of course delivery and design, and help instructors evaluate learner participation.

Evaluating Course Authoring Programs

There is no one best program which is best for all situations. The various software features discussed previously will vary in importance to individual course authors. While many tool features are common to most software programs, the quality of these varies from one program to another. The rubric below is provided as a framework for evaluating course authoring software. Course authors and designers could use this tool to help select the authoring tool that will work best for their needs.

Authoring Software Tool Evaluation Rubric

Program Title:	Version:
Publisher:	Price:
Reviewer:	Date:

Tools for Course Development:	**Importance Rating 0-4**	**Quality Rating 0-4**	**Score 0-16**
Site Search Tools			
Participant Homepages			
Course Development Features			
Ready-Made Templates			
Custom Templates			
Quick Start Features			
Tools for Collaboration:			
Synchronous Chat Capability			
Message Board			
Private E-Mail Capabilities			
Whiteboard Capabilities			
Workgroup Capabilities			
Tools for Course Management			
Course Grade Book			
Assessment Tools			
Course Site Security			
Course Reports			
Student Progress			
Site Resource Use			
Course Evaluation			
Software Support			
Total Score			

Figure 2: Authoring Software Evaluation Rubric

The rubric lists the primary features of authoring programs. To use the rubric, the reviewer should first decide how important the features listed are to them. Using the following scale, enter a number from 0 to 4 for each listed tool. If there are other important tools which are not listed, they can be added to this form.

0 = Not Important
1= Minor Importance
2= Some Importance
3=Very Important
4=Extremely Important

After rating the importance of the tools, review the actual authoring software program or a demonstration version of it and enter your assessment of the quality of each tool using the scale below from 0-4. Consider ease of use, power, and flexibility in your assessment.

0= poor quality or not available
1= Weak
2= Fair
3=Good
4=Excellent

After evaluating the features of a software program, multiply your **Importance Rating** by the **Quality Rating** and enter the result in the **Score** for each tool. Tools which are rated 0 in importance will receive a 0 regardless of the quality rating so the reviewer can pay little attention to these tools. Either lower importance ratings or lower quality ratings will cause the score for a tool to be low. The highest overall ratings will result from those tool features which have ratings of both high importance and high quality. After evaluating all of the features of an authoring tool program, total scores for each item can be totaled by adding up the scores of all the tools and entering the result in the **Total Score** cell. After reviewing all of the authoring software programs available or reviewing those selected for further indebt consideration, the total scores and individual scores can be compared and a final selection made.

Use of this evaluation rubric forces reviewers to decide which features are important to them as well as providing a framework for evaluating the features of the programs being considered. This tool could be used by a selection committee or by individual designers or instructors to help them select the authoring tool which is most likely to meet their needs.

Conclusion

Use of this evaluation rubric by course designers will help them evaluate the course authoring tool options available to them and to select a tool which will work best for their unique needs.

Building Worldwide Mentoring Tools: Content Analysis of Visited Web Page and Matching

W. Curtiss Priest, Ph.D., Director, Center for Information, Technology & Society
Jared Luxenberg, Center Fellow
August 21, 2002

Abstract

Peer-to-Peer (P2P) Communications has become increasingly more recognized as a powerful tool for learning. In a project supported by Cisco Academies we have designed, built and are testing a new tool for P2P. We wished to have online mentors matched to online learners, but, the problems of successful matching, taking into account the current interests of the learner is challenging. Our design is to: 1. Give K-12 learners web-based learning resources 2. The student has a hover button that tracks their journey and says "Find me a Mentor" 3. They press that buttons: a. The contents of the currently visited web page is read b. We interpret the key concepts or topics of the visited page c. We employ a sophisticated matching tool (like the "find similar" for web pages at Google) to get a ranked list of relevant mentors d. Using an intermediate server, we find which of these mentors are online e. We make the match within seconds and place the learner in touch with the mentor via IM

Background

Mentor-Matcher is a knowledge sharing tool. To grasp how it performs knowledge sharing, it is useful to put this tool in perspective of other knowledge sharing tools. Once it is defined in those contexts, the technique for constructing the tool is addressed, followed by how it is currently being piloted.

The history of computer-based knowledge sharing tools goes back to the creation of online databases, such as by Lockheed Dialog, which terminals could connect to via packet networks in the early 70's.

Also created in the early '70's was a knowledge sharing tool called EIES by Murray Turoff at the Stevens Institute of Technology. Called computer teleconferencing, this tool and others like it permitted an asynchronous dialog among a group of participants where, again, using a dial-up terminal, users could dial to a central computer and post notes to a set of discussion topics.

Quite separately, on the UNIX side of computing, a hodgepodge of "news feeds" were created called Usenet. Either using telephone connectivity, directly, or by obtaining a "feed" from a computer networked to other computers, the user would receive a stream of messages sent to the "group" on the local machine. The user could either reply to a message (called threading) or open a new subject of discussion by announcing it in the subject line of the message.

Yet another mode of knowledge sharing was the Bulletin Board System (BBS). Here permanent messages could be posted in "Forums" and some of the first online chat sessions and chat rooms were created using software such as PCBoard. Other knowledge sharing occurred through the exchange of freeware and shareware files, also placed under topic headings (or directories).

In the '80s, with the prevalence of the PC, it was now possible to distribute knowledge sharing systems – a form of communications which in the '90s was called Peer-to-Peer communications (P2P).

This author developed (and patented) the first P2P knowledge sharing system that combined e-mail communications, a knowledge database, and a topic structure. A topic structure (or controlled vocabulary) need be thought of as no more than a set of directories containing messages sent in the "context" of the topic.

A later implementation of such a P2P knowledge sharing system was Microsoft's Outlook which permitted the user to exchange information within "categories." Like the Priest implementation, both the category and the information were bundled into a header, a header different from a typical e-mail header.

With the advent of the Internet (net), a wholly different form of knowledge sharing grew, which actually resembled the original online database format more than later P2P implementations.

The net permitted thousands of different sites to flourish, and each contained knowledge of one kind or another. Early pioneers such as Yahoo and Lycos saw the need to comb these sites for information and provide a portal to an index of this information via web-based search engines. The technique behind the scene was the "webcrawler" which gathered words from site after site, stuffing them into a single searchable index. So these tools resembled the early text database tools of the '70s except that the "databases" were much more widely distributed.

On the net, the BBS chat rooms gave way, first to IRC (Internet Relay Chat) and then to P2P chat such as AOL Instant Messenger.

Mentor-Matcher Design

In a prior project we had designed a desktop agent (Tracker) that followed K-12 students using the web for learning resources. In that 81% of a student's time is spent outside of school (P. Kenneth Komoski, "The 81 Percent Solution," *Education Week*, January 26, 1994, p. 52), the goal was to provide a way to encourage learners to use the net to learn more. And, hopefully, the more passive activity of watching around six hours of television a day might be reduced and replaced with something more constructive.

A learning resource portal site was constructed (http://www.eLearningSpace.org aka eLs) with support from the U.S. Department of Education. Students receive a "learning credit" for each hour spent learning at some 4000 identified resource sites and can exchange those credits for donated goods (such as brand name shoes, etc.) via an online auction site (much like eBay).

Cisco Academies showed interest in this work and have been constructing the backbone of a knowledge sharing system for the 8000 or so academy sites around the world. We suggested that the time was right to combine knowledge sharing tools in a way that merged the abilities of web-based search engines and instant messaging.

The design problem was "how to elicit mentoring strengths of online mentors and match those abilities with the current learning needs of the learners "

The national standards efforts had produced a set of topics and sub-topics in the area of math, science, and reading. So, using Javascript we built a topic/sub-topic list where sub-topics and sub-sub-topics can be display by clicking on a plus sign next to the higher topic – a technique used in Acrobat and other indexed lists.

This approach works well because mentors have a well defined set of strengths that do not change much over time. However, a student's learning interest changes by the hour.

Somehow we needed to make a match between a topically defined person – the mentor, and a learner who is selecting and viewing web resources.

This problem is similar to the web search engine problem of finding web pages similar to the currently viewed web page. Ah, but the mentor topics were stored in a database; how to make these behave like web pages?

To solve this problem we create a set of local web pages with a key for each page back to each mentor. But how to populate the pages with lots of words?

Since several encyclopedias are online, we could build a tool that "expanded" a knowledge topic – say "planets" – into a web page of up to 30,000 words discussing planets. To do this we built an intermediate tool called "WordScooper."

After the mentor signs on to the project and provides a set of topics and/or sub-topics, the server immediately has WordScooper query Microsoft's Encarta for words on that subject. We created rules where WordScooper behaves a bit like a webcrawler, taking words from various levels of encyclopedia pages by following the links on the top page. We ignore pages that are not subordinate to the top web page.

So, now we have reduced the design problem to trying to match the learner's currently viewed web page (an indicator of their knowledge needs) with our locally stored set of web pages (which are keyed back to the mentors).

Knowing that there are several dozen web search engines and that many of these are available in several ways to search one's own web pages, we went to http://kresch.com/search/search.htm which lists all known search engines and their features. While the feature of "find similar" was **not** in their summary of features, they **did** have active links to sample sites employing the particular engine. Using this we reduced the list to four possibilities. Of these, the engine by Thunderstone (Webinator) appeared to be widely used by colleges and universities and, best of all, one could obtain the search engine software and run it under the local server's OS (in our case NT5). This is free, provided the server can access the Thunderstone site to receive authorization to run. [Alternatively, the entire text-based, SQL featured search engine (called Texis) can be purchased for $11,000 (U.S.).]

The matching and messaging process operates as this: 1.) Webinator is instructed to bring down the web page currently viewed by the learner and convert the page to plain text; 2.) Webinator is instructed to use its "metamorph" facility to create an internal set of thirty frequent and unique words which define the content of the web page; 3.) a search engine query is submitted with that list, searching all of our local web pages of mentor-related word-expanded topics; 4.) a rank order list of relevant mentors is returned; 5.) an intermediate server of ours determines which mentors are currently online, and displays a list to the learner of online mentors and the word that caused the match – each item in the list is a "link" to each online mentor; 6.) the learner clicks on one of the links; our online AOL-IM-like server sends a message to the mentor including the student's name and a display of the URL the student is currently viewing; the mentor may accept or refuse the "assignment;" if he "yes"," our intermediate server sends a message of acceptance to the learner and a two-way chat occurs; 7.) we log the entire chat session and its duration so that the learner can receive learning credits (as above) by verifying that the sites are on the list of educational web pages approved by eLs and logging the minutes in the student's eLs portfolio. The data gained by tracking the student's web browsing had to be detailed (keystrokes, etc.) and be in a form that was easily accessible from ASP scripts.

In first researching tools, we wished to use client side Javascript to track web browsing. This approach presented some control issues. Netscape would not allow tracking outside of the domain the Javascript page was hosted on, and some of the features of the script did not work properly in Internet Explorer (IE). Since Javascript implementations vary from browser to browser, and some users have Javascript turned off, this solution was not feasible. We looked for other ways to track web surfing. We looked at server-side solutions, such as a backwards proxy, but the overhead associated with these out weighed their benefits. We eventually found a way to automate IE on the client side, eliminating the need to run Internet traffic through a central server.

Microsoft provides an ActiveX interface to launch an instance of IE. Events are fired when the user visits URLs, closes the window, reloads the page, etc. This allows total control over the browser, and it provided the degree of control we needed.[*]

The field test stage has begun, and the tool has met and exceeded all expectations for performance.

In summary, the project illustrates a useful way to combine two different ways of accessing knowledge: 1.) use of keywords or a controlled vocabulary, and 2.) full-text searches. The choice of one and/or the other relates to the ability or inability to use a controlled vocabulary as pieces of this design problem have demonstrated..

---

[*] The authors express their concern that "all roads" seem to lead to IE and await the U.S. Justice Department suit results against Microsoft in this regard.

Using Animated Pedagogical Agents to Teach Entomology

Haiyu Qi[1]
University of Maryland
CALCE Electronic Products & Systems Center
College Park, MD 20740 USA
qihaiyu@calce.umd.edu

Juan E. Gilbert
Auburn University
Human Centered Computing Lab
Computer Science & Software Engineering
107 Dunstan Hall
Auburn, AL 36849 USA
gilbert@eng.auburn.edu

J. Wayne Brewer
Auburn University
Entomology & Plant Pathology
242A Animal Dairy Science
Auburn, AL 36849 USA
brewejw@auburn.edu

Abstract: Animation technologies are widely used in the areas of entertainment, such as video games. Animation technologies have also been implemented in education in the form of animated pedagogical agents (Johnson, 2001). In this paper, animated pedagogical agents are used as teachers in an introductory level CD-ROM based Entomology course at Auburn University. The designed course is self sufficient, as the animated teachers go through the lectures, provide quizzes and communicate verbally with the students. This new CD-ROM based course has several advantages, such as inspiring, attractive, flexible, cost saving and students evaluated this course to be very effective as teaching tool.

Introduction

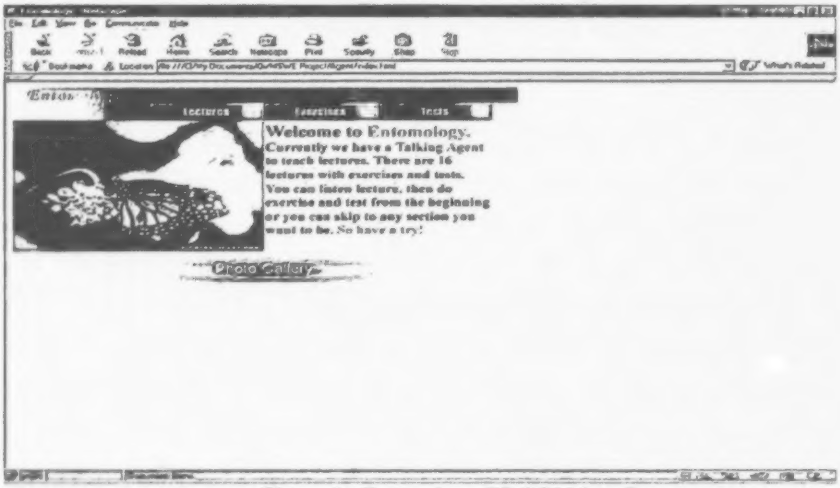
The CD-ROM Entomology course, figure 1 is based on Entomology 2044 – An Introduction to the Study of Insects. This course is an independent study course created by Dr. J. Wayne Brewer, Professor in the Department of Entomology at Auburn University. This course consists of sixteen lessons contained in a course book and a series of videos. Each lesson includes a reading assignment in the required textbook, a set of lesson objectives, a written lecture on the assigned subject, written exercises to be submitted for grading and a set of practice test questions. The completed lessons, quizzes and exams are submitted to the instructor through the Auburn University Distance Learning Center for grading. From September 2001, the authors worked together to redesign the original Entomology course to one CD-ROM course. In this new course, there is an animated pedagogical agent (Johnson, 2001) who represents the traditional instructor. The agent addresses the lecture, provides quizzes and corrects practical test questions instead of a human teacher. All course contents are on one CD-ROM, which will be delivered to the students by the Auburn University Distance Learning Center. The CD-ROM course has the following advantages:

1. More inspiring - Instructor can add any inspiring contents, like questions, quizzes easily as compared with video tapes traditionally used for distance learning courses.
2. Attractive – Teaching by agents (animated teachers) can be fun for students if designed appropriately.
3. Flexible - Students can design their own learning process based on the necessary requirements.
4. Feedback - Educator can communicate with students easily and in time. All feedback can be processed quickly and precisely.

5. Cost saving – Educator and students can save money on tedious video recording, shipping or mailing.

However, there are also some limitations on this new CD-ROM course design:

1. Text-speaking technique – Though the text-speaking technique has improved, it can not compare with the real human voice.
2. Third party developer - Educators or students need a third party for the agent development, such as multimedia specialists.
3. The basic requirement for students –The student should have a computer with necessary support system together with the working knowledge of simple computer operations.



Welcome to Entomology.
Currently we have a Talking Agent to teach lectures. There are 16 lectures with exercises and tests. You can listen lecture, then do exercise and test from the beginning or you can skip to any section you want to be. So have a try!

Figure 1: Entomology CD-ROM Interface

In the following section, the implementation, architecture and importance of the proposed CD-ROM course will be discussed.

Implementation

The Entomology course is implemented using JavaScript, HTML and a third party plugin. All contents are on one CD-ROM. When the student inserts the CD into a Windows computer, the application runs automatically .

Haptek Plugin

This project was built using the Haptek VirtualFriend 4.1 plugin, which is available as a free download from the Haptek website (Tech News – Haptek.com, 2002). JavaScript is used to control the VirtualFriend plugin. The core channel of communication with the plugin is a function called *SendText()*. *SendText()* simply sends a string of text to the plugin. If the string is simple text then the VirtualFriend will speak the text via speech synthesis. However, the VirtualFriend has a set of special commands that can be embedded in any sentence used to control the plugin, these commands are called Haptek Hypertext. The Haptek Hypertext commands can direct the plugin to download a new texture, perform an animation sequence, morph, or even load an entire new scene. For convenience, most of the Haptek Hypertext commands have been encapsulated in a set of easy to use JavaScript functions.

Architecture

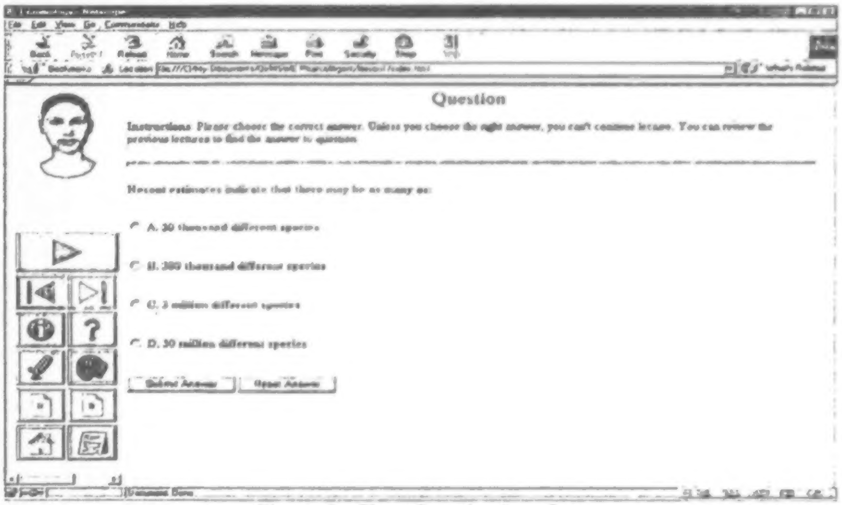
The physical architecture of the CD-ROM entomology course begins with a root directory. The root directory contains images, software needed such as Microsoft Speech API, Microsoft TTS Engine

BEST COPY AVAILABLE

(Tech News – Microsoft.com, 2001), Haptek Plugin, Cygwin and three subdirectories – Agent, NoAgent and Animation directories. Considering some computers may not have the minimum system requirements, there is a version of course without the Agent in the NoAgent directory.

In the Agent version, an animated teacher goes through the lectures, provides quizzes and communicates with the students verbally. The No-Agent version presents the same content and explanations as the Agent version but the Agent is not present. The Entomology course interface is organized into four sections: Lectures, Exercises, Tests and a Photo Gallery, which is shown on Figure 1.

There are sixteen lessons in total. Students can access each lesson by clicking the corresponding link. Each lesson's interface consists of two frames: Navigation frame (left) and Content frame (right). In the navigation frame, there is one animated instructor and several function icons. Students can control the agent's speaking, choose different lessons, and skip to exercise or test sections by clicking the function icons. To help students master the content easily and fast, the content is divided into small concepts. Each concept is further subdivided into many small scenes so that agent can speak sentence by sentence. Between each concept there is a short question related to the previous concept. Students are required to correctly answer the short question. If the student can not answers the question correctly, he/she will not be permitted to proceed to the next concept in the lecture. Students can go back to the previous concepts to find answers. Figure 2 shows the lesson interface with the short question.



Question

Instructions: Please choose the correct answer. Unless you choose the right answer, you can't continue lecture. You can review the previous lectures to find the answer to question.

Recent estimates indicate that there may be as many as:

○ A. 30 thousand different species

○ B. 300 thousand different species

○ C. 3 million different species

○ D. 30 million different species

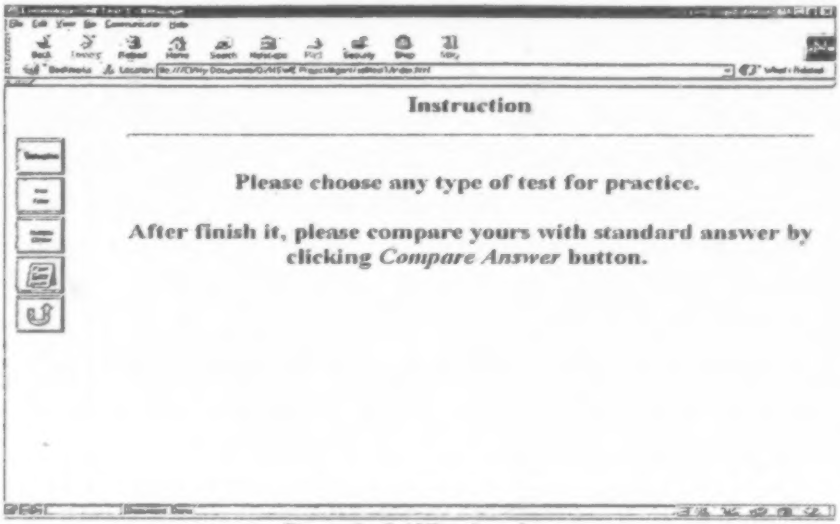
Figure 2: Short Question Interface

There are also sixteen written exercises in total. Each exercise is related to each lecture and includes three parts: definition responses, discussion responses and short question responses. Students can check their answers for correctness by clicking on the "compare answer" icon. In the navigation frame there are six icons: *Introduction*: is linked with an HTML page to explain the exercise section. *Definition responses*: is linked with an HTML page to show some terms needed to be defined. *Discussion responses*: is linked with an HTML page to show some discussion questions to be answered. *Short question responses*: is linked with an HTML page to show ten short questions and after students fill all the blanks they can click the compare answer button leading to a pop up dialogue box showing the percentage of correct answers. *Menu*: by clicking this icon the current exercise interface switches to an exercise list interface so that the student can choose different exercises from the links. *Back*: by clicking this, the current exercise interface switches to the lesson interface.

There are also sixteen self tests in total, each test is related to each lecture or written exercise and includes two parts: *multiple choice* and *true-false*. Students can compare their answers with standard answers after they finish any of two parts. In the navigation frame there are five function icons: *Introduction*: it is linked with an HTML page to explain the test section. *true-false*: it is linked with an HTML page to show ten true-false questions to let students choose true or false. *Multiple choice*: it is linked with an HTML page to show ten multiple-choice questions to let students choose one right answer.

BEST COPY AVAILABLE

Menu: by clicking this button the current self-test interface switches to self-test list interface so that students can choose different self-tests from the links. *Back*: by clicking this button the current self-test interface switches lesson interface. The self-tests interface is shown on Figure 3.



Instruction

Please choose any type of test for practice.

After finish it, please compare yours with standard answer by clicking *Compare Answer* button.

Figure 3: Self Test Interface

The Photo Gallery section, links an HTML page with nine insect images to provide some direct impression of insects to students. There is a separate Animation Directory. It includes two graphics animation applications written in OpenGL. One is a butterfly and the other is a dragonfly, the students can control these by using the keyboard.

Conclusions

The CD-ROM Entomology course has animated pedagogical agents to represent the course instructor role. Course contents are organized into four sections: Lectures, Exercises, Tests and a Photo Gallery. With text-to-speech technology, Haptek VirtualFriend 4.1 plugin and software development, students can be instructed as verbal and visional ways simultaneously. There are several significant features in this course, such as inspiring course contents, attractive teaching style, flexible study arrangement, and cost-savings for both students and educators. All those features satisfy the high education trend in the new centaury. This CD-ROM Entomology course proves to be a good teaching tool as evaluated by one of the students of this course. According to this success, this new education style may be considered to apply on various courses in CALCE Electronic Products and Systems Center, University of Maryland in the near future.

References

1. Johnson, W.L. (2001). Pedagogical Agents. [Online]. Available: http://www.isi.edu/isd/carte/ped_agents/pedagogical_agents.html
2. Tech News – Microsoft.com (2001), Text To Speech [Online]. Available: http://research.microsoft.com/srg/docs/intro2tts.html
3. Tech News – Haptek.com, (2002), VirtualFriend 4, [Online]. Available: http://www.haptek.com

---

[1] Mr. Haiyu Qi is a Ph.D. student at CALCE Electronic Products & Systems Center, University of Maryland directed by George E. Dieter Professor Michael Pecht and Dr. Michael Osterman.

BEST COPY AVAILABLE

Open Goal-Based Scenarios: An Architecture for Hybrid Learning Environments

Lin Qiu and Christopher K. Riesbeck
Department of Computer Science
Northwestern University
Evanston, Illinois 60201 USA
{qiu, riesbeck}@cs.northwestern.edu

Abstract We describe a software toolkit called Indie, for building hybrid Investigate and Decide (Indie) learning environments. In Indie learning environments, students can run simulated experiments, construct reports arguing for different claims, and submit these reports for critiquing. The Indie learning environment is one example of the Goal-based Scenario (GBS) learn-by-doing environments. Previous examples of GBS systems have been self-contained software-based learning environments. The content of the learning environments is always pre-defined, which leaves little space for open-ended activities. We overcome this problem by creating an architecture for hybrid GBS's that provide the option for having human coaching in the learning environments. This brings the possibility of having open-ended activities in GBS's as well as the opportunity for incrementally augmenting the content at instruction time. Indie has been used to construct Corrosion Investigator, a learning environment for engineering undergraduates in the domain of biofilms.

Introduction

The Goal-based Scenario (GBS) (Schank, 1994; Schank, Fano, Bell, Jona, 1993) framework for computer-based learn-by-doing (Dewey, 1916) environments is designed to engage learners in active purposeful learning (Bransford, Brown, Cocking, 1999). A GBS begins by giving learners some large realistic problem that needs to be solved. With support from the learning environment, students learn target skills and underlying concepts in pursuit of goals within a context rich environment. The content of a GBS system is authored in advance based on real-life cases, common pitfalls, war stories, and so on. GBS's provide not only a simulated world for interaction, but also modules for expert coaching and critiquing, so that the learners are not limited by the availability of domain experts.

In order to support such computer-based coaching and critiquing modules, GBS's have to be closed world systems. The vocabulary of operations and situations has to be specified in advance so that rules can be written to provide accurate and timely feedback. Once deployed, learners can only do what the GBS has been prepared to support, so designers have to anticipate every action a student might want to do, and the most appropriate feedback for such actions in all situations. GBS's require significant upfront design, implementation, and piloting by content developers working with domain experts and test subjects, in order to provide learners with a rich challenging environment. There is no easy way to add new operations, coaching, or critiquing later in order to incorporate new developments in the domain or locally relevant content. Furthermore, it is difficult for GBS systems to accommodate the interests of open-ended teaching and learning paradigms (Collins, Brown, Newman, 1989; Gardner, 1991; Papert, 1993).

To overcome the above difficulties, we have been creating an architecture for hybrid GBS's and applying it to a subclass called Indie (Dobson, 1998). In Indie learning environments, students learn how to solve problems by running experiments and using the results to support or refute possible diagnoses. A hybrid Indie learning environment does not only have traditional support in a GBS from the computer, but also allows human experts in the feedback loop to handle totally open-ended inputs from the students that previously are not allowed and understood by the system. Open-ended activities are therefore made possible with the help from the human expert. Meanwhile, new material can be introduced in the interactions by students and faculty during the running of the GBS. There no longer exists a point where the system content is frozen. Introducing a human expert into the learning environment makes both the learning environment and the development of the learning environment open.

Indie Architecture

Indie is a content-independent Java-based software toolkit that includes a content authoring tool and a runtime learning environment (Fig. 1). The content authoring tool provides a user-friendly knowledge input interface for experts to enter content knowledge into a knowledge base, e.g. scenario challenge, experiment options, result generation methods, and domain background information. The Indie Learning environment reads in content files and become instantiated to a web-based learning environment. The Indie learning environment has a common interface, including support for a splash screen, a welcoming "challenge" document, a "background" screen where students can browse materials describing the scenario and domain content, a "lab" interface where students can order tests and collect results, and a "report" interface where students can construct arguments for and against possible diagnoses, using the evidence gathered from the tests. Indie learning environments automatically generate lab test results based on requests from students and provide scaffolding for students to construct arguments. Working as middleware between the students and instructor, it tracks student working progress for the instructor and lets the instructor role-play characters in the scenario.

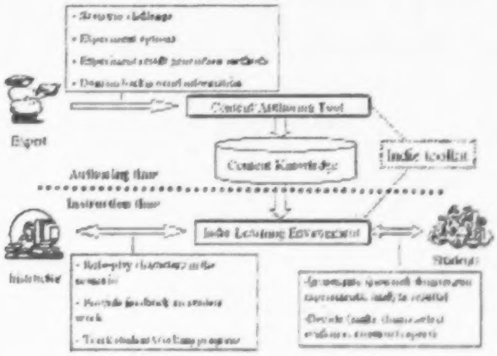

- Scenario challenge
- Experiment options
- Experiment result generation methods
- Domain background information
Expert
Content Authoring Tool
Content Knowledge
Indie toolkit
Authoring time
Instruction time
Instructor
Indie Learning Environment
Students
- Role-play characters in the scenario
- Provide feedback on student work
- Track student working progress

Figure 1: Architecture of the Indie toolkit

Though authoring time and instruction time in Figure 1 respectively refers to the time when the expert inputs knowledge into the system and the time when the instructor works with the students through the learning environment, they are not necessary separate periods. In other words, the instructor can work as the expert to augment the system while engaging in working with the students. Having the instructor working in the learning environment keeps the system from totally depending on pre-defined content, which is crucial when the content knowledge in the system is still under development.

An Example: Corrosion Investigator

We used Indie to build the Corrosion Investigator application, a learning environment for engineering undergraduates in the domain of biofilms. In the learning environment, students take the role of consultants to help a company determine the cause of pipe corrosion. Students need to make conscious decisions about which tests to run and which test results support the claims they make in order to solve the problem in a timely and economical manner. This requires students fully understand the purposes of the tests and the implication of the test results.

To run tests, students go to the Experiment page (Fig. 2). Here, students can look for tests by entering test names into a textbox. Tests matching the name will be shown. Students can view the description of the tests and possible variable values for the tests. Currently, there are five tests in Corrosion Investigator. A few more will be added. If no test matches the name that students enter, students will be asked to try another name, or email the Scientific Consultant, a character played by the instructor in the scenario, for help. Using an open-ended interface for test names forces students to research and brainstorm about what tests might be relevant. It also allows tests to be used that the scenario authors hadn't predicted. Hence, the problem solving activity is more open-ended and closer to real life situations. Such activities help students develop adaptive expertise (Bransford et al., 1999). New tests and results can then be incorporated into the system for reuse by future students. This approach does require an expert in the loop, though, to interpret reasonable but unexpected test names, and to generate plausible test results on the fly.

BEST COPY AVAILABLE

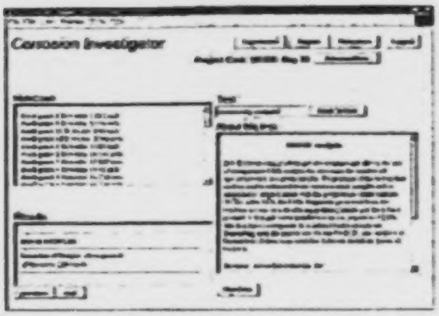


Figure 2: The Experiment screen in Corrosion Investigator.

When the test results become available, they appear in both the Notebook and Test Results area (Fig. 2). Test Results area displays the test results in a readable manner. The Notebook records all the test results that the user has received in a list that can be used for constructing a report. Most of the numbers in the test results are generated randomly based on constraints specified in the domain files.

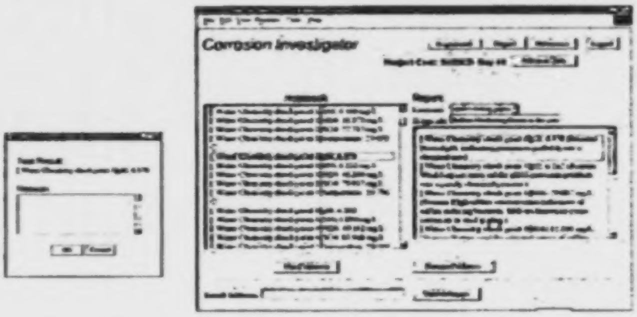


Figure 3: The Report screen in Corrosion Investigator.

When students feel they have gathered enough information, they can go to the Report screen (Fig. 3), make claims, and apply evidence in the Notebook towards that claim. Students need to specify the reason for using a test result as evidence. They also need to use many pieces of evidences to support their claim, because the strength of the argument, and its freedom from irrelevant evidence, is a key area for critiquing. After finishing constructing the argument, students click the Submit button to submit their reports. The system emails the report and the data in the Notebook to the instructor. The instructor reviews the report and emails feedback to the students. Students then continue working based on the feedback.

Related Work

A previous version of Indie was developed in Lisp on the Macintosh by the Institute of Learning Sciences (ILS) at Northwestern University. Over a dozen of Investigate and Decide learning environments were built with the old Indie (see Dobson, 1998). Our new version is Java-based for portability and web-delivery, and uses XML files to represent the domain content. Most imporantly, the new Indie supports human coaching and critiquing as well as much more complex tests, and random test result generation.

See Dobson (1998) for more related work.

Future Work

Six first-year graduate students in the Civil Engineering Department in Northwestern University used Corrosion

BEST COPY AVAILABLE

Investigator in a class in May 2002. After using Corrosion Investigator for 3 weeks, students completed a survey regarding their experience. Their average score to the statement that "overall, this is an excellent system for doing the project" was 2.16 on a scale of 1 to 5 (1 stands for Strongly Agree, 5 stands for Strongly Disagree). The question "How difficult is it for you to find out the right test to run?" got the most negative score, 3.83 on a scale of 1 to 5 (1 stands for Very Easy, 5 stands for Extremely Hard). This shows that the most difficult aspect of the interface to use was the mechanism for finding tests to run. Improving the interface for finding tests to run thus becomes one of our future research issues. Other parts of the system were considered not difficult. As for the professor of the class, the software significantly reduced his work during the project phase, especially on test result generation.

The content knowledge for Corrosion Investigator was written in XML format directly without using the Indie authoring tool because the tool is still under development. We are using a class-based dialog box approach that proved quite successful in the previous Indie for building the tool.

Acknowledgements

This work was supported primarily by the Engineering Research Centers Program of the National Science Foundation under Award Number EEC-9876363. Matthew Parsek, an assistant professor in Civil Engineering, developed the original biofilm course that Corrosion Investigator was based on. He later expanded and refined the content in his course for Corrosion Investigator. Ann McKenna, a post-doctoral fellow in the School of Education and Social Policy, guided the development and evaluation of the original course.

References

Bransford, J. D., Brown, A. L., & Cocking, R.R. (Eds) (1999*). How people learn: Brain, Mind, Experience, and School.* Washington, DC. National Academy Press.

Collins, A., Brown, J.S., & Newman., S. (1989) *Cognitive Apprenticeship: Teaching the Craft of Reading, Writing, and Mathematics*, In L.B. Resnick (Ed.) *Knowing, Learning, and Instruction: Essays in Honor of Robert Glaser*, Lawrence Erlbaum Associates, Hillsdale, NJ

Dewey, J. (1916) *Democracy and Education*, The Free Press, New York.

Dobson, W.D. (1998). Authoring Tools for Investigate and Decide Learning Environments. *Ph.D. thesis*.

Gardner, H. (1991) *The Unschooled Mind, How Children Think & How Schools Should Teach*, BasicBooks, New York.

Papert, S. (1993) *Children's Machines: Rethinking Education in the Age of the Computer*, BasicBooks, New York

Schank, R. (1994). Goal-based scenarios: *A radical look at education*. Journal of the Learning Sciences 3, 4, 429-453.

Schank, R., Fano, A., Bell, B., & Jona, M. (1993). The Design of Goal-Based Scenarios. *Journal for the Learning Sciences* 3:4. 305-345.

Making Your Online Learning Environment a Success
Clemson University's Approach

Carla Rathbone
Director of Collaborative Learning Environment
Clemson University
United States
bone@clemson.edu

Abstract: A popular topic of discussion in higher education is online learning environments. Everyone wants to collaborate, learn anytime and anywhere and do this with little or no experience required. Competition between commercial versions of online class environments, locally developed versions and a hybrid of the two has inundated our educational institutions. Regardless of the choice, how do you make it succeed? More importantly, what makes faculty and students buy in to this new way of teaching and learning? This article looks at how Clemson University is addressing these issues of what makes an online learning environment useful and how to encourage the innovative use of this environment. We will conclude with a look at how we have been able to expand our services to a portal concept that addresses the computing needs of all users at Clemson and extends these personalized tools and services for use in the classroom and the workplace.

Introduction

Clemson University is a public, land-grant research university with a total enrollment of 17,465 students and approximately 1200 faculty. Clemson's Collaborative Learning Environment, better known as MyCLE, was created in 1997 to lead the university in incorporating technology into the teaching and learning process, providing a wide range of technological services for use in the classroom. This online learning environment was developed internally to provide collaborative work space and web tools for all 6000 class sections each semester with no administration required by the professor. This system integrates information from our legacy Student Information system, Novell Directory Services and numerous customized applications. Access to the online learning environment is through a single computer user ID and password. Membership in the class workspace is automatically maintained through a dynamic link to the Student Information System. Each class has a consistent suite of course tools and file folders with common folders for turning in and reviewing homework, storage of class materials (such as course syllabus and assignments), public web folders, team folders, student surveys, grading, discussion boards and library reserves. In support of both synchronous and asynchronous learning, Clemson University's online learning environment is globally accessible fromboth our network and the web.

Background

The Collaborative Learning Environment department is department of the Division of Computing and Information Technology (DCIT) and was established with support from the Provost office with a $150,000 annual funding. We have continued to receive this funding every year to support training positions, provide faculty incentives and purchase new hardware and software for training and faculty development labs. Additionally, DCIT restructured its academic support to focus on supporting this new learning environment. Currently the CLE department consists of 12 full-time employees, six to eight students and two faculty fellows to promote and support the use of MyCLE.

Clemson University's Approach – Support and Services

Communication and support have been the cornerstone of the implementation process of our online learning environment for both faculty and students. The approach used by the CLE has itself been a collaborative effort and included many departments and groups across campus. Partnerships have been formed, new training programs established and student and faculty labs upgraded as outlined below, all as part of creating and supporting a successful collaborative learning environment at Clemson University.

Partnerships

- Office of Teaching Effectiveness and Innovation (OTEI) and CLE share office space and work together to assess the technological needs of faculty in teaching and learning. Joint workshops and seminars are provided on a regular basis.
- Student Government and CLE worked together to produce a syllabus repository for students. This repository of course syllabi allows students to research class descriptions prior to registration. It also allows faculty to automatically upload their class syllabi to MyCLE.
- The University Library and CLE developed a process to allow the library to post class reserves electronically through the university's online learning environment.
- CLE works with the Office of Off-campus, Distance and Continuing education to determine standards and tools for distance learning and co-sponsor seminars for faculty to learn how to use these tools.
- CLE Advisory Board (consisting of 2 faculty representatives from every college and student representation) evaluates the needs of faculty and students in the use of the online learning environment.
- CLE faculty fellows (faculty members who are given additional funding to serve) act as mentors to their colleagues in the use of technology. The faculty members sponsor workshops, address discipline-specific needs, write articles for the faculty newsletter and assist in beta testing new tools and features of the online learning environment.

Training and Support Programs

- A computer literacy program was designed and implemented for 100 level courses, specifically English 101 to introduce students to Clemson's computing environment.
- In-class training for course-specific instruction may be requested by faculty and is held during the regularly scheduled class period.
- Short courses are offered each semester to all faculty and students
- One-on-one consulting is available to assist faculty and students in the use of MyCLE.
- A newsletter, Faculty Directions, is published quarterly that showcases the work of faculty using technology in the classroom.
- Faculty training classes are scheduled each semester covering the use of MyCLE and supported web and multimedia application.
- Faculty Laptop development program is implemented this Fall to address faculty use of laptops (required this year in College of Business and Behavioral Science, College of Engineering and Science undergraduates and also for the first year MBA students).

Labs

- A faculty development/multimedia lab was created for scanning of text files, images/slides, video capturing and editing; color printing, digital media and web page creation.

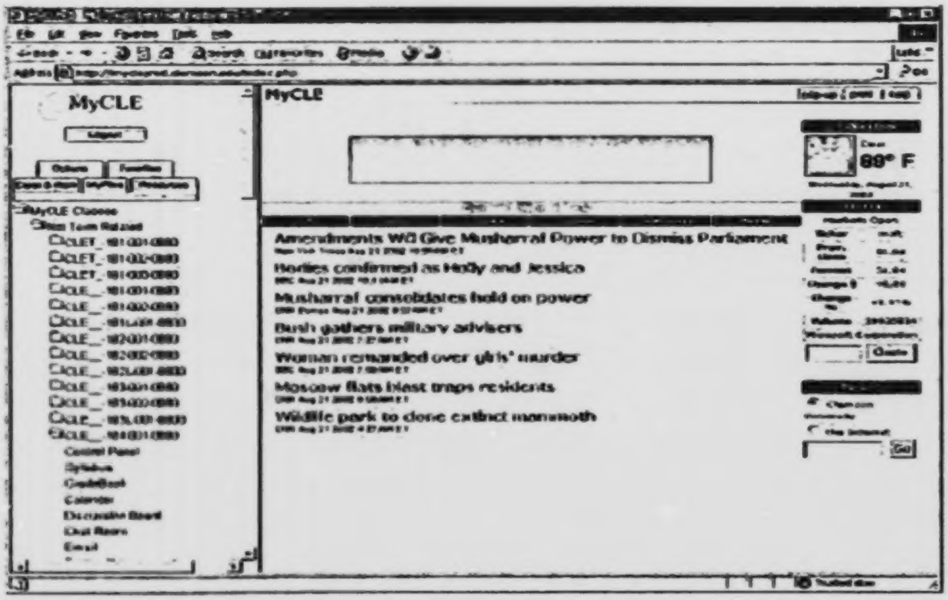
- A "virtual laptop" environment was developed allowing students to have access to files, programs, email, bookmarks, etc. from any lab computer on campus or dorm room
- Over eighty classrooms have been converted to "smart classrooms" and equipped with a podium containing a network-connected computer, VCR, cable TV connection, and with a ceiling mounted high quality projector.
- Laptop requirements have been implemented this semester to include freshman in College of Business and Behavioral Science, College of Engineering and Science and also for the first year MBA students.

Conclusion

This level of services and support throughout the CLE, combined with the ease of use and availability of our online learning environment, has proven to be successful with faculty and students. Currently 85% of all students and teaching faculty representative of all five colleges use some components of the online learning environment in their classes. As more faculty and students become comfortable using the tools and features, the gradual transition to online learning becomes a reality allowing more flexibility and alternative methodologies in the teaching and learning process.

The CLE continues to develop and expand the services offered in order to meet the needs of the Clemson University campus users. Over the past year we have been able to implement the portal concept to extend and personalize these services to administrative units across campus because of the successful use in the classroom. Work groups are automatically created in addition to scheduled classes to provide access to these tools and services in the classroom and workplace. This includes various web tools, shared file space, personalized applications and access to university systems. Some of the current uses for work areas include our SACS Self Study groups, student organizations, administrative business units and student advisory committees.

For more information go to http://cle.clemson.edu. For a look at the online learning environment, contact clc-l@clemson for a guest account and enter at http://mycle.clemson.edu.



Amendments Will Give Musharraf Power to Dismiss Parliament

Bodies confirmed as Holly and Jessica

Musharraf consolidates hold on power

Bush gathers military advisers

Woman remanded over girls' murder

Moscow flats blast traps residents

Wildlife park to clone extinct mammoth

Figure: 1: Clemson University's Online Learning Environment (MyCLE)

Without any doubt, there are special challenges to providing adult education as such in a developing country.

The first and foremost challenge is to spread a relatively scarce resource - knowledgeable content providers (i.e., lecturers) - over a huge geographic area. Another challenge is to find the necessary financial resources to fund the delivery of adult education in the face of pressing basic necessities such as providing primary health, welfare, and safety care. On top of this, in South Africa there is the added imperative of an urgency to empower millions and millions of illiterate adult black South Africans due to the educational backlog because of the previous government policy of apartheid.

Against this background, a new company with the apt name of *eDegree* was formed in South Africa with a capital investment by PricewaterhouseCoopers three and a half years ago, with the specific objective of harnessing the advantages of e-learning as one of the most viable solutions to meeting the above-mentioned challenges.

In many ways, in retrospect, it was a case of "fools rush in where angels fear to tread". I believe we were one of the very first companies/institutions in the world to deliver a fully-fledged Bachelor of Commerce, as well as an MBA degree, completely online. At the other end of the spectrum, our Adult Basic Education and Training programme (i.e., a fast track for illiterate adults from grade 1 to grade 9) delivered on CD was surely a world first.

I would like to share my company's experience in providing e-learning to the African continent (and, more specifically, in South Africa) with you. During this time, we have learnt to move at lightning speed, to redirect and re-engineer every two to three months, to navigate through uncharted waters, building new models as we progressed and, yes, also from time to time looking back in amazement at our ignorance 30 days before.

By utilising e-learning, the expertise of the relatively small pool ofhigh-level content providers who are able to contextualise knowledge within local circumstances is being distributed on a national level.

Furthermore, course delivery via a virtual classroom (text and/or audio), synchronous and/or asynchronous, lends itself admirably to bringing learners into contact with peers and lecturers all over the country and continent, drawing on one another's unique yet comparable third-world circumstances. (Bandwidth restraints in Africa limit the use of streaming video to a very large extent at this stage.)

On top of this, e-learning now provides African learners with direct access to the best international resources available through the WWW or by means of e-mail for the first time.

It is important that one should recognise that there are different categories of adults who would benefit from online learning. Young undergraduates have learning requirements that are quite different from those of highly motivated mature learners in the professional workplace. And how on earth does one go about teaching a completely illiterate adult to use a computer? Does it make any sense at all to use such a highly sophisticated piece of technology to educate somebody who has never even used a pen or pencil?

An understanding of the relevance of learning requirements and styles must precede the design and implementation of learning programmes. The learning environment and the facilities available to support the learner, both online and off-line, should reflect the elements of sound pedagogy relevant to the groups concerned.

Developing a training course for the South African market requires developers and providers to create courses that are not simply didactic, but that also reflect the principles of learner-centredness, lifelong learning, flexibility in learning provision, the removal of barriers of access to learning, recognition of prior learning, provision of learner support, relevance, differentiation, redress, nation-building and non-discrimination, critical and creative thinking, flexibility, and progression.

It is neither desirable nor appropriate for large numbers of academic staff (even should they be available) to become experts in the use of authoring software. In any case, the design of effective courseware materials involves much more than the use of an authoring tool. In our opinion, it is more appropriate in the development of materials that subject matter experts should be creative and work with and advise experts in instructional design, in graphical design, in the production of audio and video materials, and in a range of other services to ensure courseware of high quality than for them to try to do everything themselves.

Therefore, the core business of *eDegree* is to assist public and private higher education institutions and companies to redesign and package their course content to optimise the e-learning capabilities to the full. This we do by training faculty in e-learning instructional design principles and, thereafter, digitalising their courseware on a five-tiered scalable index according to different parameters such as cost, target population, and technical considerations.

At *eDegree*, we also take responsibility for the administration and management of the delivery of the e-learning courseware if the client so prefers, with the academic institution at all times the custodian of all matters pertaining to academic standards.

e-Learning courseware design

Partly to help economise on development costs, increasing interest is being shown in the concept of reusable "learning objects" defined as the grain size of the smallest unit of production within learning material. We use the term "learning object" to refer to the smallest study unit that a learner might wish to take: full courses should be structured by combining such small units. Structuring course content in the form of independent learning objects implies that multiple learning outcomes and, therefore, multiple curricula needs can be met by re-using the same learning objects. This has the advantage that different qualifying authorities (universities, colleges, and companies) can select relevant outcomes or objectives for learners from the same pool or repository of carefully constructed learning objects. The learning objects are relatively self-contained from a learner's perspective and are structured to enable the learners them to be assessed.

To provide this level of flexibility, the ideal is that *eDegree* will need to make available stand-alone learning objects for learners throughout the African continent, which could form part of a fuller course leading to an award, or they could simply be independent units prepared for a specific market. This will enable potential consumers to select learning objects, either separately or in combination, to suit their needs – albeit with guidance about their coherence and about the possibilities for an award.

Developing material in the way we propose requires subject expertise to be combined with a range of skills associated with instructional design. The development process is time-consuming and expensive, which is one reason why these scarce resources are centralised in one specialised service provider such as *eDegree*.

Constructing courseware by means of learning objects implies that no duplication – and, therefore, unnecessary use of an expensive limited resources – takes place. On the contrary, extensive reuse of knowledge is made, packaged in such a way that immediate updates at relatively low cost can be done quickly.

This way of organising knowledge does, of course, have enormous implications for courseware design. But even more importantly, it demands a whole new way of thinking about curriculum development and structuring of qualifications.

One of the outcomes of this approach is that the World Bank has awarded us a grant for developing a world-first Online Authoring course, i.e., an individualised online programme to train subject matter experts in the unique instructional design methodology necessary for designing an online learning experience, enabling them to transform their existing content knowledge to optimise the benefits of the online learning environment. This has been a formidable challenge and a tremendous opportunity.

We have succeeded in developing a curriculum design through a flexible modular architecture built on the learner's personal (lecturing) profile, his/her target audience, different learning styles, etc. In practical terms, this means that instead of a linear approach, SMEs are prompted to follow a non-linear route through the learning material in a way that best serves their needs and those of their target audience. By first assessing which learning outcome a learner lacks, he or she is then branched to the specific learning object underlying success in mastering the outcome.

Within the course content, different instructional design principles and how they impact on learners from varying cultural and educational backgrounds are addressed. Not only does this add to the applicability of the programme within the different educational contexts worldwide, but it is also believed that from our experience gathered in the multicultural South African educational environment, we are uniquely positioned to develop a novel product of this nature.

In order to add functionality to the front-end tools, the use of artificial intelligence to automatically evaluate the didactic applicability of selected multimedia features has been developed – also a unique attribute of this programme.

An unique e-learning challenge

It is imperative that, given the African education scenario, special attention is given to training of adults on lower levels also. It is with this in mind that *eDegree* has put a very special effort and millions of rnads into developing an Adult Basic Education and Training (ABET) programme, essentially training illiterate adults to read and write.

The term "ABET" connects literacy with basic, general adult education and with training to enable income generation. ABET learners exist in a wide range of learning constituencies, including organised labour in the formal economy, self-employed and underemployed people, the unemployed youth and adults in urban areas and settlements, the rural unemployed, and women heads of households in both urban and rural areas.

The ABET audience is diverse. It is also located in the dynamic world of globalisation and technological advance. It is vital then that material provided to meet ABET learning needs is flexible, so that it works within a wide range of contexts. Our programme lends itself to two modes of delivery: the traditional classroom-based method and the computer-aided method guided by the facilitator. The computer-aided approach to ABET aims to bring together classroom-based and distance learning, taking the best from both approaches and forming a new method focused on meeting individual learner needs.

While ABET learners can never be expected to complete courses independently, the lessons learnt in forming sound distance learning principles relate to the independent nature of self-paced learning. Incorporating multimedia into the learning equation enables learners to learn at their own pace, while still enjoying the support and guidance of a facilitator and the camaraderie of fellow learners.

The benefits of e-learning in an ABET context are many and varied: over and above the benefits of monitoring capabilities, and providing independent, self-paced learning, instruction given is standardised, and e-learning allows for easy adaptation of material. The endless capabilities of multimedia with sound, animation, and graphics make explaining concepts to learners at lower levels far easier. A learner who is able to watch the animation of different shapes moving together to form letters, letters moving together to form sounds, and sounds moving together to form words is able to "experience" a new concept, rather than accept static representations of the concept, filling in the blanks where necessary. Reference tools come alive in front of learners' eyes – an alphabet library, combining the name of each letter, the sound it makes, how to write it, and an associated picture, makes learning to read and write more than memorising lists of sounds and shapes; it becomes an integrated learning *experience*.

The process of developing an effective e-learning programme becomes significantly more complex when South African developers are faced with the challenge of providing programmes in 11 official languages.

The challenge is compounded when the programme being provided is essentially one enmeshed in language, such as an ABET course. Teaching someone to read and write in English is vastly different from teaching someone to read and write in another language. Think of a literacy course in French. The French language is bound by grammar rules such as the masculine and feminine gender of nouns. Simply translating a French literacy course into English will not produce a meaningful programme. It is not only grammar rules that cannot simply be translated – think of idioms, poetry, and humour specific to the English language. Before the process of developing content for courses in 11 languages can begin, generic components must be isolated, language-specific components for each language identified, and a way forward mapped out. Translators and language experts become vital new members of the team.

But the challenge does not end here. Instructional designers, graphic designers, and programmers require an understanding of the content in order to mould it into a meaningful learning experience. The answer cannot be to simply form a team for each language, where each member speaks the language concerned. How would one control quality and consistency? The likelihood of finding a person who speaks all 11 official languages AND with enough knowledge and experience to manage 11 multimedia production teams is slim. Furthermore, quality control and monitoring of programmes in 11 languages once these programmes have been implemented is no easy task.

Conclusion

With Africa and, more particularly, South Africa having been relatively isolated from the rest of the world for very long for various reasons, we take special care to keep at least up to date in terms of fast-moving international best-of-breed e-learning practices.

Globalisation demands high productivity, an advanced skills base, and a competitive edge. We should maximise our potential in focus areas, while taking advantage of international skills in other areas. Globalisation offers us the opportunity to compete in world markets for the first time. This enables us to make use of state-of-the-art technology, while sharing knowledge and ideas with specialists who have a common passion and purpose.

Life on the Bleeding Edge: How Emerging Technologies Can Help New Teachers

Pamela Redmond
Teacher Education Department
University of San Francisco
Redmond@usfca.edu

David Georgi,
Teacher Education Department
California State University, Bakersfield,
dgeorgi@csub.edu

Abstract: The Teaching Learning Interchange (TLI), a federal Preparing Tomorrow's Teachers to Use Technologies project, will be in its second year of applying several emerging technologies to help new teachers in several ways. This presentation will report actual second year results compared with the first year expectations listed below.

The Teaching Learning Interchange (TLI), a federal Preparing Tomorrow's Teachers to Use Technologies project, will be in its second year of applying several emerging technologies to help new teachers in several ways. This presentation will report actual second year results compared with the first year expectations listed below.

The target population consists of "preintern teachers," a designation in California for teachers who are not credentialed and have not passed subject matter competency. The intent of the preintern program is to provide a way for those wishing to enter the teaching profession to attain subject matter competency and a credential while they are working in the classroom. The program originated because of a severe teacher shortage in California.

TLI has partnered with 15 county offices to have access to preinterns and corporate partners who are developing new technologies.

ClearPhone provides software for conducting video conferences among small groups anytime/anywhere via Internet access. TLI identified a number of subject matter science specialists (the area of greatest need) from the Exploratorium. They are being connected with preinterns who need to attain subject matter competence. Each participant will be given a net cam, whiteboard and software. Online meetings will be conducted in which several preinterns can meet with a specialist and discuss topics covered on the Praxis science test. The whiteboard allows participants to share lesson plans and student work samples.

Expectations are that both the specialists and preinterns will give ClearPhone high marks in the ability to meet from distant locations. Those in rural areas with long distances are expected to have similar benefits to those in congested urban areas, notably the efficiency of meeting without the disadvantages of travel to a common location. The preinterns in the project are expected to score higher on Praxix than preinterns in general.

Lesson Lab provides online video of classroom practice that is particularly useful in helping preinterns understand and plan for the complexities of classroom management and lesson delivery. LessonLab has a unique software package that allows instructors and preinterns to time index a video of classroom practice while online. For example, an instructor can create an assignment to demonstrate a particular teaching practice, like responding to the efforts of learners. The assignment can provide a link to where an example, say at 12 minutes 32 seconds of a 60 minute video. The assignment can then require preinterns to view all or some of the entire video and mark where they see examples of effective or ineffective practice and write narrative descriptions of their perceptions. When the assignment is completed by all the preinterns, a chart showing all the examples marked by preinterns can be displayed, forming the basis of a dialog on examples marked by many and those marked by only one or two. The advantage of this approach is that teaching is shown within a realistic context including both effective and ineffective teaching practice. Preinterns can explore practice via synchronous and asynchronous online discussions to obtain deep levels of understanding of the complexities of teaching. Both instructors and preinterns are expected to report that this technology is helpful in improving their classroom management, lesson planning and delivery.

Apple Computer recently redesigned its Apple Learning Interchange (ALI) to include video cases along with Units of Practice for particular lessons and links to related resources. A search engine is included on this portal that links Units of Practice to state and/or subject standards. Preinterns will be given structured access to the ALI. They are expected to report that the ALI is useful in obtaining and adapting lesson plans, viewing examples of successful practice and accessing resources and standards.

In conclusion, the experiments of the TLI in providing such state-of-the-art technology to new teachers is expected to produce a wealth of useful applications that have great potential in future teacher preparation programs, as well as identifying a number of potential problems that go along with such innovations.

Diversify, Diversify, Diversify! Why Gender Mainstreaming in Educational Media Does Not Mean one Size Fits All.

Bernd Remmele

Bernhard Nett

Frank Roehr

Britta Schinzel

Benjamin Stingl

Tanja Walloschke

Institute for Computer Science and Social Studies
Dept. 1: Modelling and Social Impacts – RION Rechtsinformatik Online
University of Freiburg, Germany
remmele@modell.iig.uni-freiburg.de

Abstract: Distant Education and Internet-supported classroom education pose specific problems to the establishment of gender equality in Higher Education. Instead of discussing these problems from the perspective of insufficient competencies among women, it is stressed that the specific media have to allow different (also female) user strategies. Especially the integration of presentational and communicative functions into educational software promises to show general (ungendered) success. These assumptions will be rested on experiences of the Internet based teaching network RION.

Introduction

'RION – Rechtsinformatik Online' is an Internet based teaching network of nine German universities and three different disciplines, i.e. law, informatics, and economics (Rechtsinformatik is the German expression for computer and law - C&L). It is designed to create an Internet platform including a learning space for the field of computer and law.[1] This field is gaining more and more importance with the new media and it is constantly changing with them, however it does not fit into the traditional structure of German law teaching. So there are some gaps, which RION tries to fill with its interdisciplinary, and ICT based approach.

The authors, who are an interdisciplinary group (computer science, law and sociology) themselves, are responsible for the didactical consulting, the gender mainstreaming and the evaluation of the whole project. One main objective of our evaluation is therefore the problem of gender and new media. Though we raise data about computer literacy according to the present computer practice and get the expectable result (i.e., the male practise is 'more advanced' than female), we do not think that this is mainly question of deficient female competencies. The statement that there are such differences between the sexes in the usage of ICT in Higher Education does not mean women have to become like men; rather we have to reconsider the interaction structure of the media and the practises they allow in order to promote the implementation of software that can be used successfully by different users. Why should different user groups (there are more differences then that between men and women) adapt to the media instead of adapting the media to the different interest and the relating competencies.

From this perspective computer literacy has to be seen in the framework of a definition of media competence, which is conceptualised in a more complex way than just by superficial present practise. A timely definition of media competence has to add contextual knowledge about the media to the limited determinations of mere ICT handling; this involves some critical faculty especially regarding the social dimension of the media and their usage (Cf. Baacke 1999). We want to point out that this comprehensive conception also involves another perspective on the C (commu-

---

[1] http://www.ri-on.de
RION is financed by the Federal Ministry of Research and Education in the framework of the sponsorship programme „New Media in Education". RION is a cooperation of the Universities of Freiburg, Oldenburg, Münster, Karlsruhe, Berlin, Hannover, Göttingen, Darmstadt and Lüneburg.

BEST COPY AVAILABLE

nication) and its connection with the I (information), because the ways communication is organized in educational software – if at all – do not reflect the whole spectrum of services and features, demanded by different user interests. Of course this does not sounds really new, as most of it complies with constructivist pedagogics. Constructivism also focuses on contextuality. Information has to be framed in a given context to be meaningful, and this means also that it is socially situated. So when contextualization was discovered as a chance for education in the nineties, constructivism became popular in pedagogics. Therefore regarding ICT in (higher) education the interactive potential of the computer should be moved into the center of interest. Students should no longer be considered as mere consumers. Instead, their involvement ought to be promoted by making it decisive in regard of what happens (Cf. Siebert 1999; Specht 1998).
As gender mainstreaming is an enterprise that goes to the roots of organizational and technological structuring, it is clear that gender mainstreaming is directly concerned with possible user strategies in the realm of educational software. One of our basic assumptions is that the disciplinary (learning) culture of informatics is decisive for the learning models implemented in educational software (regardless of the design of the user interface and similar apparent qualities, which are mostly expressions of an analogous production process). This model is determined by the singling out of the learners (i.e. no grouping in the strict sense of the word takes place), assumed standardized basic knowledge, and clear-cut separation from other scientific disciplines and practical usage. In the respective software we thus have mainly space for lecture-scripts, and - if at all - communication-tools, which are somehow stuck on to the central presentational core, without building a functional unit.[2] This obviously is not constructivist.

Evaluation Results

A basic survey carried out at the beginning of RION showed in regard to the (Western) Internet-standard-applications more or less equal results for men and women. However there were significant differences in advanced computer use or - to say it in another way – in male domains, like hardware, programming, games and discussion boards to the disadvantage of female participants. These results are supported by the fact, that in discussions of male students the computer is an issue more often than among female ones: so technical expertise is exchanged more frequently within male dominated networks.
Certain internet tools tend to support gender-specific communication styles, and especially discussion boards do so in a way, that has often lead to frustration of female participants (Cf. Herring 2000). With the data of our survey we can establish the thesis that gender-specific user profiles, in consequence of specific media biographies, correlate with diversified self-conceptions: In regard to the self-estimation of their computer competence, female students rate themselves significantly lower.

"I know, that I can handle my computer well."				
	exactly	rather correct	rather not correct	no
female (20)	10.0%	50.0%	40.0%	0.0%
male (49)	40.8%	49.0%	10.2%	0.0%

We asked students of law and economics from different universities, who are studying C&L,[3] with a questionnaire to rate the assertion "I know, that I can handle my computer well." As the table shows no one answered 'no' and half of the women as well as half of the men choose 'rather correct'. However 40% of the female said 'rather not correct' whereas the same percentage of the male answered 'exactly'. This clear difference regarding the 'computer self efficacy'[4] and the respective gendered satisfaction pattern leads of course to lesser practice in this field, so that we get a vicious circle of less experience and lacking contentment.

Experiences with the MOO used by RION (called JurMOO) may point at a way out of these circumstances.[5] To understand this claim we first have to know what makes a MOO so special. A MOO is a Mud (multi-user-domain) object oriented. This means that the whole setting including the "characters" is programmed in an object-oriented manner - and the users themselves may change all these elements. If you look at the user interface of a MOO[6] -

---

[2] Kirkup & Prümmer (1997) also connect gender problems with the design of communication features. "For distance education to take this seriously, systems must have designed into them connection networks among students with the chance to communicate and meet."

[3] Though in general the proportion of sexes in law and economics is balanced, where there is the choice more men are taking courses in C&L.

[4] Cf. http://www.chssc.salford.ac.uk/healthSci/selfeff/selfeff.htm

[5] http://lem.iig.uni-freiburg.de:7000/

[6] Basically a MOO can be used via Telnet; the JurMOO of RION can also be accessed via a browsable Java emulation (http://lingua.utdallas.edu/encore/).

which admittedly needs some familiarization - there are three 'frames'; on the right side there is something like a web page, the 'rooms' of the MOO; and on the left side there are the two frames – a big one on top, a small one at the bottom -, which are something like a mixture of a chat client and a command line. With the different commands you can change the structure and the content of the 'rooms' and objects. Everybody is represented by an individual character. MUDs and MOOs are normally used for text adventures, with battle lines and quests created by the players themselves in the framework of some fantasy plot; but they also find some usage in Higher Education contexts.[7] So MOOs are bad means for simply distributing traditional top-down teaching (Bruckman & Resnick 1995), but instead are able to support active groups of learners.

Depending on the structure of the MOO there is a diversity of possible things to do: usually 'move' from one 'room'/web page to another, give a message to all in the same room ('say'), give a message to one specific character, write mails, and describe, change or build rooms or objects; but there also special things to do like marry (one or more persons), smoke a cigarette, cuddle etc. … 'Move' and 'say' are of course the mostly practised actions. And because these actions are tightly interweaved on the user interface, it can be said that the distinctive feature of a MOO is that it directly combines communicative and presentational functions. This complex condition allows diversified user strategies. Thus the potential of the MOO is its combination of information and communication, and the easy shifts between them (Hoadley 1999).

Among other purposes RION used its JurMOO for the preparation of a two-day-workshop on broadcast law for law students.[8] For several weeks before the workshop the participants discussed the subjects of their presentations with each other and with tutors, and they built a 'room' where they put their table of contents etc. for annotation.[9] The development of the whole course was evaluated by questionnaires (e.g. regarding computer literacy and self efficacy), interviews and analyses of the server log of the MOO.

	'move' - first 150	'move' - total	'say' - first 150	'say' - total	actions all together
female (16)	53 %	56 %	37 %	36 %	100 % (8762 actions)
male (18)	73 %	67 %	21 %	26 %	100 % (8827 actions)

The most striking result of our evaluation is the existence of different however converging user strategies for females and males.[10] The table shows the percentage of 'move' and 'say' in relation to all used commands specified by the sexes, in respect to the first 150 actions of each person and to their total amount. Obviously women 'say' more and 'move' less than men at the beginning; women still 'say' more on the long run (Also female messages in average are longer, so that a female did 'say' almost twice as much as a male during the whole course.[11]) While organizing the common task the gendered preferences converge however to a certain degree. There is a development especially with the male participants. Whereas women only 'move' a little bit more with time, men clearly 'move' less and 'say' more.[12] This convergence of user strategies throughout the virtual seminar was however only made possible by the special characteristic of MOO, the integration of communicative and presentational functions. And it were the men who 'adapted' primarily.

Thus concerning the satisfaction pattern, there is another interesting result. Female students were more content with the use of this tool than the male ones. Comparing the ratings of male and female students, both evaluated JurMOO´s influence on the quality of the individual presentations for a final face-to-face situation and the overall help provided by the tool pretty equally. In contrast, a relatively strong positive deviation of the ratings of the female students existed for JurMOO´s contribution to the understanding of co-students and their presentations (in the mean 5.4 for women to 4.3 for men out of a 0-10-scale), while positive deviations of the male ratings are related to the

---

[7] E.g. http://clark.colgate.edu/dhoffmann/text/ACTFL2000/moovass1.htm, telnet://moolano.berkeley.edu:8888/; cf. Holmevik, & Haynes 2000.

[8] http://www.uni-muenster.de/jura.tkr/alte_version/lehre/materials/Verlaufsplan Seminar WS0102.pdf

[9] Due to the constraints of German mass faculties like law, to discuss a presentation in advance is more than unusual. Normally nobody has an idea of the connections of his subject with that of a fellow student, therefore he has also quite little interest in the presentations of others.

[10] Regarding gender-different but converging learning styles cf. Campbell 2000, p. 137.

[11] The average length of messages was for females: 35,39, and for males: 31,78.
In average a female did 'say' 7081 signs, whereas a male did 'say' 4191 signs.

[12] This table shows the development in smaller steps.

	0-49	50-99	100-149	150-199	over 200
female 'move'	50 %	54 %	54 %	56 %	57 %
male 'move'	69 %	79 %	71 %	50 %	66 %
female 'say'	39 %	37 %	35 %	35 %	36 %
male 'say'	23 %	17 %	24 %	43 %	27 %

coordination impact of JurMOO for the seminar (5.2 to 5.7). One possible interpretation could be, that female students welcomed the more communicative style, whereas male students saw the seminar preparation by JurMOO more as a measure to improve the overall teaching quality of the seminar. The promotion of the mutual understanding regarding what each is doing and learning contributes of course also to the development of an actual learning group, which is one of the big problems of distant education.

Conclusion

Our results regarding the possible convergence of user strategies and the higher female contentment with the mutual understanding support the assertion that the use of a MOO-like tool can be a promising instrument for gender mainstreaming in distant education. The gender gap (regarding in possession/access of, assumed knowledge about, and usage of new media technology) can be smoothed by a systematic integration of communicative and presentational functions, because the changed status of the communicative function directly affects the participation structure and with it the satisfaction of women.

To allow the convergence of these different strategies and the establishment of a learning group sharing its knowledge this technical side has however to fit in an overall didactical setting, where e.g. the incentives have to be tuned in a much more deliberate way than in classroom education. The conditions for (equal) participation in scientific discourse furnished by educational multimedia can be substantial for didactic success, because in this way the contextualization of each owns contribution is provided. So this approach first set by the interest in gender equality fits into the general realm of constructivist learning theory. The fact that men 'adapt' to a more participatory style, if the didactical and technical setting stimulates it, shows the general potential of this approach.

References

Baake, D. (1996): *Medienkompetenz als zentrales Operationsfeld von Projekten, in:* Baacke, D. e.a. (Ed.): *Handbuch Medien: Medienkompetenz*, Bonn Bundeszentrale für politische Bildung.

Berszinski, S., Messmer, R., Nikoleyczik, K., Remmele, B., RuizBen, E., Schinzel, B., Schmitz, S., & Stingl, B. (2002): *Geschlecht (SexGender). Geschlechterforschung in der Informatik und an ihren Schnittstellen*, in: FifF-Kommunikation 3/02.

Bruckman, A., & Resnick, W. (1995). *The MediaMOO Project. Constructivism and Professional Community*, Convergence

Campbell, K. (2000): *Gender and Educational Technologies: Relational Frameworks for Learning Design*, in: Journal of Educational Multimedia and Hypermedia 9(2), pp. 131-149.

Haynes, C., & Holmevik, J.R. (1998): *Highwired. On the Design, Use, and Theory of Educational MOOs*, UMP, Ann Arbor

Herring, Susan, 2000: *Gender Differences in CMC: Findings and Implications*, in: CPSR Newsletter 18 (1), http://www.cpsr.org/publications/newsletters/issues/2000/Winter2000/herring.html.

Hoadley, C.M. (1998): *Between Information and Communication, Middle Spaces in Computer Media for Learning*, in: Hoadley, C., & Roschelle, J. (eds.:) *Proceedings of Computer Support for Collaborative Learning, CSCL 1999*, Stanford Univ., Palo Alto, California

Holmevik, J.R., & Haynes, C. (2000): *MOOniversity. A student's guide to online learning environments*. Allyn and Bacon, Boston, London, Torronto, Sydney, Tokyo, Singapore

Huber, B., & Remmele, B. (2001): *Ein Fall fürs Internet. Didaktische Überlegungen zu einem kooperativen Lernkonzept für eine instruktionistische Fachkultur*, in: Wagner, E., & Kindt, M. (Ed.): *Virtueller Campus. Szenarien – Strategien – Studium*, Münster Waxmann.

Kerres, M. (1998). *Multimediale und telemediale Lernumgebungen: Konzeption und Entwicklung.* München Oldenburg.

Kirkup, G., & Prümmer, Chr. v. (1997): *Distance Education for European Women*, in: The European Journal of Women's Studies 4, pp. 39-62.

Nett, B., Huber, B., Knirsch, S., Meyer, L., Remmele, B., Röhr, F., Schinzel, B., & Stingl, B. (2002): *Tailoring Educational Elements for Academic Teaching - The JurMOO*, in: Proceedings of the Information Science and IT Education Conference IS 2002, Cork, http://ecommerce.lebow.drexel.edu/eli/2002Proceedings/papers/Nett078Tailo.pdf

Schinzel, B. (2001): *e-learning für alle: Gendersensitive Mediendidaktik*, in: Ernst, U. (Ed.): *Gender und Neue Medien*, Innsbruck, http://fem.uibk.ac.at/nmtagung.html

Schulmeister, R. (1997). *Grundlagen hypermedialer Lernsysteme: Theorie, Didaktik, Design*, München Oldenburg.

Siebert, H. (1999). *Pädogogischer Konstruktivismus. Eine Bilanz der Konstruktivismusdiskussion für die Bildungspraxis*, Neuwied Luchterhand.

Specht, M. (1998). *Adaptive Methoden in computerbasierten Lehr-/ Lernsystemen*, GMD Research Series, 1998, No. 24, GMD, St. Augustin

Stingl, B., & Remmele, B. (2002): *Das JurMOO - Kommunikation und Kooperation in der virtuellen Seminarunterstützung*, in: *Virtueller Campus 2002*, Münster Waxmann.

Faculty Rewards and Incentives for E-Learning

Judi Repman
Randy Carlson
Department of Leadership, Technology, and Human Development
College of Education
Georgia Southern University
Statesboro, GA USA
jrepman@gasou.edu
rcarlson@gasou.edu

Abstract: This brief paper provides an overview of successful strategies and policies related to faculty rewards and incentives that promote participation in distance learning. Best practices and suggested strategies related to faculty motivation for e-learning will be presented.

Introduction

In his classic work on the diffusion of innovations, Everett Rogers offers this definition: "*Innovativeness* is the degree to which an individual...is relatively earlier in adopting new ideas than the other members of a system" (1995, p. 22). Rogers goes on to classify adopters into several categories: innovators, who are ahead of the curve; early adopters, who follow innovators and are often seen as opinion leaders within the organization; the early majority, who typically make up about one-third of the members of the system; the late majority, who tend to be skeptical about innovations; and, the laggards, who make decisions based on "the way we've always done it" (1995, p. 261-265).

Many E-learning attendees fall into the categories of innovators and early adopters. You embrace e-learning enthusiastically and lead your organization in creatively applying cutting edge technology in the teaching/learning process. Can you keep going it alone or in small numbers? The answer is probably not. Unless members of the early and late majorities (about two-thirds of the organization) begin to participate in e-learning, your efforts may be marginalized. E-learning will not be seen as part of your organization's mission or vision, nor will its value be recognized or rewarded. Since the participation of the early and late majorities is critical to the success of any innovation, we're going to examine characteristics of these groups. We'll also examine some possible rewards and motivators for higher education using Rogers' diffusion of innovations categories as the framework for the discussion. Those of you in corporate e-learning environments where tenure and its security are traded for other rewards can translate the following arguments to those that are meaningful to your organization.

Motivation

Incentives and rewards are closely related to motivation. Motivation theory supports the notion that incentives don't come in a "one size fits all" model. Intrinsic motivation, when an individual's desire to learn something or do something becomes rewarding in and of itself, is certainly a critical component of adoption of an innovation like e-learning. It plays an important role in the risk-taking behavior exemplified by innovators and early adopters. These groups embrace e-learning because it offers new and different ways to address teaching and learning issues and it promises to improve the efficiency and/or the effectiveness of instruction. Extrinsic motivation has its source external to the individual. Money in its various forms (cash, promotion, time off) is probably the most powerful and common extrinsic motivator.

However, some people are motivated by praise or recognition from their peers or supervisors. In a school setting, grades are the most common extrinsic motivators for students. While members of the early and late majorities may come to feel the same intrinsic motivation to participate in e-learning as time goes on, some kind(s) of extrinsic or external rewards or incentives might need to be used to get the process started (Bower, 2001).

Early and Late Majority Adopters

A large body of research in areas ranging from prescribing new drugs through the spread of educational technologies supports our earlier statement that most members (60-70%) of any group can be classified as early or late majority adopters (Rogers, 1995). The early majority adopters don't want to be the first to try something, nor do they want to be left behind. This group relies on the judgment of people that they consider to be opinion leaders. After observing the behavior of the opinion leaders, the early majority will usually go ahead and give the innovation a try. A little extra support and/or encouragement may be needed for the early majority to move beyond trial to adoption of an innovation. Late majority adopters are more skeptical. They may wait until there is little other choice but to adopt an innovation. Peer pressure may have to be considerable to initiate action (Rogers, 1995). One interesting consideration is that resistance to change is an important part of the natural cycle of the diffusion process. "Even those who approve of an innovation are likely to find some aspect of their cultural or social identity challenged, and some professional or psychological comfort zone intruded upon" (Ellsworth, 2000, p. 166). To be receptive to the value of e-learning, early and late majority adopters must first resist it. Whether or not they get past this resistance phase may depend on the rewards and incentives available. The first area that must be addressed is very basic: Do faculty think that e-learning is relevant to the mission of their organization?

Centrality to Mission

The rapid growth of e-learning has taken many institutions by surprise. Higher education has its fair share of laggards in leadership positions, so it isn't surprising that few institutions specifically mention e-learning, distance learning or distributed learning in their mission statements. Yet it is crucial for members of the early and late majorities to see the link between e-learning and the institution's mission. In a survey of Management faculty, Rahman found that the most important reason given against online teaching was that faculty believed that it was not part of the university's mission (2001). The same study found that e-learning adopters *did* believe that e-learning was part of the university's mission! Centrality to mission is important in building intrinsic motivation for e-learning. If the mission statement doesn't clearly discuss e-learning, Rahman suggests that less direct phrases like "student centered university" and "access" be highlighted as supportive aspects of the mission. Georgetown University's Research, Curriculum, and Development Group page (http://www.georgetown.edu/uis/rcd/index.html) provides an example of a direct link between a university's teaching/learning mission and faculty technology use. No matter how the link is made between the mission and faculty practice, the connect/disconnect becomes overt when faculty try to figure out how the primary reward system (promotion and tenure) accommodates e-learning and faculty development.

The Higher Education Reward System: Promotion and Tenure

While many educational institutions actively seek to hire junior faculty with both the skills and the desire to engage in e-learning, these new roles and responsibilities are not reflected in promotion and tenure policies or guidelines (Wilson, 2001; Young, 2002). One important consideration is the weight given to course development and delivery in promotion and tenure criteria (Prestera & Moller, 2001). Some call this movement "the scholarship of teaching" and suggest that examination of relationships between teaching activities and student performance should be part of the higher education reward system (Bass, 1999; Cambridge, 1999). We don't want to stifle the creativity and energy of faculty who are excited about high-tech possibilities for learning, nor do we want to set them up to fail under the existing system.

Many faculty who are enthusiastic users of instructional technologies still value traditional definitions of research and service. At the same time, the diffusion of e-learning offers many possibilities for faculty and administrators to take part in a dialog about promotion and tenure. Early and late majority adopters may need to have these issues out on the table before they are even willing to try e-learning. If these groups are already hesitant about new technologies, their reluctance will only be reinforced if they feel that the reward system might actually punish them (i.e. denial of promotion and/or tenure).

Many e-learning innovators see themselves as educational entrepreneurs. As noted in the ACE/Educause report *Distributed Education and Its Challenges: An Overview*, "Some faculty may be willing to trade security (i.e. tenure) for greater economic opportunities and payoffs." (2001, p. 13) The entrepreneurial faculty member may not even want to work for an institution where the primary reward system (i.e. promotion and tenure) is based on the face-to-face classroom model of teaching and traditional definitions of research and service. This problem is compounded when many potential early and late majority adopters are untenured and thus at the greatest risk for personal failure in terms of this reward system.

Extrinsic/External Motivators

Promotion and tenure is the most visible extrinsic reward system in higher education. Faculty members who don't earn promotion from assistant to associate professor and tenure in the required 5- or 6-year cycle find themselves looking for their next job. But promotion and tenure aren't the only external motivators around. Three categories of external motivators have been widely used to promote change in higher education: monetary incentives, workload incentives, and training and support.

When 1500 faculty members in Kentucky were surveyed about incentives for distance learning, financial incentives were ranked lowest (Wilson, 2001). Rahman's (2001) study demonstrated the same surprising finding, although in his study junior and adjunct faculty members ranked financial considerations higher than senior faculty. What does this mean to administrators trying to promote e-learning? It means that, unlike the movies, faculty aren't sitting in their offices screaming "Show me the money!" into the telephone. We're sure that most faculty wouldn't turn down money if it is offered, but it does seem that faculty actually consider other factors to be at least as important as money.

Workload considerations do seem to be more important to faculty members, primarily because of the amount of time required to design and deliver instruction using new tools and instructional strategies. Conference presenters demonstrating distance learning modules or courses almost always mention how long the development process took – and if they don't mention it someone in the audience will ask. Casual hallway conversations about on-line courses focus on the amount of time it takes to respond to the flood of student e-mails and threaded group discussions. Common workload incentives include summer grants and release time for course development (Rahman, 2001). Release time may be as little as one course for one semester, which supposedly is adequate to get a course ready for web-based delivery. This release time vanishes once the course is on the web. Given the emphasis placed on publication in refereed journals that is the cornerstone of many promotion and tenure systems, it isn't surprising the early and late majority adopters are reluctant to invest large amounts of time mastering new technologies and reconfiguring courses and student learning activities.

The same faculty surveys report that training and support for e-learning are critical (Rahman, 2001; Wilson, 2001). Bower notes that "fear of appearing incompetent may cause faculty to resist involvement in any activity for which they have not had the proper training" (2001, p. 2). There are many models for faculty support. Some institutions employ teams of instructional designers who will consult with faculty and basically do all of the technical work associated with changing to an on-line format. Other institutions offer group training sessions and individual consultations for faculty members, but the faculty member has the primary responsibility for doing the work. Using students to provide this support is an increasingly popular option.

The University of Central Florida (http://reach.ucf.edu/~coursdev/) offers all of these services through the UCF Course Development and Web Resources Virtual Development Team. This kind of centralized model might not fit the style of all institutions but it does save faculty members from trying to figure out who to call to answer a certain kind of question. Many institutions have adopted approaches recommended by the Teaching, Learning and Technology Group (http://www.tltgroup.org/) to support faculty use of educational technology. Making these kinds of resources available and appealing to early and late majority adopters is critical. Innovators and early adopters need to share their expertise and insight through institutional support systems—even if attendance at workshops, chats, etc is not always high.

Conclusion

As the ACE/Educause report notes, "In an era when many students have never known life without the Internet, when time is constrained for adult learners seeking additional education, and when worldwide demand for education is at an at all-time high, the classroom no longer bounds the learning environment" (2001, p. 2). Many faculty have heard this directive and have acted on it. Now it's time to get other faculty on board, focusing on the early and late majority adopters. Innovators need to fight the tendency to say "nobody paid *me* any extra money or gave me any help when *I* taught my first on-line class" and recognize that external motivators may be needed to move the process along.

References

American Council on Education (ACE) & Educause. (2001). *Distributed education: Challenges, choices and a new environment.* Washington, DC: ACE. Retrieved April 15, 2002, from http://www.acenet.edu/bookstore.

Bass, R. (1999). The scholarship of teaching: What's the problem. *Inventio, 1*(1). Retrieved April 15, 2002, from http://www.doiiit.gmu.edu/Archives/feb98/randybass.htm

Bower, B.L. (2001). Distance education: Facing the faculty challenge. *Online Journal of Distance Learning Administration, IV* (II). Retrieved April 15, 2002, from http://www.westga.edu/~distance/ojdla/summer42/bower42.html.

Cambridge, B. (1999, December). The scholarship of teaching and learning: Questions and answers from the field. *AAHE Bulletin*. Retrieved April 15, 2002, from http://www.aahe.org/Bulletin/dec99f2.htm.

Ellsworth, J.B. (2000). *Surviving change: A survey of educational change models.* Syracuse, NY: ERIC Clearinghouse on Information and Technology.

Prestera, G.E., & Moller, L.A. (2001). Organizational alignment supporting distance education in post-secondary institutions. *Online Journal of Distance Learning Administration, IV* (IV). Retrieved April 15, 2002, from http://www.westga.edu/~distance/ojdla/winter44/prestera44.html.

Rahman, M. (2001). Faculty recruitment strategies for online programs. *Online Journal of Distance Learning Administration, IV* (IV). Retrieved April 15, 2002, from http://www.westga.edu/~distance/ojdla/winter44/rahman44.html.

Rogers, E.M. (1995). *Diffusion of innovations.* (4th ed). New York: The Free Press.

Wilson, C. (2001). Faculty attitudes about distance learning. *Educause Quarterly, 2*, 70-71.

Young, J.R. (2002). Ever so slowly, colleges start to count work with technology in tenure decisions [Electronic Version]. *Chronicle of Higher Education, 48* (24). Retrieved April 15, 2002, from http://chronicle.com/free/v48/i24/24a02501.htm

Empowerment Through Equitable Access: Middle School Students Developing Strategic Skills In E-Learning Environment

Reynolds, Thomas
National University
USA
treynold@nu.edu

Serdyukov, Peter
National University
USA
pserdyuk@nu.edu

Abstract: Infusing technology in school is successful when it is a convergent process: a technology-based environment is created to provide computer and Internet applications in all classes, and, at the same time, computer or information literacy programs integrate strategic skills with technical skill development. Such a synergetic approach combines practical computer-based assignments in the computer literacy class together with complex intellectual activities. This paper describes such a symbiotic e-Learning project for middle school students.

Information and Computer Technology (ICT) plays a dual role in education: it is the object of learning and, at the same time, a tool for learning. As part of school curriculum, it is intended to help students to master the use of computers and the World Wide Web. This goal is pursued through computer or information literacy programs in schools that assist students in learning how to use contemporary technology. Remarkably, computer literacy in schools is often regarded as a goal in itself and as a particular subject area. However, ICT is also used as a teaching and learning tool in practically all classes and in students' independent work. Computers help to enhance students' learning activities and empower them to solve higher order cognitive tasks. This is why infusing technology in school is successful when it is a mutually beneficial process: on the one hand, a technology-based environment is created to provide computer and Internet applications in all classes, and, at the same time, computer literacy programs integrate strategic skills with technical skill development. Such a synergetic approach combines practical computer-based assignments in the computer literacy class and complex intellectual activities. The students then are engaged in solving cognitive tasks in accordance with K-12 Content Standards (1) while developing basic computer and Internet skills.

The task of teaching computer and information skills together with developing higher order skills is aggravated by limited access to information technologies and Web-based educational resources in schools located in low-income multicultural areas (2). Consequently, it is crucial to provide equitable opportunities for disadvantaged students from these areas to use contemporary educational resources and technologies in order to fully benefit from the mainstream school instruction.

This paper describes an e-Learning project being jointly developed by Marston Middle School, San Diego Unified School District, and National University, La Jolla. In this program that was initiated in 2001, the University professors together with student teachers teach an ethnically and culturally diverse class of 15 students of 12-14 years of age. The class takes place on Saturday mornings and lasts 2.5 hours. The goal of this project is to create a specific e-Learning environment to help diverse school students become computer and Internet literate and, at the same time, develop their cognitive and social skills that will contribute to their mainstream learning. Specific objectives of this project are:

- Build a model of instruction for a symbiotic information literacy and developmental program.
- Implement K-12 Content Standards in a Flexible School Program.
- Help students develop computer and Internet skills.
- Create conditions where students will apply their knowledge and skills acquired in the regular class to real-life problems solved by using ICT.
- Teach students to solve cognitive tasks while learning to use e-Learning tools.
- Bring about positive side effects in reading and writing.
- Develop a collaborative community of learners.
- Train schoolteachers and student teachers to effectively run the program.

The model of learning we are investigating now consists of five steps:

1. Task Setting. A problem is described and the task for students is defined.
2. Model presenting. Students are explained and shown ways to solve the problem using a computer and the Internet. This is where various computer uses are demonstrated and skills taught.
3. Individual work. Individual information search and processing
4. Small group work. Students share the information they collected and created, and collaboratively develop a project.
5. Whole class work. Project presentation and discussion.

In the process of this program implementation, several tasks are being solved: students learn to pose questions, to define intellectual tasks, to find and process online information, to solve problems and develop projects, to work collaboratively in a group, and present their findings to the class.

ICT is explored and applied in its many roles: as a tool for learning, for solving problems, for information search and processing, for electronic computer-mediated communication and as a game machine for developmental purposes.

The students' learning outcomes will be assessed in the end of the year. In the meanwhile, we observe students' evident success in mastering e-Learning tools together with growing interest and motivations for learning. They are able to solve more complicated cognitive tasks today than in the beginning of the year. The next step will be to improve the model and to expand the current effort to include new schools, with concomitant recruitment of both students and teachers.

The importance of this program goes beyond the framework of the current project: our intent is not only to expand it to other schools across the school district, but also to use it in preparing teachers at National University as a practical example of equitable access to education provided for diverse student population through an e-Learning program.

References:

1. California Department of Education. Educational Technology Office. California Technology Assistance Project Summary of Year 2000. Statewide School Survey Findings. June 2000. California Statewide Report. http://www.cde.ca.gov/edtech/ctapsurvey.htm

2. A Commitment to Standards-Based Education for California's Middle Grades Students http://www.cde.ca.gov/middle/tcs.html

A Multi-Disciplinary Framework for the Design and Evaluation of Computer Supported Learning-Environments

Christoph Richter, Heidrun Allert
Learning Lab Lower Saxony, University of Hanover, Germany
{richter, allert}@learninglab.de

Abstract: This paper outlines a framework for the design and evaluation of information and communication technology in learning environments. This framework is intended to support multidisciplinary cooperation during the entire project lifecycle. In contrast to other approaches it does not merge the distinct approaches but links them via a common communication platform. An extended scenario-based approach is outlined to meet the special requirements for this purpose. The domain specific approaches are interpreted as special views on the common artefact. The framework integrates the design of the social learning environment with the development of adequate technology based support. Additionally, an elaboration of this framework in form of a conceptual toolbox is drafted.

Motivation

We specify a framework for the design and evaluation of information and communication technology in learning situations. This framework has its origin in our experiences in consulting different projects within the Learning Lab Lower Saxony [L3S]. The Learning Lab Lower Saxony is a multidisciplinary research lab that focuses on the development of innovative learning technologies and is a member of the Wallenberg Global Learning Network. Within the L3S the main task of the eTeam (evaluation team) is consulting and coordinating design and evaluation of distributed projects in collaboration with the project members. The concept of theory-based evaluation is guiding this work (Nash, 2001).

Conceptualizing design and evaluation of information and communication technology in learning situations is a multidisciplinary enterprise and is accompanied with specific challenges. While it is often stated that multidisciplinary approaches are crucial in this field, there is a lack of concrete methods to facilitate this cooperation.

The diverse disciplines, which contribute to the development of technology supported learning environments, apply specific methods of modelling, implementing and evaluating domain specific artefacts. These distinct approaches and methods are widely used within each discipline. An approach, which connects these methods is still missing. The framework we present facilitates the combination of the different approaches without losing the specific advantages of each method. To respect each domain specific method facilitates multidisciplinary cooperation.

Problem Description

The following disciplines are mainly involved in the development of technology supported learning environments: computer science, media design, learning science, program evaluation. Within multidisciplinary projects any of these disciplines make unique contributions that cannot be compensated by any other discipline. Beside their distinct focuses every discipline has developed specific methods to model, implement and evaluate the artefacts they produce.

- In computer science various concepts taken from the field of software engineering are widely used. While the Unified Modelling Language (UML) is a common approach to model different aspects of software artefacts, methods such as usability testing are used to assess the artefacts.
- In educational science specific teaching and learning models to design learning environments are in use. Instructional principles such as PBL, Case-Based learning, Competency-Based learning e.g. work as

frameworks for design. Beside this methods of pedagogical evaluation that focus on motivational and instructional aspects e.g. are applied.

- We understand program evaluation as a separate discipline because it provides unique methods for describing projects, ways to guide the development and also provides concepts for assessment and evaluation. For example in theory-based evaluation methods have been developed to describe an evaluand including the views of all stakeholders (Strömdahl & Langerth Zetterman, in process). Program evaluation has been applied in fields as diverse as education, economy, health care, ecopolitics and many more (e.g. Wottawa & Thierau, 1998).

Any of the mentioned disciplines have developed concepts that can be used during the whole project process from planning to a completing summative evaluation of the artefact. But every single approach focuses on domain specific aspects and neglects other. While approaches in the field of software engineering are specialized to support the development of technical systems, they are often unsuitable to describe sociotechnial systems (see e.g. Goguen 1994). On the other hand methods to model educational settings focus on social processes and tend to view technology only from a user perspective. While methods of program evaluation are applicable to support any kind of project they strongly require clear and unambiguous description, which can only be provided by the projects themself.

Towards a Solution: a Scenario-based Communication Platform

While there are attempts to develop approaches specifically addressing the design of technology supported learning environments it has been argued that it is not useful to build a unified framework that subsumes several approaches from distinct disciplines (e.g. Bannon, 1994). In contrast our framework provides a method to explicitly link the already existing domain specific approaches without subsuming them under one theory. We consider any of these domain specific approaches as specific view on the common artefact (the intended educational setting). The crucial point in linking the different views is to establish a communication platform that can be used by any stakeholder. Also it has to be ensured that all stakeholders can translate the joint description of the artefact into their domain specific models.

The scenario-based approach provides this communication platform (see Fig. 1). Scenarios have been used in many different domains. For example in different areas within the Computer Science (e.g. Rolland et al., 1998) as well as for purposes of strategic planning in fields as business, economics, politics (e.g. Kahane, 2000).

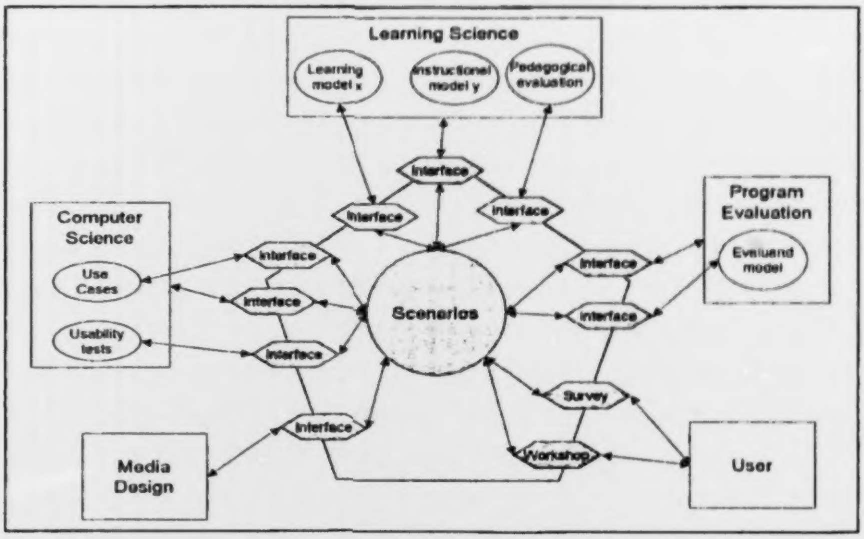


Figure 1: The core elements and interrelations of the *scenario-based communication platform*

BEST COPY AVAILABLE

We refer to the definition of scenarios proposed by Carroll (2000): A scenario is a concrete story about use. Scenarios include protagonists with individual goals or objectives and reflect exemplary sequences of actions and events. This definition is much broader than other definitions of scenarios and more comprehensive than the concept of use cases proposed by Jacobson et al. (2001).

The use of natural language as the basis for the communication platform helps to introduce domain specific knowledge into the discussion on the joint artefact. On the other hand narrative stories can be told on any level of abstraction as well as any level of granularity. Scenarios can also be written and discussed by the end users of the artefact.

In order to use scenarios to link several domain specific design approaches it is necessary to extend existing scenario-based approaches. On the one hand scenarios have mostly been used in projects dealing with work and not with learning. On the other hand scenario-based approaches do not systematically address socio-technical and social aspects of the artefact. Some scenario-based approaches (e.g. Benner et al. 1993; Kyng, 1995) actually broaden the scope, but do stress the importance the context in general and lack a definition of context. Those, which provide a well elaborated framework focus on work.

The core elements and interrelations of the *scenario-based communication platform* are illustrated in Fig 1. The elements in the domain-specific boxes represent some examples. The domain-specific concepts are related to the shared scenarios via interfaces. In this context an interface is a specific method that allows to transform domain-specific concepts into scenarios and vice versa. Some of these interfaces have already been outlined. Carroll (2000) describes how to link scenarios and use cases. Bødker et al. (1995) have developed a work-oriented checklist that helps to identify and reflect about core aspects of a concrete work situation described in a scenario. While this checklist links the sociological CSCW literature to scenarios similar checklists to link instructional models to scenarios are conceivable. We also recognize a lack of interfaces between scenarios and program evaluation. The interfaces to the user are formed by surveys, workshops or other methods that help to reveal the users point.

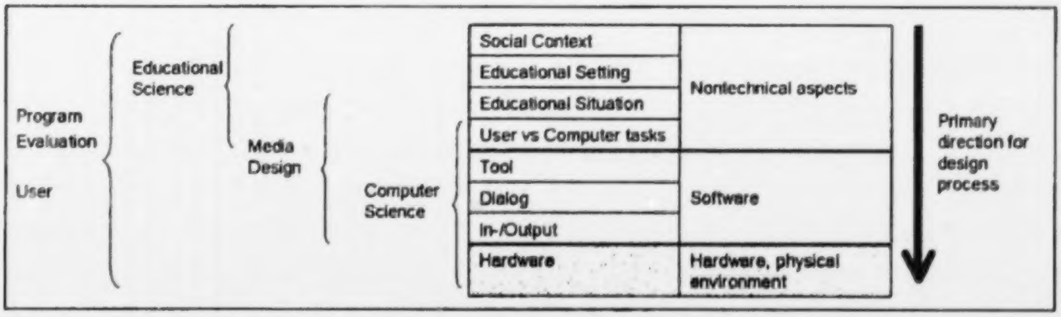


Figure 2: levels of granularity (based on a diagram by Koch et al. 1991, p. 30)

Scenarios, which are concrete stories of human activities, can be told on different levels of granularity. Fig. 2 lists 8 levels that are relevant to the design of technology supported learning environments. According to Koch et al (1991) we presume that the design of computer supported systems has to start on the social and organizational levels. Later within the progress of the project, scenarios also address the technology that supports learning and teaching. This does not eliminate the necessity to reflect on the social effects evoked by the technology. This proceeding does ensure that technology supports the learning situation and not vice versa. Fig. 2 also shows that the different groups of stakeholders with their different views on the learning situation contribute at different layers. As a consequence of this not all stakeholders are involved during the whole process to the same degree. A typical problem we are confronted with: At the beginning of a project the computer scientist does not realize what the learning scientist focusses on. Later the learning scientist cannot estimate whether the implementation the computer scientists works on does exactly meet the requirements of the proposed learning environment.

Conclusion and Further Work

The proposed framework provides several advantages compared to approaches that try to merge different domain specific methods. The use of a common communication platform and interfaces enables all stakeholders

BEST COPY AVAILABLE

to use their domain specific methods without modification. This helps to conserve the unique advantages of the different methods and enables multidisciplinary cooperation at the same time. The framework is useful to develop sophisticated evaluation strategies, which can combine a broader range of variables, survey methods and data. Therefore this approach facilitates the concept of triangulation, called for in the field of evaluation and empirical research methodology (see e.g. Worthen et al. 1997; Mayring 2002). Understanding the design and evaluation of educational settings as a multidisciplinary challenge reflects the complexity of this task.

At the moment we already use scenarios in consulting several projects at different stages of the project lifecycle. Our next step will design, apply and evaluate a conceptual toolbox for the design and evaluation of educational settings supported by technology. The tools are intended to support projects but also provide a framework for those who consult projects. Basic tools will describe and facilitate the writing and management of scenarios at the centre of the communication platform. Further tools will form the interfaces: we will draw into account already existing methods, like workshops, checklists etc. but also design completely new methods. For example: The interfaces of learning science will provide prototypical scenarios, which explicitly represent specific instructional models, learning theories and paradigms. These scenarios will correspond to several sets of educational metadata. These sets of metadata will explicitly model learning paradigms, principles and theories and therefore allow to share and re-use conceptual structures. On the other hand this interface will support consulting: often projects state a specific learning theory or learning paradigm (constructivism e.g.), but do not actually address it in their design. Scenarios help to discuss the relevant aspects.

Furthermore we will create interfaces that link the scenarios with program evaluation. These interfaces will support the design of appropriate evaluation plans. The results of evaluation provide feedback to all stakeholders and help to refine the existing scenarios.

References

Bannon, L.J. (1994). Problems of Interdisciplinarity. *Interdisciplinary Foundations of System Design and Evaluation.* Position Papers for Dagstuhl Seminar 9348. pp. 8-9. http://iug.uni-paderborn.de/iug/veroeffentlichungen/1995/rks_dagstuhl.

Benner, K. M.; Feather, M.W.; Johnson, W. L.; Zorman, L.A. (1993). Utilizing Scenarios in the Software Development Process. *Information System Development Process*, Elsevier Science Publisher B.V. (North-Holland), 117-134. http://citeseer.nj.nec.com/benner93utilizing.html.

Bødker, S.; Christiansen, E.; Thüring, M. (1995). A conceptual toolbox for designing CSCW applications, COOP '95, *International Workshop on the Design of Cooperative Systems*, pp. 266-284, Juan-les-Pins, January 1995.

Carroll, J.M. (2000). *Making use: scenario-based design of human -computer interactions*. Cambridge: MIT press.

Goguen, J.A. (1994). Requirements Engineering as the Reconciliation of Technical and Social Issues. In: Jirotka, M.; Goguen J.A. (eds). *Requirements Engineering: Social and Technical Issues*. London: Academic Press. pp. 165-199.

Jacobson, I.; Booch, G.; Rumbaugh, J. (2001). *The Unified Software Development Process*. Boston: Addison-Wesley.

Kahane, A. (2000). *How To Change the World: Lessons for Entrepreneurs from Activists*. Global Business Network Publications. http://www.gbn.org/public/gbnstory/articles/ex_kahane.htm.

Koch, M.; Reiterer, H.; Tjoa, A.M. (1991). *Software-Ergonomie: Gestaltung von EDV-Systemen; Kriterien, Methoden und Werkzeuge*. Wien: Springer.

Kyng, M. (1995). Creating Contexts for Design, In: John M. Carroll (Ed.) *Scenario-Based Design: Envisioning Work and Technology in System Development*, pp. 85-107. John Wiley and Sons.

Mayring, P. (2002). *Einfuehrung in die qualitative Sozialforschung - Eine Anleitung zu qualitativem Denken*. 5. Aufl. - Weinheim: Beltz.

Nash, J.B., Plugge, L.; Eurlings, A. (2001). Defining and Evaluating CSCL Evaluations. In A. Eurlings & P. Dillenbourg (Eds.), *Proceedings of the European Conference on Computer-Supported Collaborative Learning* (pp. 120-128). Maastricht: Universiteit Maastricht.

Rolland, C., Ben Achour, C., Cauvet, C., Ralyté, C., Sutcliffe, A.,Maiden, N.A.M., Jarke, M., Haumer, P., Pohl, K., Dubois, E., Heymans, P. (1998). A Proposal for a Scenario Framework. In: *Requirements Engineering Journal*. Vol. 3, No. 1, Springer Verlag pp.23-47.

Strömdahl, H.; Langerth Zetterman, M. (in process). *On theory-anchored evaluation research of educational settings within ICT environments*. http://www.skeptron.ilu.uu.se/MonicaLZ/arkiv/tea-slutmanus.pdf.

Worthen, B.R.; Sanders, J.R.; Fitzpatrick, J.L. (1997). *Program Evaluation : Alternative Approaches and Practical Guidelines*. 2nd ed. New York: Addison Wesley.

Wottawa, H.; Thierau, H. (1998). *Lehrbuch Evaluation*. 2. vollst. ueberarb. Aufl.- Bern: Huber.

Inclusive Workforce Development in an *E*-learning World

Creating a Fully Inclusive Twenty First Century Workforce System

> *(For workforce development programs and their business customers), e-learning holds the potential of contributing to significant gains in worker skills, productivity and performance. E-learning also can deliver significant cost savings when compared to traditional types of (workforce) training. Equally important, e-learning can provide access to high-quality training content from countless sources throughout the world. This, in turn, can lead to improvements in individual and organizational performance. (For workforce communities) e-learning's promise rests in its potential as a driver of value-added economic growth. By opening the door to dramatic boosts in business performance, productivity and the number of skilled workers, e-learning can play an essential role in economic development initiatives at all levels. (For individual citizens), e-learning can broaden opportunities for skill development and employment in high-quality jobs for all segments of the population, contributing to income growth, improved lives for Americans, and a more informed and contributing citizenry. A Vision of E-Learning for America's Workforce, Commission on Technology and Adult Learning (2001)*

Lessons Learned

We have recently completed a century and a millennium. Our Old World in the twenty-century has come to an end and a new world is upon us. We now relate differently, play differently, learn differently and work differently than our parents. While this is true for most of us, many are still stuck in the twentieth century depending on an old world workforce system. "The world is fast polarizing into two potentially irreconcilable forces: on one side, an information elite that controls and manages the high-tech global economy; and on the other, the growing numbers of permanently displaced workers, who have few prospects and little hope for meaningful employment in an increasingly automated world"[i]

"Just as e-learning presents a number of opportunities for individuals, organizations and society, it also poses some serious questions for the future, including: How do we ensure consumer protection and high-quality learning in an open e-learning environment? In a learner-centered system, what is the best way to assess what individuals are actually learning? How can we best certify learning results? And how do we promote equitable access to the technologies and the high-quality.[ii]" The digital divide is one of the most important civil rights issues facing our modern information economy. As telecommunications increasingly entwines itself with educational, social, financial, and employment opportunities, those workforce communities lacking access will find themselves falling further behind the rest of society. The Internet has the potential to empower its users with new skills, new perspectives, new freedoms, even new voices; those groups and communities who remain sequestered from the technology will be further segregated into the periphery of public life.[iii]

Within this group of permanently displaced workers are most individuals with disabilities, as employment continues to be the area with the widest gulf between those who are disabled and those who are not, with nearly 2/3 of those that want to work unable to gain access to employment. (Harris, 1986, 1994, 1998 and

2000.) Accessibility problems have increased dramatically with new developments in hardware, software and Web page design. With limited access to the information superhighway, those who could benefit the most are being overlooked.

Workplace diversity is increasingly recognized as an organizational asset. Many companies operate in global markets, and a diverse work-force is more capable of serving a diverse customer base. Moreover, in industries and workplaces that thrive on creativity and innovation, a diverse work force produces different perspectives, different approaches to solving problems, and a richer pool of ideas. As we enter the 21st century, according to the Department of Commerce Office of the Technology Policy, two-thirds of new work force entrants will be women and minorities. Yet, today, women and some minorities including people with disabilities are underrepresented in the technical work force. This outcome partly originates in the current workforce development pipeline.[iv]

During the past decade, university and private entrepreneurs have invested tens of million of dollars and ten of thousands of hours to plan, promote and deliver Web-based and related forms of distance education. Yet, often these initiatives move forward as if it was something new, a kind of unintended consequence of the Internet. While technology, specifically e-learning has raised the aspirations for more automated online workforce development opportunities, the current economic downturn appears to be producing significant on-line enrollment downturns at many educational institutions and a number of dot-com education providers have simply vanished, thus providing early important e-learning development lessons.[v]

First among these lessons is that anytime anywhere e-learning really can expand learning opportunities by mixing convenient access with enhanced, effective customized multimedia content. However, contrary to popular consensus, the next learned lesson is that content is not king, and in absences of a supportive facilitator and an appropriate enabling infrastructure, content has little value. Learning is still change, and people only change when they have to change, when the pain of learning becomes less than the pain of maintaining the status quo. Up to 75% of e-learners drop out of non-instructor facilitated courses before completing them, reports Gerard Prendergast.[vi]. "It's the tutoring processes that will determine whether people complete their learning experience successfully," he concludes. Trained tutors also provide a crucial intangible – encouragement, especially for those lacking even basic computer literacy skills that are more likely to served by a one stop center.. He also claims that with trained tutors, the dropout rate in his study of corporate e-learners was reduced from 75 to 8 percent. Mix these trained tutors with high quality, engaging, customized, and validated e-learning content that is easy to view and read, along with high speed Internet connections and computers; and a model for a next generation workforce lifelong learning system begins to emerge.

A Next Generation Workforce Development System Vision

> *I have learned about two ways to think about technology: one is called automating, the other is called informating. One will give you incremental improvement; the other will give you big improvement. Unfortunately training programs and technology tend to focus on automating. The means that you bolt technology on top of what you are already doing... You get very different results when you informate. The real revolution is information and communication, not technology. Let go of the word technology. If you focus on it, then you'll just do what you're already doing. The trick in planning as we move forward is to think about (workforce) information systems, whole systems of the flow of information and communication — Alan November -from Creating a New Culture of Teaching and Learning.*

Most one stop workforce centers are now taking that first step in getting wired, but they must also consider the needs of the learners, the teachers, and the communities that support them. Access, content, literacy, pedagogy and community—may not be enough to complete the entire digital divide puzzle, but they go a long way in providing a picture of what is at stake. What is needed is a dynamic e-learning culture that embraces the inherent contribution of all people as life-long learners to meet the needs of both the individual and society. Not only do dynamic e-Learning cultures need to address personal, community, and organizational aspects of learning – they also have to attend holistically to what best influences learning for individual learners given the particular knowledge and skill areas being developed. For the optimal development of positive e-learning contexts and cultures, attention is needed to research validated principles that can meet the learning needs of all learners. New roles for workforce center administrators, teachers or learning facilitators, and students must be considered. Envision that traditional concepts will be abandoned as all become learners and interchange roles from learner to expert learner.

Leaders will need adaptive expertise and political leadership to evolve new forms of assessment and accountability in dynamic e-learning cultures. Effective assessment and evaluation practices need to hold workforce training programs accountable for customizing e-learning using activities based on individualized e-learning plans implemented in a workforce community context. Private sector developers are spending millions of dollars to optimize e-learning systems. The workforce system needs to develop private sector partnerships to ensure that universal design principles are incorporated in all next generation learning systems as well as to validate these system with a diverse array of adult learners. Accountability policies for training and job placement, assessment and evaluation practices aligned with core standards and indicators, funding criteria, and articulated outcomes that are balanced for individual and societal needs are required.

> *Issues of learner achievement cannot be separated from issues of teacher expertise, professional development, prevention and intervention strategies, curricular alignment, assessment strategies, leadership, and funding. To be successful, efforts must include changes in all of these areas. It is one thing to embrace the idea that all can learn; it is another thing to make sure they do learn. –from Blueprint for Student Success*

An NSF sponsored study at Western Michigan University evaluating the use of Smart*Force* e learning with students with disabilities attending community colleges is being conducted. The current e-learning market leader is Smart*Force* with over 1.5 million online learners world wide including much of the U.S. military provides 24/7 online live mentoring support to supplement an extensive learning management system (LMS). Early results seem to support Prendergast's claim on the importance of trained tutors in the e-learning process. Customers of second chance programs within Workforce system can especially be expected to benefit from the personal encouragement that a 24x7 trained tutor can provide while using a comprehensive, customizable e-learning management system like that being developed by Smart*Force*.

Recommendations

1. Promote, quality e-learning experiences including the provision of appropriate infrastructure, accessible learning environments, support systems and trained tutors to use with corporate quality e-learning management systems that are both customizable and comprehensive.

2. Create an e-learning workforce culture that supports student motivation, learning, and achievement while also supporting the teacher's (tutor) need to also be a learner.

3. Pursue healthy e-learning networked communities that works for everyone, and encourages rather than eliminates diverse perspectives.

4. Provide the tools and capacity for networked workforce learning communities that can expand and transform notions of e-learning in ways that produce healthy and productive lifelong learners within a larger integrated networked community of learners.

5. Provide new approaches for measuring, certifying and reporting on authentic e-learning outcomes.

6. Ensure equitable access to e-learning opportunities that are available and known to all.

7. Pursue public - private sector partnerships to conduct research and development on how adults learn and how to measure adult learning in meaningful ways.

8. Advocate to all that even the most advanced technology-supported networked learning communities need to be supplemental to the human elements of insight, understanding and encouragement provided by trained tutors (instructors) engaged with the learner in a guided partner relationship. Such a relationship must allow the learner to take ownership of their own career development plans by making informed choices and the taking responsibility for reaching and resetting their careers goals in this brave new e-learning world. [vii]

---

[i] Rifkin, J. E., (1995), The End of Work: The Decline of the Global Workforce and the Dawn of the Post Market Era, J P Tarcher; London.

[ii] Merrill, S.E. & Wiigenhorm A.W., Introduction, (2001) A Vision of E-Learning for America's Worker, A Report of the Commission on Technology and Adult Learning, ASTD and NGA Center for Best Practices.

[iii] Carvin, A. (2000) Mind the Gap: The Digital Divide as the Civil Rights Issue of the New Millennium, Multimedia Schools, Jan.-Feb., 2000, p.2-4.

[iv] Mearns, C.A. & Sargent, J. F. Jr. (1999) The Digital Workforce: Building Infotech Skills at the Speed of Innovation, U.S. Department of Commerce, Office of Technology Policy

[v] Green, K.C., (2001) Distance Learning: Lessons From the Early Years, Converge: Innovations in High Education 4(10) (60-62).

[vi] Prendergast, G. Online Learning Europe 2001 Conference & Expo in London, England. (2/13/01).

McCombs, B. L. (2000, July). Learner-centered psychological principles: A framework for technology evaluation. Invited paper presented at the U.S. Department of Education's Regional Conferences on "Evaluating Technology in Education," Atlanta.[vii]

A Multi-Dimensional Project to Assess Student Information Competence Skills

Ilene F. Rockman and Gordon W. Smith
Division of Information Technology Services
Systemwide Library Services
Office of the Chancellor
The California State University
United State
irockman@calstate.edu
gwsmith@calstate.edu

Abstract: As librarians and faculty work together to integrate information literacy into course offerings, an area often overlooked is assessment. When evaluation methods are used, they tend to be campus-based and quantitative in nature. The California State University (the largest system of undergraduate higher education in the United States) has recently undertaken a multi-campus, multi-year, and multi-dimensional project to assess student information competence, especially in this current technologically rich and complex distributed learning environment. Results have wide-ranging implications for the design of library portals, gateways to information, and web-based retrieval tools. In addition, results show the need for librarians and faculty to collaborate to teach students how to find and critically evaluate information, and to become more aware of the wide range of information formats available.

Introduction

As distributed learning technologies permeate higher education, librarians find themselves providing an increased number of technologically-based services for students who cannot, or choose not to, come to the traditional library. Remote access to subscription-based databases and electronic books, information tutorials for distant learners, and virtual reference services are just some of the examples of services which have been offered by academic libraries during the past several years.

Librarians, working closely with faculty members, have also recognized the importance of teaching information literacy skills in this rapidly changing, complex information environment. Although students may be facile with sending e-mail, downloading music, developing a web page, or watching a streamed video, students are entering our colleges and universities with uneven skills and abilities in finding, evaluating, managing, and ethically using information resources in all of its various formats, critical skills for academic success and lifelong learning in the 21st century.

Nationally, reports indicate that "less than half (48 percent) of students feel confident in their ability to find information—essentially, in the skills needed to research a topic" (National Center for Postsecondary Improvement, 2001, p. 29). In one recent study, "based on their library website experiences, over half of the students (55%) report having a difficult time finding complete articles that include charts, tables, and photographs." (OCLC, 2002, p. 7). In addition, "when asked to describe problems and drawbacks they face when looking for information, end users consistently describe a number of factors: knowing what information is available, determining the quality/credibility/accuracy of information, information is too hard to find, being able to compare across information alternatives, having sufficient training". (Outsell, 2001, p. 5).

These studies support the need to assess information competence skills of students, and to recommend strategies for overcoming deficiencies.

For the past several years, The California State University system (the largest and most diverse system of higher education in the United States, serving over 388,000 students on 23 campuses) has undertaken a multi-campus, multi-year, and multi-dimensional research project to assess the information competence skills of its undergraduate students. This paper will report on the goals, methodology, and results of the project.

Background

In 1994, the California State University (CSU) Council of Library Directors created a strategic plan, *Transforming CSU Libraries For The 21st Century* (1994). A key component of that plan was information competence, with the twin goals of (1) providing CSU students with instruction and assistance enabling them to use recorded knowledge and information as an integral part of their university education and (2) collaborating with CSU faculty to provide training and assistance in the use of recorded knowledge and information necessary for their teaching and scholarship.

A key strategy for accomplishing the goals was the establishment of basic competence levels in the use of recorded knowledge and information, and processes for assessment of the competence. In order to carry out this strategy, a CSU Information Competence Work Group was established in 1995 composed of faculty members, administrators, and librarians. Its charge was to develop an information competence program for the CSU. In turn, the Work Group created an Assessment Task Force in 1998 comprised of librarians and faculty. The Task Force ultimately engaged the services of the Social and Behavioral Research Institute located at CSU San Marcos to assist in the design and execution of a multi-dimensional, multi-campus, and multi-year assessment project.

Goals

Utilizing the expertise of faculty members, librarians, assessment coordinators, ethnographers, and social and behavioral scientists, a multi-dimensional, multi-campus, and multi-year research strategy was developed. The goals of Phase I of the assessment strategy were to establish a baseline of student information competence based upon a standard series of questions. Phase II goals focused on student performance or information-seeking behavior to answer the question, "how do students search for information"?

Methodology

Phase I of the study employed quantitative research methods. In Spring 2000, 3309 students (drawn from a random sample) were surveyed to acquire aggregate data to suggest a baseline of students' information competence skills via an originally created questionnaire, based on scenarios, delivered by trained telephone interviewers. The high response rate (77.7%) yielded an average interview length of 24.76 minutes. Results showed that while students do use the Internet as a common source of information, other resources (such as books, reference works, and individuals) are also used.

Phase II, conducted a year later in Spring 2001, was more qualitative and complex. Intended to capture what students do when they search for information, seventy-six students from various CSU campuses were randomly selected to participate in an all day assessment activity on one of four CSU campuses (Fullerton, Northridge, Sacramento, or San Jose). They were compensated for their transportation and their time, and were accompanied by 20 librarians and 10 faculty members. The students were presented with one of four scenarios, and given free reign to use any resources available to them in the campus libraries, including assistance from reference librarians.

A variety of qualitative assessment methods were employed including direct observation, screen capture software, video and audio taped interviews, recording of ethnographic field notes, and focus groups. These methods were intended to shed light on how students formulate a research query, look for information using technology-based retrieval systems, and evaluate the appropriateness of what they find—all key factors in determining information competence.

Results

Results of the Phase I and II research projects show that students frequently use the World Wide Web as an initial step in pursuing answers to questions. In addition, results from Phase II indicate that (l) the online environment influences the way students search for information, and that students tend to over-value current information found on the world wide web over in-depth treatments often found in books and journal articles (whether electronically or print-based), providing them with a false sense of success and misplaced confidence in their search results; (2) students embrace the virtual library for its convenience, flexibility, timeliness, and access to large amounts of information; and (3) although technology makes some information more accessible and convenient to use, it may also limit (or telescope) the information which students actually retrieve.

The results have wide ranging implications for the design of library portals, information gateways, and web-based retrieval tools with embedded, point-of-use instruction.

In addition, the results reinforce the need for faculty and librarians to work together to (l) design course assignments and learning outcomes throughout the curriculum which will reinforce the development of students' information competence skills and abilities (2) teach students how to find, apply, ethically use, and critically evaluate information resources (3) assist students to become more aware of , and the differences between, the wide range of information choices and formats available to them and (4) help students to become successful, self-directed learners.

References

The California State University (1994). *Transforming CSU libraries for the 21st century: A strategic plan of the CSU Council of Library Directors*. Long Beach, California: California State University. Available from: http://www.calstate.edu/LS/archive/lib_strat_plan.shtml

Dunn, K (January-March 2002). "Assessing student information literacy skills in the California State University: A progress report". *Journal of Academic Librarianship*. Vol 28 No.1/2, pp. 26-35.

National Center for Postsecondary Improvement (May/June 2001). "The landscape: A report to stakeholders on the condition and effectiveness of postsecondary education". *Change* Vol 33 No. 3, pp. 27-42.

OCLC Online Computer Library Center (June 2002). . "OCLC White Paper on the information habits of college students". Available from: http://www2.oclc.org/oclc/pdf/printondemand/informationhabits.pdf

Outsell, Inc. (July 2001). "Managing online information to maximize corporate intranet ROI." White Paper. Available from: http://www.moreoverpartner.com/collateral/Information_Portal_ROI.pdf

Virtual Community of Teachers in Switzerland – Are Teachers Ready to Share Online?

Andreas Röllinghoff, Andreas Ninck
Learning Lab, Berne University of Applied Sciences
Morgartenstr. 2c, CH-3014 Bern, Switzerland
[ninck, rollinghoff]@hta-be.bfh.ch
http://www.fnl.ch

Abstract: Educational institutions are becoming more and more aware of the gap between the huge potential of new learning technologies, and their modest application in the classroom. As an answer to this situation, the seven Swiss Universities of Applied Sciences have set up a joint initiative called Forum New Learning, with the main purpose of enhancing knowledge and expertise in new learning technologies for a broader group of interested teachers. This initiative creates the framework for a network of competence among teachers as a 'community of practice'. Members consult and teach each others. They act as learners in areas where they need training, or act as teachers in areas where they possess competence useful to others in the community.

Keywords: Promotion of New Learning Technologies, Virtual Community of Practice for Teachers, Virtual Learning Community among Teachers, Knowledge Sharing, Distributed Faculty Support, Learning Organisations

Introduction

First, the short answer to the question asked in the title: The extent to which most teachers and faculty members are ready to share their knowledge or products in a virtual community is nearly zero. But similar to existing local communities the little percentage of people that do participate actively, is capable of bringing the community to life. They create – in time - a rather comprehensive wealth of material and discussions covering most of the questions and subjects concerned provided that there is a dedicated moderation of the community.

The (not so) long answer follows now. After the obvious success of communities such as *AskMe* (www.askme.com), *PhotoNet* (www.photo.net) and Linux the obvious question was: will teachers be willing to do the same? Our analysis of existing types of communities helped us learn to distinguish between communities of clients, from communities of interest, communities of practice, employee knowledge networks or communities of learners, etc. We visited a number of initiatives on the Web aimed at teachers such as *Virtual Learning Space* (itlearningspace-scot.ac.uk) and *Education with New Technologies Networked Learning Community* (learnweb.harvard.edu) at Harvard, etc., which each differ in aim, scope and especially the extent to which their moderation reaches out to each member. This helped us to define our own objectives.

Mission: Teaching with Technology

Our initiative started with the insight that teachers who are new to online course authoring are considerably hampered in their effort to go virtual, by questions such as: What is the adequate software? How do students learn online? They often hardly know what the potential benefits of the New Learning Technologies (NLT) could be, and how much effort is required to implement some useful and pedagogically effective learning scenarios. More over they have great difficulty finding training or counselling in faculty support that is adapted to their situation. Nevertheless there are a number of teachers who are motivated to use NLT in their courses. How can their efforts be supported? In consequence and in analogy with a professional association our initiative aimed for a virtual community of practice. This community would organise faculty members and provide services such as training, help members to come together to exchange their knowledge and learn from each other, eventually try to define a standard of quality, and most of all collect the state of the art knowledge - but online.

Reaching the Members

To start building a community presupposes that you can reach the persons who might be interested. Some experts advise to start with a newsletter. It seems that another possibility to reach a growing number of prospective members is by giving courses. This was done in our case by giving training workshops all over Switzerland through the Swiss Universities of Applied Science (UAS) training centre 'Didactical Cycle of Ongoing Formation' based in the UAS Freiburg under the heading 'New Learning Technology'. After the courses we invited the participants to share their developing expertise, their experience, questions and problems in a password protected environment. In the absence of a better solution we chose a WebCT course platform (www.webct.com) for this purpose. To give people a reason to go there we placed all of the material that we produced for our workshops into this environment that we called 'FNL-Community and decided to actively animate the Forum through a moderator. This moderator then frequently posted messages, gave information and answered questions that the few participants had placed in the forum. Next we formulated a research project in the framework of the SVC in the UAS with the aim to support teachers of the UAS using new Learning Technologies. When the project was accepted into the larger program 'Swiss Virtual Campus' (cf. http://www.virtualcampus.ch) we integrated the community into the project that we named 'Forum New Learning' (FNL) (cf. http://www.fnl.ch). This began in December 2000 with a head start of 40 members, a number of core information pages, a functioning (though awkward) platform with a forum and a data bank and most importantly the money to pay for a technician, translation and the moderation.

Apart from the platform WebCT, the FNL-Community is also supported by a Web portal, a collaborating team of scientific specialists in 5 UAS and three language regions in Switzerland and by regularly held face-to- face workshops. Members can organise their learning individually, yet share their insights collectively with their peers. In contrast to comparable traditional institutions, the service and counselling is not carried out by a geographically central office, but through a distributed network of persons, which consists of an avant-garde of teachers who have already, or are just starting to build specific knowledge in the field of NLT. These pioneers use the community as a network of competence, with the main purpose to instruct and motivate a broader group of interested teachers to gradually build a generalised competence in the use of NLT.

Virtual Community as Faculty Support

The present state after 20 months. About 200 German and French speaking teachers – have been using a shared file data base and communicate within a forum of a specially -designed course platform.

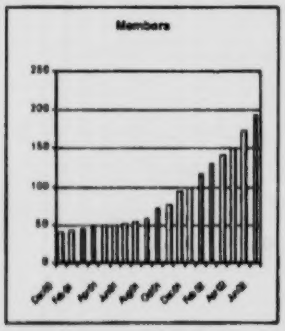


Figure 1. Development of number of members.

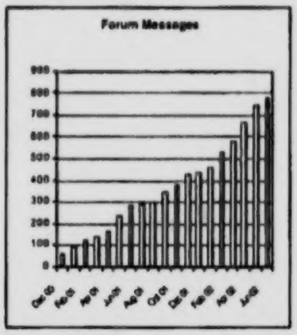


Figure 2. Development of number of messages

- About 300 documents provide training as well as hints and tips for areas such as the use of the WebCT platform, the design of online learning materials, and related pedagogical questions.
- About 800 messages have been posted in the electronic discussion forum by members debating the technical and pedagogical problems they have encountered in their online courses.
- A FAQ gives access to the main technical questions that have been discussed in the first 14 months.

- Course materials have been contributed by the members in 4 areas:
  - online learning activities
  - presentation of learning materials
  - online project learning
  - scientific publications, articles, training material etc.

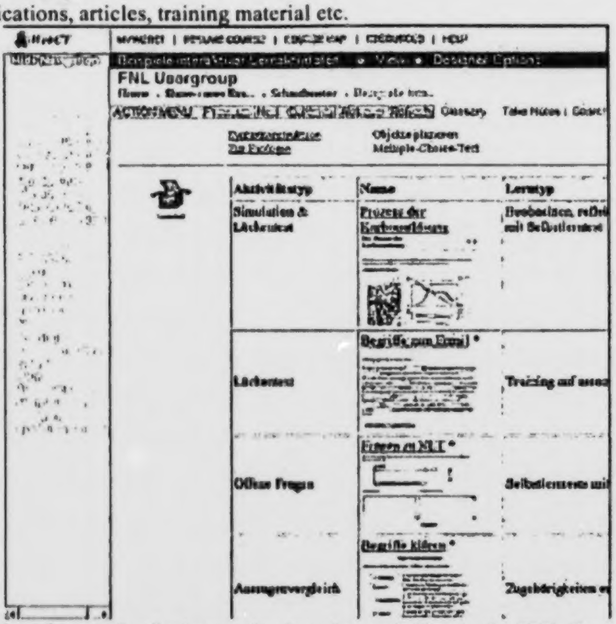


Figure 3. List of examples for interactive learning activities in the FNL-Community

- The differentiation of competencies among members is under way and noticeable. Some teaching-subject related groups are formed for mathematics and language teachers. Others have become the person of reference for specific competencies such as the use of tests or 'streaming video'. Some members have started to volunteer as assistant moderators in sub-divisions of the discussion forum and in workshops.

Interpretation of Some Developments

What is written and how:
Only 147 (73%) from 201 enrolled persons have ever actually entered the Community . Many of these have not posted any or only one message in the forum. Only 26 members have contributed 4 or more messages, 10 of these have sent 10 or more messages.
Many messages are simple requests for information or reactions. This indicates a learning of a practical type. Only very few forum initiatives, 15 out of 125 in the last 6 months, have led to discussion threads with more than 5 replies, thus allowing for a 'deeper' learning process, e.g. a change in pedagogical convictions. The percentage of these longer threads that have been initiated by the moderator has dropped in 6 month from 66 % to 26%. More members have become self- initiating.

What is read:
In the first three months of the FNL-Community most reading concerned technical matters. With the appearance of more pedagogical and didactical material these have reached – after a year - the same popularity. Today the most read texts concern pedagogical and didactical material as indicated by their higher hit rate.

How material is shared:

BEST COPY AVAILABLE

- Overall 19 members contributed learning material or elaborated teaching ideas outside the forum. These have been 'published' in the data bank and are accessible under 'Learning Objects' and 'Show cases'. It is noteworthy though that only 4 of them did so unsolicited. As the contributors need to make a supplementary effort to explain the use of this material to other teachers, this - seemingly - has a limiting effect on the sharing process!

Outlook

The FNL-Community of Practice' has also become a 'Community of Learners'. It has progressed from a practical solutions swap-shop to a platform allowing for broader exchange, including methodological aspects of pedagogy and didactics. To become a valuable learning community, on an academic level, the community will have to lift its intellectual attractiveness by providing a framework for higher level exchanges and profounder learning events. It will nevertheless continue its basic service of practical solutions in technical and methodological matters. To manage this,

- more information has to be gained about the way the community is used by the members. A survey is under preparation to research members' needs and suggestions.
- more (active) members have to be won. We therefore will publish most of the actual password protected content to convince a larger public of the quality of our material, and also simplify the login procedure.
- and to make the usergroup more accessible, a more community-adequate software will soon replace the current clumsy platform. This will provide members with modern community management features such as events reporting, profiling, interface adaptable to users needs etc.
- a higher degree of involvement among the members must be reached as a basis for more voluntary commitment as assistant moderators or material contributors. We will experiment with a new type of meeting with revolving partners in small working groups.

The first results are encouraging. A reinforcing loop has been set up, where teachers are not only taught about new learning technologies, but where they also return a lot of practical and didactical knowledge, feeding the knowledge bases used for their own learning. This process is still heavily subsidized through the FNL. However as the number of active members increases an acceptable ratio of financial input to learning result should be reached before the end of the project in 2003.

Literature

BROWN, J.S., DUGUID, P. (1991). Organizational Learning and Communities-of-Practice: Toward a unified View of Working, Learning and Innovation, *Organizational Science*, 1, S. 40-57.

KIM, A.J. (2000). *Community building. Secret Strategies for Successful Online Communities on the Web. Berkley,* CA.: Peachpit Press.
NONAKA, I., TAKEUUCHI, H. (1995). *The Knowledge Creating Company. How Japanese Companies Create The Dynamics of Innovation.* New York, Oxford: Oxford University Press.

SENGE, P. et al. (2000). *Schools that Learn*. London: Brealey Publishing.

Gyrus: An E-Environment for Faculty Development and Student Learning

Teams of educators and technologists at universities around the globe have been seeking solutions to the various challenges posed by the new technologies. One such team of faculty from Santa Barbara City College and the University of California, Santa Barbara have created a course development system called Gyrus and two supporting hubs. The course development environment of Gyrus is designed as a plug-in to Macromedia's Dreamweaver <www.gyrus.nu>. It assists faculty in creating pedagogically sound online courses and course materials. The Gyrus teacher hub has an online syllabus maker <www.teacherhub.org and the student hub is an online student learning environment <www.studenthub.org>. The latter can be used independently by students or integrated into lessons and assignments by faculty using the Gyrus course development areas. All courses and instructional materials created using Gyrus and its hub sites can be used in conjunction with face-to-face classes, local server sites, or commercial online delivery systems.

As a courseware production environment, Gyrus integrates research-informed pedagogy with technology-based instructional methods designed to increase student involvement, independence, and success through active learning, reflection, and metacognition. Gyrus provides faculty with pedagogical resources, including templates and guided instructional processes incorporating "best practices." Its tool sets accelerate content production by helping authors systematically plan and evaluate their instruction, both online and on campus. Guided processes assist faculty in creating syllabi, interactive lectures, and multi-media assignments. Learning skill templates make it quick and easy for faculty to assign skill building assignments that will assist students in learning course content.

Gyrus's Instructional Principles:

The underlying framework of Gyrus as an course design tool is the PIE Principle. That is, designing instruction is an iterative process involving planning three aspects: Planning, Implementation, and Evaluation (PIE). These three aspects of instruction inform one another as the instructor "moves" back and forth between them to complete an effective lesson. While most faculty will readily see the logic of this, the implications for preparing online instruction can be very interesting. Gyrus' environment for creating assignments strongly encourages the faculty author to consider all three aspects of each assignment during the initial planning of any course.

Gyrus' Resource Browser:

In addition to the teaching ideas embedded in the framework of Gyrus, (e.g., tools templates, and guided processes), an online information center assists faculty as they develop course and assignments. It consists of three areas: Student Success Resources that Santa Barbara City College faculty have been gathering as "best teaching practices" for student success and have made them available via the Web; Study Skill Resources offering modules that faculty can send to their students (individually or as groups); and information on teaching topics such as learning styles, communicating with difficult students, teaching styles, and tips for new faculty.

Gyrus' Student Learning Environment:

Gyrus also consists of online learning resources, tutorials, and guided processes that students can use independently or faculty can integrate into lessons and assignments <www.studenthub.org>. It is often the case that students don't understand the intricacies of what is meant when then are asked to compare and contract ideas, summarize articles they have read, or write a report using authoritative Internet sites. At the StudentHub, students find information and guided processes on these and other skills. The searchable site offers a study environment that seeks to assist students in increasing their academic knowledge and skills while helping them to learn how to learn.

An Evaluation of Gyrus' Effectiveness:

Gyrus was developed through a grant by the Fund for the Improvement of Postsecondary Education. As a pilot project it was used in three California community colleges on a limited basis. Results of a two-year evaluation are as follows:

1. Grades assigned to students in course sections that used Gyrus-authored assignments were significantly higher than grades assigned to students in sections of the same courses taught by the same faculty members before or concurrent with their exposure to Gyrus. Persistence too was higher in these sections.

2. Participating faculty reported that exposure to the pedagogical aspects of Gyrus, through both the hands-on training and the system itself, positively affected the way they conceived, prepared, and offered instruction in all their classes, both on-line and on campus. They viewed it as an important source of professional development and reported it as improving their pedagogical skills.

Conclusion: These results are encouraging and suggest that pedagogical tools provided in Gyrus (i.e., teaching skill resources, assignment templates, learning skill templates, pre-made student study skill assignments and skill building exercises) serve to promote both faculty development and student learning. Commercial venders who create course delivery systems are only just beginning to add pedagogical resources for course development. However, none have yet incorporated the kind of assignment makers and guided process the Gyrus provides. Gyrus results indicate that this would be a productive direction for course development software and e-learning delivery systems.

The Concord E-Learning Model

Raymond M. Rose
Concord Consortium
United States of America
ray@concord.org

Abstract: Since 1995, the Concord Consortium has pioneered online instruction. Over the years we have developed and refined the Concord Consortium e-Learning Model for the design and operation of online courses. Using this model, we have delivered over 200 successful courses reaching more than ten thousand teachers, students, and online course developers. Our approach is based on collaborative learning in asynchronous groups guided by trained facilitators.

First, what exactly is an online course? It's a course delivered over the Internet, but that definition—rudimentary, although accurate—is insufficient. The type of online course that The Concord Consortium feels are most effective is one in which there are clearly written assignments that engage the students in active learning with each other, and in which the instructor, plays an integral role as a facilitator of that learning. The Internet is used both as a resource and as a means for connecting particpants based on mutual interest in the content—regardless of individual schedules, geographic location, or physical ability to come to class.

Since 1995, the Concord Consortium has pioneered online instruction. Over the years we have developed and refined the Concord Consortium e-Learning Model for the design and operation of online courses. Using this model, we have delivered over 200 successful courses reaching more than ten thousand teachers, students, and online course developers. Our approach is based on collaborative learning in asynchronous groups guided by trained facilitators.

The type of online course we create is one in which instructor and students will communicate and collaborate on a regular basis. Within the course, students will assess their own growth and learning through group discussion and reflection, peer review, instructor feedback, and self-evaluation. The richness of these interactions will translate into positive and meaningful learning experiences for the students that will carry over into their face-to-face lives.

The following nine key characteristics define The Concord Consortium's approach to delivering quality e-Learning.

Asynchronous collaboration. Participants don't have to be logged on to the course simultaneously; they work in an asynchronous environment in which text-based, threaded discussion and collaborative problem solving form the core learning strategy. Compared to synchronous tools (chats, shared whiteboards, shared applications, and audio conferencing), these asynchronous discussion groups are less expensive, more thoughtful, and far easier to schedule, particularly across time zones. This means that participants can explore the curriculum at their own pace, taking time to reflect carefully and record their thinking.

Explicit schedules. Instructors of online courses relying on collaborative discussions schedule lessons within a specific timeframe so participants can share similar experiences and insights. One major topic provides the focus for the week, with a sequence of activities, discussion, and reflection. For instance, if the content of a video is essential for an upcoming discussion, then the schedule must specify that everyone view the video clip sometime within a few days prior to the discussion. Each participant is then required to make an initial contribution to the discussion. Over the next few days, participants respond to the comments already posted. The best schedule preserves the "anytime, anywhere" flexibility of online courses, while also ensuring that all participants bring similar experience and currency to the discussion.

Expert facilitation. Online courses are led by a qualified person specifically trained in online facilitation. Leading an online discussion is a skill that is learned; it is not sufficient to simply assign an online course to even a highly respected classroom teacher. Teaching strategies that work well in a brick and mortar classroom can have unintended effects online, halting rather than deepening dialogue and learning. Like a good teacher in a traditional classroom, the expert facilitator doesn't ask all the questions or provide too many answers. However, effective online community leaders use many other strategies to stimulate student exchange and guide the conversation toward important content, intervening in discussions only when it serves to move the group more clearly toward learning objectives.

Inquiry pedagogy. Designers create effective online courses with many specific elements that contribute to sound pedagogy for inquiry learning. Graphics, simulations, and role-plays, if used effectively, help learners explore and make sense of content. Course objectives are explicit and matched to the measures used in qualitative assessments. Instructors establish a clear set of rubrics for postings to ensure that evidence of learning is embedded in the discussions.

Community building. Learning through collaboration requires participants to take intellectual risks. It is the responsibility of course designers and instructors to proactively design and nurture a community culture in which participants are supportive and honest. The facilitator establishes and shapes intellectual and emotional norms, modeling appropriate behavior and steering harmful input toward higher learning ground for all. There are many ways to foster this sense of intellectual trust and safety. Providing class time for participants to become acquainted is an essential first step. This is achieved by leading fun ice-breaking activities in the beginning of the course and sustaining a social life for the group with a café or student lounge discussion thread where non-course topics are welcome throughout the course. Written expectations about good group processes are also helpful. For example, instructors encourage participants to use inclusive and collective language that focuses on content in discussion posts. Anonymous polls, role playing, use of smaller discussion groups with rotating roles, or weekly online meetings are all effective techniques for building and maintaining group cohesion.

Limited enrollment. There are between 12 and 25 participants in a class to keep collaborative learning manageable. Online discussions need a critical mass, so smaller is not necessarily better. Subgroups with as few as two or three are useful for the intense exchange required to produce something complex, like a cumulative project. Slightly larger teams of four to five work well for focused dialogue on readings, video clips, simulations, or other shared experiences. In an online environment, these subgroups remain part of the public record so everyone can glean the insights shared in small group exchanges.

High-quality materials. Course designers include the widest feasible range of media and activities to appeal to different styles of learning. In addition to Internet resources, they effectively use books, kits, labs, and other media to supplement online materials. In a science course, for example, students view a visual simulation or use modeling software to understand a concept. Offline, they conduct experiments with simple materials. Web-based graphics or content shed light on other aspects of the subject. Students engage in explorations, surveys, creative works, and self-reflection, as appropriate. Multiple, short assignments using a variety of approaches and media help preserve course flexibility, reinforce key concepts, and nurture different strengths.

Purposeful virtual spaces. In a face-to-face classroom, the structure of conversation is fluid and invisible. We know or learn to do our social chatting before and after class and during breaks. When the instructor asks if people have questions about the assignment, that's when we ask. Online, course designers create explicit structures so the community gets what it needs without interrupting the flow of content-based discussions. Typically included are a "Student Lounge," a "Questions about Assignments," a "Technical Questions," and a "Class Meeting" discussion space for debriefing course experiences.

- **Ongoing assessment.** The idea of using one high-stakes test to measure achievement may work well in a closely monitored classroom. Online, however, assessment is a continuous, ongoing process. Instructors find evidence of achievement in participants' daily contributions to online discussions, and learn each student's unique "voice" and approach to solving problems through their postings. The online version of a literature course, for instance, includes regular small group discussions on assigned readings and essays or longer projects, which undergo a sequence of peer review, revision, and final submission for grading. Instructors hold daily submissions to standards that foster constructive dialogue and learning by communicating clear objectives for project outcomes and specific criteria for postings.

A Framework for Analyzing Online Learning in Post-secondary Education

Leona Rousseau, M.I.D.
Program Leader
Lethbridge Community College
Canada
l.rousseau@lethbridgecollege.ab.ca

Abstract: Can online learning environments facilitate or enhance the cognitive process of learning? Online learning environments are being employed with increasing frequency for post-secondary teaching and learning. Despite existing studies, the ability and capacity of online environments to foster and or enhance the learning process has not been fully ascertained. Factors defining how the cognitive process of learning might be fostered or enhanced remain incomplete as are the specific advantages and disadvantages of online environments as viable new learning environments. If online learning environments cannot be shown to facilitate or enhance the cognitive process of learning, they will be difficult to advocate as new learning environments for higher education. Will online environments fulfill the promise of 'revolutionizing' education, or merely join their predecessors in a cache of teaching and learning strategies. This paper will provide a brief overview of findings from a recent study of online learning in design education and offer a theoretical framework in which to analyze online learning environments in post-secondary programs beyond design.

Introduction

Can online learning environments facilitate or enhance the cognitive process of learning? This paper will provide a brief overview of findings from a recent study of online learning in design education and offer a theoretical framework in which to analyze online learning environments in post-secondary programs beyond design.

Online environments have become a significant influence in our lives with both positive and negative effect. Their presence and persistent use yield both advantages and disadvantages. With escalating use in all business sectors, the complete integration of this technology in post-secondary education has become vital, but how is it best utilized or applied in the academic realm? Post-secondary institutions have embraced and adopted online environments for teaching and learning and will soon be faced with the impact of those swift decisions. Online environments have been touted as having far-reaching benefits to teaching and learning by those with zealous expectations, infectiously spurring further acclaim. In stark contrast, critics argue that while more information may be available there is less knowledge, clearly to the detriment of learners. There is a critical need for what Hlynka calls a "dispassionate middle-ground", a sober look at what online environments realistically have to offer. What might they contribute to learning itself? How can they support the acquisition of knowledge, or can they? How do online environments truly differ from any other media or learning environment? Will online environments fulfill the promise of 'revolutionizing' education, or merely join their predecessors in a cache of teaching and learning strategies.

Online learning environments are being employed with increasing frequency for post-secondary teaching and learning. Academic programs are being pressured by administration, learners and other stakeholders to offer courses and or entire programs online and must decide how to meet these growing demands without compromising quality. Online courses are often implemented without seriously considering or comprehending the impact, the advantages and disadvantages, to learners and the learning process. Despite existing studies, the ability and capacity of online environments to foster and or enhance the learning process has not been fully ascertained. Factors defining how the cognitive process of learning might be fostered or enhanced remain incomplete as are the specific advantages and disadvantages of online environments as viable new learning environments. If online learning environments cannot be shown to facilitate or enhance the cognitive process of learning, they will be difficult to advocate as new learning environments for higher education.

Methodology

An integrative inquiry was recently conducted to determine what, if anything, online environments may uniquely contribute to the cognitive process *of learning to design in post-secondary design* education. Salient knowledge from existing studies was collected, analyzed, and synthesized. Selected data was then organized into a conceptual framework that focused specifically on the cognitive process of knowing or learning and its relevance to the cognitive process of learning to design, allowing new perspectives and insights to be drawn. Lonergan's Method of Human Understanding (his cognitional theory) was employed as the theoretical framework for several reasons that distinguish it from other learning theories and make it a fitting construct for analyzing online learning in post-secondary programs beyond that of design. The method is universal and deals with knowledge acquisition at a fundamental level rather than focusing on specific aspects of learning such as memory, outcomes, observable behaviour or the like. It offers a unique philosophical perspective that takes into account the complex layers of human consciousness, responsibility, ethics, the role of human error in learning and two ways of knowing. The method also provides a means to analyze the impact and potential of online learning environments at each level of the cognitive process, each level of consciousness, in addition to the whole.

Lonergan believed that "all conscious and intentional operations of knowing occur by means of a dynamic interlocking pattern" (Creamer, 1996, p.66) consisting of four primary levels which build on one another: experience, understanding, judgement and decision. The following diagram, derived from Creamer (1996, Table 5.1, p.74), illustrates Lonergan's multi-level Method of Human Understanding.

Level of Human Consciousness		**Questions Evoked at Each Level**
	KNOWING	
Responsible	**DECIDING** Deliberating	(what ought to be done?)
Rational	**JUDGING** Reflecting	(ask is our understanding correct? What is so? True? Valid?)
Intellectual	**UNDERSTANDING** Inquiry Conceiving	**(INSIGHT)** (relationships and meanings…)
Empirical	**EXPERIENCE** Remembering Perceiving Sensing	(imagining, anticipating, feeling…) (seeing, hearing, touching, tasting, smelling)

Figure 1: Levels of Lonergan's Method of Human Understanding

Each level of consciousness cited in Lonergan's method calls on a different and distinct set of human faculties. Ascending vertically through the levels the first, "experience", requires data collection through the five senses and also calls on one's memory, imagination and intuition to inform. The more data or experience that can be observed or gathered, the more complete the level, which improves the potential for success at subsequent levels. The "intellectual" level necessitates investigation and the formulation of ideas and concepts based on the empirical and subconscious data from the previous levels. Lonergan believed it was within this level that "insight" occurred, during which all thoughts from previous levels merged in such a way as to bring about some clarification and understanding of the information or data. It is through "insight" alone that we make the leap from the level of pure data to understanding (Creamer, 1996). Insight is defined as mental acuity, a drawing of relationships between previously disparate bits of data, to suddenly see what previously went unseen. Understanding is not itself knowing but leads to knowing. Knowing requires judgments which Lonergan explains as distinguishing "alchemy" from "chemistry" (Lonergan, 1993, p.147). This elucidation of previous empirical and intellectual levels then leads to the following "rational" questioning of what is known up to that point. The "rational" level requires reflection on data that has been gathered, on thoughts and on insights gained, to determine whether things are what they seem; a double-check as it were, or verification of what is thought to be correct. Then, "judgements" may be made as to the quality, soundness, and accuracy of one's understanding at the current level. The succeeding level of consciousness "responsibility", calls for consideration and review of appropriate and ethical 'actions' that might be taken in light of one's understanding, at which point a final "decision" must be made. The decision is not absolute, but the "most probable" outcome or decision given our understanding of the situation, context, problem or question. Since each level depends on the knowing achieved in the previous level one cannot successfully proceed to the next level until the objective, achieved through self-question and answer, of the preceding level has been satisfactorily met. The cognitive process is dynamic rather than a rigidly defined sequence. The knower or learner oscillates between levels until questions at each level are sufficiently answered. Lonergan believed, as did Plato, Dewey and constructivists today, that the answers to such questions ultimately come from within, from the one seeking knowledge, the knower or learner.

How can aspects of online environments facilitate this process? Can the elements or characteristic aspects of these environments foster knowledge acquisition at each level and knowing as the ultimate outcome?

Findings

In the study conducted, each level of the cognitive process of learning to design (experiencing, understanding, judging, deciding, knowing) was examined in relation to the various elements of online learning environments (such as vast global resources and opportunities for diverse collaborative endeavours) to determine if such elements facilitated or enhanced the cognitive operations at each level and on the whole and to identify the inherent advantages or disadvantages associated with such elements at each level and on the whole. The findings indicated several factors and unique aspects of online learning environments that facilitate/enhance and those that hinder the cognitive process of learning to design at the levels of experience and understanding. For example, while there is an unprecedented volume of accessible information and data from diverse sources online to facilitate the cognitive levels of experience and understanding, these same resources could lead to *mis*understanding and *un*knowing when questionable content is asimilated into the knowing process by the learner.

Results of the study indicate that online learning environments have the potential to facilitate and or enhance the cognitive process of learning to design primarily at the levels of experience and understanding. Due to the predominantly reflective nature of the higher, more complex cognitive levels of judgement and decision, online environments may lack the potential to contribute significantly at these levels of cognition.

Conclusions

Lonergan's Method can be applied as a framework for examining the learning process and product (knowing) in many fields of study. Once the process, the levels of knowledge acquisition in a particular field are understood, elements or aspects of online environments that may facilitate or enhance that process may be determined. While this study focused on design education specifically, the cognitive process of learning remains the same for learners in any post-secondary program and thus the findings may be more generalizable. Regardless of curricula, online learning environments appear to hold the most promise in facilitating or enhancing knowing for the learner at the cognitive levels of experience and understanding with marginal impact expected at the higher cognitive levels of judgement and decision. Online environments could facilitate improvement in the learner's ability to judge and decide if, for example, the online sources accessed, and communication exchanged, elicited deeper reflection or deliberation by the learner. Since each level of Lonergan's Method builds on the preceding level, facilitating or enhancing knowing at the level of experience and understanding can make knowing at subsequent levels of judging and deciding more certain or more 'probable'. In this way, facilitating or enhancing knowing at any level of the cognitive process of learning can to some extent enhance learning as it ultimately contributes to the 'most probable' knowing.

References

Creamer, David G. (1996). *Guides for the Journey*. Lanham: University Press of America, Inc.

Hara, N. and Kling, R. (2001). Students' distress with a web-based distance education course: An ethnographic study of participants' experiences. Center for Social Informatics, Indiana University, WP 00-01-B1. http://www.slis.indiana.edu/CSI/wp00-01.html

Hlynka, Denis. (1998). Course lecture in Internet Pedagogy, July 1998, University of Manitoba.

Johnson, Scott D., Aragon, Steven R., Shaik, Najmuddin, and Palma-Rivas, Nilda. (2001). Comparative analysis of learner satisfaction and learning outcomes in online and face-to-face learning environments, in *Journal of Interactive Learning Research* (JILR) Vol.11, No.1. (AACE) Association for the Advancement of Computing in Education. http://www.aace.org/pubs/jilr/v11n1.htm

Johnston, Michelle A. and Cooley, Nancy. (2001). Toward more effective instructional uses of technology: The shift to virtual learning, in *The Technology Source*, November/December 2001. http://ts.mivu.org/default.asp?show=article&id=869

Jonassen, David H., Peck, Kyle L., and Wilson, Brent G. (1999). *Learning with technology: A constructivist perspective*. New Jersey: Merrill, Prentice Hall.

Khan, Badrul H. (1997). *Web-based Instruction*. B. Khan Ed. Englewood Cliffs, NJ: Educational Technology Publications.

Lonergan, Bernard (1993). *Collected Works of Bernard Lonergan*, Volume 10 Topics in Education. Robert M. Doran and Frederick E. Crowe, Eds. Toronto: University of Toronto Press.

Matthews, David and Weigand, John. (2001). Collaborative design using the internet: A case study, *Journal of Interior Design*, Vol.27, No.1, 2001.

The Advisory Committee for Online Learning. (2001). *The e-learning e-volution in colleges and universities, A Pan-Canadian Challenge*. Industry Canada: Ottawa, ON. http://www.schoolnet.ca/mlg/sites/acol-ccael

Asynchronous Learning Environment for Language, Communication and Culture Study

Irina Rozina
Department of Information Technologies
Institute of Management, Business and Law
Russia
rozina@iubip.ru

Ronald D. Eckard
Department of English
Western Kentucky University
United States
ronald.eckard@wku.edu

Joe Downing
Department of Corporate Communications
Southern Methodist University
United States
jdowning@mail.smu.edu

Abstract: The inter-cultural dialog in a contemporary global society is proceeding with amazing speed due to advancement of synchronous and asynchronous telecommunication technologies. Electronic dialog users need to be prepared to use such technologies as e-mail, WWW-based technologies, forums, IRC, etc. Scholars are challenged to develop innovative teaching and learning methods to hold inter-cultural dialog properly and efficiently (basically e-mail and web-form for a Cultural Values survey). Here we present some successful Correspondence, Cultural Value and Communication Projects for language, communication and culture learning run at some Russian and US Universities from 2000 through 2002, based on asynchronous technologies (basically e-mail, and web-form for Cultural Values survey). The results of these projects confirm our pedagogical hypothesis that students from different countries can be themselves language, culture, communication teachers and a source of appropriate knowledge due to asynchronous learning environment design based on e-mail and web technologies.

Introduction

The cross-cultural interaction in a modern global society is proceeding with amazing speed due to advancement of asynchronous and synchronous telecommunication technologies. This means that educational organizations are challenged to teach their students how to use new computer-mediated communication technologies (e-mail, WWW, forums, IRC, etc.) and to research how to develop them properly and efficiently in education. Here we present some successful methodology, which was introduced in joint Correspondence, Cultural Values and Communication joint projects aimed at language, communication and culture learning. The project was carried out by the Institute of Linguistics, Rostov State Pedagogical University; Philology Department of Institute of Management, Business and Law, Russia and English and Communication Departments of Western Kentucky University, USA from 2000 through 2002. The educational activity that we called an educational project helped the students to develop their skills for using telecommunication technologies, which connected them and gave them a more appropriate medium for language and culture learning.

The Theoretical Aspect

The main hypothesis of these projects comes from our understanding that students from different countries can themselves be language, culture, communication teachers and a source of appropriate knowledge. This hypothesis is built on the best known of Lev Vygotsky's social theoretical concept of proximal development zone (ZPD). According to Vygotsky the culture gives students the cognitive tools needed for their development. Foreign students are conduits for the tools of the foreign culture, including language and communication differences. The tools the culture provides students include social context, language and asynchronous telecommunication technologies for interactive connect and information exchange. In turn contemporary telecommunication technologies bring additional methods, tools and criteria for successful learning environment development. Thus we gradually see that the evolution of learning environment is based both upon theoretical and practical grounds.

The first thing that helps educator in this new learning environment is that learners become more active participants. The second is that the learners accept and incorporate previous and current learning practices from different subjects such as language, computing and telecomputing that rely upon emotional and social factors. Thirdly, many successful learning tools were initially not aimed at learning: word processors, spreadsheets, simulations programs, expert systems, email, mailing list and all WWW-based communication tools. In our project virtual learning communities were developed with the goal to activate these tools for new learning environments.

Effective learning is a many-faceted process that benefits from these new tools. Generally, positive characteristics of these application tools for effective learning are follows:

- Stimulating active intellectual involvement on the part of the learner.
- The student, rather than teacher, is in charge of learning activity - students determine when and how they use the computing and telecomputing to support their efforts to present information, collect data, solve problems, collaborate, and persuade others or foreign respondents.
- The learners have a great deal of control of the writing communication via e-mail. Students prefer to use a word processor with grammar and spelling checkers, the thesaurus, vocabularies, various editing aids such as replacements, block moves, coping, citing, etc.
- The correspondence project methods are aimed at accomplishing more creative tasks than traditional methods of teaching language, culture, communication, computing and telecomputing methods.
- These learning media assimilate new genres, fashion in writing (handling, slang, emoticons, abbreviations, signatures, etc), and new network etiquette (netiquette) in order to express meanings.
- Collaboration using learning media promotes mutual tolerance and provides responsibility to make students from both countries conscious of their identity and their responsibility to help one another to learn culture, communication and language as well.

Transcripts were collected from a graduate level virtual conference seminar course taught during summer session, 1998 at Northern Arizona University. Participants were in-service classroom teachers. A kindergarten through high school grade range of classroom assignments was represented by these teachers. Course work included outside class reading assignments of selected current research in the field, a final research paper, and active participation in the on-line discussion forum with focus questions by the instructor. The seminar offered was a Tools for Teachers course designed to promote reflective practice. Seven teachers from four different communities participated in this pilot course during the summer of 1998. Five of the participants were female and two were males. An interactional sociolinguistics (Schiffrin, 1995) approach was used to examine the texts of conversations. This approach draws upon concepts of culture, society, language, and the self. The meaning, structure, and use of language is socially and culturally relative (Gumperz, 1982). Meaning in dialog, like that of conversation, is socially constructed. Data was also examined for evidence of micro displays of sex class linked gender identities; displays that are commonly associated specifically with either gender. An example of this is the use of tag questions. Female participants, much more so than males, tend to use tag questions as a discourse strategy to invite response and inclusion or solidarity within the group. (Tannen, 1994) Simple quantitative analysis was done to determine total lines of text generated by each participant, amount of participation, total sums of questions, statements, as well as number of directed responses sent and received. Patterns of participation were mapped/graphed and correlated to the contexts of interactions. Style, register, and "voice" or tone analysis were also used on the data sets to try to discover the dynamics among the participants.

The Practical Approach

The role of teachers from all classes is to help learners with their communication, culture and language skills. Learners periodically send to their teacher and /or partner teacher a request or a copy of their email to see the communication problem or how they progress and help them if they wish. The pedagogic (cultural and educational) aim is:

- to encourage learners to exchange cultural information,
- to comment / "correct" the language of each other as a form of mutual self-help among students (peer collaboration).

Before the beginning of the Correspondence Project e-mail partners were given some guidelines from their virtual class teachers. For example, the guidelines adapted from the International E-mail Tandem Network (Jane Woodin, 1997 Brammerts, Kleppin, Szymanski 1996-1998, http://www.slf.ruhr-uni-bochum.de/email/help/helpeng01.html#questions). The same approach was used in the Correspondence Project to create learning media between students from Rostov State Pedagogical University and Valenciennes University, France for Russian and French languages study.

Brainstorming was one of the methods we used to prepare ideas and materials for the Correspondence Project. For example, we encouraged our students to brainstorm about their impressions and knowledge of the other country. Then we provided our students with the results of the Internet survey about the traditional impressions, or the list of perceptions, beforehand prepared at partner class or our Cultural Values survey. We asked them to compare results and talk about some topics.

Thus in a class at Rostov State Pedagogical University, the students were asked to brainstorm and express their perceptions of Americans and to freely express what they know about the U.S. Some were repetitions and some were contradictions. We discussed students' own lists for recording and categorizing their impressions. If we had enough answers from a partner class, the most interesting pen pals' responses were shared aloud in class, then discussed. Some cultural information as to why these differences might exist was given. We then divided their responses into positive and negative descriptions. In our current project we listed all terms in order of frequency; therefore, in the last version of the database terms those, those listed first or second were provided by more than one student, perhaps even several students.

In the Cultural Values Project both the Russian and the American students filled out the surveys (hard, soft or Web-based form http://rspu.edu.ru/li/cultural_value/survey_e.html) and exchanged their finding results (personally forwarded to partner or collected as full database of all student responses). In the Cultural Values survey database some values were rated the highest on the Russian responses and certain common or different on the American responses. We came up with a few questions in class for them to ask their pen pals. The teacher helped them with providing some information on the types of things that might be different when comparing the Russian and American cultures. Students discussed results and asked questions based on their partner's most important values and full database results.

In the Communication Project the goal of the assignments was to analyze the mediated (e-mail) communication (computer-mediated communication, CMC) with colleagues from a different culture - American and Russian. To do this, students analyzed their email conversations by applying interpersonal and CMC theories we've discussed in this class. Teachers paired up students for responsibility to maintain e-mail contact between students. Usually at least three to five interchanges occurred between partners. If partner did not respond, teachers tried to assign their student a different partner. Students save copies of all email correspondence (including the copies of messages they sent out). Printouts of these e-mails were included in the students' final paper. For example, American students used any three or more of the communication theories (Norm of Reciprocity, Differences between Men and Women in Communication, Social presence Theory, Media Richness Theory, Hypersonal Interaction Theory). A final paper identifies the theory that they use to analyze the communication with their e-mail partner, give a brief overview of the theory. Students need to determine what communication behavior the theory seeks to explain or describe, use examples taken directly from collected e-mails to either confirm or disprove the specific tenets of each theory.

Usually students conducted each e-mail exchange for one semester. Once each student had a partner, we encouraged them to exchange emails as often as possible. Many of them corresponded more than once a week. We met at a class officially once a week, and teachers mentioned the time and day of our meeting in a mass e-mail to both the American and Russian students, so that they might try to send their replies before the beginning of our class period each week.

We conducted the class in both a formal and informal manner. Therefore, students often felt free to disclose and then revise their initial impressions and correspondence problems. As the students received responses, they would share them with the group. The responses were disclosed usually in the form of reading their partner's original text aloud. We are not sure if they ever revised their initial impressions, since they didn't share many of these original impressions on the lessons.

Conclusion

As a result of these projects, Russian students increased their English vocabulary, positively change their perceptions about Americans and American culture, and began to practice appropriate netiquette even during the course of these one-semester-long projects. The results of this study confirm our hypothesis that students from Russia and the U.S. can themselves be teachers of language, culture, and communication due to an asynchronous learning environment design based on e-mail and web technologies.

Ergonomics of the Study Environment of Online Learners

Carolyn Rude-Parkins
Department of Leadership, Foundations, Human Resource Education
University of Louisville
United States
cparkins@louisville.edu

Abstract: This presentation reports a literature review and a survey of ergonomics of the study environment of online learners. It reviews the parameters of physical ergonomics already established for office-based workers, and applies them to the online learner's reported study environment. Factors of interest include the work station desk, seating, computer monitor, keyboard and mouse, room lighting, and room environment. The online learners were students in virtual university courses offered in Kentucky. They rated conditions of their workstation related to five factors and identified their perception of the importance of each factor.

Introduction

Ergonomics is in the news as the U.S. Department of Labor considers workplace ergonomic rules, recognition of the safety considerations inherent in workstation design. Office ergonomics applies science to workplace design to maximize productivity while reducing operator fatigue and discomfort (Revelle, 2000). Office environments are more likely to be designed for effective, safe, comfortable and efficient work, due in part to office furniture manufacturers' consideration of these factors. But nearly one-third of American households have a home office. Distance learners often spend considerable time at their home workstation, which may not be built around the same ergonomic strategies and principles as the one in their office. University classrooms observe ergonomic design in lighting, chair and table heights. When students participate in their classes in a university setting, there is some control of the ergonomic factors. But distance learners choose and often create their own learning spaces.

According to Alan Hedge, professor of ergonomics at Cornell University, if a person sits at his or her home computer for more than one hour a day, ergonomics need to be a priority (Goff, 1999). "Even worse, the risk of musculoskeletal injury is nine times greater when you spend four hours a day at the computer than it is for a one hour-per-day user." The Bureau of Labor and Statistics finds that musculoskeletal disorders now account for one-third of all occupational illnesses and injuries (Revelle, 2000). These disorders are occurring in the workplace where researchers have been studying the problems, as well as solutions, for many years. Professional groups, unions, employees filing lawsuits and winning judgments, concerned companies with budgets to purchase ergonomically designed furniture and equipment, insurance companies looking to lower their costs, medical practitioners wanting to solve medical problems, etc., are all working together for a safer workplace.

Lone individuals working or studying at home or other "unplanned" locations, do not have all of these groups fighting to protect them. He or she has a paper due for class, and it must be done. Having an ergonomic workstation is the least of their worries. The workstation may be a card table or a kitchen table. The seat may be a stool, sofa, or kitchen chair. Lighting will be whatever is available for normal household use.

Literature Review

Researchers have found that when a learning environment is well designed, a high caliber of learning will occur (Knirk, 1987; Woodson, 1992). Additionally, "the physical environment impacts on learners not only physiologically, but also emotionally and psychologically" (Knirk, 1992). Inappropriate conditions take a physical and mental toll in terms of visual stress, musculoskeletal stress and psychological stress (Yeaman, 1986).

An issue raised in the literature is whether or not students are being taught about ergonomics, and potential health risks associated with computer use. Yeaman (1986) recommends a preventive ergonomics approach which would teach students what the potential problems might be. Rasicot (2000) opines that educators are "training" the workforce of the future, but aren't teaching, let alone demonstrating, how to prevent these ever increasing problems. Yoder (1993) questions whether or not we've forgotten ergonomics, and are now indirectly teaching students how to get carpel tunnel syndrome. Adults over 30 who learned keyboarding using a typewriter (pre-PC days) learned posture, machine alignment, lighting, chair and table height considerations, as basics taught in every class. Schools that do not teach or practice ergonomics in the classroom could be putting students at risk for future injuries" (Rasicot, 2000, p.24).

This literature review offers a brief look at specific components that are the focus of this study: workstation seating and desk, computer keyboard, monitor and mouse, room lighting and room environment

The first element is the workstation. Whether one is creating a workstation for his or herself, or creating a computer lab at a university, adjustability is the key to setting up ergonomically correct workstations (Rasicot, 2000). Getting the most accurate adjustment for the individual user at the time of use is the prime objective of ergonomics. Comparatively little research has been done on the home office, while countless studies have been conducted on the workplace ergonomics of the workstation (Robertson, 1992; Wright and Friend, 1992; Yeaman, 1986).

Another issue distance students confront is the keyboard type and placement. "One of the worst problems is badly placed keyboards. Arms should be level. Wrists should be flat, much like a piano player. Wrists should not rest on the computer keyboard or table when typing." (Yoder, 1993, p. 30).

Seating is an absolutely essential element to a well-designed workstation. Not only does it immediately influence the user's comfort, it also affects the way one interacts with the rest of the workstation (Badolato, 1995; ANSI/HFS, 1988). Seating has been identified as the most frequent source of health-related symptoms by office workers, regardless of whether or not their job functions entailed the use of VDTs

The Video Display Terminal (VDT) is another issue in home office ergonomics. Badolato (1995) observed that a typical VDT user views not only the VDT screen but also the printed materials used in the task being performed. Therefore, in planning a workstation, one needs to consider both. As for the visual display itself, one needs to consider the following five elements: the size of the display, the height of the display, the distance between the display and the viewer, the viewer's angle of observation, and the viewer's need for sharp detail (Leed and Leed, 1987, p. 234).

Issues of lighting for computer workstations are complex. They must illuminate the work surface where documents might be, but they must also be positioned so as not to create glare on the computer monitor. "Lighting is but one aspect of the luminous environment of any workspace, as part of the collective balance of general illuminance levels, window light control, and surface reflectance and contrast. All of these aspects must work together to provide a visual environment that facilitates learning and productivity without being distracting, tiring, unpleasant, or otherwise inadequate to the task" (Badolato, 1995, p. 39). "The varying recommendations for lighting VDT work spaces are in part due to the need to maintain balance between the lower light level requirements for viewing the VDT, and the higher requirements of hardcopy tasks" (Badolato, 1995, p. 40).

Distance Learners may use laptop computers for their work, however the state of Minnesota does not recommend laptops as primary computers. Cornell University's Ergonomics Web (CUergo, 2001) site offers tips for using a laptop computer. It suggests that for laptop posture, occasional users are better off sacrificing neck posture rather than wrist posture. Full-time users should attempt to set up their laptop as close to a desktop configuration as possible. Mobil professionals who frequently transport a computer need to consider not only the size and weight of the computer, but also the accessories that go with it. If the total system weighs 10 lbs or more, they should consider a carry-on type bag that can be pulled along.

When deciding what to put into a home office, remember that something is ergonomic if it fits you. "People have to remember that if they are going to spend $1500 on a computer, then they need to spend $500 on a workstation, or else it is like buying a nice suit with no tie or shoes" (Goff, 1999). In addition, it is essential to examine the entire work environment to determine all possible causes of discomfort. In other words, it is unlikely that changing only one workplace element, such as the keyboard, will eliminate all discomfort and disorders. It is more important to pay attention to the basics – including good lighting and a desk that isn't facing the window to avoid glare – than investing in gadgets. "In most homes, I suspect that does not happen. But it is absolutely important. The beauty of working at home is you have control over these things (Goff, 1999).

The Survey

The survey instrument used in this study is based upon the literature review and is an adaptation of Badolato's (1995) survey. It contains 65 questions and is web based, allowing electronic data collection. The sections include questions about the study environment's seating, desk, monitor and mouse, room lighting, and room environment. The subjects are students in online university courses offered in Kentucky in fall 2002. Demographic data include questions on the student's physical size, gender, special needs, amount of daily and weekly use of a computer, location of their work area, characteristics of equipment used and type of connection. Data collection is under way as this paper is submitted.

References

Badolato, M.J. (1995). *A user assessment of workspaces in selected music education computer laboratories*. Unpublished doctoral dissertation, Boston University.

CUergo (2001). 5 tips for using a laptop computer. *Cornell University Ergonomics Web*. Retrieved December 4, 2001, from http://ergo.human.cornell.edu/culaptoptips.html

Goff, K. G. (1999, November). Safety in the home office. *Insight on the News*. Retrieved December 10, 2001, from the FindArticles.com database.

Knirk, F. G. (1987). *Instructional facilities for the information age*. New York: Educational Resource Information Center.

Knirk, F.G. (1992, September). Facility requirements for integrated learning systems. *Educational Technology*, 26-32.

Leed, K. B. and Leed, J. R. (1987). *Building for adult learning*. Cincinnati: Leed Design Associates, LDA Publishing.

Rasicot, J. (2000). *Ergonomics 101: How to guard against health problems in the computer lab*, 24-26. Retrieved November 11, 2001, from http://www.electric-school.com.

Revelle, T. (2000, June). Ergonomics 101: Working painlessly. *Interiors & Sourcés*. Retrieved December 4, 2001, from http://www.humanscale.com/ergo info/ergo_101 main.htm

Robertson, M. M. (1992, Summer). Ergonomic considerations for the human environment: Color treatment, lighting, and furniture selection. *School Library Quarterly, 20(4)*, 211-215.

Wright, C. and Friend, L. (1992, May). Ergonomics for online searching. *Online*, 16(3), 13-15, 17-20, 22-27.

Yeaman, A. R. J. (1989). Resources for improving computerized learning environments: An annotated review of human factors literature. *Tech Trends, 34(6)*, 30-33.

Yoder, S. (1993, December/January). Ergonomics forgotten or are we teaching carpal tunnel syndrome? *The Computing Teacher*, 30-31.

Educational Technology in the Classroom: Emphasizing Process Before Training

Until teachers understand how, when, why, where to use technology as a tool for learning, technology integration in their classrooms will not take place. Technology integration has not happened by placing a computer in every classroom, by training teachers in a one-day in-service to use PowerPoint, or by "grading" teachers on their use of technology on teacher assessment instruments. The issue is, then, what can be done to help teachers understand and use technology as an integrated tool for student learning?

Classroom teachers are faced with a major dilemma. They know that their students, now called the "net generation" (Wright, 2001), have technology skills that may exceed their own. In fact this techno-generation's skills in technology use is expanding at exponential rates. Parents of this generation, expect their children to be technologically challenged to increase skills, and that their children's education be fun, interesting, and entertaining. Moreover, parents expect their children's education to be "customized, flexible, and immediate" (Hay, 2000). Faced with students whose expertise is greater than the teachers, parents who expect a tailored education, and administrators who evaluate teachers on their use of technology in the classroom. Add to this equation the public's belief and the media's reinforcement of that belief that teachers are not adequately educating children in the basic areas of reading, writing, and arithmetic. Is it any wonder that teachers are confused, frustrated, and at times resistant to the use of technology?

The status quo is definitely not working. Computers sit in the back of the classroom used only by a few students as a reward for finishing their work or by the teacher to do administrative work while children are in other classrooms. In-service information is carefully filed away, and teacher unions are fighting the technology requirement on assessment instruments. What is needed is a change in focus. Technology should not, and was not intended to be, the focus in classroom instruction. Teachers do not (or should not) teach technology—they should teach their content. When teachers say, "I am teaching computer today." We should be asking why.

Teachers need to be reassured that the primary focus of their teaching is on the content of their courses. Technology is used as a tool for learning. Once teachers understand that their basic responsibilities have remained intact, in-service training and practice of technology integration can occur.

The first step in technology integration at Robert Morris University (RMU) is to assure teachers that their content is the focus. The RMU program starts in traditional ways. We teach our pre-service teachers and train our faculty and pubic school faculty to create content rich lesson plans. Our preferred design is a modification of the Madeline Hunter design. We then ask teachers to evaluate their plan using the ASSURE model to aid in technology integration as an instructional and learning tool.

In structuring our program, the questions for us became, how do teachers design classroom instruction in ways that infuse instructional technologies for a positive learning intervention and how can we teach this to our preservice teachers? The answer lies in teaching careful planning. Lesson planning can follow a design format such as *ASSURE* (Heinich et al, 2000). This design formula considers such pedagogical factors as: anticipate audience (A), state objectives (S), select technology (S), utilize technology (U), require learner participation (R), and evaluate lesson (E). Certainly not unique, this formula follows a general blueprint for lesson plan design with one exception—integration of technology.

Using this model, teachers anticipate the type of learners in their classrooms. To do this, we ask that teachers survey their students using one of several learning style inventories as to the type of learning style students feel most comfortable. Teachers are often surprised that many of their students are not visual or auditory learners. They often discover that while their students have a preferred learning style, students are comfortable with a mixture of styles. We also suggest that teachers survey their students before introducing a new unit or concept. There are several ways in which we suggest that teachers complete this step, but the point is that teachers need to know what their students know before teaching. Although many teachers understand the importance of knowing what their students know before teaching, it is even more critical when using technology.

According to a 1999 survey, 71 % of "U.S. households with children ages 8-17 have computers, and 67% of those computers are connected to the Internet" (Annenberg Public Policy Center, 2000). What this means to public school teachers is that many of their students technologically aware of the ways in which the computer and Internet can be used as a learning tool, many are comfortable with using these technologies without teacher instruction. Even more importantly, Tapscott (1999) argues, that because children come to school with these skills, "liner learning [must] give way to hypermedia-based learning, instruction becomes construction and discovery, teacher-centered instruction cedes to learner-centered instruction."

The next step in the ASSURE model is to state behavioral objectives. Good teachers have good behavioral objectives for their lessons; however, they do not always state these objectives for their students. ASSURE emphasizes the need to clearly state the objectives in ways that the students understand what they are to do. At RMU, we teach the writing of behavior objectives using Bloom's taxonomy. This ensures that teachers and students know what the expectations of the lesson and that students are clearly engaged in active learning. In the ASSURE model, the objectives for the class will be written from a pedagogical point of view based on the specific course outline.

Technology planning then occurs in the execution the objectives of the lesson—the next two steps of the ASSURE model focuses on the when, where, and how to use the technology. We ask that teachers inventory the types of technologies available to them (both hardware and software). The inventory needs to be updated frequently, and it ensures that teachers are aware of new purchases or equipment failures. After the inventory, teachers select the technology they feel will be facilitate learning. The technology is selected to better facilitate the objectives of the lesson and the type of learners in the class. Next, the teacher must utilize the technologies in a professional manner. A fluid delivery helps to ensure learning; therefore, we stress the need to practice delivery with the technology. During this step, teachers can evaluate their use of technology. We ask teachers to answer the following question, "Where was the focus of the lesson—on the content or on the technology?" Unless teachers feel as comfortable with using technology as they do the overhead, for example, the technology becomes an "add-on" component of the lesson instead of an integrated part. Essentially, this design formula promotes a positive intervention of technology into teaching.

Next, the ASSURE model requires that students are actively participating in learning. The most often type of technology that we observe in classrooms is teachers using

PowerPoint presentations. During these presentations, the lights are down, students are staring ahead or are given instructions to "take notes," and teachers read the text on the slides. In this scenario students are not actively engaged in learning. They are merely observers of learning. We suggest that teachers allow students to participate by creating some of the slides, using graphic organizers (either on line or hard copies) while information is being disseminated, and that students are required to "research" information via the Internet to add to the learning. Even very young students can and do help to create information that can be uploaded to the class web page, create new letters using publishing software to send to parents, print pictures and other information from Internet sources, use electronic libraries to find articles, and use other software to help their peers gain a better and more complete understanding of concepts and ideas. We suggest that teachers brainstorm various ways that students can become more involved in their learning. We realize that student involvement may require the teacher to reorganize the physical layout of the classroom, redirect time on task, and redo lesson plans. We know, however, that when students are actively participating in their learning and have ownership of their learning, they will take more responsibility for their learning.

Finally, the ASSURE model requires that teachers evaluate the lesson and the student learning. Teachers need to carefully reflect on the positive and negative aspects of the lesson. The model, however, also requires that students evaluate their learning. This is important—and perhaps a little different—in that students are not often asked about what they learned and if the way in which information was delivered was beneficial to them. By knowing what is working and what is not, teachers can better plan for the next lesson.

Using technology as a positive intervention implies a conceptual understanding of technology as more than a motivational tool or a substitute for more traditional types of instructional methods or pedagogy. It means that technology must not be thought of as a reward for students who have finished their schoolwork. Understanding technology as a positive intervention means that teachers do not use technology for drill and skill programs for remedial students and a reward or enrichment activity for their gifted and talented students; instead, technology must be thought as a way to help all children, whatever their ability level, use technology in the same ways they use and are given access to other intervention techniques and methods.

Newman (1990) examined this issue of intervention and formulated the framework for six critical questions. These include the following:

1 What is the pedagogical goal of the lesson, and what pedagogical theory does it satisfy?
2 What is the instructional intervention that has the potential to achieve the identified pedagogical goal?
3 As the intervention is implemented, what factors enhance or inhibit its effectiveness in achieving the pedagogical goal?
4 How can intervention and its implementation be modified to achieve more effectively the pedagogical goal?
5 How has the instructional environment changed as a result of the intervention?
6 What unanticipated positive or negative effects does the intervention produce? (Reinkins & Watkins, 2000).

The ASSURE model helps to answer the above questions; it also helps teachers understand the importance of using technology as an integrated learning tool.

A custom fit

The general trend in the use of technology in k-12 schools has been to "streamline" the process through an approach that basically requires familiarity if not expertise using specific software in prescribed ways (usually project-based). While this is not an "incorrect" approach, my own observations and research have demonstrated that it favors students who already have both computer and academic skills and places inexperienced and/or under-achieving students at a disadvantage. This in spite of the widely held belief idea that technology in schools lowers the discrepancy between different schools and districts. In other words, the "digital divide" extends beyond technology access to a question of "appropriate" technology access.

Self-paced and self-evaluative instruction that adapts to the skill level and time required of individual users has been developed (and introduced) in recognition to this multiple user/multiple needs. This has proven effective, but leaves out some crucial scaffolding required by the second "needier' student group.

My hypothesis is that more academically experienced and successful students already have a variety of schema and learning strategies as well as hands-on computer experience that they bring to a new learning situation which employs [computer] technology. A model for teaching with technology based on such students almost guarantees further alienation and sense of disempowerment on the part of the students in the second group. Merely providing powerful tools does little to encourage an interest in learning in these individuals.

I have sequenced the use of computer technology by the students through four distinct steps. In the first, content is provided by models/examples/simulations. Students respond to questions using self-paced and looped learning software. (i.e. incorrect responses allow for another viewing of the content area.) This is much like the existing self-paced and self-evaluative instruction mentioned earlier.

In the second step students and the teacher/instructor look at the underlying structure and design of provided examples. They use concept and idea mapping software to create graphic models of these efforts, and then use the same software to plan and outline a project of their own.

The third step has the students using software of various sorts (word processing, graphics, presentation, etc.)) to actually design and create projects that are consistent with their outlines.

The final stage has students present the projects to the class, providing an overview, answering questions, and summarizing their efforts.

This approach has proven itself to be effective in a variety of ways. Students remember the material better, can discuss and present their point of view more persuasively, and -in general - are more engaged, which - given the nature of the audience - is probably the most important thing. The reasons for this are fairly straightforward:

- Having little experience with either appropriate models or responses, students cannot be assumed to know how to properly use software, regardless of its level of complexity. Offering such models as well as a means to analyze and deconstruct them is crucial.
- Applying this new analytical knowledge to thinking about and creating a framework for a new project allows - in fact requires- higher thinking skills.
- Making use of production tools to give actual form and shape to the project not only reinforces the relationship between plan and content but emphasizes the process.
- Presenting the material to an audience forces a critical distance and an analysis to allow a view of the initial concept, the actual plan/structure, and the finished product in addition to the development of communication skills often sorely required by this audience.

Much of this is a staple in the day-to-day things that a teacher will do in a classroom, but it has not yet really been applied to the use of technology in the classroom. At this point I don't believe that specific hardware or software is crucial to the educational use of technology or that it will make a significant difference to the learning process of a student unless it is specific to the context and learning needs of that individual.

I have been working with a participating teacher in a continuation high school in San Bernardino, California. All of the students are individuals who have been transferred to this school because of academic and behavioral problems at their previous schools. Such schools are the last stop in a "open" system; after this individuals will go to the "Juvenile Hall" schools which are the current version of "reform schools" ; in both cases generally regarded as the introduction to the prison system. In this specific instance, we have taken a collection of recycled computers (both Mac and PC) and set up a computer lab environment that allows students access to the web as well as a variety of programs, but that is hardly "high-tech". We have introduced a sequenced program in economics, history, and geography that is individuated and that allows students to deal with the content in the ways outlined above. Our results have been remarkable on all levels, from attendance (traditionally a problem with such students) to test scores to more qualitative indicators (types of projects, student interaction, etc.)

I believe this research suggests an additional approach or perspective to technology instruction within teacher training. I still need to conclude my study, and I would like to follow it up with further research (different content, applications, broader samples, etc.) as well as extend the study to other Colleges of Education.

The Internet in Education: Two Different Examples

Nicoletta Sala
Academy of Architecture - University of Italian Switzerland
CH 6850 Mendrisio – Switzerland –
nsala @ arch.unisi.ch

Abstract The Internet is a good resource in teaching and learning activities. The aim of this paper is to present two different experiences which involve the Internet in educational paths in high school and university. In our first experience, named Web Learning Environment (WLE), we have evaluated the use of the WEB and its resources to develop a learning environment. We have applied our approach in a classroom (sixteen students, aged 16-17) of a high school in Italy. The project has been divided in six different phases: the knowledge of the Internet, the research in the Internet, the access to the FTP, the didactics with the Internet, the communication using the "Net", and the creation of a cooperative hypertext. Second experience, named "Cybermath", is an attempt to build some hypermedia modules to introduce the fundamental of Mathematics in a undergraduate course at the Academy of Architecture of Mendrisio (University of Italian Switzerland), Switzerland.

Introduction

The Internet and computer systems have been testified to have significant impact on learning and teaching Using the new media and the Internet in the learning process we have observed that the role of the classroom teacher is evolving from that of a giver of information to that of a facilitator of student learning (Sala, 1999; Sala, 2001). The aim of this paper is to present two our different experiences which involve a high school and university. The first project, named Web Learning Environment (WLE), represents an attempt to stimulate the active use of the Internet (and its resources) in the educational process. For this reason it has been divided in six different phases: the knowledge of the Internet (directly in the Web), the research of some educational information in the Internet, the access to the FTP (e.g. to download some interesting software tools to introduce in the educational process), the didactics with the Internet (using educational hypermedia online), the creation of a cooperative hypertext, and the communication using the Internet. The aim of our second project, named "Cybermath", was to create a remedial course of Mathematics to help the heterogeneous students that attend the Academy of Architecture of Mendrisio (Switzerland).

First Experience: The Internet To Create A Learning Environment In A High School

Innovative use of technology combines telecommunications (e-mail, online resources), multimedia authoring (home page editors), user-friendly convenient applications software are modifying respectively the role of the teachers and of the students in the didactic environment. The role of the classroom teacher is evolving from that of a giver of information to that of a facilitator of student learning. The role of the students is more active than the last years. Our first educational project is an attempt to build an active learning environment using the Internet. It has been divided in six phases: the knowledge of the Internet, the research in the Internet, the access to the FTP, the didactics with the Internet, the creation of a cooperative hypertext, and the communication using the "Net". In the first phase the students, organised in eight groups each composed by two persons, have learnt the Internet directly in the Web using some special interactive lessons, developed by the "Polo Didattico e di Ricerca di Crema" Italy. These lessons are available at the Internet address: http://weblab. crema.unimi.it/ internetcourse/. Using these interactive lessons the students have learnt: the story of the Internet, the correct navigation in the Web, the recognition of the different types of hyperlinks (e.g. hot words, icons, buttons, and images), the netiquette, and the basis of the telecommunications (computer networks, protocols). In the final part of this phase we have proposed to the students a test to evaluate the knowledge on the subjects explain in the hypertext lessons. In the he second phase our students have learnt to use the search engines (e.g. Altavista, Yahoo, Google, Vivisimo), comparing their performances using the same keywords. They have also discussed these results using an information technology point of view. In the third phase the students have analysed the capability to download, to install and to use some shareware and freeware software (on mathematics, geometry, Italian literature, information technology) in their educational process. In the four phase the students have used some educational Internet sites dedicated to the Italian literature, to the physics, and to the mathematics. The students have improved their composition technique, after the exercises proposed on these Internet sites. In the fifth stage the students have created a cooperative hypertext (using HTML) dedicated to Bonaventura Cavalieri (1598 - 1647) (an Italian mathematician) for an International Conference of Mathematics. In course of execution the phases have been: the bibliographical research of information (using some traditional textbooks and the Internet); the choice of information to put in the hypertext; the hypertext's story board; the realisation of the user interface; the encoding of information in hypertextual form; the control of hypertext (links, hot words, etc.). Sixteen students, organised in eight work groups, have developed the following parts: "Cavalieri's biography"; "Cavalieri: the religious figure", "Cavalieri's scientific production", "Cavalieri and the town of Verbania", "Bibliography", and "Other sites on Cavalieri" (with some links to other Internet sites). The students put a particular care to make "friendly" the user interface for easy navigation, and to avoid the "Lost in hyperspace" problem (Conklin, 1987; Calvi,1997). This hypertext, available at the Internet address: http://www.verbania.alpcom.it/scuole/cavalieri/cav0e.htm, has been written in two languages: Italian and English, and it has been organized in a hierarchical structure, because to avoid some of the navigational issues associated with hypertext (Girill & Luk, 1992; Lin & Davidson-Shivers, 1996; Last et al, 2001; Stanton et al., 2001). This phase is an example of "Learning by Doing" environment because the students have also learnt the history of mathematics during the hypertext development. This is also an example of cooperative learning (e.g. to build the knowledge of the use of the software and hardware tools involved in the hypertext development). After this phase we have controlled the students' learning rate using some tests. The sixth phase has been dedicated to the asynchronous communication with other European schools using the e-mail. In a particular case a disabled student of our classroom has researched some Italian and Swiss "cyber-friends". Internet became for him a new way to overcome his handicap and his isolation. In this case, the absence of face-to-face cues and prior personal knowledge of the other students have helped the disabled student to overcame his inhibition.

Second Experience: The Internet To Create A Learning Environment In University

Second experience involves the use of the Internet to build a hypermedia course of Mathematics (Sala, 2001). This hypermedia course, named "Cybermath", is necessary because the students that attend the Academy Architecture of Mendrisio (University of Italian Switzerland) come from different countries and different kinds of high schools, for this reason the project "Cybermath" intends to develop a propaedeutic course of Mathematics to introduce some particular subjects. The aim of the project is to help the students to overcome the strong dislike for the mathematical subjects using a medium, the computer, which has a good communicative impact. Inside this project different media are involved, but their use is calibrated to avoid the cognitive overloaded; for example: animation techniques (e. g., the generation of a cosine function a or conic); digitised television camera images to illustrate some architectural application of mathematical concepts (e.g., the golden section or the symmetry); audio supports to stress some topics in a lesson where it is not possible to use a written description; Virtual Reality environment (e.g. to manipulate some particular geometrical objects).The project intends to develop a distance learning model:

- to introduce the fundamental of Mathematics;
- to permit to the students to overcome the problems of the different background before the beginning of the academic year;
- to help the students to reach a good grounding in Mathematics.

We have established the following didactic objectives:

- to know and to apply the fundamental of the Algebra and Analytical Geometry,
- to solve some typical problem of the Analytical Geometry,
- to know and to apply the fundamental of the Trigonometry,
- to know and to apply the fundamental of the Mathematical Analysis,
- to know the interconnections between the Mathematics and the real world (e.g., the mathematical applications in architecture, in economics, in arts, and life science),
- to prepare the students to use the new media inside a continuos training.

Figure 1 shows our Distance Learning Environment.

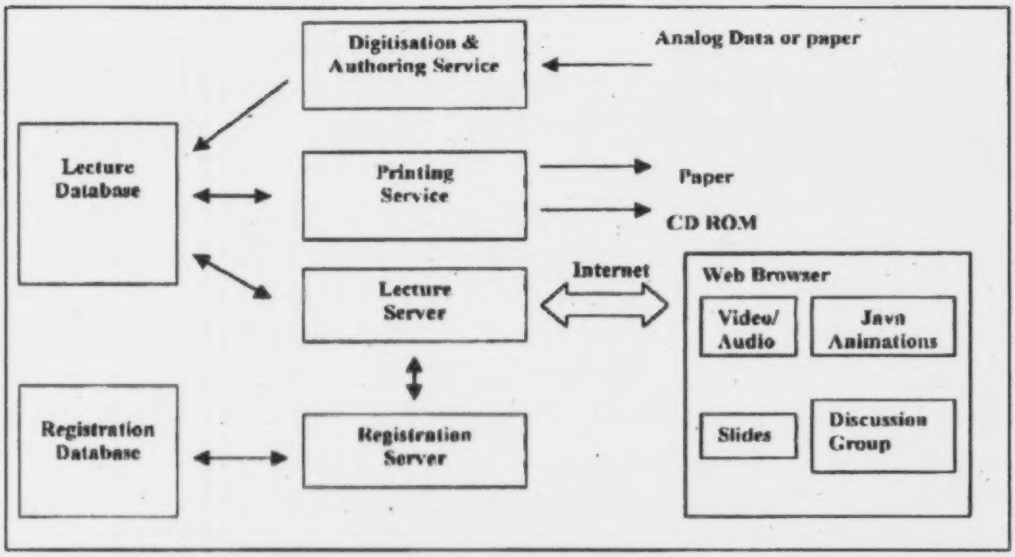


Figure 1 Cybermath's Distance Learning Environment.

"Cybermath" learning environment provides the user registration; the hypermedia lessons; the course materials; the tests online; some active links to other Internet sites dedicated to the mathematics.

The modular structure of this project will permit the addition of the other modules that will render the course flexible for all faculties where the Mathematics is present. This hypermedia course is structured on a set of lessons (modules), in three languages: Italian, English, and German. In each module, organized like a hierarchical hypertext, the graphics interface is "user friendly" for an easy navigation (to avoid the Conklin's problem "lost in hyperspace") (Conklin, 1987). The learners can use "Cybermeth" in two different ways:

- the asynchronous use of the hypermedia online modules (e.g., students study at home using different ways to communicate with the tutors: e-mail, Forum of discussion and Video Conference);
- the synchronous use of the modules, in university, with the presence of the tutors.

In this way, the students can adapt the learning rate to their time availability and cultural background. They can study the fundamental of Mathematics using the Internet as a medium to receive the information, and then self-verify their knowledge level by solving practical exercises and answering a series of questions. Each lecture includes several tests to control the level of the acquired knowledge on the educational objectives and lesson subjects. Examinations include: simple questions or problems, and multiple choice tests. Other important educational objective is to train the students to integrate the hypermedia solutions in their learning processes and in their vocational training. This hypermedia course is organised in six modules using a hierarchical hypertext. In fact, recent researches showed that a more tree-like or hierarchical text structure limits navigational difficulties as compared to a purely heterarchical structure (Girill & Luk, 1992; Stanton et al., 1992; Lin & Davidson-Shivers, 1996; Billingsly, 1982). The hypermedia modules have been written using the Dynamic Hypertext Markup Language (DHTML) with the aid of Java Applet and Java-Script procedures to introduce multimedia codes. Virtual objects, e.g. virtual polyhedra, created using Virtual Reality Language Modelling (VRLM) are also used to help the leaning impact.

Conclusions

Our projects are two different attempts which propose an active use of the Internet and the World Wide Web inside the teaching process in agreement with other researches (Putri Ratna et al. 2001, Maraschi et al., 2001, Choi et al., 2001). The "Net" and the multimedia technologies offer significant benefits in educational process, and they show that there are clear educational advantages to be derived from cooperative student activities. Our projects present a modification of the role of the teacher. Before information technology revolution, the teacher was only a giver of information now he is a facilitator of student learning. This approach is in agreement with Papert's point of view: "Better learning will not come from finding better ways for the teacher to instruct but from giving the learner better opportunities to construct" (Papert, 1990, p. 3). The typical student of the new millennium will be academically independent and will study using distance learning modules. He will be self-motivated with an inquiring nature. This student will be able to articulate questions and will be better able to discuss academic subject matter than the students educated in today's traditional classroom environment (Ben-Jacob et al., 2000). The benefits to develop an educational environment using the "Net" are learning without any restrictions as time or space; courses based on modules with flexible time schemes; great responsibility taken by students in the learning process, and active role of the students in their learning environment.

References

Ben-Jacob, M. G., Lavin, D. S. & Ben-Jacob, T.K. (2000). The Learning environment of the 21st Century. *Educational Technology Review*, 13, 8 – 12.

Billingsly, P.A. (1982). Navigation through hierarchical menu structure: does it help to have a map? *Proceedings of the Human Factors Society 26th Annual Meeting*, 103 – 107.

Calvi, L. (1997). Navigation and disorientation a case study. *Journal of Educational Multimedia and Hypermedia*, 6 (3/4), 305 – 320.

Choi, K., Lee, S. & Lee, J. (2001). The Development of the Learner Analysis System for Remote Education On The Web. *Proceedings International Conference on Computers in Education (ICCE)*, Seoul, Korea, 1161 – 1164.

Conklin, J. (1987). Hypertext: An Introduction and Survey. *IEEE Computers* 2(9), 17- 41.

Girill, T. R. & Luk, C. H. (1992). Hierarchical search support for hypertext on-line documentation. *International Journal of Man-Machine Studies*, 36, 571 – 585.

Last, D.A, O'Donnell, A.M. & Kelly, A.E. (2001). The Effects of Prior Knowledge and Goals Strength on the Use of Hypertext. *Journal of Educational Multimedia and Hypermedia*, 10(1), 3 – 25.

Lin, C. & Davidson-Shivers, G. (1996). Effect of linking structure and cognitive style on students' performance and attitude in a computer based hypertext environment. *Journal of Educational Computing Research*, 15, 317 – 329.

Maraschi, D., Cerri, S. & Martinengo, G. (2001). From CD-ROM to Web-Served: Reserve Engineering of an Interactive Multimedia Course. *Proceedings IEEE International Conference on Advanced Learning Technologies*, Madison, Wisconsin, USA, 203 - 204.

Papert, S. (1990). Introduction. In I. Harel (Ed.) *Constructionist learning*. Boston: MA MIT Media Laboratory, 1-8.

Putri Ratna, A. A., Bayuaji, L.& Salman, M. (2001). Design and Implementation of Distance Learning in Basic Computer Course. *Proceeding of the IASTED International Conference Internet and Multimedia Systems and Applications.* Honolulu, Hawaii, USA, 51 – 55.

Sala, N. (1999). Surfing in the Web: An Experience of the Use of Internet in Educational Process. *Proceedings World Conference on WWW and Internet WEBNET 99*. Honolulu, Hawaii, USA, 1411 – 1412.

Sala, N. (2001). Cybermath - The Future of Learning of Mathematics: A Case of Study. *Electronic Proceedings of World Conference on Open Learning and Distance Education ICDE 2001*, Dusseldorf, Germany.

Stanton, N.A., Taylor, R.G. & Tweedie, L.A. (1992). Maps as navigational aids in hypertext environment. *Journal of Educational Multimedia and Hypermedia*, 431 – 444.

MISTRAL: an intelligent platform for distance education incorporating teaching strategies which adapt to students' learning styles

Pedro Salcedo Lagos
Department of Educational Research and Information Technology,
Faculty of Education, University of Concepción
CHILE - psalcedo@udec.cl

Yussef Farrán Leiva
Facultad de Ingeniería, Dpto. de Ingeniería Informática
y Ciencias de la Computación, Universidad de Concepción
CHILE - yfarran@udec.cl

Eduardo Mardones Fuentes
Department of Educational Research and Information Technology,
Faculty of Education, University of Concepción
CHILE - psalcedo@udec.cl

Abstract: This work presents **Mistral** an intelligent platform for distance education that fully automates the process of creating and maintaining adaptative courses on World Wide Web (WWW).

The first section of the paper analyzes the state of the art in the area of authoring tools for intelligent tutoring systems and adaptive educational systems, folowed by a description of the authoring and deployment processes. The next section centers on the course creation process. The paper finishes with one empirical results taken from one real authoring experiences and the conclusions derived from them.

INTRODUCTION

Between 1970 and 1990, computer-assisted teaching was strongly influenced by the incorporation of Artificial Intelligence techniques into the ways computer systems and new teaching strategies were developed. Seymour Papert and Marvin Minsky, to take just two examples, regarded computer science not only as an explanatory instrument of the way learning and thought function, but also as an instrument for change which could alter and possibly even improve the way people learn and think [Papert, 1981]. A concrete example of this can be seen in the work of PEG (the PROLOG Education Group) in the University of Exeter (in Great Britain). This group works on the design and application of "open education" programs which facilitate students' work in the organization of and access to important knowledge through historical simulations, problem-solving adventure simulations, and so on.

Looking elsewhere, we find two main types of application: *intelligent tutoring systems* (ITS) and *interactive learning systems*. "Microworlds" contextualised in *environments of interactive development* are the most developed of this type of application.

Intelligent tutoring systems generally have well-defined and commonly accepted learning objectives like factual knowledge and procedural abilities – this being the result of an objective perspective of knowledge – which can be measured through standardized tests. The developers of these systems have used traditional learning, teaching and evaluation methods to try to show that they have significantly improved the speed and quality of students' learning. And, to a certain extent, they have successfully achieved their aim.

Although the full bibliography is incredibly large, it is possible to cite several books, articles and congresses which have compiled the work done in the last few years: [Wenger,87], [Clancey,87], [Self,88], [ITS,88], [BBS,89], [ElCo,90], [Fra Ga,90], [Birn,91a], [Good,91], [FaPso,92], [Costa,92], [ITS,92], [PoRi,92], [ReShu,92], [LaDe,93], [GreMc,94], [Salcedo,99], [SaFa,96], [SaFa,00], [SchaCle,95], [ITS,96], [Regian,97], [ITS,98], [ITS,00], [KeFoFe,01] and [ITS,02].

During the last decade, ITSs and Adaptive Hypermedia Systems (AHS) have overcome their laboratory prototype status and have begun to be installed in classrooms and in workplaces, showing themselves to be very effective [Murray, 1999]. Despite the fact that these systems are every day more widespread and efficient, they are still difficult and expensive to build, a factor impeding their wider use. In order to foster the creation and use of these systems, the objective has been established to build "authoring tools" in order to facilitate the construction process for people without past experience of Artificial Intelligence. The study of these tools has arisen practically at the same time as the ITSs themselves, and different prototypes have already been constructed. In his work *Authoring Intelligent Tutoring Systems: An Analysis of the State of the Art* [Murray, 1999], Tom Murray describes each prototype's particular characteristics as concerns the creation of the teaching-learning system and the tutoring system which is generated.

Moreover, the rise of the Internet over the past few years has led to projects which relate to its use for distance education. Distance education systems on the World Wide Web, based on the use of AHS and ITS, have become especially important. The same can of course be said of systems, or platforms, that include "authoring tools", which have meant that these systems can actually be developed. Several of these systems are described below:

- **TANGOW** (Task-based Adaptive learNer Guidance On the Web). This platform is designed to develop courses over the Internet [Carro, 2001] which can adapt to students, taking into account their personal characteristics (age, language, etc) as well as their achievements during the learning process.
- **APHID** [Kettel, Thomson & Greer, 2000] is a prototype which semi-automatically generates personalized hypermedia applications based on a group of hypermedia elements, a domain model and a learner model.
- The **AHA (Adaptive Hypermedia Architecture)** system [Bra & Calvi, 1998] facilitates the creation of adaptive courses for the World Wide Web. The AHA system is based entirely on the Web, in so much as it only uses standard languages and tools. In order to develop an adaptive course, one only needs to create a group of HTML pages and add comments to them, including the conditional instructions which are evaluated, in order to decide which contents will be shown to users and which will not.
- **Arthur** [Gilbert & Han, 1999] compiles the different teaching styles of different instructors who teach the same contents and makes them available to each student.

The system proposed by this article serves a similar purpose: *MISTRAL* is an aid for developing adaptive and accessible courses over the Internet. Its usefulness resides in how it helps teachers, who are not experts in computing, to construct teaching-learning systems in the specific fields in which they *are* experts. It facilitates personalized teaching in which courses can adapt to students' learning strategies and requirements.

2. MISTRAL. General Description

The functions of *MISTRAL* can be summarized as follows:

- It makes possible the planning and administration of different courses for multi-users.
- It facilitates the acquisition of knowledge.
- It builds the concrete structure of the course (AHS/ITS) from the specifications of given contents and activities.
- It is based on the evaluation strategy of "Portfolios". It generates, on the server, a folder structure for each course and student where the latter can deposit his/her activities so that the teacher can evaluate him/her later using the portfolio technique.
- It incorporates knowledge in order to detect and diagnose the level of learning achieved in the unit and the sequence of activities necessary to support the unit.

- It automatically generates a personalized Virtual Classroom, with discussion groups in which students with different learning styles participate. In order to strengthen their different styles, class-members contact each other by electronic mail. A participatory follow-up system notifies students (again by e-mail) of low participation in certain activities.
- It builds the course, selecting or generating regulations and whatever else is necessitated by the knowledge specified (which can be modified or updated).

3. The Process of Constructing a Course using *MISTRAL*

This process has two phases:

- *Phase 1: entering the domain*. The main purpose of this phase is to structure the knowledge that the system acquires into objectives from which derive the contents as well as the different activities that the teacher or administrator deposits on the server.
- *Phase 2: incorporating learning strategies and evaluation*. The main purpose of this phase is to incorporate the sequence of activities which corresponds to a concrete style and form of evaluation.

4. Example

Thanks to the *MISTRAL* platform, various courses and adaptive Websites have already been developed. Evaluations have proved the effectiveness of *MISTRAL* as a system for teaching and administering distance courses.

The first course developed with *MISTRAL*, whose main objective was to exemplify how the system works, was related to "Analysis and Design Oriented to Objects" for third-year IT Engineering. The course provides proof of the different possibilities of the platform's adaptability:

- The structure of the course adapted itself to the students' personal characteristics as well as to their pre-knowledge of programming languages and modeling tools. The designer (a teacher) decided to incorporate the possibility of choosing the programming language to be used during the course (C++, Pascal Object, Visual Basic, etc) or starting with a review or in-depth study of a language and choosing the modeling tool (Rational Rose, Microsoft Visual Modeler, GDPro, etc) which allowed him to adapt activities and the sequence of the contents.
- The structure of the course could be adapted to suit each student's learning style. The system measured each student's style and later adapted the most suitable strategy to his/her characteristics.
- After the student developed the sequence of activities most appropriate to his/her style as suggested by the system, the structure of the course was adapted to the learning he/she had accomplished. If the student had not accomplished the minimum grade during the evaluation, the system proposed a series of complementary activities (different from the previous ones) which allowed the student to improve his/her learning.
- The activities suggested by the teacher were very diverse, saving him a considerable amount of work, thereby creating the possibility of using material which already existed on the Internet.
- The private discussion group brought together students with different learning styles so that these different styles could be encouraged.
- The possibility of depositing different types of work on the server (portfolio technique) allowed both the student and the teacher to revise what they had accomplished.

Conclusions

In this article, I have presented a tool which will help to create and administer adaptive distance courses over the Internet. With *MISTRAL*, course structures and contents are managed independently, thus facilitating the process of adapting to each student.

Once more courses have been successfully developed with this educational distance platform, our next goal is to validate *MISTRAL* tools in terms of the actual facilities that *MISTRAL* provides for constructing and administering new distance courses. Our hope is that *MISTRAL* will be validated and put into practice as a result of the success of these courses' learning-teaching processes.

References

[BBS,89] Bierman, D., Breuker, J. and Sandberg, J., eds. (1989). **Artificial Intelligence and Education: Synthesis and Reflection**, Springfield,VA: IOS.

[Birn,91a] Birnbaum, L., ed. (199la). **Proceedings of the Conference on the Learning Sciences**, Charlottesville: AACE.

[Clancey,87] Clancey, W.J. (1987). **Knowledge-Based Tutoring: the GUIDON program**. Cambridge, Mass.: MIT Press.

[Costa,92] Costa, E., ed. (1992). **New Directions in Intelligent Tutoring Systems**, Berlin: Springer- Verlag.

[ElCo,90] Elsom-Cook, M., ed. (1990). **Guided Discovery Tutoring Systems**, London: Paul Chapman.

[FaPso,92] Farr, M.J. and Psotka, J., eds. (1992). **Intelligent Instruction by Computer**, Washington, DC: Taylor and Francis.

[FraGa,90] Frasson, C. and Gauthier, G., eds. (1990). **Intelligent Tutoring Systems: at the Crossroads of Artificial Intelligence and Education**, Norwood, N.J.: Ablex.

[Good,91] Goodyear, P. (1991). **Teaching Knowledge and Intelligent Tutoring**, Norwood, NJ: Ablex.

[GreMc,94] Greer, J.E. and McCalla, G.I., eds. (1994). **Student Modeling: The Key to Individualised Knowledge-Based Instruction**, Berlin: Springer.

[ITS,88], [ITS,92], [ITS,96], [ITS,98], [ITS,00], [ITS,02]

[KeFoFe,01] Kenneth D., Forbus and Paul J. Feltovich (2001) **"Smart Machines in Education"**, Forbus and Feltovich Editors.

[LaDe,93] Lajoie, S.P. (1993). **Computer environments as cognitive tools for enhancing learning**, in S. Lajoie and S. Derry (eds.), Computers as Cognitive Tools, Hillsdale, N.J.: Erlbaum.

[Papert,81] Papert, S. (1981) "Desafio a la Mente", Ediciones Galápagos.

[PoRi,92] Polson, M.C. and Richardson, J.J., eds. (1988). **Foundations of Intelligent Tutoring Systems**, Hillsdale, N.J.: Erlbaum.

[Regian,97] Regian, J. W. (1997). **Functional Area Analysis of Intelligent Computer-Assisted Instruction.** Report, TAPSTEM ICAI-FAA Committee, Brooks Air Force Base, Texas.

[ReShu,92] an, W. and Shute, V.J., eds. (1992). **Cognitive Approaches to Automated Instruction**, Hillsdale, N.J.: Lawrence Erlbaum.

[Salcedo,99] Salcedo Lagos Pedro (1999). Tesis Magíster **Prototipo de un tutor multimedial adaptativo inteligente con base en la propuesta de un modelo para el usuario**, Universidad de Concepción.

[SaFa,00] Salcedo Lagos Pedro, Farrán Leiva Yussef (2000), **Implementación y Evaluación de un STI**, Jornadas UNED 2000. Conocimiento, Método y Tecnologías en la Educación a Distancia, Palencia - España.

[SaFa,96] Salcedo Lagos Pedro, Farrán Leiva Yussef (1996), **Modelo de un Tutorial Inteligente**, Revista PAIDEIA – nro.21. Ediciones Universidad de Concepción.

[SchaCle,95] Schank, R.C. and Cleary, C. (1995). **Engines for Education**, San Mateo: MorganKaufinan. Schank, R.C. and Edelson, D.J. (1989).

[Self,88] Self, J. (1988). **A perspective on intelligent computer-assisted learning** /Computers in Education 5-13 pp. 239-246 / Open University Press.

[Wenger,87] Wenger, E. (1988). **Artificial Intelligence and Tutoring Systems**, Los Altos: Morgan and Kaufmann.

Integration of Cognitive Theories into the Instructional Design of Educational Technologies

The focus of this discussion is the incorporation of cognitive theories in the instructional design of educational technologies. The specific topics covered include simulations for business games and medical studies as well as how cognitive theories can be applied to distance learning courses taught using a course management system such as Blackboard. It is critical to apply theories of cognition to how individuals learn in these environments. Such environments have the possibility of providing a dynamic experience for the user and provide a vehicle for life-long learning.

The recommendations provided in this paper focus on how instructional technology should be designed using theories of cognition. Issues of how content should be presented include context, opportunity for practice and elaboration, incorporation of visual aides, and the hierarchical organization of material. In addition, visual perception and recognition are considered in the development of realistic simulations.

1. Recommendation: The context in which information is presented should enable students to process the information at a deeper level.

Validity of Recommendation:

The level of processing determines the amount of information that will be remembered. Better learning will result if information is presented in a context that allows learners to participate in elaborative processing. Anderson and Bower (1972, as cited in Anderson, 2000) had subjects try to remember simple sentences. In one condition subjects just studied the sentences and in the second condition subjects were asked to generate an their own elaborations. Subjects who created their own elaborations were better at recall. It is speculated that the advantage was caused by the redundancy created by the elaboration.

Elaborations created by either the teacher or student are successful as long as the information to be learned is enhanced by this process. Stein and Bransford (1979, as cited in Anderson, 2000) created groups that required students to remember a set of simple sentences. In one group subjects were required to generate their own elaborations which helped in recall. Subjects in the experimenter-generated elaborations had better recall because the elaborations were carefully constructed to enable information retention.

Context can greatly influence memory by affecting what is encoded into the memory trace that records the event. This is dependent on how much the learner integrates the context with the memories. Smith, Glenberg, and Bjork (1978, as cited in Anderson, 2000) showed the importance of physical context. In their experiment subjects learned two lists of paired words on different days and in different places. Subjects were able to better remember the pairs when they were recalled in the same place they were first learned.

Memory for the to-be-remembered information can also be dependent on the context of other to-be-remembered material in which it is embedded. Thompson (1972, as cited in Anderson, 2000) had subjects study a pair of words such as "blue sky" and were told they would be responsible for recalling only the second word in the pair. Subjects were better at recall when they were presented with the pair of words instead of just the one.

Recommendation Application:

This recommendation will be applied to a computer-generated simulation used for surgical training. Such simulations will allow surgeons to practice hundreds of procedures prior to patient contact, and the practice carries no risk to live patients.

The surgical environment is digitally reconstructed allowing the student to learn in a context that is similar to the context in which the skill will be later applied. For example, the use of a computer monitor during Minimally Invasive Surgery (MIS) simulation replicates the use of a monitor for the actual procedure on a patient. In addition, students can manipulate surgical instruments and receive feedback by viewing the results of these manipulations on a physiological model.

The simulation will also incorporate the use of strategically placed elaborations. As students learn about a particular surgical procedure, the students will be presented will additional information that will enable retention. For example, the simulations will also mimic the look, sound and feel of the real procedure. Digitally created organs will not only look like real organs, they will act like real organs by undulating and reflecting the light when touched, and compress when squeezed or cut.

2. Recommendation: Learners should be provided with feedback and the opportunity to practice/rehearse new information.

Validity of Recommendation:

A memory's level of activation, which determines how accessible a memory will be, is determined in part by how much the memory has been practiced. Each time we use a memory trace it will increase a little in its strength. Strength of a trace is determined by how active it can get, and this accessibility can be increased by repeated practice.

A study by Pirolli and Anderson (1985, as cited in Anderson, 2000) showed the effects of practice. They had subjects practice simple sentences and then examined the effects of practice on the subject's ability to recognize the sentences. The data showed that memory performance improves as a function of practice – the power law of learning. As a memory trace becomes stronger, it can receive more activation, which facilitates retrieval.

Elaborative processing leads to better recall as well as the number of inferences that can be recalled. When students elaborate on material that they are studying they tend to recall more information and recall inferences that they did not study. In studying textual information students should be encouraged to either answer questions while reading or, preferably, generate their own questions.

Frase (1975, as cited in Anderson, 2000) compared the effects of making up questions and the effects of answering them. The results show that when subjects read to in order to make up questions they correctly answered 70% of the relevant test items and 52% of the irrelevant items. When subjects read to answer questions they correctly answered 67% or relevant questions and 49% of irrelevant questions.

Experts seem to display a special enhanced memory for information about problems in their domain of expertise De Groot (1965, 1966 as cited in Anderson 2000). Newell and Simon (1972, as cited in Anderson, 2000) have speculated that in addition to learning meaningful patterns, experts have also learned what to do in the presence of such patterns. In order to develop such expertise in a domain, an individual must spend a great deal of time practicing. Ericsson, Krampe, and Tesch-Romer (1993, as cited in Anderson, 2000) state that in deliberate practice, learners are motivated to learn and not just to perform. Individuals carefully monitor how well their performance corresponds to the perfect performance and where errors occur.

Recommendation Application:

Practice, feedback, and the opportunity for meaningful elaboration of information should be provided to learners during a simulation. In this example, business students will be engaged in an economic simulation similar to the popular "beer game". The student in this simulation will be able to choose between three roles; the manufacturer, distributor, or retailer.

As students engage in the simulation they are able to practice theories of economics and receive feedback on their choices. For example, if the student chooses the role of retailer there is a chance that he/she can become overstocked on a product or he/she might not be able to meet the customers' demands for the product. The simulation would provide the student with the opportunity for practice in various roles and receive immediate feedback in the form of visual representations such as graphs. After extensive practice, students will be able to see patterns (chunks) and make predictions based on those patterns.

In addition, elaboration techniques can be implemented to help students retain information. The simulation can begin with a case study or scenario that will allow students the opportunity to form questions that will be answered during the actual playing out of the simulation. After the simulation students should be given time to reflect on what they have learned and try to answer the questions that they made up with the opportunity to review relevant information. .

3. Recommendation: In addition to lectures and readings, visual aids should be used to support the information being presented.

Validity of Recommendation:

Subsystems of our working memory allow us to process information from different modalities simultaneously. Baddeley and Hitch (1974, as cited in Smythe et al., 1994) proposed that working memory was composed of a central executive and an articulatory loop. The executive controls the use of various slave systems and the articulatory loop that acts a storage device for the rehearsal of information. Baddeley and Hitch were able to show that subjects were able to rehearse digits while at the same time carrying out a reasoning task. These results support the theory that our working memory is made up subsystems.

Evidence for a third subsystem that deals with visuo-spatial material also exists. The visuo-spatial sketchpad allows the storage of images. The Hayes (1974, as cited in Smythe et al., 1994) reported that subjects described "moving" symbols around in their minds and used these symbols for simple mathematical operations. In addition, Frick (1984, as cited in Symthe et al., 1994) found that when subjects were asked to rehearse a set of digits that were presented visually while at the same time rehearsing a set of digits presented orally there was an increase in the span remembered for the mixed condition.

Visuo-spatial and verbal tasks do not interfere with each other as much as they do with themselves. Paivio's Dual code theory (1971, 1986 as cited in Anderson, 2000) states that verbal and visual information are represented in different ways. His research has shown that visual images greatly enhance the memory of corresponding verbal information. The Dual code theory receives support from research conducted by Roland and Friberg (1985, as cited in Anderson 2000), which demonstrates that different neural regions in the brain process verbal and spatial information.

It is important to present visual information so that the learner can retain this information and it is accessible for later recall. An important function of imagery is that it enables us to construct new objects in our minds and these objects can then be inspected. A study by Finke, Pinker and Farah (1989, as cited in Anderson, 2000) shows that we make judgments on these objects and come to the same conclusions as the judgments we could make on seen objects. Wallace (1984 as cited in Anderson 2000) indicates that the imagery system can reproduce a detailed visual representation.

Visual images are important to include in the instructional design rather than just textual/verbal descriptions of objects because individuals will have a harder time manipulating imagined objects versus a visual representation. Kihlstrom, Rose and Gilsky (1992 as cited in Anderson 2000) cite that it is more difficult to rotate an imagined image than a picture. These results show that it seems harder to process an image than an actual stimulus.

Recommendation Application:

When constructing an online learning environment it is important not to rely too heavily on text to provide information to your learners. Returning to the medical example, if an instructor was using a course management system such as Blackboard to teach an online medical course he/she would be able to provide students with recommended texts, links to related articles that might be in PDF form or a word file, and lecture notes in a similar file type. But it is also essential to include visual aids, such as diagrams, pictures, streaming video, and links to web sites that might contain even more visual information about the subject

If the topic of a course includes the human heart students would have a difficult time imaging its structure and function by just reading about it. Students would need visual aids that would enable them to manipulate the heart mentally. For example, students may need to recall what a certain defect look like on the heart and how that would affect its function. Visual aids will also enable students to retain information about what they had read in the course. Photographs, diagrams, streaming video of a real beating heart, or a 3-D representation will provide students with additional ways to cognitively process the information.

4. Recommendation: Information about a topic should be hierarchically organized and broken down into subcomponents.

Validity of Recommendation:

The organization of information presented to learners is very important to the retention of that information. Bower, Clark, Lesgold, and Winzenz (1969, as cited in Anderson, 2000) asked subjects to learn all the words in four "tree" hierarchies and then compared two conditions of learning. These conditions were divided into an organized condition and a random condition. The organized group had a better advantage of recalling the information than the random group. Analysis showed that the subjects in the organized group recalled the tree in order of the tree hierarchy. This systematic recall of going down the tree from the top enabled subjects to cue their memories.

Complex mental images can be organized into chunks, a unit of knowledge representation (Miller, 1956; Simon, 1974, as cited in Anderson, 2000). These chunks combine a number of sub units and they also serve as the basic unit in a larger structure. Evidence also exists for the hierarchical organization of spatial images. McNamara, Hardy, and Hirtle (1989, as cited in Anderson 2000) had subjects memorize the location of the contents in a room. Subjects divided up the room into sub areas and formed separate sub images of the objects in these areas.

Research also shows that subjects store long sequences of information hierarchically which are then divided into subsequences. Klahr, Chase, and Lovelace (1983, as cited in Anderson 2000) looked at how long it took subjects to generate letters in the alphabet subsequences. Recall times were faster if the letter was in the beginning of the subsequence and slower at the end. It is thought that subjects are scanning through the subsequence until the target letter is found.

Recommendation Application:

Returning to the medical example, in teaching a course related to the human heart it would be important to present the information in a hierarchy, which would include the vascular system and other systems of the human body. The hierarchy would provide the learner with cues to recall information about the human heart.

More specifically, to understand the flow of blood in the body it is essential to understand certain hierarchical systems of the human body such as the vascular system and pulmonary system. The next step in the hierarchy is to provide information about which organs make up these systems and then provide information about the individual parts of these organs and their functions. An understanding of how blood flows would require knowledge of the lungs and the individual components of the heart. Finally, the long sequence of events that enable blood to flow can be divided up into 6 subsequences.

A diagram or picture of the human heart should be presented to the learner in a hierarchical structure. A structure of the heart would include its 14 separate components and how they fit together in this structure. When studying such a complex image, students can remember the individual components as chunks as well as their spatial relation to each other.

5. **Recommendation:** While engaging an individual in a learning activity, the learner should not be overwhelmed with competing tasks or unrelated information.

Validity of Recommendation:

Research shows that that it is difficult to retain multiple unrelated memories about the same stimulus. McGeoch and MacDonald (1931, as cited in Smyth et al., 1994) demonstrated that the learning similar information hinders the retrieval of the original set of data learned. These findings are constrained to the remembering of meaningless information, interference does not occur when the memories are redundant

Bradshaw and Anderson (1982, as cited in Anderson 2000) had subjects learn some information about famous people to test the effects of interference and redundancy. There were three conditions; subjects learn a single fact, subjects learn a target fact and two unrelated facts, and subjects learn a target fact and two related facts. Their findings show that recall was better when the subject had learned the two related facts and worse when subjects learned the two unrelated facts.

The learning environment must ensure that modalities do not conflict. Learners can process multiple stimuli at one time as long as two or more stimuli do not require central cognition. Karlin and Kestenbaum (1968, cited in Anderson, 2000) presented subjects with both a visual and a verbal task in which they were to complete the first task and then the second. The delay between the 2 stimuli was manipulated. The results show that at short delays the subjects were delayed in performing the second task due to interference caused by the first task. The interference occurs when the subjects must encode an auditory stimulus, which requires them to finish the first task. This central bottleneck will occur if we require learners to think about multiple things at once.

Recommendation Application:

A course designed to instruct medical students about heart disease would need to present information to the learner that is specific to this topic. Presenting related information about heart disease will strengthen the individual's memory trace, but presenting unrelated information would interfere with the individual's ability to retain information. For example, if discussing the link between smoking and heart disease the information should be constrained to the heart and not to other effects of smoking, such as lung cancer.

In a multimedia learning environment, it might be tempting to include as many different learning opportunities as possible such as streaming video, audio, and animated graphics. The instructional designer must be careful not to require the learner to engage in two activities simultaneously that would create a "bottleneck" for the learner. For example, the learner can be presented with a brief textual description of a particular heart aliment and then shown a video of an actual heart with this condition, but a learner would be unable to retain information if he/she were required to read the text and view the video at the same time.

6. **Recommendation:** When creating multimedia-learning environments, careful consideration should be given to the construction and use of graphics so that they can be easily perceived and processed by the learner.

Validity of Recommendation:

Cognitive theories of how we perceive objects are important to the creation of realistic graphics used in instructional technology. It is important in such learning environments that the representations of objects be as realistic as possible, which requires a great deal of consideration into how we perceive the world. David Marr (1982, as cited in Anderson, 2000) proposed the term 3-D model to describe how visual cues combine to create a representation of the locations of surfaces in three-dimensional space. These cues include texture gradient, elements appear closely packed together as the distance from the viewer increases, and stereopsis, an individual's two eyes receive slightly different information about the world. Another cue involves parallax, as more distant points move they will move slowly across the retina than closer points.

Object perception and object recognition are also important principles in the creation of visual aids. Object perception considers how Gestalt Principles of Organization influence how we perceive objects. Palmer (1977, as cited in Anderson, 2000) found that when subjects were asked to recognize parts of figures they could distinguish the parts most rapidly when they were the segments predicted by the gestalt principles. Object recognition is the idea that a familiar object can be seen as a known configuration of simple components.

Visual attention of the learner is another critical factor to consider when presenting information. Erikson and Erikson (1974, as cited in Anderson, 2000) concluded that narrowing our visual "spotlight" gives maximal processing to that part of the visual field but it takes time to shift attention to a different part of the field. Since learners fixate on the portion of the visual field to which they are attending, it is important not to overload the monitor with too much visual information that will compete for the learners' attention.

In addition, since we have brief visual memories, learners must be given time to attend to information displayed otherwise it will quickly fade from memory. Sperling (1960, as cited in Anderson 2000), through a series of experiments, demonstrates that visual information is held in a brief sensory store, but unless we attend to it and process it further, it will be lost. While designing a multimedia-learning environment it is important to give learners enough time to attend to the visual information being presented.

Recommendation Application:

Realistic 3-D simulations are frequently used to provide training that would be impossible or dangerous in a real setting. It is important that the environments and objects of a simulation are as realistic as possible. In constructing a 3-D object to simulate the human heart, designers must consider how individuals perceive the world. Cues such as texture gradient and parallax must be employed as well as gestalt principles of organization.

How visual material is presented to learners in a multimedia-learning environment is also important. The learner should not be overwhelmed with multiple objects on a screen that compete for attention. Visual material should be presented so that individuals can focus their attention on one area of the monitor. For example, when presenting students with a visual representation of how the human heart pumps blood the student's visual attention will be directed to the particular part of the heart being used. It would be ineffective to introduce a competing visual representation in a different location on the monitor because the student will be unable to focus adequate attention on both visuals. In addition, learners should have enough time to process the visual information presented.

Bibliography

Anderson, J.R. (2000) Cognitive Psychology And Its Implications, Fifth Edition. Worth Publishing.

Smyth, M.M., Collins, A.F., Morris, P.E., and Levy, P. (1994) Cognition in Action. Erlbaum Associates.

Evaluation of a Website with Learning Objects for Cell Biology - Target Groups and Usability

Uwe Sander
IWF Wissen und Medien gGmbH
(IWF Knowledge and Science non-profit limited company)
Germany
uwe.sander@iwf.de

Thomas Huk
Christian Floto
Learning Lab Lower Saxony [L3S]
c/o Technische Universität Braunschweig
Institut für Sozialwissenschaften
Germany

Abstract: The website cells.de offers learning objects for cell biology as a teaching and learning repository. We wanted to find out whether we had been able to address diverse target groups in the teaching and learning process with our offering. Using log files, a questionnaire and usability tests, we found that students and pupils used the website as a resource for learning, while lecturers and teachers used it mainly for presentations and projects. We were also able to show that we could address users in different countries.

Introduction

Production of high quality E-Learning material is expensive, and may well cost 50.000 € for one hour of usage (Schulmeister 2001). Costs per user may be reduced if it is possible to address multiple target groups at the same time. To contribute to the discussion in this economic and pedagogical important field, we therefore evaluated a website about cell biology which is targeted at diverse users. We wanted to find out whether we were able to address diverse target groups in the teaching and learning process, particularly students, pupils, teachers, professors and laymen, using our website as a teaching and learning repository. In Germany we already had observed that pupils of the high school in the year 11 to 13 in special courses in biology had to deal with similar learning objectives as had students at university level in introductory courses in biology (Bereiter-Hahn 1998). Thus, we thought it possible to address students and pupils using only one teaching and learning repository. Additionally, the learning objects of our teaching and learning repository were produced so they would not only be suitable for students and pupils, but also for high school teachers in the year 11 to 13 in special courses in biology and university professors in Biology. As an additional target group we envisaged private users that have an interest in cell biology for a variety of possible reasons. Having published our website in German and English language, we also wanted to find out whether we were able to address users in countries were German or English is the native language, or in countries where the knowledge of English is well developed. We thought it plausible to address learners and teachers in different countries; the basis for this expectation was our observation that cell biology teaching and learning is not influenced strongly by regional or cultural factors.

Description of the website

The website cells.de (see www.cells.de) is maintained by the German IWF Wissen und Medien gGmbH (see www.iwf.de). IWF is an educational institution that has an assignment in higher education. It provides audiovisual media for higher education. From 1998 to 2002, in co-operation with the Bio center at the University of Frankfurt and two private companies, IWF build up a comprehensive media archive for cell biology. This was conducted in the context of the German Federal Ministry for Education and Science funding for the "further development of the scientific and technical book for multimedia knowledge representation". The project's objective was the progressive preparation and application of an interactive knowledge representation in cell biology – a modular media service.

The website cells.de is one major offspring of this project. It was launched in April 1999 and continuously improved since then. It contains digital media in Internet quality as well as additional information for university and school on the subject of cell and molecular biology. Collections of links exist to learning and teaching material, dictionaries and documents on experimental exercises, journals and occupational information. Searching aids and a lexicon are integrated, as are FAQ (frequently asked questions) and a guest book. Digital media are the main component of "cells.de". 132 videos and animations in QuickTime and RealVideo video format and 3D objects (QTVR) are offered in German and English language. Additionally 41 shockwave animations (computer animations and interactive learning modules) are available in German language. These digital media are available for free in full-length versions. They are specially prepared for the purpose of teaching and learning at universities and schools.

Thematic foci of the website are plant cells, animal cells, cell types, cell structures and cell functions. Several didactical and pedagogical approaches were used when producing the learning objects. Introduction, explanation, consolidation and review of learning objectives are generally presented using audiovisuals, particularly short videos or animations, combined with audio presentation of text. These presentations generally are used to visualize processes. Rotateable 3D-models and 3D-animations are used to visualize structures. Besides these presentations, learning tasks are offered using Shockwave animations. Learners can work through interactive computer animations, e.g. by clicking on a distinct part of an animation to select the correct answer.

Methods

Log files

For the structural analysis of the groups of users we used assessment of log files and a questionnaire. Log files from Mai 7th to June 30th 2002 were downloaded from the server at IWF that hosted www.cells.de. They were analyzed with Web Trends Log Analyzer 6.0. The log files were stripped of visits caused by co-workers of the IWF and of visits by roboters, spiders and crawlers, thus eliminating visits that do not stem from users that access the website searching for information. We registered 227,824 successful hits on the entire site and 19,900 visitor sessions. Visitor sessions were considered terminated when no activity were detected for 30 minutes. Log files for 5 days were missing due to technical reasons.

Questionnaire

A questionnaire was constructed with ten sets of questions for the German version, and eleven questions for the English version of the website. One set of questions used free text as an answer ("what did you like about…"); the other could be answered by choosing an already prepared answer. The questionnaire could be filled in online. It was linked on the German and English start page of www.cells.de from Mai 7th to June 30th 2002. 38 German and 27 English questionnaires were filled in. Cluster Analysis was performed with SPSS 11.0 for Windows using the algorithms "single linkage" and "average linkage between groups".

Usability Test

To find out if users were able to use the website, a usability test was performed in cooperation with the company eResult GmbH in Göttingen, Germany. To find people with an appropriate profile, participants were acquired using an Online-Access-Panel. Three students of Biology or Medicine, three pupils (high school), one teacher and one lecturer participated. The behavior of participants was recorded using following steps:

- First contact with the website and rummaging around, behavior of participants recorded with the site covering method as described by Wilhelm 2002 (10 minutes)
- Focused intense interview (10 minutes)
- Scenario based testing: searching for content (20 minutes)

Findings

From Mai 7th to June 30th 2002, 19.900 user sessions were registered on cells.de by log files. These visitors downloaded or streamed 12.360 videos and 3.154 Shockwave files. For example, the video "Plasmolysis - Epidermal Cells: Onion" was requested 241 times, the QuickTime VR object "Rotateable Plant Cell: 3D model" 118 times and the video "Flagellar Motility - Euglenoid" 111 times.

The questionnaire carried out in this period indicated that students were the major user group of cells.de (35%), followed by teachers (26%) and pupils (19%). Learning was the main motivation of the users (60%), but the website was also used to rummage around (32%), for presentations (29%) and project work (21%). Cluster analysis indicated that lecturers and teachers used the website mostly for presentations and projects, while

students and pupils used it for learning. Even if only 9 % of visitors saw themselves as private users, use at home (58%) was dominating the use at universities (33%) and schools (22%). Most of the users have been visiting the website for the first time (45%) or have been visiting it only for a few times (42%). 88% of the users had a good or very good overall impression of cells.de. To find the website in the Internet, search machines (45%) were more often used than links (26%) or suggestion of teachers or lecturers (22%). 64% of the visitors questioned came from the German speaking countries Germany and Austria, while 36% originated from other countries. This finding is supported by the analysis of log files: 63% of the visitors use the German version of the website, while 37% use the English version. The questionnaire showed that visitors from the United States (15% of the overall users) are the most frequent non-German visitors.
The majority of tested users in the usability test thought that the start page was structured clearly (after the first contact with the website and after rummaging around for 10 minutes). However, the intention of the site was not understood at the first glance. Only half of the users realized immediately that multimedia learning content could be requested. The overall structure and classification of the available multimedia content about cell biology was considered to be usable by a majority of test users. However, it was criticized that some pages with a lot of information had to be scrolled, and at first glance were confusing. In a scenario based testing the participants were asked to search for a video about cell division. Several retrieval methods were available: two search engines, browsing and a site map. Four users were able to find relevant multimedia content at once; two needed a second try, then using alternative retrieval methods. Two users needed external help to find relevant multimedia content. After the tests, 7 of 9 test users said that they wanted to use cells.de again.

Conclusions

We wanted to find out whether we had been able to address diverse target groups in the teaching and learning process using our website as a teaching and learning repository. We could demonstrate that the website attracted a substantial amount of visitors that downloaded the available multimedia learning objects. Students and pupils found the website to be a valuable resource for learning, lecturers and teachers for presentation and projects. This indicates that these target groups could use the offered multimedia learning content in the teaching and learning process. An overall usability of the website could be demonstrated, even if the tests carried out with students, pupils, lecturers and teachers showed a few weaknesses when navigating in the website. Thus we could show that we were able to successfully address different target groups. We also wanted to find out whether we were able to address users in different countries. Even if most visitors came from German speaking countries, we were also able to address a substantial amount of international users, in particular from the US. Further research has been initiated to find out in more detail how the offered learning objects are used in the learning and teaching process (Huk 2002).

References

Bereiter-Hahn, J.: personal communication (1998)

Huk T. & C. Floto (2002): Criteria of Evaluation of Audiovisuals in Multimedia Productions (CRIMP). In: Wagner, E & S. András (Eds): EDEN Second Research Workshop Hildesheim, EDEN Secretariat: 151-153.

Wilhelm, T., Yom, M. & Beger, D. (2002). Site-Covering - Eine innovative Methode zur Erfassung der Informationsaufnahme und des Entscheidungsverhaltens auf Webseiten, in: Planung und Analyse, 29. Jg., Heft 2, S.46-50

Schulmeister, R (2001). Virtuelle Universität, Virtuelles Lernen. (pp. 368-369), Oldenbourg Verlag München Wien

Workplace Environments Are Evolving: Is Adult E-Learning Keeping Pace?

Michael Ellis Scheuermann
Drexel University
michael.scheuermann@drexel.edu

Abstract: Modern organizations are evolving into dynamic workplaces, challenging employees to become involved in new, exciting ways. *Reengineering* challenges employees to embrace roles that are evolving as quickly as their organizations. New roles provide *empowerment* for employees who become increasingly *self-managed* within these *learning organizations*. Personal growth is not only initiated and nurtured – but expected. More of these employees are entering our virtual classrooms, welcoming the opportunity and challenge that higher education represents. The focus of this paper is whether educational institutions are up to the task. Have they evolved as other modern organizations? Are they prepared to extend through e-learning the work that learning organizations began? Is higher education up to the challenges that these individuals bring from their workplaces into our virtual classrooms? Moreover, are we as e-learning educators prepared for these dynamic, empowered, and self-managed individuals?

Today's adult students engaged in e-learning are often professional men and women who work for a living and take college courses via the Internet. As employees during the day, these individuals face workplace roles that have been evolving rapidly. First, they are often involved in *self-managed teams*. Second, they are *empowered* as employees within their organizations. Third, firms have been undergoing *reengineering* wherein organizations evolve into flatter configurations with far fewer reporting levels, thus expecting employees to take on additional responsibilities. Fourth, *participative management* in organizations is an emerging concept enabling more men and women to determine what decisions should be made, with little, if any, upper management intervention. Fifth, one of the key tenets of managing and orchestrating *change* in organizations today is to involve workers from all levels in change initiatives, as early as possible in, and then throughout, the process. Finally, these men and women find themselves working then in what Senge (1990) termed *learning organizations*, where new ideas are needed, knowledge must be transferred, and behaviors must change.

These substantive organizational developments represent considerable challenge to educators. They are suddenly faced with an evolving set of expectations from their adult students. At work, these individuals are taking charge of their own careers and their own organizations on a broad-based, multi-dimensional, and escalating basis. They expect to be able to do the same in their virtual classrooms. Organizations are not merely *enabling* employees to participate in new ways. They are *expecting* these men and women to perform in myriad evolving initiatives. Hence, when these individuals engage in e-learning as adult students, we, as instructors, need to determine how to participate most effectively with them.

After long, often difficult, and challenging workdays the last thing these nontraditional students need is an academician who is going to unilaterally direct their learning. In these settings, we, as educators, can, instead, leverage the workplace experiences that these individuals have just had, building upon them across their e-learning courses. Kidd (1973) called this the art of learning rather than schooling. Livingstone (2001) noted that in this information age there is more knowledge accessibility in our learning society within which workers can extend their learning. Adult learning theory includes the need for nontraditional learners to participate in the formulation of their learning in order for that learning to be most effective (Brookfield, 1986). This concept aligns with the experiences these nontraditional students have throughout their workdays.

Moreover, Friere (1970), Houle (1996), and Mezirow (2000) determined that adult education must include some element of empowerment, while Dewey (1926) said that education must be a constructive process rather than a passive activity. Kidd (1973) spoke about the *learning transaction*, where students must be involved in the process. Knowles (1990) envisioned shared learning enmeshed with shared authority. Collaborative teaching and learning (Conti, 1978) has been found to be a significant component of adult learning theory. Instructional models formulated by Merriam and Caffarella (1999) included both student self-direction and control of their own learning. Houle (1996) described education as a *cooperative* rather than *operative* art that functions in a facilitative way. Rachal (2002) investigated concerns regarding learner control. Solomon (2001) observed that negotiated content and activities were integral to learner-centered pedagogy. According to Sgroi (1998) it is the students' responsibility to direct their own learning while Peters and

Armstrong (1998) referred to the teacher as a member of the group of learners, a participant in collaborative learning. Brookfield (2000) stated that learners and facilitators cooperate in the learning enterprise on curriculum, practices, and objectives.

In their careers today, these individuals are expected to take control in order to improve their workplace performance. They are *empowered, self-managed*, and integral to *reengineering* and *change* processes within their new *learning organizations*. Simply put, they are *involved* and *engaged*. As educators, developing and delivering e-learning courses for adult students, we can leverage the strengths that these students develop during their workdays. We can utilize them to enhance the e-learning environment and experience, for ourselves and our students. We can, to the greatest practicable extent, (a) involve them in the development and construction of the e-learning courses, (b) focus on learning rather than schooling, (c) empower students in our courses as they are empowered in their workplaces, (d) share our authority and control, (e) collaborate with students from development, through delivery, to evaluation, (f) incorporate self-directed learning, (g) facilitate rather than dictate, (h) negotiate course content and activities, (i) challenge students with heightened responsibilities, (j) engage learners, (k) increase our participation with them, and (l) cooperate with students all across our course timelines.

References

Brookfield, S. D. (1986). *Understanding and facilitating adult learning*. San Francisco: Jossey-Bass.

Brookfield, S. D. (2000). Transformative learning as ideology critique. In J. Mezirow & Associates (Eds.), *Learning as transformation: Critical perspectives on a theory in progress* (p. 125-150). San Francisco: Jossey-Bass.

Conti, G. J. (1978). Principles of adult learning scale: An instrument for measuring teacher behavior related to the collaborative teaching-learning mode. *Dissertation Abstracts International, 39* (12), (UMI No. 7912479).

Dewey, J. (1926). *Democracy in education*. New York: The Free Press.

Freire, P. (1970). *Pedagogy of the oppressed*. New York: Herder and Herder.

Houle, C. O. (1996). *The design of education*. (2nd ed.). San Francisco: Jossey-Bass.

Kidd, J. R. (1973), *How adults learn*. Chicago: Follett.

Knowles, M. S. (1990). *The adult learner: A neglected species* (3rd ed.). Houston: Gulf.

Livingstone, D. W. (2001). Expanding notions of work and learning: Profiles of latent power. *New Directions for Adult and Continuing Education, 92*, 19-30.

Merriam, S. B. & Caffarella, R.S. (1999) *Learning in adulthood*. (2nd ed.). San Francisco: Jossey-Bass.

Mezirow, J. (2000). Learning to think like an adult. In J. Mezirow & Associates (Eds.), *Learning as transformation: Critical perspectives on a theory in progress* (p. 3-34). San Francisco: Jossey-Bass.

Peters, J. M. & Armstrong, J. L. (1998). Collaborative learning: People laboring together to construct knowledge. *New Directions for Adult and Continuing Education, 79*, 75-85.

Rachal, J. R. (2002). Andragogy's detectives: a critique of the present and a proposal for the future. *Adult Education Quarterly, 52*, (3), 210-227.

Senge, P. (1990). *The fifth discipline: The art and practice of the learning organization*. New York: Doubleday Currency.

Sgroi, A. (1998). Teaching-learning partnerships in the arts. *New Directions for Adult and Continuing Education, 79*, 23-32.

Solomon, N. (2001). Workplace learning as a cultural technology. *New Directions for Adult and Continuing Education, 92*, 41-51.

E-Commerce Privacy and Security: Degree of Awareness Among College Students

Abstract:

Two main issues related to the participation in electronic commerce are the assurance to consumers that their transactions are secure and their privacy protected. Very little information is available about consumer awareness of safeguards to protect them from privacy and security related frauds. The proposed experimental study will create simulated e-commerce web sites (one secured, one unsecured) to find out the degree of awareness and knowledge of college students about the privacy and security of their transactions. Once the student logs on to the computer, she is randomly assigned to one of the two versions of a web site dividing the sample in two groups. The sample will be drawn from students taking classes with the researchers during the Fall semester of 2002. Descriptive statistics and Analysis of Variance will be used to analyze the data. The findings of this study can be used for consumer education and public policy recommendation purposes.

Introduction:

On-line shopping has increased dramatically during the past decade. According to the CommerceNet/ Nielsen Internet Demographic Survey, Internet users over the age of 16 in the United States and Canada increased by 59% from 57.8 million in 1997 to 92.2 million in 1999 (http://www.commerce.net/research/stats/wwwpop.html). The latest Forrester Online Research Index shows that consumers in the United States spent nearly $4 billion on line during the month of July 2001 (http://www.forrester.com/ER/Press/Release/0,1769,621,00.html).

Along with the advantages brought by electronic commerce for consumers, several concerns have been identified. Two of the main issues are related to the assurance of privacy and security of on-line transactions (Briones, 1998; Caudill & Murphy, 2000; Miyazaki & Fernández, 2001;). The Federal Trade Commission (FTC) conducted a study in 1998 where 1,402 commercial web sites were analyzed to "determine whether self regulation is an effective means of protecting consumer privacy on the Web". They found that a variety of personal information is collected from consumers such as "name, e-mail address, postal address, telephone number, fax number, credit card number, Social Security number, age and date of birth, gender, education, occupation, income, hobbies, interests, and the type of hardware and software used by on-line consumers". The information collected may also be released to, or accessed by, third parties compromising not only privacy, but also security. Furthermore, the FTC found that only a small number of the Web sites surveyed offer either a Privacy Policy Notice or an Information Practice Statement where consumers are informed about the use of the information they provide. (http://www.ftc.gov/reports/privacy3/survey).

Based on their study, the FTC recommended legislation to provide basic standards for the collection of information on line (Newsweek, 2000). In response, web developers and on-line businesses through entities such as the On-Line Privacy Alliance and the Platform for Privacy Preferences or P3P, argued against additional legislation and provided self regulation alternatives in the form of third party seals of approval and voluntary Private

Policy Statements (http://www7.software.ibm.com/vad.nsf/Data). Some of the privacy and security related third parties seals of approval include the Better Business Bureau, CPA WebTrust, TRUSTe, VeriSign, and Web Assurance Bureau (Miyazaki & Fernández, 2001).

Regardless of the outcome of this debate (legislation vs. self regulation) the assumption is that consumers do read, understand and use the information about privacy and security provided on the web site before they decide to make an on-line transaction. In other words, consumer awareness of these safeguards is an assumed condition that may not always be present. This is a research problem that merits investigation. Furthermore, if educated, technology oriented consumers; such as college students, show that the assumption is incorrect, then it can be argued that consumer education on topics of privacy and security on on-line transactions need to be addressed as part of the discussion related to regulation.

Objectives:
In order to investigate privacy and security issues, the proposed experimental study will create simulated e-commerce web sites (one secured -Group S, one unsecured- Group U) to answer the following research questions:

1. Do college students involved in an e- commerce transaction recognize and use security and privacy protection devices (private policy notices, seals of approval, etc.) within the site?
2. How do the provision of security and privacy protection devices influence purchasing decisions among the students?
3. Is the amount and type of information provided by students doing an on line transaction using a "secured" site different from the amount and type of information provided by those students using an "unsecured" site?

Methodology
Sample:
Students from the Departments of Technology and Family and Consumer Sciences enrolled in courses with the investigators during Fall 2002 (5 courses) will be invited to participate in this study. The sample will include approximately 100 students in their junior and senior years.

Experiment:
All participating students will logon during their regular class time to an e-commerce simulated website offering products and services such as CDs, clothes or travel. Students will be informed that the web sites are simulations, however they will be encouraged to treat the transaction as a real one. Furthermore, the web sites will be designed so that participants a) can access the web site for only one transaction and b) can not go back to change data once they have completed the transaction or have decided to prematurely terminate it.

As students logon to the website they will be randomly assigned to two almost identical web pages. One group of students (Group S for 'secured) will be 'connected' to a web page that represents a secured version of an e-commerce company as indicated by safety symbols of Certification Authorities such as WebTrust, TRUSTe and VeriSign. In addition to the symbols of the Certification Authorities, the web page will contain a privacy statement with carefully stated Privacy Guidelines. These guidelines will include statements about:

- sharing customers' information with other companies;
- tracking customers as they move around the site;
- capturing information not related to the purchase such as SSN;
- capturing survey information;
- providing ways for customers to discover and change information collected from them.

The second group (Group U for unsecured) will be 'connected' to a version of the web site that will not contain the safety symbols of the Certification Authorities provided on the web site for Group S nor the privacy statements.

The formation of two distinctive groups based on the creation of two 'almost' identical web pages will allow the researchers to test the hypotheses and to address the research questions discussed above.

Instrumentation and data collection:

As the students do their transactions, they will be asked to provide personal information. The information requested some of which is unnecessary for the transaction, will include:

- name, e-mail, postal address
- telephone and fax numbers
- credit card number(s)
- Social Security number
- Age, gender, date of birth
- education, occupation, income
- hobbies, interests.

As soon as students have completed or prematurely terminated the transaction, they will be led to an on-line evaluation tool to answer a questionnaire that will collect demographic information such as age, class rank and major. Additional questions will assess students' awareness of the safety symbols and privacy statements used on the experimental website. If students decided to terminate the transaction before completion, they will be asked to provide reasons.

In addition, the transaction itself will serve as part of the instrumentation. For example, the decision to provide the SSN or credit card information will be automatically recorded. A database will be created with this information.

The following data will be collected to address the objectives of this project:

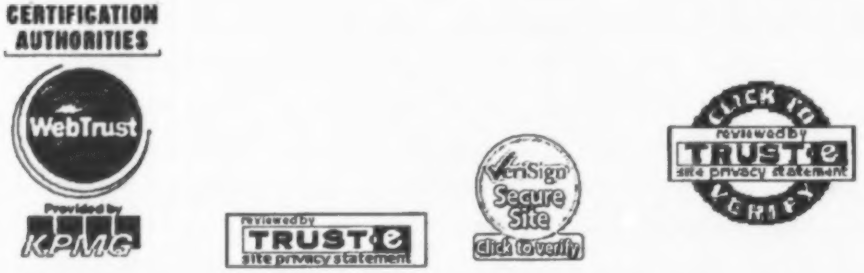
- number of students from Group S that accessed both the safety symbols and the privacy statement provided on their secured website;
- number of students that terminated their on-line transaction prior to completion and

- amount of personal data (such as Social Security Number, credit card information, etc.) that was provided by students from either group.
-

The methodology and instruments will be submitted for approval to the Institutional Review Board (IRB) for Human Subject of Illinois State University.

Statistical Analyses:
The Statistical Analyses will include descriptive statistics such as frequencies, and percentages as well as analysis of variance (ANOVA) to compare Group S and Group U with respect to a) the use and knowledge of safety symbols and privacy statements, b) premature termination or completion of the transaction, and c) amount of personal data provided in their e-commerce transactions.

It is expected that the findings of this study can be used for consumer education and public policy recommendation purposes. With these goals in mind the results of the study will be disseminated through scholarly publications and presentations. It is recognized that the use of technology by consumers in their market transactions is a relatively new area of research with a number of unanswered questions open for future investigation.



port,

CommerceNet (http://www.commerce.net/research/stats/wwwpop.html)

Federal Trade Commission Survey of Commercial Web Sites (available online http://www.ftc.gov/reports/privacy3/survey)

Forrester Online Research Index
http://www.forrester.com/ER/Press/Release/0,1769,621,00.html

Miles, G.E., Howes, A. & Davis, A. (2000) A framework for understanding human factors in web-based electronic commerce. *International Journal Human -Computer Studies*, 52, 131-163 (available online at http://www.idealibrary.com)

Miyazaki, A.D. & Fernández, A. (2001). Consumer perceptions ofprivacy and security risks for on line shopping. *The Journal of Consumer Affairs*, 35(1): 27 - 44

BEST COPY AVAILABLE

A Dose of Reality in the Classroom

Diane M. Schuch-Miller, Greenfield Coalition, Wayne State University, USA, schmild@focushope.edu

Marie D. Lee, Greenfield Coalition, Wayne State University, USA, leem@focushope.edu

Abstract: The engineering education community is demanding that Engineering graduates are better able to solve problems. However, traditional lecture does not allow learners to engage with and manipulate new knowledge and skills in preparation for application in situations other than those described in textbooks. Reality-based learning (RBL) is the approach adopted by Greenfield Coalition (GC). This paper discusses the methodology for designing RBL activities as well as several examples.

The Need for and Value of Reality-Based Learning

One of the challenges of engineering education is that students are not able to extrapolate information from a textbook problem to the real world experiences of an engineer on the job. This is due, in large part, to the lecture style of teaching and learning which does not allow learners to link the new information to a familiar context. Furthermore, it does not allow students to test their own hypotheses and discover through their own experiences. The difficulty, then, is to identify other instructional methods that are better able to develop critical thinking, problem analysis and decision-making skills. At the Greenfield Coalition (GC), the answer has been reality-based learning (RBL).

No matter what your feeling on reality-based television might be, the "reality-based" theme has application and value in the classroom. Students often ask the question, "Why do we have to learn this?" Reality-based problems present content and concepts in real world contexts. The "why" is apparent throughout the activity. The question then becomes, "How can this problem be solved?" How will the learner solve the problem at hand? What materials in the textbook, on the Internet, in the instructor's direction or in the brains of peers will be essential for completing the activity?

Used by medical schools for years, this immersion approach of reality-based learning gives students the ability to apply new knowledge and skills in a manner that, based on their prior experiences, makes sense. In doing so, learners test theories and make unique connections to previous knowledge. This method lets students organize the new concepts in a more logical and relevant framework.

Instructional Design for RBL

RBL can be designed and utilized in multiple disciplines. Concepts in a text or lecture can be transformed from words on a page or in the air to active, participative, discovery problem-solving. By "doing," retention and transfer of knowledge and skills dramatically increases. To create an activity for RBL, a performance-based objective must be explicitly stated. Then, a suitable assessment method must be identified. Finally, an activity that allows the learner to meet the assessment can be crafted and implemented.

A well-written, performance-based objective should contain four components: audience, behavior, condition, and degree, often referred to as ABCD. These objectives state observable, measurable behaviors to be demonstrated by the students upon completion of a learning segment.

A natural choice for assessment with reality-based learning is authentic assessment. Authentic assessments test the learner in a capacity beyond a paper and pencil examination. In the real world, students will be challenged to make decisions, solve problems, use tools, and discuss with their peers. They will be assessed by their company and customers in the work they do. Besides the instructor, assessment in the classroom can come from work supervisors, peers, and even the student. Ideally, authentic assessments should depict actual on-the-job tasks or deliverables and therefore, can take the form of a product design, process implementation, presentations, discussion participation and a myriad of other possibilities. Once a performance-based objective is identified and an authentic assessment method is determined, a RBL activity can be created for the learning application.

Reality in activities comes from problems that do, have, or might occur in the real world. At the Focus: HOPE Center for Advanced Technologies (CAT), candidates work and learn in the same environment. During the day they participate in manufacturing engineering operations, such as machining, sales, purchasing, engineering design and shipping, for a t ier one supplier to the automotive industry. For students in a more traditional educational setting, the real world can often be simulated through computer-generated graphics and animations, a collection of written documents, transcripts and videos of interviews, still and moving images, or through examination or investigation of their own environment.

Consider solving an economic depreciation problem in a textbook. This method allows students to practice the calculations only. Conversely, an activity, using Microsoft Excel – an authentic tool, requiring the selection of the best method of depreciation considering the tax implications to the company – not only provides practice, but also provides for the application of knowledge and skills in a situation hat has a real impact, greater meaning and provides a richer context for learning than a textbook problem.

RBL Examples

At GC, RBL is utilized throughout many courses. Following is a set of examples from several courses.

Students learn about the launch of a new product by applying each phase of the process to a mechanical pencil. This allows them to familiarize themselves with the process by doing rather than reading about it. Furthermore, process maps and templates used by engineers are included in the course materials.

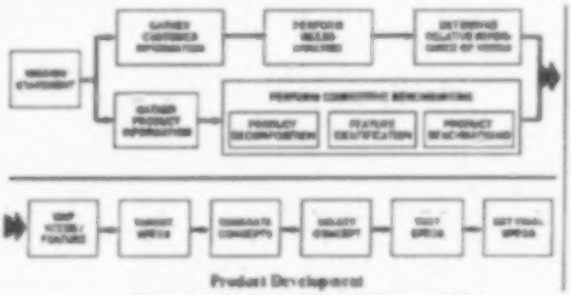


Figure 1. Product Launch Process Map

In a course on engineering economics, a capstone case analysis necessitates the application of techniques and decision-making tools presented earlier in the course. In this case, a situation is used from the CAT where shipping deadlines for pulleys are missed due to delays in the balancing operation. A wealth of resources is provided for students to begin their investigation. Further, WWW links are included to trigger research as deemed appropriate by the learner. The final deliverable for this case is a recommendation for resolution to the situation. A thorough analysis of alternatives, including a decision tree, must be included in this report. A presentation to Focus: HOPE management is also an expected outcome.

To support courses in Tool Design and Construction, Engineering Economics, and Manufacturing Systems, comprehensive case studies in manufacturing have been crafted. One of these studies examines the instability of boring tolerances in a turned pulley. It is difficult to determine exactly what causes the irregular measurement, however, this is the precise challenge for the student investigating this case. These situations depict real challenges faced by manufacturing engineers.

BEST COPY AVAILABLE

Figure 2. Pulley Process Map for GC Case Studies

In courses focusing on tool design and machining processes, technology is used to represent machining processes that are more difficult to view up close and in person. Here, a turning operation is depicted. Students can view either an animation showing a detailed perspective of the turning process or a video showing the broader view of the part, the machine, and its surrounding environment.

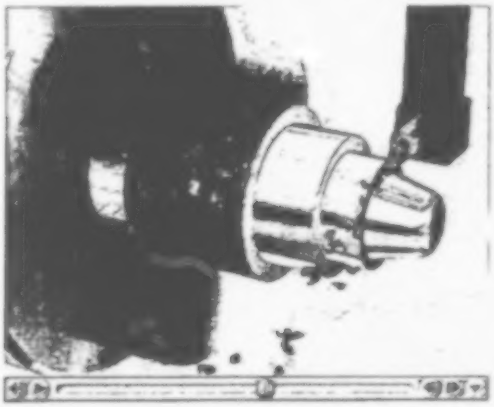


Figure 3. Animation of Turning Process for GC Courses

The concept of cycle time is discussed in manufacturing systems and operations management courses. In both courses, learners use a computer-enabled simulation to move machining centers around a virtual shop floor. Following the movement of each machine, students can run the production line and see the impact of each machine on the overall output of a production line.

BEST COPY AVAILABLE

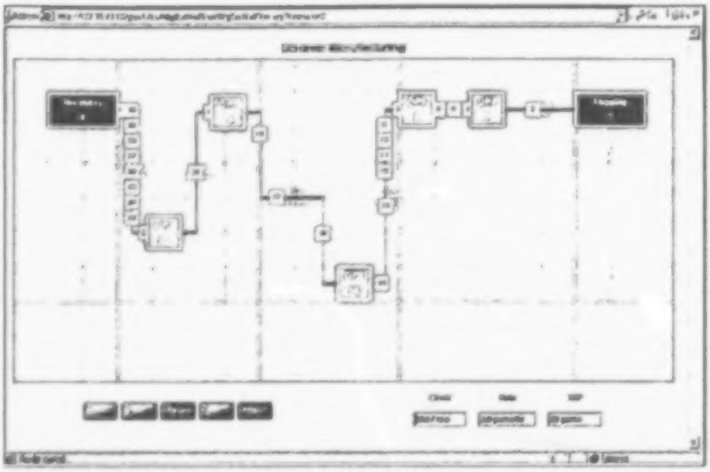


Figure 4. Discrete Manufacturing Simulation for GC Courses

The above mentioned examples are just a few of the reality-based learning activities at GC. Other examples involve observing data from the General Motors Crossover line to examine the concepts of variability of data and the effect of randomness. A set of experiments is being designed to support courses in thermodynamics and thermophysics. In a course on the business aspects of the manufacturing organization, students examine how departments work together through the implementation of a role-play simulation that involves classroom interaction as well as online participation.

Content Management

The online component of GC courses is specifically designed to be independent and transferable to other teaching and learning institutions. By using an object-oriented, asp-driven database structure, GC can deliver only the portion of the course, session or activity that is desired by others.

Implications/Conclusions

Applying their knowledge and skills to real situations gives students greater confidence in their abilities. The experience of working on real situations and data gives them valuable experience and sets their expectations for working in the field. Students genuinely appreciate the shift in the teaching and learning environment, and the result is a motivated, interested and active learner.

Acknowledgements

The Greenfield Coalition is partially supported by a Grant EEC-9630951 under the Engineering Education Coalitions Program at the National Science Foundation. Focus: HOPE, our industry and academic partners have contributed valuable resources to support the development of Greenfield.

BEST COPY AVAILABLE

COLOR-CODING REDUCES MEDICAL ERROR: E-LEARNING & THE BLENDED APPROACH

Terry A. Seelinger, MHA, e-Learning Manager, Corporate Information Services, Duke University Health System, Durham, North Carolina, USA terry.seelinger@duke.edu

Karen H. Frush, MD, Medical Director, Children's Services, Duke University Medical Center, Durham, North Carolina, USA frush002@mc.duke.edu

Abstract: The healthcare world faces a challenge for which Blended Learning is a natural fit. How does a large organization deliver just-in-time plus ongoing training and education to a geographically dispersed population with different needs and learning styles who cannot leave their posts for very long? Duke University Health System employs a learning management system and applies Blended Learning as a strategic approach to delivering content at all levels. One element of this effort trains users in a simple color-coding system for pediatric patients that allows them to quickly and easily arrive at the appropriate level of medication, radiation, or equipment size. E-learning for color-coding delivers content in a blended solution that meets the variety of needs and fits the many learning styles of professionals at Duke.

The health care world faces a challenge for which Blended Learning is a natural fit. How does a large organization deliver just-in-time plus ongoing training and education to a geographically and professionally dispersed population with different needs and learning styles who cannot be away from their posts for very long? Duke University Health System (DUHS) employs a learning management system and applies Blended Learning as a strategic approach to delivering learning content at all levels. Blended Learning uses a multi-level approach to combine aspects of online and face-to-face instruction, ranging from static reference material on a web site through self-paced content available at the user's convenience to asynchronous or synchronous, instructor-led sessions via the web.

A prominent project currently underway at DUHS brings Blended Learning to pediatric care as a comprehensive approach to a multi-disciplinary endeavor aimed at reducing medical errors. This widespread effort encompasses areas such as:

- Emergency care
- Bio-terrorism, chemical warfare and disaster response
- Radiation exposure reduction
- Injury reduction

At the core of this effort is a simple color-coding system that allows providers to quickly and easily arrive at the appropriate level of medication, radiation, anesthesia or equipment size for their young patients. E-Learning for color coding delivers content in a blended solution that meets the variety of needs and fits the many learning styles of the professionals at Duke.

Background

Providers recognize the significant problem of medical error in health care, and recent efforts to determine the frequency and severity of errors have yielded alarming results (Lesar, Lomaestro & Pohl 1997) (Leape, Brennan, Laird et al. 1991). Studies have demonstrated that many mistakes are directly related to adverse drug events (ADEs), (Bates, Boyle, Vander Vliet, Schneider & Leape 1995) (Thomas et al. 2000) and medication dosing has been shown to be the stage in drug therapy which contributes most heavily to ADEs (Bates et al. 1993) (Bates, Cullen, Laird et al. 1995) (Leape, Bates & Cullen 1995).

Errors abound in pediatric medication dosing, largely because of conventional dosing methods (Jonville et al. 1991) (Skaer 1991) (Lesar, Briceland & Stein 1997). Healthcare providers are trained to calculate medication dosages using mathematical equations, based on the size of a child, and this calculation step has been pinpointed as a high error activity (Rowe et al. 1998) (Lesar 1998) (Koren et al. 1986) (Kausahal, et al. 2001) Pediatric care is often the most error-ridden of all hospital services (Potts & Phelan 1996), with the emergency department coming in a close second. Time constraints associated with emergency care contribute to medical errors and several factors compound the risk of error when pediatric care must be delivered emergently:

- The need to estimate patient data, which may be unavailable at the time of the emergency, for input into medication dosing formulas. Patient weight, for example, is critical in dosing formulas, but evidence suggests that both physician and nurse estimates of children's weights are unreliable (Harris et al. 1999).
- Limited opportunities for prescription monitoring.
- Lack of pediatrics-trained emergency providers,
- Inability to rely on standardized dosing (i.e. adult ampule),
- Lack of familiarity with proper equipment sizing in children,
- The stresses of managing a life-or-death scenario involving a child
- The overall time limitations affecting each step from assessment to treatment.

Emergency care protocols require rapid delivery of care, but clinicians faced with tasks such as calculating dosages, or changing formulations to deliver the appropriate *concentration* of a medication cannot focus on the priorities of emergency treatment protocols.

Pre-calculated medication dosing charts and "code" cards have been used extensively to reduce error, but the child's weight must be known before the cards can be used. The only method currently available to estimate a child's weight *and* determine correct medication dosage and equipment size is the Broselow Emergency Tape (Lubitz et al. 1988).

In the early 1980s, James Broselow, an emergency medicine physician from North Carolina, developed a simple tool to increase the accuracy of weight estimation in children using established height-weight correlations from the National Center for Health Statistics (NCHS) (Hamil et al. 1979). The Broselow Emergency Tape established length measurements as an accurate method for predicting equipment sizes (based on endotracheal tube sizes and drug doses) for children in emergencies when weight measurements were impractical (Lubitz et al. 1988). The tape was length-based and grouped children, according to height, into color-coded zones for equipment selection. Each color zone contained kilogram body weight increments for medication dosing. Thus, a single length measurement provided emergency equipment selection information (color) and pre-calculated drug doses by kilogram increments. The Broselow Emergency Tape was well received and widely distributed across the country to EDs and EMS agencies, primarily through EMSC grant-related efforts.

As the tape was introduced, a Pediatric Emergency physician from Florida, Robert Luten, was working on a similar concept. Luten recognized the importance of the "zone concept" for medication dosing and other size-related variables, as well as equipment sizing (Lubitz et al. 1988). His research led to the creation of a color-coded tape with appropriate equipment sizes for seven different color zones. As the color-coding concept was further developed, Broselow and Luten worked collaboratively to revise the color zones on the original tape to new zone boundaries derived from more recent data. Drug doses determined by the new zones are, on average, less than 3.1% different than doses calculated from an individual patient's weight (Luten et al. 2001) This value is clinically insignificant for emergency drug dosing, especially when accurate single kilogram patient weights are unobtainable.

The revised Broselow-Luten Pediatric System (B-LPS) simplifies the complex problem of treating a child in an emergency. The zone color provides a single marker that allows access to many therapeutic modalities, including pre-calculated medication doses, pre-determined equipment sizes, fluid volumes, ventilator settings and other size-related variables. B-LPS zones also help prevent "downstream" errors (those that occur after a correct decision has been made in the resuscitation process) by providing a constant reminder of the patient's specific color (and thus the appropriate equipment size and medication dose). The B-LPS allows emergency providers the convenience of a standardized, unit-based *system* without the distraction of estimation, calculation or formula identification. The emergency treatment team then can focus on larger assessment and treatment decisions.

Color Coding Project

In the most immediate manifestation of the color coding initiative, Duke is collaborating with colleagues in Texas and New Jersey on a federal grant where the overall goal is to develop and evaluate an educational program to increase appropriate use of the Broselow-Luten Pediatric System and decrease medical error in the pediatric emergency setting. The program is being evaluated throughout the development cycle, using formative and process evaluation techniques. Primary outcome measures include medication dosing errors, equipment sizing errors and time to implementation during simulated events. Provider comfort level is assessed as a secondary outcome measure using surveys and scripted interviews after participation in the program.

One of the objectives of this project is to develop curriculum for multidisciplinary emergency providers using three delivery methods: printed, CD-ROM and web-based, to allow participation by units/agencies/facilities with all levels of technologic resources. The content developer has drafted the educational training program, consisting of the theory of B-LPS, development of color zones, and the concept of zone dosing vs. conventional dosing calculations. Learning objectives have been collaboratively developed with an advisory group to target the needs of the pilot populations. Core content is delivered using several different methods, based on the resources available at learning sites, and allows students to choose learning methods best suited to their learning style, while also allowing full utilization of locally available computer resources:

- Printed materials for participants who have limited or no computer access.
- Distributable CD's for participants with computer access but no Internet connectivity.
- For sites that have internet access, the education program is delivered in a two-tiered manner, using Lotus LearningSpace, a web-based learning management system:
- Tier 1 – Self-paced Study (for participants without high-speed web access)
- Training comprises content modules delivered via the Web. Participants log in to a web site, navigate through the material in the prescribed order and take related quizzes on the material to demonstrate their understanding.
- Tier 2 – Synchronous Online Sessions (for participants with high-speed web access)

Each participant or group of participants "attends" a live session conducted via the Web. The instructor teaches from a central project office and leads the group through a demonstration of the B-LPS system using animated graphics and videos. A period for questions and discussion follows. Participants log in to the same web site as in the first tier and view the graphics and video on their computers. The instructor and trainees telephone a toll-free conference call number to participate in the audio component of the session.

These delivery methods will allow the curriculum to be used effectively immediately, regardless of computer availability, while allowing the program to expand as computer and Web resources at individual sites expand. Furthermore, multiple delivery methods will allow home- and office-based, self-paced learning to complement more traditional training approaches.

Broader Blended Learning

Even as clinical practice is dynamic and constant, so is the ever-growing scope of color coding in health care. The growing interest in additional areas where color coding can be applied has drawn further support from the grant's federal funding agency to address issues such as disaster response, bio-terrorism and chemical warfare. Educational content on these topics will be updated and adapted for delivery via the dukehealth.org web site, further extending the blended approach to color coding.

Medical error is an urgent issue in health care and the problem in pediatrics is particularly acute. And color coding makes a valuable contribution to medical error reduction. At Duke, the blended approach to e-learning offers the best method for delivering engaging content most efficiently and effectively.

References

Bates DW, Boyle DL, Vander Vliet MB, Schneider J, Leape LL (1995). Relationship between medication errors and adverse drug events. *Journal of General Internal Medicine*, (10), 199-205.

Bates DW, Cullen D, Laird N, et al. (1995). Incidence of adverse drug events and potential adverse drug events: Implications for prevention. *Journal of the American Medical Association*, (274), 29-34.

Bates DW, Leape LL, Petrycki S. (1993). Incidence and preventability of adverse drug events in hospitalized adults. *Journal of General Internal Medicine*, (8), 289-294.

Hamil PW, Drizl TA et al (1979). Physical Growth: National Center for Health Statistics percentiles. *American Journal of Clinical Archives*, (32), 607-629.

Harris M, Patterson J, Morse J (1999). Doctors, nurses, and parents are equally poor at estimating pediatric weights. *Pediatric Emergency Care*, 15 (1), 17-18.

Jonville AE, Autret E, Bavous F, et al (1991). Characteristics of medication errors in pediatrics. *The Annals of Pharmacotherapy*, (25), 1113-1118.

Kausahal R, Bates DW, Landrigan C (2001). Medications errors and adverse drug event in pediatric inpatients. *Journal of the American Medical Association*, (285), 2114-2120.

Koren G, Barzilay Z, Greenwald M (1986). Tenfold errors in administration of drug doses: A neglected iatrogenic disease in pediatrics. *Pediatrics*, 77 (6), 848-849.

Leape LL. Bates DW, Cullen DJ. Systems analysis of adverse drug events (1995). *Journal of the American Medical Association*, 274 (1), 35-43.

Leape LL, Brennan TA, Laird N, et al. (1991). The nature of adverse events in hospitalized patients: Results of the Harvard Medical Practice Study II. *New England Journal of Medicine*, (324), 377-384.

Lesar TS. Errors in the use of medication dosage equations (1998). *Archives of Pediatric Adolescent Medicine*, (1152), 340-344.

Lesar TS, Briceland L, Stein DS (1997). Factors related to errors in medication prescribing. *Journal of the American Medical Association*, 227 (4), 312-317.

Lesar TS, Lomaestro BM, Pohl H. (1997). Medication-prescribing errors in a teaching hospital: A 9-year experience. *Archives of Internal Medicine*, (157), 1569-1576.

Lubitz DS, Seidel JS, Chameides L, et al (1988). A rapid method for estimating weight and resuscitation drug dosages from length in the pediatric age group. *Annals of Emergency Medicine*, 17 (6), 576-581.

Luten, RC, Wears RL, et al (2001). A Color-Coded Pediatric Therapeutic and Patient Safety System: The Broselow-Luten System. Submitted to *Pediatrics*, June 2001.

Potts MS, Phelan KW (1996). Deficiencies on calculation and applied mathematics skills in pediatrics among primary care interns. *Archives of Pediatric Adolescent Medicine*, (150), 748-752.

Rowe C, Koren T, Koren G (1998). Errors by pediatric residents in calculating drug doses. *Archives of Disease in Childhood*, 79 (1), 56-58.

Skaer TL (1991). Dosing considerations in the pediatric patient. *Clinical Therapeutics*, 13 (5), 526-544.

Thomas EJ, Studdert DM, Burstin HR, et al. (2000). Incidence and types of adverse events and negligent care in Utah and Colorado. *Medical Care*, (38), 261-271.

Reusable Learning Objects: Critique & Future Directions

First Author: Steven Shaw, Ph.D.
Second Author: Sarah Sniderman, M.A.

Introduction

The concept of reusable learning objects is at the heart of current thinking in the field of elearning (Wagner, 2002; Wiley, 2002). The concept is simple: instructional content is broken down into small pieces of content which can be re-used, re-purposed and shared across courses and potentially across organizations. In academic research, the concept has been alive for more than a decade, often linked to a vision of shared object libraries that might leverage the creation of low-cost, high quality instruction (cf. The MERLOT project). In the corporate world, RLOs are viewed as a solution to problems associated with on-going maintenance of training programs in dynamic fields, and the periodic changes in IT that require redeployment of existing courses on new platforms every few years.

Despite the promise of RLOs, actual examples of successful deployment of RLO technology are thin on the ground. There are several explanations for this, some related directly to RLOs and existing, associated standards, and some related to wider technology -related and organizational issues.

In this paper we first provide an overview of these issues and then explore the future of RLOs based on emerging technology, new design methodologies and new approaches to organization.

General technology issues

The limited impact of RLO technology can be attributed, in part, to several more general technological barriers. A basic one is the cost and relative inflexibility of existing, large scale Learning Management Systems (LMS). In large organizations, these systems are often implicated in complex implementations that cost seven figures, while the implementation projects are also "owned" by IT services. Once implemented, established structures are "locked in" to a large extent, due to the costs and effort required by the initial implementation, and possibly also due to ownership by IT. For small organizations, the cost of LCMS systems is prohibitive, and the systems are not scalable, particularly given the pervasive use of "per seat" licensing agreements.

Existing technology standards pose their own problems, as well, at least for some organizations that may have their own specific requirements. For example, SCORM compliance basically dictates that curricula managed by the system are lockstep; no branching is permitted. Hence, existing commercial LMS systems do not generally support branching, and various workarounds are required (such as handling branching within an integrated Learning Content Management System or LCMS) for this, and other, limitations.

Current generations of LCMS and authoring tools have their limitations, also (Chapman & Hall, 2002; Spohrer, Sumner & Shum 1998). Typically, authoring and LCMS systems are client-based. They support a classical Gutenburg publishing paradigm, requiring the services of individuals with specialized technical skills and knowledge, and a workflow model that involves role differentiation and a multi-step publishing process: there are subject experts, instructional designers, courseware authors, media producers, graphic designers; there are scripts, storyboards, media assets, assembled courseware. This model works well given certain assumptions, in particular the assumption that training program content has a reasonable shelf life. The reality in most modern organizations is that knowledge is dynamic, and training content is under constant revision. In the current world, best practices, business strategies, business rules, procedures, policies, products and services are all found to be in a more or less constant state of flux.

The Gutenburg paradigm is not responsive to this reality, even in its contemporary digital incarnation. It is unlikely that RLO approaches, operationalized within technology that reflects the Gutenburg paradigm, can meet the challenge. Why should organizations invest in the kinds of analysis and process changes required of an RLO approach, not to mention the supporting technology, when the larger paradigm within which the RLO concept is currently embedded poses a significant barrier to timely maintenance of training systems?

The RLO approach is one of the finer points of elearning strategy and technology. Basic barriers to entry into systematic elearning strategies such as those described in this section have necessarily impeded the development of methodologies, technologies and standards related to RLOs.

Conceptual and methodological issues related to RLOs

Despite a proliferation of technical standards and standards bodies -- SCORM, IMS, AICC, ADL, Dublin Core, ARIADNE, IEEE LTSC, to name just some -- there are really no accepted nontechnical standards concerning the actual nature and grain-size of learning objects from a content perspective. Typically, standards allow anything from a low-level subtopic all the way to an entire curriculum to constitute a learning object. Selection of appropriate grain-size is a nontrivial decision within a RLO strategy. Once having made that decision, description of RLOs so that they can be searched out within a large repository is also nontrivial. The problem is exactly the one we have all experienced through our frustration with Internet searches. Existing meta-data standards are technical in nature: they assure interoperability and reusability of objects. They do not point the way to indexing schemes that will ensure learning objects are locatable.

At least part of the problem is related to lack of content models for specific domains or fields. Only the aviation industry has a well-established, well-validated content model that has served over time as the basis for structuring information and documents. Developing a content model or taxonomy that can serve to guide organization and indexing of learning objects is a significant task, and not one that is a part of traditional instructional systems design methodology. It is in fact a true, very significant knowledge engineering task. Some work in the direction of extending instructional design methodology in the direction of learning object approaches exists. Perhaps the most commonly cited is Cisco Systems' Reusable Learning Object Strategy. But these extensions really only provide general guidance while pointing at the harder knowledge engineering tasks.

To make matters worse, even once a set of guidelines for describing contents in meta-data have been worked out there remain significant problems. First, authors of learning objects must be able to apply the guidelines in a consistent manner. This requires training, just as librarians require training and practice to apply the Dewey Decimal system consistently. Secondly, filling out content and authoring related meta-data fields may be a time-consuming task, if the content model is relatively sophisticated. Finally, and perhaps most significantly, in general, any conventional indexing scheme, even if implemented in meta-data, has real limitations. Full text indexing of learning objects will lack discrimination. Mechanical indexing, on the other hand, cannot cope with the fact that the same subject may be referred to by multiple names (the "synonym problem"), nor that the same name may refer to multiple subjects (the "homonym problem"). Using current approaches, success at finding the right learning objects in a large repository might be as likely as finding the exact information you want on the internet via your favourite search engine.

A final conceptual problem relates to the notion of context (Augier, Shariqu & Vendolo, 2001). Current theories of learning and instruction emphasize the situated nature of learning, and the requirement to contextualize information presented to the learner if one is to expect long-term retention, understanding and transfer of training to operational environments. Small-grained learning objects would typically be void of context and would have to be recontextualized for specific purposed and audiences. Outside of more abstract domains such as, for example, statistics, it is possible that the requirement for context will work against the leverage of a learning object approach by limiting sharing and reusability. There is some academic work in the direction of formalizing and describing context, but its applicability and practical value has hardly been demonstrated.

To summarize, it hardly obvious what, exactly, learning objects should comprise, and existing instructional design methodologies are not based firmly on an object-oriented approach. The importance of context poses a complication for learning contents organization on any finer-grained object basis. Content models are required but are in short supply. And new methodologies for indexing are definitely needed if we are ever to locate relevant learning objects once they have been created and stored. Finally, the importance of context poses a complication for any organizational scheme for learning content predicated on the basis of finer-grained objects.

Organizational Issues

RLOs are ultimately, and logically, linked to other applications beyond training, including corporate document and image management systems, knowledge management systems, and human resource information management systems. In a truly comprehensive, rational and strategic approach to managing intellectual capital within an organization, small units of content maintained in a repository would be shared and reused across different applications. A standard operating procedure, for example, would appear in different places -- memos, manuals and training materials, say -- but would be stored in one instance and presented within these different documents as they are created and formatted dynamically. Such a vision complicates IT considerations, standards adoption, information architecture design and obviously raises barriers of an organizational nature. How exactly is an overall organizational information architecture to be designed and implemented? How is the required level of co-ordination and the required depth of analysis to be achieved?

And how, from a technological standpoint, is this vision to be accomplished? Document mark-up languages such as SGML and XML hold the key to multi-purposing of content. Many existing LMS and LCMS systems support XML, to the degree that they can export data in an XML format. However, reuse across different document types requires a further degree of sophistication in document formatting that is not part of the current functionality of LMS or LCMS systems. Extensible Style Sheets (XSLs) provide the required functionality, but some considerable technical expertise is required to design, implement and maintain these within an organization.

A typical problem in large organizations, one which only partially captures the complexity alluded to above, concerns the integration of LMS and LCMS systems with human resources information management (HRIS) systems. Many larger organizations maintain competency databases within the HR function. These databases contain models which describe, in varying degrees of detail, the knowledge, skills and attributes (KSAs) which are required of different jobs, roles or tasks, and they document the KSAs possessed by any individual employee at a given point in time. Competency models may be tied to performance review systems, employee professional development programs, and to decisions and planning related to hiring, succession and promotion (McLagan, 1997; Mirabile, 1997; Sanchez, 2000).

LMS systems manage training: they register individuals in training programs, track their progress and performance throughout different courses and report related information concerning individuals or groups. Logically, if a competency approach is in place, it is desirable to integrate LMS and HRIS systems. Completion of courses by an individual, registered by the LMS should lead to updates to the competency model describing that individual.

But how exactly will this work? There is probably not a one-to-one mapping of courses to competencies to begin with, and stated course objectives may be more, or less, precise. Take a more sophisticated situation where we envisage courses assembled from learning objects and customized to meet individual requirements. Could there be a one-to-one mapping in this case. Not very likely. First, there is the grain size issue. Does one learning object correspond to one item with the KSAs? Are the learning objects described in a corresponding way? How does this work? Can the competency model replace a content model? Can you build courses out of learning objects designed to correspond with the competency model? Is this a logical and a practicable thing to do? And competency models typically describe the specific behaviours that would demonstrate generic KSAs within particular roles or domains: a theatre director and an engineering project lead may both exhibit leadership qualities, or conflict resolution skills, but it won't look the same. So are we once again confronted with the problem of contextualization of learning objects? Finally, competency models are not all cut from the same cloth. Some define competencies in terms of attributes of individuals (the KSAs) while others define them in terms of tasks or results or outputs. Some models focus only on what differentiates superior performers. Models also differ in regard to their level of detail. This variety complicates the prospect of any coordination between a content model developed by an industry, domain or sector and a given organization's competency model. Clearly, the relationship of learning objects and LMS reports to competency databases is not obvious. In this example we have not even stepped outside the limits of the HR/Training domain and already significant problems are apparent.

The future of RLOs

Despite the problems identified above, RLOs seem to be the future. Emerging technologies offer some hope for resolving key impediments to successful implementation of RLOs. New trends in organizations promise to facilitate integration of learning object strategies within more encompassing information and knowledge management initiatives. Given that such wider initiatives are undertaken at the highest level of strategic planning in organizations, they may in turn provide more momentum and opportunity for learning object initiatives on the training and human resource fronts, where traditionally spending has been viewed more strictly and simply from a perspective of cost. In the future the imperatives of regulatory bodies may also play some role in driving the development of the necessary content models on an industry or sector-wide basis, as has happened in part in the aviation industry.

On the technology front, there are several promising developments. First, XML-related technology and standards are maturing. Future LCMS technology will take greater advantage of tools such as XSLs to facilitate the integration of LCMS with other knowledge and information management tools within organizations.

Second, primary barriers to entering into elearning will continue to fall. The next generation of LCMS tools will be browser-based (see Rocket KM from EED Knowledgeware Corporation as an early-to-market example of this next generation). Anyone within an organization may be empowered, or tasked, to create, validate or edit learning objects, through their desktop browser. A new post-Gutenburg paradigm of information and knowledge dissemination can thereby be implemented. Up-to-date knowledge and information can be moved to the frontlines of organizations in a timely manner, allowing a fuller realization of the potential benefits of learning object approaches. Plain vanilla (no plug-ins required), browser-based LCMSs will also offer an additional advantage: there will be minimal requirement for IT input to implement the tools, thus limiting IT ownership and control of elearning, knowledge transfer, and learning object initiatives.

Newer LCMS and LMS technologies are also being priced more competitively, and using pricing strategies that are more scalable: for example, pricing may be based on licenses tied to the number of servers distributing content, rather than the number of seats. Economic barriers to entry into elearning in general for smaller organizations are falling.

Methodologies for design based on the learning object paradigm are still under development. Future developments may see the explicit use of heavy-duty knowledge engineering techniques to develop and validate content models. Integration of elearning and electronic performance support with wider, strategic, organizational KM and information management initiatives will provide the justification for the depth of analysis and the effort required to accomplish this task.

The issue of context its role in RLOs is a thorny one. Indexing learning objects to indicate contexts where they are applicable or reusable is likely a nonstarter for some domains, though in some instances reusability may not be a key issue for these domains. However, an analogous problem is encountered in case-based reasoning (CBR), an AI approach which has produced a significant body of work, and which met with success in certain domains (Aamodt & Plaza, 1994; Kolodner, 1993). The basic idea behind CBR is that most high-level cognition (e.g., problem-solving, design tasks) does not proceed from first principles. Rather we retrieve cases concerning similar situations and their solutions from memory (or external resources) and adapt components of the solutions to the current case. Cases must be broken down into components; decisions must be made about the grain-size of cases, and; case components must be indexed for situations in which they may fail or be successfully adapted. The parallel to the problems of defining RLOs and indexing them for applicable contexts seems quite good, at least on the surface, and some of the lessons derived from CBR research may be generalizable to the RLO context.

Finally, the general problem of indexing learning objects from a contents perspective begs a solution. The solution may come from the new methodology conveyed in topic maps. Topic maps provide an approach that marries the best of several worlds, including those of traditional indexing, library science and knowledge representation, with advanced techniques of linking and addressing. Topic maps create a semantic web. The map captures the subjects of which resources speak, and the relationships between subjects, in a way that is implementation-independent. It conveys knowledge about resources through a superimposed layer, or map, of the resources. The map furnishes directed graphs which indicate meaningful relations among resources.

The topic map paradigm has been under development since 1993, when it was first articulated in a working document from the Davenport Group. The paradigm was more fully developed thereafter in the context of the GCA Research Institute (now known as IDEAlliance), in an activity called Conventions for the Application of HyTime. Early in 2000, the topic map paradigm was fully formalized for the first time as an ISO International Standard, ISO/IEC 13250:2000. Since then, TopicMaps.Org was founded in order to develop the applicability of the paradigm to the World Wide Web, and to realize its enormous potential to improve the retrieval and management of information.

Conclusion

There is considerable work to be accomplished on all fronts -- design methodology, organizational approaches to learning and knowledge management, collaboration within sectors and industries on content model development and standards, and technology -- before the potential of learning objects and RLOs will come to fruition. Despite the obstacles, there are trends apparent in all these areas that offer promise, not least of all on the technological side.

Select Bibliography

Aamodt, A. & Plaza, E. (1994). Case-based reasoning: Foundational issues, methodological variations and systems approaches. *AI Communications*, 7, 184-223

Augier, M., Shariqu, S. & Vendolo, M.T. (2001). Understanding context: its emergence, transformation and role in tacit knowledge sharing. *Journal of Knowledge Management*, 5(2), 125-136.

Chapman, B. & Hall, B. (2002). *Learning content management systems: Comparative analysis of systems used to construct, organize and re-use learning objects"*. Brandon Hall.com

Cisco Systems. (2000). *Reusable learning object strategy*. (http://www.cisco.com/warp/public/10/wwtraining/elearning/implement/rlo_strategy.pdf)

Kolodner, J. (1993). *Case-based reasoning*. California: Morgan Kaufmann.

McLagan, P.A. (1997). Competencies: The next generation. *Training & Development*, 51(5), 40-47.

Mirabile, R.J. (1997). Everything you wanted to know about competency modeling. *Training & Development*, 51(8), 73-77.

Sanchez, J.I. (2000). The art and science of competency models: Pinpointing critical success factors. *Personnel Psychology*, 53(2), 509-511.

Spohrer, J. Sumner, T. & Shum, S. B. (1998). Educational Authoring Tools and the Educational Object Economy: Introduction to the Special Issue From the East/West Group. *Journal of Interactive Media In Education*. (http://www-jime.open.ac.uk/98/10/spohrer-98-10-paper.html)

TopicMaps.org Authoring Group (2001). XML Topic Maps (XTM) 1.0. (http://www.topicmaps.org/xtm/1.0/)

Wagner, E.D. (2002). The new frontier of learning object design. *The eLearning Developer's Journal*. June 18. (www.elearningguild.com)

Wiley, F.A. (Ed) (2002). *The instructional use of learning objects*. Bloomington, Ind.: Association for Educational Communications and Technology.

The Design of Interactive Applets for Mathematics Education

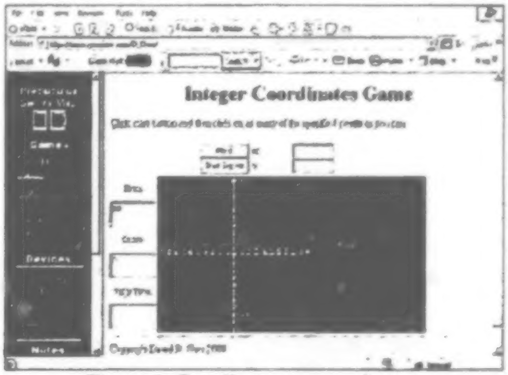
David B. Sher
Mat/Sta/CMP Dept.
Nassau Community College
1 Education Dr.
Garden City NY 11530
sherd@ncc.edu

This paper discusses the design of interactive applets for mathematics education. These applets were designed to use the Java AWT package (the graphical user interaction package that was part of the original Java distribution) so that they should run on the maximal possible set of browsers. The web site for these applets is http://www.calclet.com. Several challenges of designing applets for education are:

- Instructions for applets so they can be used.
- Layout of applet elements for reliability and ease of use.
- Interactive graph paper.
- Data sets from potentially unreliable internet sources.
- Using applets in a computerized classroom.

Web Page Instructions

I have found two methods for designing web pages containing applets. One method is to make using the applets fairly simple so the instructions can take only one or two sentences. Such applets may have only one button and one task to perform. For example in the coordinates game, figure 1, the user has only one button to press which starts the game and only one text field to modify, total time (accommodating students with special needs). Playing the game is quite simple too. Thus students can use an applet like this quite quickly after being introduced to it.



Integer Coordinates Game

Figure 1: Coordinates game web page

More complex and sophisticated applets require more sophisticated instructions. For example in the stock modeler web page, figure 2, the user must select a stock symbol, decide which statistic of the stock he wishes to use, and then write a modeling function. There are buttons, text fields and lists that are used to perform these functions.

BEST COPY AVAILABLE

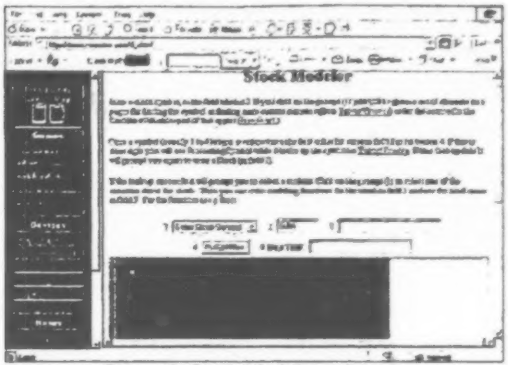


Figure 2: Stock Modeler web page

Numbering the various buttons, lists, and fields of the applet simplifies and clarifies the explanation of how to use it.

Detailed notes will be available for the applets once the package is complete.

Applet Layout

One of the most annoying aspects of designing java applets is the propensity of applets to leave out any fields or buttons that the layout manager can't fit in. There are several tricks needed to layout an applet so that the controls will not disappear and will be easy to use.

- Grid layouts make every item the same size. A large item is in a grid then every item is allocated the same space. This leads to overly large panels that then are often not displayed in the applet. Grid layouts should be used at a minimum.
- Controls for the applet can be placed around the applet on the left right or bottom of the applet. The most salient controls should be atop the applet but less important controls may be placed on the bottom. For example, in the slope drill applet, figure 3, the user selects two points and then must determine the slope. The user has the option to change the maximum value of X or Y on the graph. However, this should be used rarely to illustrate certain specific mathematical points. So, the fields and buttons to control the maximum values for X and Y are placed on the bottom of the applet.

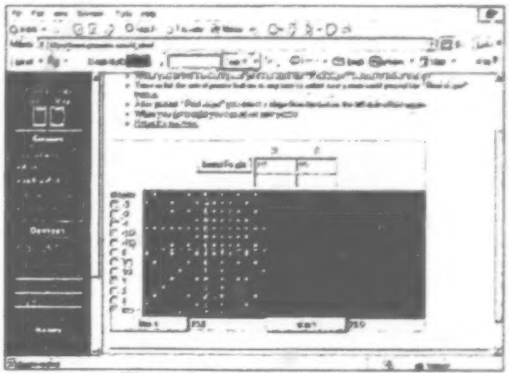


Figure 3: Slope drill web page

BEST COPY AVAILABLE

Interactive Graph Paper

Figure 1, figure 2, and figure 3 use a package of animated graph paper. This paper can change the range of the X and Y axis. Points can be placed on it or lines or more complex functions. When the user clicks on the paper, the program can determine where the user clicked on it and decide what to do about it. The slope drill, figure 3, uses all of these features. The Max X and Max Y fields allow you to change the ranges displayed. The display of two different kinds of points is shown in the figure. The user selected the blue point and the applet is waiting for one of the yellow points to be selected.

Internet Data Sets

The stock modeler, figure 2, and the economy modeler get data from internet sources. This presents two significant problems. One is that applets can only contact web sites on their own server. This was avoided by using a CGI web page on the server to access the web sites for the applet.

Another problem is that these applets are dependent on other web sites for their data. The stock modeler is dependent on Yahoo finance and the economy modeler uses the IMF. If these sites stop supplying the data or change the format the applets will be unable to access this data (stock prices or economic data). We are attempting to solve this problem by finding multiple data sources.

Computerized Classroom

While these applets can be used for distance learning, they were designed for use in a computerized classroom. These issues need to be addressed in this environment:

- Some students are uncomfortable with new teaching styles. These students often are good students, who were successful in previous math courses. My experience was that many of these students came to enjoy the games and drills available when they were successful. Usually a bit of personal hand holding was necessary to get these students started.
- Some students have serious problems using computers, due to psychological reactions or physical challenges. Every timed applet has a total time field, see figure 1. Changing the number in this field can allow these students extra time.

In the computerized classroom students often help each other navigate the web and use the applets. This collaboration among the students actually improves their performance in class. The modeling applets are designed to be used by groups of students collaboratively in semester long projects.

Summary

A package of applets has been designed for mathematics education. Several techniques for designing educational material in java are presented here. This paper focuses particularly on presentation of instructions, applet layout, use of the interactive graph paper, accessing data over the internet and using these applets in a computerized classroom. This package has been successfully used in a typical precalculus class at Nassau Community College.

Acknowledgement

The work in this paper was partially sponsored by the MSEIP program of the Department of Education, in a grant `#P120A010031` entitled `Four Colleges: Calculus + Enhancements`.

An Evaluative Study of a Distance Education Degree Program Using Focus Groups

Ching-Chun Shih (ccshih@iastate.edu)
Dan Dobill (ddobill@iastate.edu)
Ann Thompson (eat@iastate.edu)
Iowa State University

Abstract: The purpose of the three focus groups with the seven advisory panel members and 16 students was to evaluate the program in general so as to improve and strengthen the program. The participants of the focus groups identified the important or effective aspects of this program as well as its convenience, relevance, coverage of quality information, accelerated learning potential, structured lesson schedule, and the use of CD-ROM. They suggested the instructors to grade the assignments in a timely fashion. The participants thought the students of this program had fewer personal interactions with instructors or major professors than those in a traditional program. This program was as challenging as they expected, but they did not expect the intensity of the time commitment. Based on the results of this study, actions of improvement have been implemented.

Introduction

The Master of Science in Agronomy Distance Education Program of Iowa State University (ISU) has provided interactive multimedia courses delivered through the Internet and CD-ROM. This program uses three types of instructional technologies: course content, electronic communications, and electronic posting (Nguyen & Kira, 2000). The course integrates content material on CD-ROM/WWW with the interactive tools of WebCT (WebCT, 2002) on an ISU server. For electronic communications and posting, WebCT (know as the Student Notebook System in the program) has been used to allow students to interact electronically with their instructors and classmates by utilizing a course calendar, a discussion board, student homepages, an assignment area, student email addresses, and individual student records.

This program provides an opportunity for agronomic professionals working in industry and the government to obtain an advanced degree while continuing their employment. It began with an enrollment of 15 agronomic professionals in the fall of 1998. Currently, there are 128 students enrolled. By the summer of 2002, seven students completed and earned their degree. The students have to complete 12 courses, a one-credit workshop, and a three-credit creative component, which totals 30 semester credits to complete the degree (Iowa State University, 2002).

The program has conducted a series of formative evaluations to learn students' experiences in the program and to obtain an understanding and knowledge about Internet-based learning and teaching so as to improve and strengthen the program. The most current formative evaluation activities were the three focus group interviews in 2001. This paper presents the study purpose and objectives, methodology, results, conclusions, recommendations, and action for improvement based on the results of the focus groups.

Purpose and Objectives

The purpose of the three focus groups was to evaluate the program in general so as to improve and strengthen the program. Specifically, the objectives were to identify the important or effective aspects of the program, obtain suggestions for enhancing the curriculum, understand how this program was perceived as compared to a traditional one, and recognize the expectations of the advisory panel and students for the program.

Methodology

This study used the technique of focus groups to collect data. Being a form of qualitative research, the focus groups are group interviews, which mainly rely on the interactions among the participants to produce insights on the topics asked by the researchers or moderators (Morgan, 1997). Typically, the researchers encourage participants to talk to each other, ask questions, and comment on each other's experiences and points of view, which usually causes the participants to become an audience for each other (Kitzinger and Barbour, 1999).

The first focus group was conducted with the seven advisory panel members of the program while they attended the annual advisory panel meeting in March of 2001. The advisory panel members were the agronomic representatives from industry, government, academia, and student body. Only one of the seven advisory panel members was a student representative. The participants of the other two focus groups were the 16 students attending the workshop course on campus in July of 2001. There were seven students in one group and nine in the other. With the consent of the participants, the three focus groups were audio taped. Based on the analysis of the tape transcripts and the researchers' notes, the results of the three focus groups are presented as follows.

Results

Important or Effective Aspects of the Program

The participants of the three focus groups were asked to discuss the important or effective aspects of this program based on their experiences and observations. In general, they noted that the important or effective aspects of this program were its relevance, coverage of quality information, accelerated learning, convenience, flexibility, application emphasis, fixed lesson schedule, and the use of CD-ROM in the program.

The advisory panel members believed that this program provided relevant materials to students who were professionals in their fields. The student representative of the advisory panel revealed that courses offered by this program "*stimulated [students] to think creatively about the material much more than on-campus students would.*" In addition, one panel member was impressed with the various topics and quality information covered in the courses, as well as the additional references linked in the lessons. Another panel member added, "*just to have [the] access to those references, that's an incredible part of the course.*" One panel member anticipated this program would provide accelerated learning to the students because they could work at their own convenience, get a lot more done in a short time frame by being able to access the references on-line and save the commuting time. In addition, the student representative was impressed that the faculty and the course development team were able to finish developing the courses and deliver them on time. He further added that with the quality of the courses, he "*was surprised that it (this program) is not winning awards.*"

In the two student focus groups, one student admitted that convenience was a key reason for him to be involved in the program. Another two students were positive on the convenience of "not having to devote all [their] time getting to and from." Three students agreed that the option to work on the CD-ROM was a "*lifesaver.*" They also liked the convenience of using the CD-ROM and one student added, "*It is much better than being on-line... you don't have to be connected all the time.*" Another student further explained, "*Because I travel a lot, I can just pop that CD into [my] laptop and go through a whole lesson on a plane and also submit the assignments over the Internet. It is so convenient!*"

One student liked the materials he learned in the program because they were "*more in the field applicable level rather than [in] the theoretical aspect.*" In addition, another student enjoyed getting different perspectives from the diverse discussion groups. The time frame of week-by-week lesson was a very good format according to a student. He noted, "*it is structured so that you discipline yourself to get through all of the material in that lesson instead of just moving on.*" Moreover, a third student summed the effective aspects of the program by saying, "*The information I guess is affordable; it's available; it's applicable; and it is a quality course. The folks that go through this [program]...are going to be in a competitive advantage as they move through their career.*"

Suggestions for Enhancing the Curriculum

Not only did the focus group participants share their opinions about the important aspects of the program, but they also discussed their concerns about the program and provided suggestions on how to enhance the curriculum. The advisory panel suggested the program add business related courses and increase the social interaction aspect of student learning. They agreed that there was a need for the program to provide business related courses, such as business management, communications, and agriculture economics. Several panel members noted the lack of social interaction among the student peers was one limitation of the program. However, the student representative in the advisory panel stressed that he did have good opportunities to interact and communicate with his peers via emails and structured discussion topics. But he also "*enjoyed a great deal*" the face-to-face conversation he had with the students at the summer workshop. He concluded that it all depended on how to look at this aspect by saying, "*Wouldn't it be nice if we had to do this a couple times a year, but then immediately you would...[think] it's fine for us that are all within Iowa and neighboring states, but for them (people live far away) it is just trade offs...I think that kind of depends.*"

The biggest concern of the two student focus groups was with the instructors' feedback. Most of the students in the other two focus groups expressed their frustration with not getting their assignments graded in a timely manner. A student stated, "*Most of the folks (students) I have talked to have problems getting assignments, grades, and things like that back.*" Another student added, "*that is very hard to get...you don't know what your progress is.*" A third student further argued, "*I guess if we are expected to have assignments done every Tuesday morning, why shouldn't we expect the same out of the professors?*"

Several students suggested that instructors reference the textbooks in the CD-ROM lessons. One student noted, "*They (instructors) had a lot of stuff in there (CD lessons)...[they] just didn't reference back to it at all...I mean you just didn't know where you were looking.*" In addition, several students thought it would be helpful if they could submit their assignments as attachments through WebCT especially for the courses that use math symbols. Also, several students would like to use more tools in WebCT, such as e-mail, and chat room functions. Furthermore, one student suggested using MSN Instant Messenger in the program. In that way, "*you can chat while you are doing homework...you know when somebody else is on-line and it gives you a prompt,*" according to this student. Moreover, several students had concerns about the advisor system. Another student suggested assigning advisors right after students start their program and they can easily switch later. "*Just so you have someone consulting with you,*" this student explained further.

In addition, many students suggested the program make hard copies or audiotapes of the lesson contents as an option for students to purchase. Two students noted that using the hard copies were easier to make notes, study for tests, and locate the concepts they just learned compared to the WWW/CD-ROM format.

As Compared to a Traditional Program

The participants were asked to discuss how they perceived this program as compared to a traditional degree program. The panel members of the first focus group believed it was an important and necessary way to have this program and it was "*a very natural progression of how education should work.*" One member emphasized that this program "*was an additional way, and it has to be an effective way to meet a critical need.*"

Several students in the other two groups noticed the differences in interactions or self-discipline in research. They believed that they had fewer personal interactions with instructors or major professors than those in a traditional program. One student suggested, "*Maybe we need actual physical interaction, person-on-person, once a year or twice a year... the eyes, the hair, and the way you represent yourself. I want to see Dennis Todey (one of the instructors) in person.*" Furthermore, several students expressed that they would have taken classes on campus if their situations permitted. However, one student admitted that this program was better than a traditional one to him by asserting, "*If this wasn't a distance program, we wouldn't be going after our masters.*" He then continued saying, "*It is a very favorable way you are doing it... the drawback... is you don't have that long one-on-one interaction as if you would [learn from a traditional program].*" In addition, several students revealed that in this program, they had fewer opportunities to talk to their major professors about research than those in a traditional program.

Expectations for the Program

Most of the panel members' expectations for the program were related to the program quality. One member noted that at the beginning he was afraid that this program would produce a "cheap degree" and he was glad that this program did not turn out that way. Another member added, "*I think that my expectations continue to be this: How do we meet all commitments within [our] students? To ensure quality education, I think the university has an obligation to provide [the learning opportunities] to any learning individual whether on campus or not.*"

The student representative in the advisory panel stated that he "*enrolled in the program to not become a research agronomist, but to become more familiar.*" As a student, he originally expected the program "*to be less challenging than it is and to take up a little less time than it does.*" However, he was glad that this is not the case. He stressed this by saying, "*I think a program like this can be open to criticism of not being as rigorous as an on-*

campus program, so I think we need to constantly defend against that even if we error on the other side, which we have. And I wouldn't want the bar to be lowered at all in either of those areas..."

Several students in the other two focus groups expected this program to be as challenging and hard as it was when they entered the program. One student said, "***I think the difficulty level is good. I expected it to be challenging because it is not something that should be too easy or just any other Joe can come into it and get it.*** " Another student liked the information covered in the courses, which was more advanced than he thought it would be. He then continued stating, "***I don't think anybody in this room can argue that the information is not solid.***" A third student thought he learned a little more than he needed to know as an agronomist in this program, which gave him "***a little bit more credibility to people that he was talking to.***" On the other hand, several students also noticed that they did not have enough time for their families. One student said, "***The aspect we have been leaving out of here is family... not enough time for my kids. I carry my book to a ballgame.***" The students then suggested having a few students who had been in the program for a complete year to talk to new students at the orientation about their experiences and how to manage their time between family and work.

Conclusions, Recommendations, and Actions of Improvement

In conclusion, the program advisory panel and students were impressed and satisfied with the quality of the program. The participants of the three focus groups identified the important or effective aspects of this program as its convenience, user friendliness, relevance, coverage of quality information, accelerated learning, structured lesson schedule, and the use of CD-ROM in the program. The advisory panel thought that students in the program might lack social interaction among their peers whereas the students revealed their biggest concern was with the late grading or feedback they received from the instructors. The students also would like to see instructors reference the textbooks in the lessons and be able to purchase the hard copies of the course contents, do keyword searches among the courses, as well as attach files, use email, and chat room functions through WebCT. As compared to the students in a traditional program, the students believed they had fewer personal interactions with their instructors or major professors. The advisory panel was pleased to see that this program did not turn out to be a watered-down degree program as they were concerned with initially. The students thought this program was as challenging as they expected, but they did not expect the intensity of the time commitment.

The recommendations were that the program should continue providing quality courses, increase the "personal touch" among the instructors and students, as well as provide timely feedback to the students. Taken into account by the program, these recommendations have been used to improve and strengthen the program. For example, the actions of improvement included: (1) Several instructors added video clips to introduce their courses so as to increase a personal flavor in the class. (2) The Fall 2002 new student orientation was held on campus at the same time when the workshop course was offered on campus in July of 2002. A social and learning opportunity was provided for the new students to interact with the students attending the workshop. (3) The program director developed a grading policy agreement with the instructors of the program to grade, post scores, and provide feedback in a timely manner regarding assessment of student work. The results of the later course evaluations proved this effort. (4) The program created pdf format files for the CD lessons, which is an easier print solution and allow for key word searches.

References

Iowa State University. (2002). Master of Science in Agronomy Distance Education Program (WWW document). URL *http://masters.agron.iastate.edu.*

Kitzinger, J., & Sbarbour, R. S. (1999). Introduction: the challenge and promise of focus groups. In R. S. Barbour and J. Kitzinger (Eds.), *Developing focus group research: Politics, theory, and practice*, Thousand Oaks, CA: SAGE Publications, Inc.

Morgan, D. L. (1997). *Focus groups as qualitative research* (2^{nd} edition). Park, CA: SAGE Publications, Inc.

Nguyen, N. D., & Kira, D. S. (2000). Summative and formative evaluations of Internet-based teaching. In Lau, L.K. (Ed.), *Distance learning technologies: Issues, trends, and opportunities*, Boulder, Colo.: NetLibrary 2000.

WebCT. (2002). WebCT. URL *http://www.webct.com/.*

First Encounters: Using Educational Multimedia As a Learning Tool In the Traditional Classroom

Ann M. Shortridge, Ed.D.
Dale Bumpers College of Agricultural Food & Life Sciences
University of Arkansas, Fayetteville
United States
ashortr@uark.edu

George Sabo, III, Ph. D.
Fulbright College
University of Arkansas, Fayetteville
United States
gsabo@uark.edu

Abstract: Today, the use of the multimedia to teach topics is growing at a rapid pace. However, many questions concerning its educational effectiveness still exist. What does well-designed multimedia actually look like? and, How can teachers best incorporate it into their own curriculum? are examples of such questions. The primary goal of this study was to assess the instructional value of a multimedia product through its integration it into the curriculum of a traditional undergraduate course in anthropology. As a by-product, the data also offers possible answers for these questions.

Introduction

In the fall of 1996, the Arkansas Archeological Survey and the Department of Foreign Languages at the University of Arkansas, Fayetteville were awarded a $180,000 National Endowment for the Humanities (NEH) grant to develop educational software for studying Native American and European encounters in the Mississippi Valley. This project, called First Encounters, was one of only twelve proposals funded out of more than 300 submissions in the first year of the NEH Teaching with Technology Initiative. The goals of this NEH initiative were to encourage creation of content-rich, computer-based materials for teaching history, literature, and languages; to create a nationwide forum for humanities education on the Internet; and to provide teacher training for the use of these programs. The paragraphs that follow describe how First Encounters was designed and then evaluated through its implementation in a traditionally taught course.

Learning Objectives, Theoretical Underpinnings and Instructional Design Strategies

A primary goal of the First Encounters project was to help students answer the question: How does one derive from the archeological and historical record an understanding of what happened in the past? Therefore, the First Encounters CD-ROM was designed purposefully to engage students in an active investigation of many aspects of Native American and European encounters via original historical sources such as texts, maps, artworks, and archeological finds.

The Lower Mississippi Valley was chosen as the area of study because of the region's great range of cultural encounters, involving numerous British, French, Spanish, African, and Native American groups. These differing cultural perspectives between groups were used to provide a framework for students to analyze the "facts" recorded in written and pictorial documents. Since French and Spanish explorers wrote many of the original documents, language-learning tracks were also developed, making the software useful for multiple subject "teaching across the curriculum."

The English language track leads students through a detailed presentation of historical and anthropological materials that describe the encounters between Native American communities and the French, Spanish, and British explorers, traders, missionaries, and colonists who entered the Mississippi Valley during the sixteenth through eighteenth centuries. Subject modules include Two Worlds, First Encounters, Views of the Land, Exchanges, Interactions, and Legacies. The French and Spanish modules each provide four topical modules designed for enhancing foreign language skills while studying Native American and European encounters within the English track.

First Encounters was designed on Kathy Kozel's (1996) Interactive Experience Model (IEM) to provide a format for active learning across the curriculum in social studies, foreign language, anthropology, history, and geography classes at middle school, high school, and college levels. IEM may be described as an instructional design method that focuses on active learning and user engagement and is recursive in nature. Successful user engagement is defined as achieving flow state as outlined by Mihaly Cikszenmihalyi (Kozel, 1996). Briefly, flow state "is a state in which an individual has no conscious awareness of time passing; it is a state of complete engagement" (p. 62).

Following this instructional design model, hundreds of interactive screens were created to allow the students to arrive at their own interpretations by applying anthropological concepts to the raw materials of history. Further, the interactive screens engaged students in the process of learning first-hand the methods of historical and anthropological analysis by offering dozens of exercises, tutorials, quizzes, and essay prompts with step-by-step instructions.

Research Design

In order to evaluate the quality of the First Encounters CD-ROM when production was completed, Dr. George Sabo integrated the CD-ROM into an existing undergraduate course, ANTH: 4813: Ethnographic Approaches to the Past, as a learning tool. The course was taught in a seminar format that included: the CD-ROM as a central feature, traditional lectures, a WebCT discussion forum, and three textbooks. These books were: The Indians' New South by James Axtell (1997), The Old World and the New by John Elliott (1990) and The Emperor's Mirror: Understanding Cultures through Primary Sources by Russell Barber and Frances Berdan (1998). All of the reading assignments, project due dates, and other significant class schedule information was posted in the WebCT forum. In addition, students were instructed to post their essay responses in the forum. The primary objective of the course was to teach students how to critically evaluate primary source materials and extract useful information from those materials. In short, the main goal of this class was to instruct students how to do anthropological research using historical source materials.

Once again, the primary goal of this study was to assess the instructional value of a multimedia product in an authentic context within a unique case orientation. As a by-product, the data also offers possible answers to the two questions posed earlier. This study employed two types of document analysis in order to: evaluate learning outcomes, examine user patterns, and probe student perceptions and attitudes. The CD-ROM contained essay assignments that were collected from the students during the course term and qualitatively analyzed by Dr. Ann Shortridge to evaluate the quality of instructional design method used to present the materials via learning outcomes. In addition, at the end of the course students were asked write summative essays that were also qualitatively analyzed by Dr. Shortridge to: examine user patterns, and explore student attitudes and perceptions about their learning experience. A high middle and low achieving essay of each type was randomly selected and coded for themes and patterns. Three CD-ROM contained essays (one low, middle and high achieving) and six summative essays (2 low, 2 middle and 2 high achieving) were analyzed in order to gain a representative view of all of the participants. (I.e., a cross section snap shot of the entire student population can be seen by randomly selecting members from each group.) When reading the next two sections of this paper please note that "fes" denotes a First Encounters summative essay 1, 2 and so on and L, M, H denotes low, middle and high achieving levels. The CD-ROM contained essays findings are not reflected by individual student quotes, but contained in the general summary of results concerning learning outcomes.

Features of Well-Designed Educational Multimedia

Analysis of both of the data types provided a good description of what well-designed educational multimedia looks likes. It is interactive or engaging, informative, well structured, practical and yields favorable student ratings. Analysis of the CD-ROM contained essay responses showed that students were able to use the analysis techniques included within the CD's content/software to adequately identify and describe the differing and changing worldviews of Spanish explorers and Native Americans through examination of primary source material. Therefore we can assert that the analysis techniques included within the CD's content/software contributed to successful learning outcomes. Analysis of the summative essays highlighted student perceptions of the total learning experience. Selected student comments from the summative essays are provided below in order to illustrate what aspects of the curriculum the students found most valuable.

All of the students rated their own learning experience highly. One student shared the following: The ability to critically analyze various materials is a skill that any decent anthropologist needs, and I felt that I am getting closer to that goal. I might not remember exact details about the Quapaw calumet ceremony, but I feel I could semi-competently analyze historical documents on the subject. I also learned that the written word is not the definitive source to look at when researching a particular topic. One must look at a broad range of material in order to get a clear picture…(fes3_L).

Another student elaborated: The exercises really provided us with the means to (or forced us depending on your perspective) to really work with and critically evaluate an enormous wealth of primary source material, pull useful information from those materials, and use that information in an assortment of creative ways. Beyond any fragment of a doubt, we stayed busy working with this software. On top of this, I dare say that we learned diverse techniques and considerations in a way that was uniquely executed and highly effective in the goals it was designed accomplish (fes2_M).

Yet another student commented: The CD-ROM was quite a switch from other classes I have taken, which make you memorize boring facts and expect you to regurgitate them in the form of multiple-choice tests. The CD-ROM had a wide variety of materials that was open to any interpretation, so long as I could back up my points (fes3_L).

Two thirds of the students indicated that they believed that use of the CD-ROM increased their level of engagement within a traditionally taught course. One student said: I think that the CDROM allowed for the class to keep to a schedule better, since it was divided into segments, and you had to complete the essay as soon as you were finished reading the material (fes3_L).

Another student asserted: The lessons on the CD-ROM are grouped in a very intuitive and logical manner according to meaningful categories, especially for individuals who would be unfamiliar with a great deal of the jargon associated with anthropological research. Additionally, the qualifying of the exercises into beginner, intermediate, and advanced increases the utility of the program by allowing its use by a broader demographic (fes_1M).

Students also commented on the other instructional tools used in this course. Their comments highlight how educational multimedia can be successfully integrated into traditional courses. Please note that students were not requested to comment on traditional lectures and a larger sample might yield greater insight regarding computer-based tools.

All of the students asserted that they believed that the textbooks used in this course were exciting, and beneficial. Students further elaborated that the textbooks supplied needed guidelines and background information. One student said: I found the books to be rather exciting…

Another student shared: The texts functioned well as a good segue into the real meat of this course: the First Encounters software…

Yet another student asserted: The textbooks were very beneficial as a source of background information. The books helped in the understanding of what the Europeans expected to see when they left Europe and how their view of the world was shaped by their culture (fes10_L).

In addition, many of the students expressed that the textbooks integrated well with the use of the First Encounters CD-ROM. One student stated: The authors' explanation of the reality-mediation model also proved very helpful for the eventual applications and interpretations necessary for the CD-ROM [exercises and essay assignments].

> Another student shared: I felt that you [Dr. Sabo] did just as good a job of presenting theoretical models as did Barber and Berdan. And while their work was useful, I found your explanation of models to be equally useful - perhaps even more useful since the CD combined the explanation of models with practical exercises (fes9_H).

While only a few students mentioned a specific preferences for other computer-based tools, several students affirmed the value of posting assignments and engaging in discussions in the course's WebCT forum. One student's comments about the use of WebCT as a discussion and essay publication forum was as follows:

> The CD-ROM for the course, First Encounters, was both extremely informative and practical for the purpose of our course…Speaking of the essays on the books, I would like to add that I found the discussion section on the WebCT to be extremely beneficial in writing my essays. At first, I would write my essay and compare it to what others had written. That was intimidating to say the least, since most seemed to be reiterating arguments from the books, but I decided that if I messed up, I would mess up on my own merit. The amount of essays, including their length requirement, taught me how to write more precisely. Once we started working on the CDROM, I found the essays to be extremely helpful. Many people would include points that I had missed in my readings. I regret that I wasn't able to read through everyone's essays, but I did zero in on a couple of people who carried the discussions in class. The essays gave me the confidence to show my work to other people, and that was great since I had to defend my thesis this semester. I am rather shy during class discussion…I think being among graduate students made it difficult for me express myself better, since I didn't want to come across as ignorant. This final essay will probably not help diminish that image. But I also got more confidence in being able to get into graduate school (fes3_L).

Conclusions, Implications and Future Directions

A qualitative analysis of two different types of essay documents indicated that the First Encounters CD-ROM is a valuable learning tool. Analysis of the CD-ROM: contained essays indicated that the analysis techniques included within the CD's content/software contributed to successful learning outcomes Analysis of the summative essays revealed user patterns, and student perceptions and attitudes. One hundred percent of the students rated their own learning experience highly, 66% of the students indicated that they believed that the CD-ROM increased their level of engagement within a traditionally taught course, and 33% of the students indicated that they preferred learning with technology. In addition, the students also asserted that the First Encounters CD-ROM worked well with other instructional methods such as textbooks, assignments, and other computer-based tools. Therefore, it is obvious that this case study provides evidence that course authors can design effective multimedia around active learning theories and user engagement that will contribute to successful learning outcomes. However, this study is a single case study and as such cannot be broadly generalized. The results of one case study may be insightful, but the results of a series of case studies, which examine the same topic, would be more conclusive. Further case-based evaluation of the use of First Encounters in additional university and K-12 classrooms is currently underway and will provide the opportunity for a meta-analysis of multiple case results. In addition, a blueprint for disseminating the case studies along with guidelines and lesson plans on the First Encounters web site as a teacher resource is currently being drawn up.

References

Kozel, K. (1995, November). Crafting the user experience. *Multimedia Producer*, 72-80.

Kozel, K. (1996, January). The interactive experience: Designing with the spiral. *Multimedia Producer*, 61-66.

ENHANCING INSTRUCTIONAL DEVELOPMENT PROCESSES FOR E-LEARNING

Deborah Jones
Teaching and Learning Unit
RMIT Business Online
Melbourne, AUSTRALIA

Rod Sims
Teaching & Learning Support Unit
Deakin University
Geelong, Australia

Abstract

Many tertiary institutions in Australia provide support to develop online teaching and learning resources, an environment characterised by demands from students for quality face-to-face and distance education, staff concern over workloads, institutional budgeting constraints and an imperative to use management systems. There also remains a legitimate focus on using online learning to facilitate new learning strategies within a complex social setting. This paper presents an extended instructional design model in which the development cycle for online teaching and learning materials uses a scaffolding strategy in order to cater for learner-centred activities and to maximise scarce developer and academic resources. The model also integrates accepted phases of the instructional development process to provide guidelines for the disposition of staff and to more accurately reflect the creation of resources as learning design rather than instructional design.

Introduction

As managers of support units in two Australian universities, we find that academic staff often have too little time or too few skills to maximise the benefits of online learning. At the same time, our institutions, like many others, are emphasising the role of enterprise-based Learning Management Systems. Within this environment, our roles involve the design and development of online teaching and learning resources within tight timeframes and institutional constraints. This short paper provides some insights into strategies that may increase production efficiency and enable ongoing maintenance of online environments. The focus of our speculations is in the context of a single Faculty, but could be expanded to the whole unit or contracted to a single unit.

A Three-Phase Design Model

Integral to this process is he notion of iterative development or successive approximations, with initial prototypes being built to *test the water* before completion of the entire course. In the first iteration learning environments are generally created to provide functional delivery with the necessary componentry for effective online teaching and learning. This can include the outputs of a preliminary needs analysis of the learning environment and resources that are *scaled to fit* the proposed teaching and learning context. However with the second and subsequent iterations, development can be enhanced with each generational change. In addition, the model is based on a team approach, bringing together the three main elements of course development in a more lateral manner. No longer is process driving the development, but the project itself (i.e. the course) is dictating the make up of the teams (a cross section of skills from educational design and production) in a much more targeted and effective manner. These teams ideally stay formed for the duration of the project, potentially over a number of semesters, with communication and collaboration between academic staff and developers a key focus.

The model therefore reinforces both the team-based approach to the design and provision of resources as well as an *iterative* development process. One of the essential aspects of the model is the specification of *baselines* in levels that correspond to these iterations – the first relating to course functional and essential components, the second to multimedia enhancement or interactivity and the third to ongoing maintenance. These iterations are identified within the strategy as three scheduled phases of development that integrate both a methodological approach to unit development, scaffolding and quality controls and assurance, as illustrated in Figure 1.

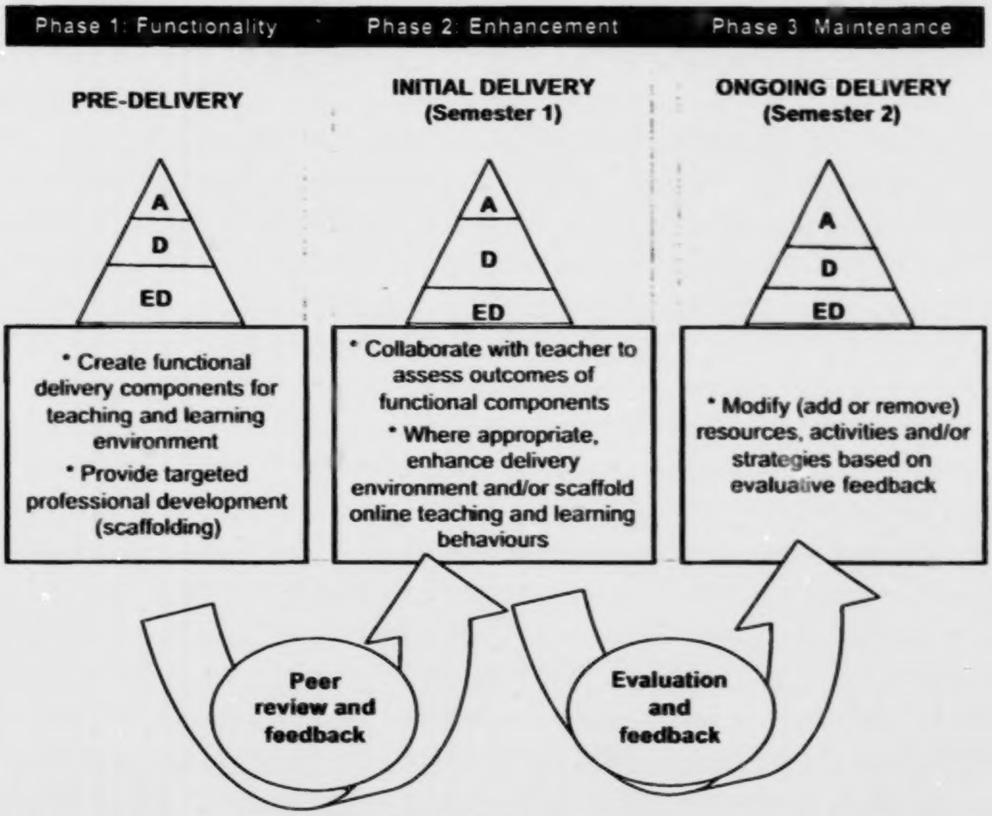

Phase 1: Functionality
Phase 2: Enhancement
Phase 3: Maintenance
PRE-DELIVERY
INITIAL DELIVERY (Semester 1)
ONGOING DELIVERY (Semester 2)
A
D
ED
A
D
ED
A
D
ED
* Create functional delivery components for teaching and learning environment
* Provide targeted professional development (scaffolding)
* Collaborate with teacher to assess outcomes of functional components
* Where appropriate, enhance delivery environment and/or scaffold online teaching and learning behaviours
* Modify (add or remove) resources, activities and/or strategies based on evaluative feedback
Peer review and feedback
Evaluation and feedback

Figure 1: Three-Phase Design & Scaffolding

An important feature of this model is the distribution of resources at each iteration (A - Academic; D - Designer; ED- Educational Designer). The outcome of our continuous improvement paradigm is to enable the academic to become an independent designer and developer, through the maintenance of online content, over a period of time. However, it is also assumed that the Designer and Educational Developer would maintain contact with the project over a period of time. The triangles indicate the relative efforts of the critical members of the project team at each phase of the process, based on the influence model (Sims, 1997), which articulated the period at which factors had specific influence over the project. The allocation of resources to enable this process involves establishing "unit teams" whose commitment will vary according to the position of the unit in the development cycle, with expertise based on the varying requirements of the course. More importantly, within the context of our work environment, it is the allocation of resources for the duration of the project life that differentiates the model, as detailed in the following description of the phases.

Phase 1: Prepare Functional Components

The aim of this phase is to design and create a functional teaching and learning online environment that will meet all learning outcomes as well as faculty teaching and learning strategies. The first phase therefore becomes easier or simpler than more traditional models of instructional design, as it is functional, and production does not

BEST COPY AVAILABLE

try to complete a final package at the first attempt - the process can therefore be likened to enabling a "dress rehearsal" for both teacher and leaner. The process also involves specifying the *core items* for this phase, such as specific teaching resources (e.g. unit guides, study guides, readings), their mode of access (e.g. print, online) and the essential educational strategies (e.g. experiential, situated, learner-centred). In this way the academic who has minimal experience with online teaching and learning environments has an relatively easy introduction to the environment while knowing that ongoing support will enable the generational development of that environment. An equally important aspect of this phase is the allocation of team members and their specific role within the project, which can be articulated in terms of:

- *The Support Team*: Providing the Educational Designer (responsible for educational advice and curriculum design), the Interactive Architect (responsible for ensuring the online interactions and communications are consistent with the design) and Information Analyst (responsible for ensuring all required learning resources and objects are available). In addition, Project Management support will be required
- *The Faculty Team*: Allocating the Content Specialist(s), who are responsible for ensuring all necessary content is defined and that all learning outcomes, learning activities and assessment tasks are defined. In addition, a commitment to the schedule and baselines/guidelines is critical.

In addition, an Online Developer, Network Specialist and Technical Specialist will both advise and be advised on required and/or appropriate learning environments. Another aspect of the concept of *influence* is that members of the development team are understood to have potential levels of influence at any stage of the development and delivery process, although that influence will be affected by the current status of the project. For example the Interactive Architect, who has the main responsibility (influence) for creating the design specifications, may also be active in the quality review of the project as it nears completion. An important concept underpinning this model is that, like actors in a play, the team members all have roles to play and particular *scenes* or *acts* within that process will require their leadership. But they can also have smaller, but by no means unimportant, roles throughout the whole development, delivery and maintenance cycle.

Phase 2: Evaluate, Elaborate and Enhance

The second phase is conceptualised to take place during the delivery of the unit, with feedback from both teachers and learners used to modify and enhance the delivery environment. This may include the introduction of content items and enhancement of teacher:learner, learner:content or learner:learner interaction conditions (Sims, Dobbs & Hand, 2002). It is also an opportunity for teachers to work in a scaffolded environment to maximise the effectiveness of online environments, where the efforts of both teacher and learner can be evaluated and the delivery environment enhanced on the basis of that evaluation. This process also allows for clearer scheduling of resources and consequently planning, production and workflow processes.

This phase will require a *team-based* approach to delivery combining, where appropriate, both academic and technical staff in two discrete components. The first requires more technically-oriented teams to "shadow" the delivery of the unit materials defined and created in Phase 1 to both assess their efficacy as well as integrate additional content, interactive learning objects and collaborative activities. The second includes the provision of targeted professional development or scaffolding on an "as required" basis for all participants in the learning process. Overall, this phase emphasises generational changes with an increased emphasis on the production (completion) of resources, with the students or learners having the role of research or evaluation assistants. There is less emphasis on handover, and more emphasis on *duty of care* through the availability of sustainable course materials and teaching resources. It is by developing and building effective communication paths between each of these three groups that a shared understanding of the project goals and learning outcomes can be established.

Phase 3: Maintain

Following completion of the course of study, additional modifications and enhancements are prescribed and implemented for subsequent delivery. The unit would then continue in "maintenance mode", involving ongoing support and training, until it undergoes a more formal review. Again, the important concept underpinning this model is that the original functional system developed will always be subject to change and that any development environment must cater for resources to be available for the duration of the life-time of a course (or unit) of study. Within tertiary institutions this can be as long as five years, the time between a unit's conception and its formal review for reaccreditation. However, the sustainability of the course is catered for by the continual process of gathering and incorporating evaluation data.

2002		2003		2004	
S1	S2	S3	S4	S5	S6
Prepare materials for S2 units	Deliver S2 units	Deliver S3 units	Deliver S4 units	Deliver S5 units	Deliver S6 units
	Shadow and enhance S2 units	Shadow and enhance S3 units	Shadow and enhance S4 units	Shadow and enhance S5 units	Shadow and enhance S6 units
	Prepare materials for S3 units	Prepare materials for S4 units	Prepare materials for S5 units	Prepare materials for S6 units	
		Evaluate S2 units	Evaluate S3 units	Evaluate S4 units	Evaluate S5 units

Figure 3: Implementing the Plan

The success factors will depend not only on the concept being accepted but also for academic staff, students and the development team to reconceptualise their roles in the design and delivery of online educational resources. For teachers there is the option to collaborate with an online development expert while delivering the course to implement modifications based on student feedback; for learners there is the opportunity to contribute to both the content base and the educational strategies. Figure 3 demonstrates how the model may be implemented over a three-year cycle, with the assumption that units of study are delivered on a semester basis.

Conclusion

Higher education in Australia is changing. To meet these changes and challenges innovative models for academic support are required, and these are our initial thoughts on one such model. In the conference presentation we will introduce the work environments in detail, describe the advantages of the influence model for instructional design (Sims, 1997) and then detail the modifications to this model to enable our 3-step strategy to be implemented. The value of this plan is the innovative ways in which it conceives the development process, not as *design – develop – implement – evaluate* , but rather *develop baseline – implement/evaluate/develop – maintain/evaluate*. We believe this model has significant potential for higher education support units and look forward to receiving feedback on our concepts.

References

Sims, R., Dobbs, G. & Hand, T. (2002). Enhancing quality in online learning: Scaffolding design and planning through proactive evaluation. *Distance Education*, *23*(2). 135-148.

Sims, R. (1997). Interactive learning as an "emerging" technology: A reassessment of interactive and instructional design strategies. *Australian Journal of Educational Technology*, *13*(1), 68-84.

BEST COPY AVAILABLE

Distance Learning Needs in Indonesia Business Companies

(Survey Research Report on Distance Learning, 2000)

ABSTRACT

In dynamic competition we are facing today, the development of human resources in an organization play a vital role to enable the organization to sustain and compete with others. The emerging and convergence of information technology and telecommunication have come up with various application that support not only for the company daily operation but also for developing its human resources knowledge and skill through e-learning.

Distance Learning, where student and teacher are connected by technology rather than by classroom, is becoming a viable option to traditional teaching methods, and is poised for major growth over the next several years. According to Group Computing Magazine, Sept/Oct 1998, the percentage of large corporations with pilot online training programs in 1997 is 81% and percentage of corporate training departments planning take training online by 2000 is 50% and percentage estimated to be delivered in 2000 is 28%.

In Indonesia, distance learning has initiated formally by Indonesia Open University since 1984 by majority using printed module. Up to now the development of distance learning is still slow. As the technology is growing fast (eg: the internet) and the significance incremental of internet user, it has created an exciting opportunities for all to implement a technology based distance learning (e-learning).

In searching the needs of distance learning in business company in Indonesia, Information Technology Research Division of PT Telekomunikasi Indonesia, tbk did a survey research to "Top Companies and Big Groups in Indonesia", mostly they have a headquarter office in Jakarta, in the year of 2000.

The objective of this survey research is:

1. To identify the awareness level of using distance learning as corporate training activity.

2. To know the perception of distance learning in business company.
3. Try to find out the need of distance learning for corporate training and technology needed for distance learning.
4. To find out the market size of technology based distance learning and potential market of each technology.

The sample of the survey was taken from 585 companies (population of "Top Companies and Big Groups in Indonesia") with *stratified cut-off random sampling*. The stratification was done based on business category of the company. With 585 companies population and 10% bound of error, we found out 85 companies as sample for this survey research. The sample in each business category is chosen through linear systematic random sampling method. The survey research was done within May to July in the year of 2000 in Jakarta. The respondent of the company was requested from the top management of the company, especially from the training center department. In order to balance the information, from each sample also requested to provide another respondents; employee of the company who ever joined the course in the company training program (trainee) and the training instructor (trainer). The result analysis of these 2 respondents will not use to represent the whole trainee and trainer. The surveyor through the questionnaire interviewed each respondent.

DISASTER MEDICINE ONLINE: AN INTERNET BASED MODULAR CURRICULUM FOR HEALTH CARE PROFESSIONALS

B. Singleton, P. Parks, A. Lund, K. Lam.
University of Alberta, Division of Emergency Medicine, Edmonton, Alberta.

Background & Need for Disaster Medicine Training

Disaster Medicine (DM) training for healthcare providers is currently lacking within Canada and throughout the world. Until 1993 there was in existence a one-week Disaster Medicine (DM) course offered in Arnprior ON, Canada for physicians. The course was delivered in a face to face style that necessitated the students travel to the site of the course. The course is now defunct and there are no known plans to resurrect the course in the future. A needs assessment completed in Alberta showed that the majority of physicians (> 70%) felt a DM course would be both valuable and something they would invest time in taking. Although physicians were the target of the needs assessment, there is a dearth of DM training available to all types of healthcare professionals. Although the Disaster Medicine Online (DMO) project began prior to September 11, 2001, the events of that day are a tragic reminder that training in DM is a need for all communities.

In January 2000, the DMO working group at the University of Alberta began work on a Distance Education (DE) solution to the DM training deficit (www.disastermedicine.ca). As development began it became evident that this project could be applicable not only to physicians but to other health care providers as well. The DE model was chosen because of a number of advantages it provides to health care providers. The DE model allows for affordable, accessible, asynchronous, and active delivery of disaster training. If students are required to travel to one location for the course there is a large financial cost for travel, accommodation, and lost wages. Health care providers are busy and taking a week off for a course may be impossible. In order to provide the best possible learning environment one would hope to receive instruction and content creation from experts within the field of disaster medicine. These DM experts are in short supply, and also originate from geographic locations across the globe. By adopting a DE model of DM training, it becomes possible to unite a large number of students from varying geographical locations with the finite pool of DM experts. The DE model allows these obstacles to be overcome, and provides a great deal of flexibility to the DM students.

Given the vast growth and availability of the World Wide Web, this medium was selected to deliver an asynchronous style course. Being asynchronous and Internet-based allows students to take the course at times and places that are most convenient and least disruptive to work and personal responsibilities. The Internet and asynchronous mode also allows classes to consist of students from numerous countries and time zones.

The course site was created using a combination of hand coding HTML and Dreamweaver 4.0. Although the members of the Course Development Team (CDT) each worked on separate portions of the course, weekly meetings were held to review all content work. At these meetings decisions were made on changes to current work and timelines were created for future work. All members of the CDT were aware of work being done by the other members of the CDT. The CDT researched, wrote content, and created the web version for the pilot modules of the course. As future modules are developed the goal is to use expert writers for the development of course content. The CDT would then be responsible for adapting this expert content to a web format, with the goal of ensuring sound instructional design. A 'Writers

Guide' was created during the development of the first module as a resource for expert writers of future modules.

Description of Disaster Medicine Online

Disaster Medicine Online is a modular, interactive, asynchronous, Internet-based course. The modular concept allows for learners (physicians, nurses, pre-hospital personnel, administrators, etc.) to participate in core modules early on, and to continue through more specialized modules to their level of training and/or interest. Interactivity is accomplished by using Computer Mediated Conferencing (CMC) boards, course facilitator (online tutor), pre-tests, and conversational style language. We feel that interactivity and solid instructional design differentiates this course from a mere informational web site, and as such places DMO in the higher category of an educational course which utilizes the Internet as its delivery vehicle.

Disaster Medicine Online consists of six DM modules and one Welcome Week module. The Welcome Week module ensures all students have the necessary computer skills to complete the DMO course. The DM modules are made up of a series of lessons with each lesson having clearly stated learning objectives. Individual lessons are intended to be completed in one sitting and may have exercises or activities within them. It was assumed most students would complete the course in the order set out by the lessons, however a student who chose to omit or complete lessons in a different order would be able to do so. The majority of the course is text and graphics with some multimedia included. Feedback indicated the multimedia was interesting however often it did not add educational value. An attempt will be made to ensure future modules contain germane and pertinent multimedia clips.

The Computer Mediated Conferencing (CMC) board is a tool used to allow students to interact with each other and for the course facilitator to interact, assist, and direct learning. Each course has it's own CMC board that is used to pose and answer questions. The boards are also used to discuss topics initiated by the facilitator or students.

Despite being asynchronous the course is run with a finite class of students and a specified start and end date. Ensuring the students stay on track during the specified timeline is one of the many integral roles the course facilitator plays. In addition to time management, the role of the course facilitator is to aid in the interactions of the student with both the learning materials and with each other. The facilitator maintains frequent communication with the students via e-mail and the CMC boards. By being readily available the facilitator can deal with not only content questions and issues, but also administrative concerns and any student problems that may arise.

Assessment of the student is done by student participation on the CMC boards and a final assignment consisting of short answer questions related to the lesson content within the module.

Evaluation of DMO course

After rigorous peer review by the CDT the course was tested for usability issues related to the web course interface. Prototypical users were given multi-step tasks to perform within the course site. A silent observer tracked time to perform tasks, errors, and any tasks that could not be completed. Based on the feedback from this usability testing some minor changes were made, but overall the course was found to be easy to navigate and understand.

A panel of expert reviewers then reviewed the course. The expert review panel consisted of Medicine, Disaster Medicine, and Distance Education experts. As much of this expert review feedback as possible was incorporated into the course prior to the initiation of the pilot course. Some changes made at this point were content modifications and coding corrections to accommodate specific software and hardware.

The pilot course consisted of the "Welcome Week" and DM 101 modules. 22 health care professionals voluntarily enrolled in the course which was scheduled for a 3-week period. Demographics on student occupation and previous exposure to DE were collected. As well, data on the specific hardware and software configurations used by the students was collected. The evaluation of the pilot was prospectively created and consisted of (i) evaluation of the course site and learning materials, (ii) evaluation of the facilitator, and (iii) evaluation of the students in meeting the learning objectives.

Feedback from students showed the layout of the course site was easy to use and effective. The decision to ensure that the language in each lesson was casual and conversational, as opposed to textbook and academic in nature, was supported by 100% of the respondents. Throughout development of the course the 'lowest common denominator', those with slow Internet connections or little computer and Internet experience, was always kept in mind. This was also supported by 100% of respondents being satisfied with the 'download time' of the course site, as well as positive comments on the value of the Welcome Week. The respondents overwhelmingly felt the length and content of the lessons were appropriate and allowed students to meet the preset learning objectives.

The majority (86.7%) felt the CMC boards were a useful educational tool and 95% of students participated in the CMC during the course. Some comments indicated that in future courses the facilitator may need to take a more active role in ensuring everyone has equal opportunity for input. It was felt by some that those that responded early on were able to say all that needed to be said. The majority of students felt the facilitator provided enough guidance and adequate communication throughout the course.

All students felt the course material was useful in meeting the learning objectives and this was evident in the outstanding student results on their final assignment.

Conclusion

The DMO Internet-based course represents an important innovation in disaster medicine training for healthcare professionals. Using distance education methodologies, sound instructional design, and simple web development, a platform for delivering quality education to healthcare providers can be achieved.

Interactive Graphic Organizers

Thilla Sivakumaran, College of Education, University of Tennessee, USA,
sthilla@hotmail.com

William Wishart, College of Education, University of Tennessee, USA,
wwishar1@utk.edu

Abstract: Graphic organizers are a way of visually representing information or concepts and may be built with text or graphics. The educational value of graphic organizers has been well documented and their use has become an important part of many instructional models. There are many books and websites with graphics organizers but none have interactive components where the students can try their hands at creating a graphic organizer. What we have created is a website that gives the students the definition, example and also an interactive component which the students can try once they understand the concept. This process allows the students to learn the information, process it during the example stage and then apply it in an interactive module phase. By providing a way for the students to progress through all three phases of the learning process we can increase the chances of them understanding graphic organizers and benefiting from this powerful tool.

There has been little research in the area of computerized interactive module. The studies that have been done in the past centered on creating computer based tutorials or simulations for traditional classes. Petty and Rosen did a study on tutorials and simulations that they created for their students in an experimental design class. The students who used the tutorial and simulations had higher test scores compared to those who didn't (Petty and Rosen 1990). The students also reported that they enjoyed using the program and that it was a positive experience (Petty and Rosen 1990). In a similar 1995 study Chaprarro and Halcomb used a computerized tutorial called STAR (Self-Test and Review) in a computer-managed general psychology course (Chaprarro & Halcomb, 1995). The students (n=136), who voluntarily used the tutorial to study for multiple-choice quizzes comprised 49% of the research group (Chaparro & Halcomb, 1995). Results indicated that, across both section types, the students who used STAR as a study tool achieved better course performance than the students who did not used STAR (Chaparro & Halcomb, 1995). In 1983 Kulik, Bangert, and Williams looked at integrating computers into the classroom. The analysis showed that computer-based teaching raised students' scores on final examinations by approximately 0.32 standard deviations, or from 50th to the 63rd percentile (Kulik, Bangert, and Williams, 1983). In addition, questionnaire responses showed that students who were taught on computers developed very positive toward the computer and positive attitudes toward the courses they were taking (Kulik, Bangert, and Williams 1983). Another fact found in the study was that it reduced the amount of time that the students needed to learn the material (Kulik, Bangert, and Williams 1983).

Studies have shown there is evidence to suggest that computerized tutorials help students learn better. What we have done is create Interactive computerized tutorials using a macromedia program called Flash. The modules created were for Graphic Organizers. Graphic organizers are a way of visually representing information or concepts and may be built with text or graphics. The benefit is being able to see visual patterns and relationships, which allows the development of better insight and understanding of information. The parts that make up an organizer have little value but put together provide the "big picture". The educational value of graphic organizers has been well documented and their use has become an important part of many instructional models. There are a number of programs for creating electronic graphic organizers such as Inspiration or Kidspiration but we have found using macromedia flash provides the opportunity to include an interactive component that allows the development of a more complete and self-contained learning module. There are many books and websites with graphics organizers but none have interactive components where the students can try their hands at creating a graphic organizer. What we have created is a website that gives the students the definition, example and also an interactive component which the students can try once they understand the concept. This process allows the students to learn the information, process it during the example stage and then apply it in an interactive module phase. By providing a way for the students to progress through all three phases of the learning process we can increase the chances of them understanding graphic organizers and benefiting from this powerful tool. It is important that the students are able to apply what they have learned and that is where the interactive module plays a key role.

The modules first phase, where the students get the information has a voice over which allows the students to hear as well as see the explanation. In the example stage, a flash animation with a voice over explains how the graphic organizer is used. Once the students have gone through the first two stages, they can try the interactive piece. This component provides an opportunity for them to use the knowledge they have just acquired. Students, when looking at an example or definition, may think they understand the concept but when they try to apply it, they are lost. Our method allows the students to test their understanding right there and then, and receive feedback. If they don't fully grasp or understand the concept they can refer back to the other two phases for help. The ability to actively use the newly acquired knowledge, receive feedback, and additional instruction or testing as needed makes this approach unique. This paper will focus on the opportunity and potential of using Macromedia Flash in this type module approach. The modules that are created will be the used in future studies to determine the effectiveness as a treatment or instructional tool. It is our belief that their use will provide improved student interest, participation and achievement as compared to traditional instruction or modules lacking the interactive component.

Chaparro, B,. & Halcomb, C. (1990) The effects of computerized tutorial usage on course performance in general psychology. *Journal of Computer Based Instruction. 7. 141-146.*

Kulik, C., Bangert, R., & Williams, G. (1983) Effects on computer-based teaching on secondary school students. *Journal of Educational Psychology, 75, 119-126.*

Petty, L., & Rosen, E. (1990) Increase in mastery level using computer based tutorial/simulation in experimental psychology. Behavior Research Methods, Instruments and Computers, *22, 2216-218.*

TEACHING CREATIVITY IN COMPUTER SCIENCE TO THE PLAYSTATION GENERATION

Stephen Skelton
Lecturer in Games Development, Interactive Television and Advanced Multimedia, UNITEC, Auckland, NZ, Owner of Maia Digital Ltd (Games Development) and Channel You Ltd (Interactive Television)
skeltand@xtra.co.nz

Abstract

*The success of today's computer science educational institutions hinges on successful innovative and creative learning strategies. This involves integrating new media technologies such as the latest console games and digital television, which our current Playstation generation has been brought up on. The fact that the games industry has outstripped Hollywood as a multi-billion dollar earner and is still growing (at approximately US$15 billion worldwide) is indicative of this influence. How do we bring the inspiration that is needed to be the next Electronic Arts into our classrooms and labs? This paper will examine these issues and is designed to explore innovation in new media, using the example of games and interactive television. I propose that if we want to attract the next generation of Playstation creatives into our classes, we must use media they are familiar with, expressed with tools that are truly engaging, interactive and exciting. We need to incorporate a creative theory for computer science... Energy (excitement) = (what) Matters * Cutting edge technology (squared = exponential growth).*

Keywords
Creativity, Innovation, Games Development, Games Design, Games Programming, Artificial Intelligence.

Introduction

The console war is heating up and the computer game superpowers are demanding more and more reinforcements from the computer science institutions.

You enter the lab. It is dark and warm with heads focused on monitors, emotion alive in the faces of all around. This is the online games testing room in some of the major universities around the globe who have realized the potential of the games industry in awakening the minds and imaginations of the Playstation generation. I am particularly interested in how we awaken that inner spark of learning, how we excite and uncover our potential Einsteins, whether it be in our students or in ourselves. In order to do that I have blended the latest in technology (games development and the medium of digital interactive television) in a series of courses designed to ignite the next George Lucas or Shigeru Miyamoto (the creator of Zelda).

Why is it that students of today are fascinated with learning through this intense medium of games? Primarily it is because it is exciting when we discover new knowledge, can find satisfaction and success in what we are doing...and have fun in the process. Games do this.

When students first come into the class they are often struggling to learn the basic skills of computing and new technologies, tend to feed back the instructions we give them and generally vanquish the thought of anything innovative initially into a far flung corner of their mind. What if we were to encourage this innate creative skill in their courses right from the word go?

Using a variety of techniques and skills drawn from software application methodologies (Macromedia, Microsoft), game structures, interactive digital media and applied physics we can challenge the boundaries of what we thought our students were capable of and open the blocks to our/their true innovative and creative power.

The New Games Industry

Take away the pain of the tech crash of April 2000 and you still have information technology making up the backbone of the world's economy. In Japan, DoCoMo, the mobile arm of telecom giant NTT (which signed up 30 million Japanese mobile users in two years) delivers games in a form that can be easily displayed on a cellphone. Sony spent over US$800 million in development of Playstation 2. And in the area of new delivery platforms, in the UK on BSkyB, for example, one interactive TV channel, Playjam, has 1.8 million viewers playing 30 minutes of games four times a week.

BEST COPY AVAILABLE

The Even Newer Teaching

This new economy is demanding. All of us teaching in this area are aware of that; huge enrolments, big demand, heavy course loads and marking. And so often the technology takes precedence over the human spirit, takes pride of place over creativity, the flame that brings us the George Lucas of new technologies. There is such a diverse group of computer science professionals demanding new and innovative ways of approaching the new economy. And there are indications we may need to be more expansive and think outside the square, in the way we teach the "new" science. The ACM SIGCSE Bulletin found shockingly low performance on simple programming problems. In a recent job test in Auckland, NZ, amongst 300 applicants for a web developer's position, less than 10% completed basic coding problems in HTML. There are alarming numbers of women that drop out of computer science courses primarily because they perceive the courses to be too technical with little space for their own individual creativity. The American Association for University Women's report, *Tech-Savvy: Educating Girls in the Computer Age* pointed out that girls found programming classes tedious, computer games boring or violent and would rather have input into the design of simulation, strategy or interactive media and games.

Playing The Game

I propose that we are often using outdated methods to teach our students computer science. Too often we are teaching courses in the same way we learned them. Computing is so different today. We must excite our students by the same innovations that are embracing the new economy.
The processes that are used in current industry games best practice might help us all to be innovative. It involves a process of

a) Setting up a "business" – this gives the students/groups an identity
b) Evolving a team, roles and a methodology – this involves a commercial group production process
c) Creating a schedule for envisioning, storyboarding, designing, testing and releasing
d) Building an educational or commercial game in 3D Studio Max, Maya, Director or Hash for a real client where possible
e) Presenting the "finished product" in a "celebration", that is exciting, that matters because it is relevant.

The Special Theory Of Creativity

E is for energy and excitement

E is for the energy and excitement that students feel when they start working with media in this way that means something to them, in fields like games and interactive television. When students are motivated in a subject area this is a key ingredient to achieving a breakthrough, on the path to innovation and creativity.
Games do motivate people, from the action, combat and strategy games that men indulge in to the chat, communication and strategy games that women enjoy.

M is for " what matters"

When we are engaged in creating things that matter to us, our mind is engaged, we see a purpose, we link practical achievements and tasks making sense in the real world and link them with activities that bring us success, joy and happiness. Our success compounds, creating "mass", accumulating events that matter in our consciousness. Through technology today we are even developing a parallel "universe" of reality in virtual reality applications where a person who has a phobia of spiders, for example, can interact with a "virtual spider" to overcome their fear. The relationship of mind to matter and the power of "events that matter" in our motivation should never be underestimated. Even at a quantum level in the famous photon splitting experiment it has been proved that experimenters have an influence just by thinking an outcome, which in turn affects the experiment. So when we think that something "matters" it profoundly affects the way we interact with our learning environment at a very deep level.

C is for "cutting edge"

C is for celeritas, swiftness, being on the edge of current development, reaching out to students through THEIR current media, THEIR up to date modes of expression, not living in the "past" of what we were brought up in or how we were taught. So upskilling, retraining and networking with the "cutting edge" research in our field is ever more critical. This enables us to bring our teaching to the market at the speed of light (= delivered on the cutting edge), linking excitement to what matters and practical achievements, thereby amassing success.

Squared is for "accelerated growth"
There is no doubt that the next 10 years of human evolution herald a previously untapped source of ingenuity that could be put to good or destructive force. We have nuclear power and weapons, the genome and genetic modification of cells, virtual reality and breakthrough discoveries into cures for many of our known diseases. Dr Valerie Hunt, in her book *Infinite Mind*, detailed an experiment by a group of computer scientists from Stanford University who programmed in the tremendous explosion of technological development and scientific knowledge coming into the world today. They asked the computer to plot the great discoveries of the world, beginning with the wheel, through the printing press, the steam engine and the splitting of the atom to the computer itself, and to project into the future and predict great upcoming discoveries. The projected computer pattern went completely off the graph at the year 2011. During the last minutes of the year 2010, the computer predicted 18 discoveries that equal the splitting of the atom. A Harvard Cyperposium (Feb 10, 2002) highlighted hot trends of the immediate future including artificial intelligence, with future robots relying on AI applications being sent into dangerous situations for police and military use (an application that has been employed in Afghanistan). Within 50 years the predictions are that AI will be on par with human intelligence.

The New Wave In Thoughtful Games

The future of games is unpredictable. We all know how fast the industry is moving. When you start making a game, you know that by the time you finish it, the whole industry will have changed.
The current trends and future are promising and have spin offs into many other areas of development

- Movie quality graphic s, ever more beautiful, realistic and 3 dimensional
- 3D cards capable of taking more and more workload off the processor
- Virtual reality at home
- Improved Artificial Intelligence (AI)
- Serious physics engines which power intelligent game worlds

Some current and future developments in AI, for example, herald this "intelligent reality".
As an example, John Taylor, the Professor of Maths at Kings College, London is "growing" an advanced artificial intelligence that he claims will give baddies brains to rival your own. The "mind" is called LAD or Language Acquisition Device.
Traditional AI grew out of efforts to crack enemy codes in WWII. Ever since Steve Grand, a self taught programmer, set out to design the first AI computer game in 1992, using ideas from neural networks, genetics and chemistry to design a rough brain biochemistry for a new breed of virtual pet, AI has been part of computer games. He called them noms and marketed the game as Creatures in 1996, creating a huge hit where players developed strong emotional ties to their creatures. Richard Evans at Lionhead Studios has created Black and White, where you aim to rule the world as a god and must win the devotion of your people. To help you win followers you have an artificially intelligent assistant.

Into The Game

Game Design

In teaching courses to the Playstation generation on games there are some basic principles we must follow to fulfill the special theory of relativity.

a) Go for a broad audience – your games and teaching must embrace both a male and female audience
b) Innovation is the key – look at cutting edge applications and help your students to create these – Myst was a winner in its time with beautiful graphics, the Quake engine is regarded by many as the staple of physics games engines, Age of Empires was one of the first with a historical theme and multiple victory conditions
c) Design by playing – teach by doing it yourself first
d) Include critical decision making as part of your gameplay and classes
e) Start with introducing prototypes and testing early
f) Make the first minutes of gameplay and classes very exciting
g) The player must be the hero or heroine (not you as the designer or programmer). Engage their minds…after some sweat they must reach victory
h) Get the player and student to invest in your game and classes – help you to build the game as a group and build assets e.g. use Half Life in architecture design or gmax to add assets to Dungeon Siege

i) Create a great story and excellent storyline – it's at the basis of every culture
j) Create a series – help your students to think about characters that can develop (like Lara and Zelda) and games that create franchises (like the Star Wars series). Similarly find the links to other courses and encourage practical end of degree thesis or project work to encompass the same professionalism that you introduce
k) Pay attention to detail e.g. graphics, sound
l) Create an intuitive interface that's easy to use
m) Provide a multiple of different experiences, from single to multiplayer (individual to group assessment), cooperative play and so on
n) Games are an art and so are unpredictable like life – it means you have to balance what you can do practically (your budget and schedule) with what you dream/envision (the quality)
o) Test, test and test again

Game Programming

So many of my students come to class disillusioned by programming, but when they apply it to games and can see the result of their work in a short space of time in 2D or 3D spaces, the light of awareness and accomplishment dawns and they get excited, filled with energy. Suddenly it matters, it has an affect on "mass" in the real world, it does something they can relate to (games and television) and it launches them at high speed into the very lucrative area of games technology. Engaging students in exciting and energizing tasks is crucial to deep learning. These Playstation or MTV fans have been profoundly influenced by this sort of media so why not indulge them by immersing them in it to create breakthrough creativity. And this may also be exactly the type of breakthrough mediathat computer science students want the opportunity to produce. Typically, women, for example, are interested in computer science that is creative, and drop out of courses they perceive to be overly technical.

The General Theory Of Creativity

So if we see this opportunity, to revolutionize the way we see the universe and computer science through excitement and creation of media that matters with the delivery mechanisms of cutting edge technologies, then we begin to curve the very fabric of time and space, providing alternative paths of reality into computer science for students where before there was none. The more human mind energy or mass that is gathered in any one spot, such as now, as you are reading this, in this spot, the more space and time will be curved around it = MORE BREAKTHGROUGH. In creating this we are also creating a portal for students to come to, an intelligence and reality, another book in the divine library waiting to be read.

Conclusion

The special and general theory of creativity leads to the conclusion that the more minds we can gather either virtually or in reality around this new, exciting, cutting edge area of research, (a subject that has mattered to us all from the moment we first started to kick a ball) the more powerful the wave generated for breakthrough creativity. Recent conferences, the establishment of e-journals and a growth in research interest in digital games have started to raise the profile of gaming research and go to show how vibrant this rapidly developing field is. To encourage this growth, support collaboration and minimize duplication of effort it is suggested that there would be benefit to the digital games research community in establishing its own international association, currently at http://www.gamesconference.org/network/ These activities would help to raise the profile of the emerging field of computer game research in a manner similar to that found in other academic fields of study. I look forward to the possibility that many of you reading this article might also want to join us on this journey.

REFERENCES

1. Cohen, D. *Game Over.* New Scientist, Vol 174 Issue 2349, 29 June 2002
2. Guzdial, M. and Soloway, E. *Teaching the Nintendo Generation to Program.* Communications of the ACM, Vol 45 Issue 4, April 2002
3. Bodanis, D. *E = mc (squared).* Walker Books, London, 2000
4. AAUW. *Tech-savvy: Educating girls in the new computer age.* American Association of University Women Education Foundation, New York, 2000.
5. Partridge A. *Real Time Interactive 3D Games.* SAMS, New York, 2002
6. INTEL. *Games Applications.* http:://cedar.intel.com/cgi-bin/ids.dll/main.jsp

FORMING COMMUNITY with TECHNOLOGY: THE DEGREE PROGRAM PLANNER

Deborah J. Smith and Evelyn K. Ting,
Empire State College, Saratoga Springs, NY
Email: Deborah.Smith @ esc.edu, Evelyn.Ting @esc.edu

Abstract: Empire State College students, in the online Educational Planning courses, attempt to build a virtual community while formulating their unique college degree plans with a web-based Degree Program Planner to input data in a standardized format. The DP Planner builds a shared community of practice--extending the capabilities of the course management system with task support in formatting the degree plans and enabling discussion of the student's evolving degree plans with their mentor and classmates in the course.

Introduction

Today's students see networked education as one option for attaining a college degree without having to entirely rearrange their lives. Computers, the Internet and software applications give many students a unique access to learning. However, the general capabilities of a course management system (CMS) may not support all types of student assignments. In this case, a custom software tool can facilitate students' assigned tasks, permitting them to focus on their interactions with each other rather than the technology. This presentation will examine the use of one software application with adult students preparing their college degree plans.

Learning Online

Grygo (2000) identifies factors essential to effective online communities including common goals, clear benefits of interaction, content geared to needs, and transparency. In educational circles, these principles are learning goals, curriculum presentation and interactions (member development); instructional media/tools (asset management) and learner support systems/services (community relations) (Ragan, 1998, Williams and Cothrel, 2000).

There are several elements that assist learning, including knowledge in a context of a community of practice, coaching and flexibility. The skills of a *community of practice* (CoP) are learned by increasing the complexity and scope of tasks the member undertakes in a specified context, from beginner level to expert knowledge within the community (Lave & Wenger, 1991).

Burton, Brown and Fischer (1984) examine student coaching as an important aspect of the learning process. Coaching assures proper skills acquisition, gives clear instructions, turns negative elements into constructive ones and critiques progress to recognize errors.

Student Experience and Instructional Design

In creating a networked student experience, an interactive model poses questions for the design process: What is the *goal* of the experience—after the student is done interacting, how will they behave differently online and in real life as a result of the interaction? Given a defined goal, what *experiences* assist the student in achieving the goal? At the heart of every interactive design project should be the question "What cool things can the *student* do?"(Kozel, 1995).

Good design must reflect these points. In networked experiences, where the student environment is crafted to be consistent, predictable and transparent, the critical parameters are *visibility*: allowing students to see what to do and what they might do next ; *conceptual metaphor*: which the designer chooses to present for the student experience; *good "mappings"*: allowing the student to identify relationships between their actions and results and *feedback*: letting students know what their actions have caused to happen (McAdams, 1995).

Mentors and Students at Empire State College

Founded in 1971, the Empire State College mission is educational access and quality with a goal of establishing new ways of teaching and learning. The college offers adult learners undergraduate and graduate degrees in geographically dispersed "centers" around New York State, through distance learning and weekend "residencies."

Students complete courses in their own home, within their own timeframe. At Empire State College, a primary belief is that learning occurs anywhere, not just in traditional academic situations. Individual faculty-student interactions, a variety of study models, prior learning credit, customized degree plans, and year-round enrollment serve to eliminate time, curriculum and access problems for students (Lefor, Benke and Ting, 2001).

Increasing enrollments and the speed of modern society produce students with pressing, pragmatic goals. Students today are often mature learners who come to the college with a distinct goal in mind; they look to their faculty member (known at Empire State College as a *mentor*) for an academic trail to reach this goal. In a shift from traditional advisement, the collaborative aspect of Empire State engages both mentor and student in formulating goals and degree plans for the student's unique educational path.

The Degree Program Planner

The pivotal document for a student at Empire State College is the individualized Degree Plan (DP) developed through mentor-student collaboration in Educational Planning (EP) courses. The student-generated Degree Program drives advisement, rather than traditional approaches of "one-size-fits all" imposed on the student by the institution. Traditionally, development and writing of the DP and rationale involved the mentor and student only, or a small in-person study group, while clarifying the framework of a student's program of studies.

Empire State College established Educational Planning (EP) online recently. Mentors assist with the two-part Internet course, enabling students to participate in private discussions with their mentor and interactive asynchronous discussion with other students in the course about their degree plans. An iterative discourse emerges among a diverse group of students and faculty where learning can be shared anytime, anywhere.

The active construction of knowledge from an adult learner viewpoint was EP 211's goal. In EP 212, the focus narrows as discussion and written work center on sample degree plans and rationales for the student's own studies at Empire State. Development of the DP is a mentor-student conversation, but DP submission is done in standardized format to the College Assessment Committee, for formal review as an academically sound program of studies. During the first two offerings of the course, students spent considerable effort achieving the correct format, then found they had trouble sharing their plans in the course space due to limits of the web and the variety of word processing software used.

In 2001, Empire State piloted an online Degree Program Planner (DPP). This Lotus Notes Domino web application using JavaScript formulates a student's DP online and allows discussion between students, their mentors and Educational Planning classmates in the Planner itself. In the DPP, students record college courses for which they are requesting transfer credit, Credit by Evaluation components (CBEs) and Empire State College studies they wish to take towards their degree. Students work on the DP over time, as the software automatically re-calculates credit totals and formats the student's plan in the prescribed format. Each plan has a discussion area, permitting all members of their EP course group to see and comment on a student's proposed degree plan.

At any time, the student can email the mentor a "Request To Review" statement with a link to the draft DP and asynchronous chat capability for mentor-student comments on revisions. Learning options in Educational Planning now range from individual work to a community of practice, where the practice is reflection on one's proposed course of study at Empire State College. (Lave & Wenger, 1991).

Summary

The Empire State College independent study model has broadened, using technology and virtual communities, to meet the educational needs and networking capabilities of adult students. The DP Planner helps build a shared community of practice by extending CMS capabilities: providing more task support in both plan formatting and discussion of evolving degree plans with a student's mentor and classmates in the course.

References

Burton, R.R., Brown, J.S. and Fischer, G. (1984). Skiing as a model of instruction. In Rogoff, B. and Lave, J. (eds.) *Everyday Cognition: Its development in a social context.* (pp.139-150). Cambridge MA: Harvard University Press.

Grygo, E. (2000). Communities prove key to b-to-b survival. *InfoWorld.* 22 (48). 33.

Kozel, K. (1995). *Crafting the user experience.* [online]http://www.kipinet.com/mmp._nov95/Design_Model_word.html

Lave, J. and Wenger, E. (1991). *Situated learning: Legitimate peripheral practice.* Cambridge MA: Cambridge University Press.

Lefor, P., Benke, M. and Ting, E. (2001). Empire state college: The development of online learning. *International Review of Research in Open and Distance Learning.* 2, (1). 1-16.[online] http://www.irrodl.org/

McAdams, M. (1995, October) .Information design & the new media. *Interactions.* 37-46.

Ragan, L.C. (1998). Good teaching is good teaching: An emerging set of guiding principles and practices for the design and development of distance education. *DEOSNEWS.* 8, (12).
[online] http ://www.ed.psu.edu/acsde/deos/deosnews/deosarchives.asp/

Williams, R.L. & Cothrel, J. (2000). Four smart ways to run online communities. *Sloan Management Review.* 41(4). 81

Web-based Support for "Teaching for Learning"

Ronald A. Smith and Paul Lam,
Education Office, City University of Hong Kong
Hong Kong SAR
ron.smith@cityu.edu.hk

Denise Chalmers,
Teaching & Educational Development Institute, University of Queensland
Australia

Abstract: There is compelling evidence that students' learning could be improved if individual teachers taught learning strategies to their students in the context of teaching their subject matter. As part of two-year "teaching for learning" project over 70 staff were trained and supported first to learn how to, and then to teach learning strategies to their students. In this paper we report on the final version of the web support http://edo.cityu.edu.hk/t4l/ that has been developed to support staff in "teaching for learning."

Introduction

The purpose of teaching is to foster deep and lasting learning. While learning can occur, and often does, without the benefit of teaching; teaching has no other purpose than to enable learning. Many universities offer programs to their students and to their teaching staff for the purpose of increasing the skills and abilities of their students as learners and of their staff members as teachers.

Student development and student learning centers offer programs, usually of short duration, to students to help them to improve not only their ability to learn (for example, study skills, time management, etc.), but also their abilities to demonstrate their learning (for example, paper writing, exam taking, etc.). In addition, some universities offer credit-bearing courses to students designed to better prepare them for success at university and beyond. City University has such a course, *Learning to Learn* (Kwan & Ko, 2000).

Staff development centers offer a wide range of programs and activities designed to help staff to improve the individual teacher's teaching skills, encourage the incorporation of new methods or technology into teaching, and support the development and (re)design of teaching plans and materials. The project described in this paper is an initiative of the Centre for the Enhancement of Learning and Teaching, a staff development unit. It is designed to encourage and support staff to teach learning strategies to their students within the context, and as part, of their regular courses in the disciplines.

One of the major concerns about learning skills/strategies programs is the lack of transfer beyond the general or generic training sessions into classes or courses in the disciplines. In a meta-analysis of the results of skills interventions on student learning, Hattie, Biggs and Purdie (1996) concluded: "The results of this meta-analysis support the notion of situated cognition, whereby it is recommended that training other than for simple mnemonic performance should (a) be in context, (b) use tasks within the same domain as the target content, (c) and promote a high degree of learner activity and metacognitive awareness. … In other word, effective strategy training becomes embedded in the teaching context itself" (p. 131).

Fuller, Chalmers, & Kirkpatrick (1995) have demonstrated that learning strategies could be taught to students within the context of a course and that this led to improved student learning outcomes. Further work (Chalmers & Fuller, 1996; Chalmers & Fuller, 1999) demonstrated that teaching staff could be successfully trained to teach learning strategies to their students. Their research has formed the basis for the project at City University.

Teaching for Learning Project

The project *Teaching for Learning: Learning Strategies for Students and Teachers* (Smith, 2001; Chalmers, Smith and Lam, 2002) grew out of the observation that the students coming to CityU were not as well prepared for university-level work as we would like them to be, together with the concern that they might be leaving without having acquired adequate study skills and learning strategies to support and sustain lifelong learning. In addition to the programs already offered at CityU, the *Learning to Learn* course, the oral and written communication courses offered by our English Language Centre, and the workshops offered by our Student Development Services, we felt it was necessary and appropriate to directly involve more of the teaching staff in working to solve this problem.

The *Teaching for Learning* project was supported by a two-year Teaching Development Grant from the UGC. One of its primary objectives was to develop materials for staff and students to support the teaching and learning of learning strategies. This paper describes the web-based materials created to support teachers in: choosing which learning strategy to teach and planning to teach it, teaching it, and follow-up steps including evaluating, documenting and re-designing it for the next time.

All teaching staff are very busy people with multiple demands on their time. Thus, it was necessary to provide the participants in the project with as much support as possible, particularly during the initial stages. In addition to expert help from the project staff and their colleagues, we thought it was necessary to develop web-based materials that could be used by the participants and that would last beyond the duration of our funding, June 2002. Various resources were developed and field-tested with staff and students during the project. They have been modified and this paper presents the "final" version http://edo.cityu.edu.hk/t4l/ that is being offered to teachers within CityU and beyond.

The approach to teaching learning strategies is based on the work of Chalmers and Fuller (1996) who present 23 different learning strategies. See Table 1.

Table 1. Learning strategies to be covered in the site, classified into four categories

Learning Strategies			
Strategies for acquiring information		*Strategies for working with information*	
1	Accessing information	9	Explaining ideas
2	Identifying main points from lectures and readings	10	Generating questions
3	Memorizing information	11	Making concept maps
4	Note making for assignments	12	Organizing ideas
5	Note making from lectures: following the lecturer's structure	13	Using a systematic approach to learning
6	Note making form lectures: Using a structure developed from prior reading	14	Using study groups
7	Note making from text	15	Writing paragraphs
8	Skim reading text	16	Writing summaries from notes
Strategies for confirming learning		*Personal management strategies*	
17	Analyzing a question and planning a response	22	Coping with the student role
18	Answering multiple choice tests	23	Study and time management
19	Assignment preparation		
20	Learning from feedback		
21	Preparing for essay examinations		

The site is structured to provide teachers with all the necessary information and tools they might need in order to teaching learning strategies to their students. It contains 4 major sections, each with numerous subsections. See Figure 2.

The first section, "Why teach learning strategies," provides the rationale for teaching learning strategies in context, as well as what other teachers and experts have said in the form of text and video clips, and addresses the concerns and worries of both staff and students.

The next section, "Choosing a strategies and planning to teach it," represents the heart of the site. It begins by providing staff with two ways to choose a learning strategy to teach. They can simply select one from the list of strategies (Table 1). Or alternatively, they can review a list of problems in learning that their students exhibit, pick one, and a learning strategy will be automatically chosen.

BEST COPY AVAILABLE

Table 2. Sections and subsections of the *Teaching for Learning* site

MAIN SECTIONS	SUB SECTIONS	Main Content
Why teach learning strategies?	What are learning strategies?	• Definition • Classification • Readings
	What are the benefits?	• Better learning • Better motivation
	Why teach them in context?	• More focused • Transfer of skills • Use skills in context • Problems with teaching out of context
	What other people say?	• Denise Chalmers • Maryellen Weimer • City University experiences
	Problems/worries	• Teachers' worries • Students' worries
Choosing a strategy and planning to teach it	How to choose a strategy	• Pick a strategy from the list • Analyze students' learning problems
	Where to teach it	• Outside class time • Lecture • Tutorial
	Creating methods and materials	• Customizable Web Pages • On-line tutorials • Lesson plans • Handouts • PowerPoint slide shows
	When to teach it	• Guidelines for deciding • A few good times
	Keys to success	• Integrate it into the course • Motivate students to learn • Model the skills
Teaching the strategy	Gaining support	• Peer support • Students' support • Support from others
	Evaluating success	• Students' feedback • Students' improvement • Other observations
	Documenting your work	• Portfolio • Video/audio/written • Case study
Next steps	Sharing your experiences	• Places to share your experiences
	Planning improvements	• Reflecting on the experience • Developing future plans

For each strategy selected, the "planning to teach" section systematically guides the teacher through decisions about where it will be taught (in class, in tutorials, outside of class; that is student self-study), when in the semester (a course calendar is provided), and what teaching materials to use. All strategies come with lesson plans, handouts, power-point presentations that can be customized to suit the teacher and his/her course. Many of the strategies also have customizable web pages that can be created by the teachers and then made available to their students. Each of these pages comes with several pre-set options that the teacher can select, plus includes spaces for the teacher to add their own unique information. This section also provides some suggestions for successful implementation, based on the research and suggestions for project participants.

The final two sections "Teaching the strategy" and "Next Steps" provide the teacher with advice on gaining support and cooperation from students and colleagues, evaluating and documents their work, and sharing their experiences and planning improvements.

The site has several special features that are particularly noteworthy. In addition to customizable web pages for students and various types of teaching materials, the site can also store the teacher's plans and allow them to return to the site to revise them. Of course, the teacher can also download his/her own plans. The project has also developed other web materials for teachers and students that are incorporated into this site. These include:

- "On-line Questionnaires: Student Learning Styles and strategies" http://celt.cityu.edu.hk/inventory/questionnaires.htm — this site that allows individual students to assess their own learning styles and strategies using four different instruments and to receive their own individual report, together with suggestions for how to improve their effectiveness as a learners. This site also enables CityU teachers to request all the students in their classes to complete a questionnaire. The students receive their own individual reports and the teacher gets a report on the class profile together with suggestions for how to better teach to the various styles/strategies.
- "Learning: Styles, Motivation and Strategies" http://celt.cityu.edu.hk/inventory/strategies/student.htm — this site designed by students and for students. It contains advice, exercises, games, questionnaires and programs to help students to better understand their own learning styles, and to improve their learning motivation and strategies. There is also a section where students and teachers can talk about how to learn more effectively. Students can access this site on their own, or teachers can suggest their students visit it.

In conclusion, this paper has described the content of a web site created to support teachers in teaching their students learning strategies in the context of teaching their course content. It is part of a larger two-year "Teaching for Learning" project and represents the final "deliverable" on the grant. It is based on the feedback we received during the training session with teachers, their reactions to earlier versions of parts of the site, as well as feedback for students. We believe it will provide a useful resource for all teaching staff, both inside and outside CityU after the project is completed.

References

Chalmers, D., & Fuller, R. (1999). "Research and a professional development programme on teaching learning strategies as part of course content." *International Journal for Academic Development.* 4(1) 28-32.

Chalmers, D., & Fuller, R. (1996).*Teaching for learning at university: Theory and practice.* London: Kogan Page.

Chalmers, D., Smith R. A., & Lam, P. (2002). "A Program of Professional Development in Teaching Learning Strategies in Context." Paper to be presented at Teaching and Learning in Higher Education Conference, Singapore, September.

Fuller, R., Chalmers, D. & Kirkpatrick, D. (1995). "Teaching university students learning and study strategies in context: An experimental study." *Research and Development in Higher Education*, 17, 139-162.

Hattie, J., Biggs, J. & Purdie, N. (1996). "Effects of learning skills interventions on student learning: a meta-analysis." *Review of Educational Research*, 66(2), 99-136.

Kwan, A. S. F. & Ko, E. I. (2000). Developing university students as lifelong learners. 25th International Conference on *Improving University Learning and Teaching*, Frankfurt, 161-167.

Smith, R A, (2001). Training teachers to teach learning strategies. *Learner-Centered Universities for the New Millennium.* 26th Improving University Teaching Conference:. Johannesburg, South Africa, 205-210.

THE LINKS PROJECT:
A USDE TECHNOLOGY INITITIATIVE

Sharla L. Snider, Ph.D.
Department of Family Sciences
Texas Woman's University
USA
ssnider@twu.edu

Abstract: Learning and Integrating New Knowledge and Skills (LINKS) was a federally funded technology project designed to integrate established and emerging technologies into the teacher preparation curriculum at Texas Woman's University (TWU). The project was supported by a U.S. Department of Education, Preparing Tomorrow's Teachers to Use Technology grant over a three-year period. The LINKS project encouraged institutionalized efforts for the teacher education program to address technology proficiencies desired by the schools and delineated by the professional associations. The project prompted changes in university faculty involvement and roles, technology curriculum content and delivery, and preservice teachers' performance and responsibilities in field-based locations. The purpose of this paper is to provide an overview of the LINKS project including final institutionalization efforts.

Perspective

The technology training received by preservice teachers is inconsistent and not focused, a problem stemming from the minimum levels of technological training at many institutions (McCannon & Crews, 2000). Instead of computers being used to their full potential, computers are often used for preparing instructional materials and not necessarily for student interaction. This is painfully true for a majority of female preservice teachers, who lack extensive experience and access to technology. These limitations are recognized by teachers, causing them to be concerned about their inability to integrate technology into the curriculum (Ertmer & Addison, 1999).

Related to this is the trend encouraging students and faculty to use technology throughout all aspects of the university curriculum. Teacher Education programs must focus on teaching how to use and integrate technology in the classroom (Brown, 2000). Additionally, the effectiveness of educational technology in enhancing and affecting student learning and achievement needs to be evaluated (Jones & Paolucci, 1999). New forms of learning aided through the use of technology have the potential to prepare students to be productive, critically thinking citizens (Gunderson & Anderson, 1999; Shive, 1999). Technology can also help teachers make their instruction more culturally relevant to the student's individual situation. Since multimedia, hypermedia, and the Internet have the potential for facilitating teaching and learning, it is of utmost importance that future teachers know how to use these tools (Duran, 1999; Johnson, 1998). In order for preservice teachers to successfully integrate technology into their classroom, they must be taught through faculty modeling the use of technology and in contextualized, subject specific settings. Ideally, all faculty members teaching preservice teachers at any point in their college education will model technology integration (Vannata & Beyerbach, 2000).

Overview

Learning and Integrating New Knowledge and Skills (LINKS), was designed to enhance the teacher preparation program at TWU by insuring systemic integration of technology into the curriculum. Three strands of the LINKS project addressed the technology needs of future teachers by supporting their development as well as the associated development of their mentor teachers and university instructors. Preservice teachers in professional coursework received specific instruction on campus as Interns I, II, and Residents as well as extended experience in the field, and they completed much of their coursework on-line using TechTrek, the web site designed to support their efforts. In field settings, LINKS personnel encouraged the awareness of mentor teachers so they could be more supportive of the attempts of preservice teachers to use technologies in instruction. Finally, university instructors of courses leading to certification were offered instruction in web-based course delivery so they might provide a model of technology integration in their own curriculum design and delivery. The LINKS program evaluated the progress toward the program goals for these three different populations, future teachers (n= 300), mentor teachers (n= 85), and instructors (n=90).

LINKS Beginnings and Development

This project was funded September 1999 through a United States Department of Education (USDE), Preparing Tomorrow's Teachers to Use Technology grant. At the time of funding, the professional preparation sequence for teachers administered in the College of Education did not include an education technology course or a means to assess computer literacy. The goal of the LINKS project was to build on the current technology integration efforts to establish a structure for instruction in and benchmarking technology skills of the preservice teacher. This goal was to be accomplished through a systemic expansion and ultimately formalized institutionalization of the integrated technology concept for preservice teacher educators. In order to impact change, three populations were supported: students, inservice teachers, and instructors.

Students. With USDE support, the LINKS program refined the integrated technology component and delivered it in collaboration with the field-based education program. Curriculum delivery included large group instruction, lab instruction, and distance education support through a curriculum website (TechTrek). The three stages of the LINKS program were developed for the three semester professional sequence designated as Intern I, Intern II, and Resident. The curriculum standards were provided a framework from state and national standards and offered students a variety of indicator possibilities for documentation of their performance. To track student progress, the Technology Passport was developed and published electronically and in printed form. The Technology Passport tracked student progress, and alerted professors in both the Colleges of Professional Education and Arts and Science to technology expectations and standards as they related to content areas and the state standard for technology applications.

Inservice Teachers. Each semester, Interns interacted weekly with inservice teachers functioning as mentors during classroom observations. Mentors participated in on-campus training sessions and received assistance designed to encourage their receptivity toward technology use. During Residency, preservice teachers were paired with supervising teachers for their student teaching experience. A select group of supervising teachers participated in specialized training dedicated to creating classroom appropriate technology products for use and evaluation in the classroom setting. Both supervising and mentor teachers completed training evaluations to assess quality and utility of training and to assess technological proficiencies, attitudes, and use.

Instructors. LINKS Faculty participants included individuals from the following disciplines: Biology, Chemistry and Physics, Family Sciences, Health Studies, Kinesiology, Performing Arts, Philosophy and Psychology, Reading, Teacher Education, and Visual Arts. Two primary training goals existed: (a) Introduction of the LINKS standards and resources, and (b) support for instructor delivery of web-based courses as models for the future teachers in their classes. In collaboration with the Distance Education Learning Team, the goals were implemented through a series of technology-training sessions divided into two categories a whole-group professional development sessions geared to broad topics, and hands-on professional development sessions specializing in specific areas for remediation or advanced work.

Institutionalization Efforts

Throughout the course of this three-year project progress and outcomes for all participants in each of the three populations was continually tracked. The significant proficiency gains in computer use and skills as well as progress in the levels of use by participants provided the necessary documentation to prompt change within the organization paving the way for institutionalization of the project. These institutionalization efforts can be found in the curriculum changes and institutional support provided to faculty.

Curriculum Changes. Based on the success of the LINKS program, integrated approach to technology course requirement is now required for all undergraduate students earning their foundation certifications. The two new undergraduate technology courses are completed concurrently with other new professional preparation courses provided in the first and second semester of the undergraduate teacher education sequence. Working in collaboration with the College of Arts and Sciences as well as the School of Library Information Sciences, the integrated technology teacher education courses are preceded by two specific courses designed to aid in the developmental process of the preservice teacher in relationship to technology skill development. These courses provide the student with a beginning foundation for technology use in the classroom as well as the opportunity to develop information literacy skills.

Institutional Support. The significant cost-share provided by the University has resulted in the establishment of appropriate instructional delivery centers in seven of the largest classrooms in the building housing the College of Professional Education. Specific administrative support has been demonstrated through the acquisition of personnel positions designed to replace the personnel efforts of those in the LINKS center. Additionally, matching funds have been given to support the various training opportunities offered to the faculty. An excellent example of this support can be found in the impetus and support provided for the development of the Post Baccalaureate program to include the use and integration of technology into the curriculum. This focus includes a unique mentoring program between faculty from Departments of Teacher Education and Reading and the School of Library and Information Sciences. This type of approach builds collaborative and lasting relationships among the faculty, a necessary element for the learning process to continue. The new instructional equipment, the new curriculum, and the increased proficiency of our faculty provide an important triangle for effective institutionalization.

Educational Importance

Integrating technology into the preservice classroom in a contextual way positively affects students' attitudes towards technology. Additionally, preservice teachers taught in this type of classroom have increased overall confidence in their technological abilities as well as in their ability to integrate technology into their own classroom (Abbott & Faris, 2000). The amount of knowledge a teacher has about technology influences the extent to which he/she uses technology. Exposing preservice teachers to technologically rich teacher education programs can cause changes in attitudes and uses through experience and instruction (Levinson & Surrat, 2000). These attitudes are especially important when considering their comfort level with specific computer technologies or when analyzing their future plans for technology in their classroom. As technology continues to evolve, it becomes increasingly important to continue innovative programs such as this in order to maintain quality of the instruction offered to the preservice teacher.

References

Abbott, J. A., & Faris, S. E. (2000). Integrating technology into preservice literacy instruction: A survey of elementary education students' attitudes toward computers. *Journal of Research on Computing in Education, 33*(2), 149-161.

Brown, J. K. (2000). Deans of education: Creating opportunities. *Converge, 3*(7), 64-68.

Duran , R. P. (1999). Learning and technology: Implications for culturally responsive instructional activity and models of achievement. *The Journal of Negro Education, 67*(3), 220-227.

Ertmer, P. A., & Addison, P. (1999). Examining teachers' beliefs about the role of technology in the elementary classroom. *Journal of Research on Computing in Education, 32*(1), 54-72.

Gunderson, L., & Anderson, J. (1999). An exploration of internet access for literacy teachers and learners. *Computers in the Schools, 15*(1), 5-11.

Johnson, D. L. (1998). Rethinking the teacher as developer model. *Computers in the Schools, 14*(3/4), 1-4.

Jones, T., H. , & Paolucci, R. (1999). Research framework and dimensions for evaluating the effectiveness of educational technology systems on learning outcomes. *Journal of Research on Computing in Education, 32*(1), 17-28.

Levinson, E., & Surrat, D. J. (2000). Integrating technology into education. *Converge, 3*(1), 46-54.

McCannon, M., & Crews, T. B. (2000). Assessing the technology training needs of elementary school teachers. *Journal of Technology and Teacher Education, 8*(2), 111-121.

Shive, G. (1999). Information technology, school change and the teacher's role. *Canadian and International Education, 28*(1), 61-74.

Vannatta, R. A., & Beyerbach, B. (2000). Facilitating a constructivist vision of technology integration among education faculty and preservice teachers. *Journal of Research on Computing in Education, 33*(2), 132-148.

Could We Smell the Cooking over the Internet? An Interactive E-Learning Solution for Home Economics Using Synchronized Multimedia

Simon So and Theresa Lai
Department of Information and Applied Technology
Hong Kong Institute of Education
10 Lo Ping Road, Tai Po, N.T.
Hong Kong SAR, China
E-mail: {swwso, tlai}@ied.edu.hk

Abstract: Many cooking demonstrations using videos allow only a linear playback of the process and are not effective for learning and teaching. In this paper, we demonstrate an interactive e-learning solution for cooking using synchronized multimedia techniques. Textual information and context-sensitive hyperlinks are timely displayed alongside with videos. Students can easily jump into any segment of the demonstrations to re-enforce the concepts and steps. Advanced features in Synchronized Multimedia Integration Language (SMIL 2.0) such as clickable video hot-spots, overlapping multimedia regions, streaming and media objects synchronization are used to enhance the effectiveness of our solution. Surely, we cannot smell the cooking process over the Internet yet, but we can do many other things using an interactive learning environment that hands-on demonstrations cannot do.

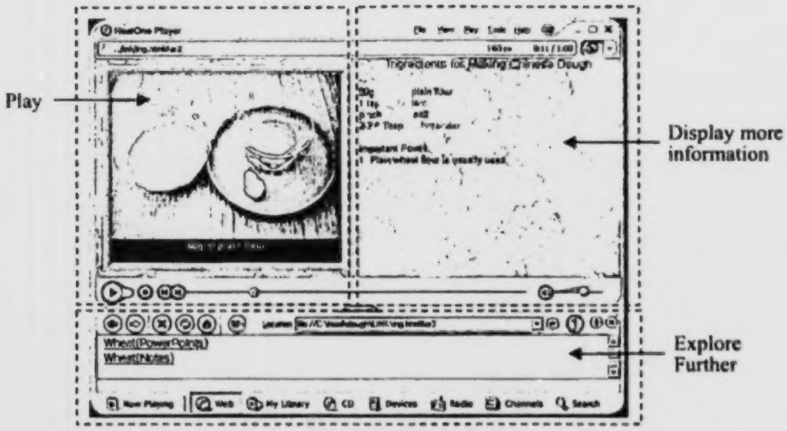
Introduction

Scientific understanding of food preparation techniques is an important part for the study of Home Economics. Very often, providing students with the knowledge of recipe development and modification under diverse range of processing conditions require hands-on demonstrations. Demonstration is a very useful instructional method to illustrate procedures and explain new techniques (Chamberlain, 1992). However, a well-executed demonstration demands much time in planning, preparation and skilful manipulation of the demonstrator, yet there are limitation in the learning and teaching processes. Firstly, it must be conducted in continuous action that could not be retaken for slower learners and absentees. Learners within a class are often varied in their abilities. Secondly, some complicated processes should be viewed closely but it may be difficult to provide sufficient space so that everyone will be able to see clearly. Although hands-on demonstrations provide authentic experience to the students and should not be substituted completely, video cases can be used to alleviate some of the problems we face in the Home Economics classes (Stephen and Leavell, 1999). Furthermore, videos open up other dimensions of learning in which conventional demonstrations cannot provide.

In this paper, we explore the effectiveness of using synchronized multimedia to provide an interactive e-learning environment for food preparation in teaching Home Economics. An example of "Chinese dough-making without raising agent" is used to illustrate our concepts. This food preparation technique is very common in making Chinese buns and dumplings. Two illustrative dishes, namely *Steamed Buns* and *Wor-tips* (steamed meat dumplings), will be used to highlight the features of our solution. Our aim is to demonstrate how we can foster an interactive e-learning environment using synchronized multimedia techniques over the Internet (Slowinski and Kennedy 2002; Williamson, 2001). Students can learn at any time and any place using streaming technology (Alesso, 2000).

Overviews of our E-Learning Environment

Our E-Learning solution is composed of the popular three-pane environment with the metaphor of "play/more/explore" (RealNetwork 2002). Figure 1 illustrates our three-pane environment. On the left is the media playback pane. On the right is the related information pane. On the bottom is the media links pane.

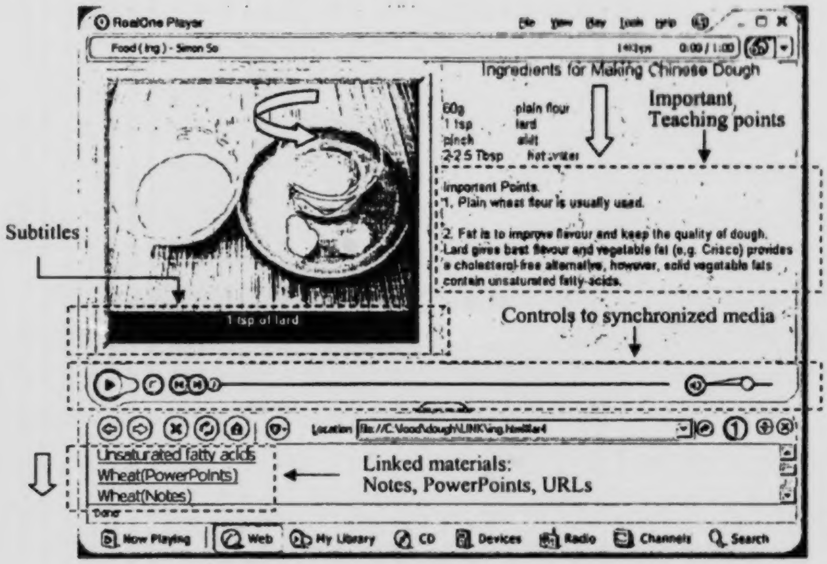


Play
Display more information
Explore Further
RealOne Player
Ingredients for Making Chinese Dough
Wheat(PowerPoints)
Wheat(Notes)
Now Playing
Web
My Library
CD
Devices
Radio
Channels
Search

Figure 1. Three-pane Environment

Chinese Dough-making Without Raising Agent

In preparing the dough, we show the ingredients for the Chinese dough as in Figure 1. The media playback pane displays the video clip of the ingredients. The teaching points associated with the ingredients are timely outlined in the related information pane. Additional links on teaching notes, materials, and URLs are click-able for further exploration as shown in Figure 3. Please note that the media playback provides subtitles in addition to the audio in the video clips. This feature is effective for learning (i.e. the dual coding / modality principle). Users can control the synchronized materials by pausing, playing and sliding the controls to skip, revisit and hold the materials at any time.



RealOne Player
File
View
Play
Tools
Help
Food (Ing) - Simon So
0:00 / 1:00
Important, Teaching points
Subtitles
1 tsp of lard
Controls to synchronized media
Location
Unsaturated fatty acids
Wheat(PowerPoints)
Wheat(Notes)
Done
Linked materials: Notes, PowerPoints, URLs
Now Playing
Web
My Library
CD
Devices
Radio
Channels
Search

Ingredients for Making Chinese Dough

60g	plain flour
1 tsp	lard
pinch	salt
2-2.5 Tbsp	hot water

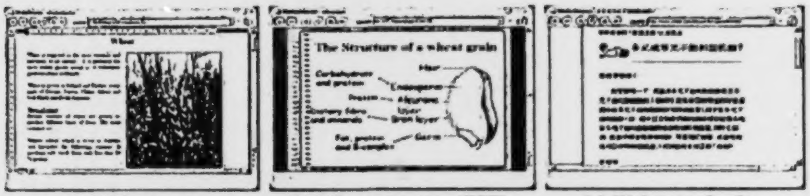
Important Points.

1. Plain wheat flour is usually used.

2. Fat is to improve flavour and keep the quality of dough. Lard gives best flavour and vegetable fat (e.g. Crisco) provides a cholesterol-free alternative, however, solid vegetable fats contain unsaturated fatty-acids.

Figure 2. A snapshot for playing the video clip of the ingredients

BEST COPY AVAILABLE


Wheat
The Structure of a wheat grain

(a) Wheat notes (b) Wheat structure (PPT) (c) Web page for fat

Figure 3. Click-able linked materials

Illustrative Dish (Steamed Buns)

In the illustration of making steamed buns, we demonstrate the effective use of multiple overlapping multimedia regions for e-learning. Very often, we need to stream media clips to different regions of the screen to show the time relationship and/or the spatial composition of the media clips. In Figure 4, we demonstrate the use of overlapping regions. When a static picture of the ginger juice is displayed in front of the overall picture of ingredients, a short video clip for the preparation is shown in an overlapping region. This stimulates the video feature of "picture-in-picture" in overlapping regions.

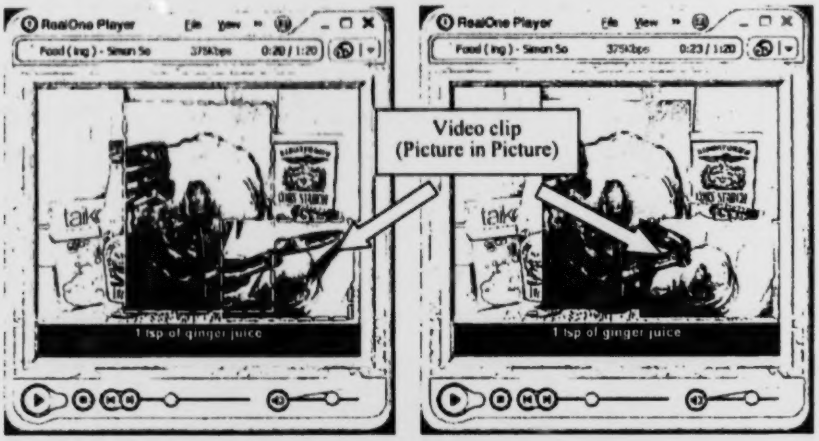

RealOne Player
File View
Food (ing) - Simon So
375Kbps
0:20 / 1:20
RealOne Player
File View
Food (ing) - Simon So
375Kbps
0:23 / 1:20
Video clip
(Picture in Picture)
1 tsp of ginger juice
1 tsp of ginger juice

Figure 4. Illustration of overlapping multimedia regions on making steamed buns

To complete our illustration, we provide the snapshots for the process of making steamed buns in sequence as shown in Figure 5.

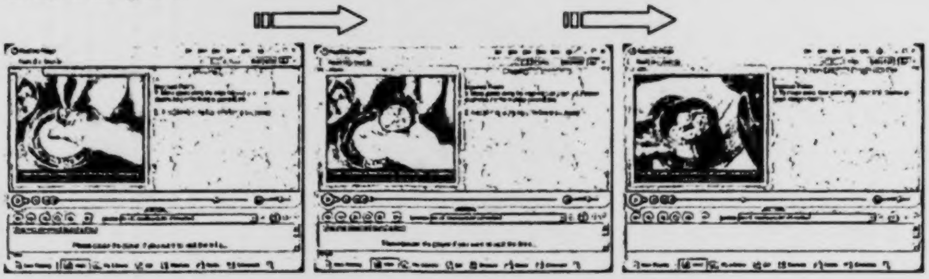


Figure 5. The process of making steamed buns

BEST COPY AVAILABLE

Illustrative Dish (Wor-tips)

In the illustration of making Wor-tips (meat dumplings), we choose the advanced feature of click-able video hot-spots to demonstrate the high-level of interaction that the synchronized multimedia can provide. During the preparation process, the irregular shape of the meat load is used to form a polygon of a click-able video area. Users can click the polygonal region to bring up the demonstration on how to prepare an equal portion of the meat load in Figure 6. This kind of interaction is powerful for e-learning. Users can directly obtain the relevant and timely information visually.

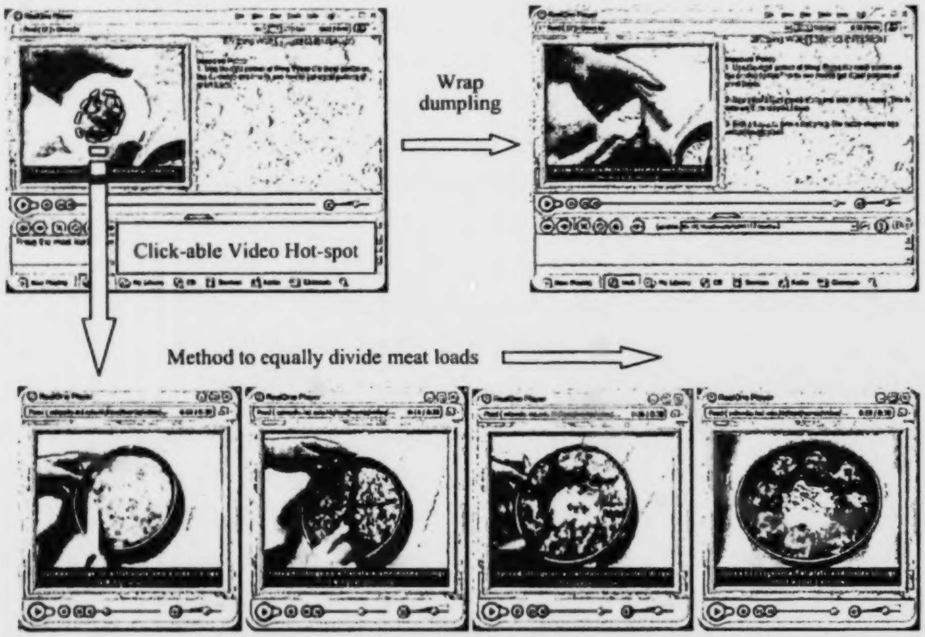

Wrap dumpling
Click-able Video Hot-spot
Method to equally divide meat loads

Figure 6. Illustration of click-able video hot-spot on wrapping wor-tips

Conclusive Remarks

In this paper, an interactive e-learning solution for the study of Home Economics is provided. The effectiveness of using synchronized multimedia techniques for e-learning is highlighted. Students can interactively learn the food preparation at any time and any place over the Internet. It opens up many possibilities that traditional hands-on demonstrations cannot do.

References

Alesso, H.P. (2000). *E-Video: Producing Internet Video as Broadband Technologies Converge*, Boston: Addison-Wesley.
Chamberlain, V. M. (1992). *Creative Home Economics Instructions*, New York: Glencoe Macmillan / McGraw Hill.
RealNetworks (2002). *RealSystem IQ Production Guide*, Seattle, WA: RealNetworks Inc.
Slowinski, M. & Kennedy, T. (2002). *SMIL: Adding Multimedia to the Web*, SAMS Publishing.
Stephens, L., & Leavell, J. (1999). Producing video-cases that enhance instruction. *Journal of Technology and Teacher Education*, 7(4), 291-301.
Williamson, H. (2001). *SMIL for Dummies*, Foster City, CA: IDG Books Worldwide.

BEST COPY AVAILABLE

LessonML: A Markup Language to Facilitate the Exchange and Presentation of Lesson Plans

Simon So
Department of Information and Applied Technology
Hong Kong Institute of Education
10 Lo Ping Road, Tai Po, N.T.
Hong Kong SAR, China
E-mail: swwso@ied.edu.hk

Abstract: In the Hong Kong Institute of Education (abbr. HKIEd), a vast amount of lesson plans for primary and secondary teaching practices are prepared by our pre-service teachers. These valuable documents are being wasted each year. One reason for this is that there are lack of formal mechanism to keep them. The other reason is that the non-standardization of these electronic documents prevents an effective exchange and retrieval of their contents. In this paper, a formal markup language for lesson plans is proposed and developed using XML. The formalization for the various components of lesson plans helps to foster a non-ambiguous data model. Using XML technology, not only we can relevantly query the lesson plans, we can display their contents in a variety of formats and styles using web-based technologies such as XSL and XSLT.

Introduction

In HKIEd, pre-service teachers are required to conduct teaching practices at their attached schools. They are normally assigned to teach their major and minor subjects so that they can gain teaching experience relevant to their subject knowledge. Among the various teaching activities they perform, they must prepare a series of lesson plans for their assigned periods. Their lesson plans are mostly in the form of typed and/or hand-written documents. After completed their field experience, there is no mechanism for them to systematically store and share them within this organization. These valuable lesson plans in large quantities are being wasted every year. However, if we can provide them with a markup language similar to SGML or HTML, they can prepare their lesson plans using the defined language. The advantages of using a standardized markup language to compose lesson plans are the following:

1. Self-description in tags such as <Teacher>, <Topic>, and <Motivation> can be established;
2. Highly structured information can be stored;
3. Searching can be more accurately;
4. Lesson plans can be easily displayed with different styles and formats; and
5. Interchange of lesson plans between organizations can be easily achieved.

In this paper, the proposed markup language is fully described with an example to illustrate the power and expressiveness of this development. One application of the markup language is also shown.

Language Overviews

There are many formats for lesson plans in the education community (AskEric, 2002; Leeck, 2002; LessonPlansPage, 2002). In HKIEd, a typical format of a lesson plan (Pang, 1992) is illustrated in Figure 1. The *learning objectives* section and the four teaching sequences namely *introduction, motivation, development and consolidation* are the essential components for our lesson plan. Some sections such as the *blackboard arrangement* section are optional. To define LessonML, we use XML DTD (Document Type Definition) to provide *validity* constraints (Buyens, 2000; Hunter, 2000; Wyke, Rehman & Leupen, 2002; Young, 2000) for our language[1] as shown in Figure 2.

---

[1] XML Schema is a better choice to define the structure, but we will use DTD to design LessonML.

Teacher:	School:
Student ID:	Class:
Cr - Year:	No. of pupils:
Subject:	Topic:
Date:	Publisher (if any):
Time:	No. of teaching periods:

Previous Knowledge:

Learning Objectives:

Teaching Aids:

Blackboard Arrangement:

Time	Aims	Learning Activities	Questioning / Exposition / Instruction	Arrangement
	1. Introduction			
	2. Motivation			
	3. Development			
	4. Consolidation			

Figure 1. A Typical Format of a Lesson Plan in HKIEd

```
<!DOCTYPE LessonPlan
 [
 <!ELEMENT LessonPlan (Header,
               PreviousKnowledge?,
               LearningObjective,
               TeachingAid?,
               BlackboardArrangement?,
               Lesson)>

 <!ELEMENT Header (Teacher, StudentID?,
            CurrentYear?, School?, Level, Class?,
            NPupil?, Subject?, Topic, Date?, Time,
            Publisher?, NLessonPeriod?)>

 <!ELEMENT Teacher (#PCDATA)>
 <!ELEMENT StudentID (#PCDATA)>
 <!ELEMENT CurrentYear (#PCDATA)>
 <!ELEMENT School (#PCDATA)>
 <!ELEMENT Level (Grade |
            Kindergarten |
            Primary |
            Secondary |
            Other)>
   <!ELEMENT Grade (#PCDATA)>
   <!ELEMENT Kindergarten (#PCDATA)>
   <!ELEMENT Primary (#PCDATA)>
   <!ELEMENT Secondary (#PCDATA)>
   <!ELEMENT Other (#PCDATA)>
 <!ELEMENT Class (#PCDATA)>

 <!ELEMENT NPupil (#PCDATA)>
 <!ELEMENT Subject (#PCDATA)>
 <!ELEMENT Topic (#PCDATA)>
 <!ELEMENT Date (#PCDATA)>
 <!ELEMENT Time (Minute | Period)>
   <!ELEMENT Minute (#PCDATA)>
   <!ELEMENT Period (#PCDATA)>
 <!ELEMENT Publisher (#PCDATA)>
 <!ELEMENT NLessonPeriod (#PCDATA)>

 <!ELEMENT PreviousKnowledge (PKItem+)>
   <!ELEMENT PKItem (#PCDATA)>

 <!ELEMENT LearningObjective (LOItem+)>
   <!ELEMENT LOItem (#PCDATA)>

 <!ELEMENT TeachingAid (TAItem+)>
   <!ELEMENT TAItem (#PCDATA)>

 <!ELEMENT BlackBoardArrangement (BBLayout+)>
   <!ELEMENT BBLayout (#PCDATA)>

   <!ELEMENT Lesson (Introduction, Motivation,
          Development, Consolidation)>
   <!ELEMENT Introduction (Minute?, Aim?, Activity?,
                 Question?, Exposition?, Instruction?,
                 Arrangement?)*>
   <!ELEMENT Motivation (Minute?, Aim?, Activity?,
                 Question?, Exposition?, Instruction?,
                 Arrangement?)*>
   <!ELEMENT Development (Minute?, Aim?, Activity?,
                 Question?, Exposition?, Instruction?,
                 Arrangement?)*>
   <!ELEMENT Consolidation (Minute?, Aim?, Activity?,
                 Question?, Exposition?, Instruction?,
                 Arrangement?)*>

   <!ELEMENT Aim (#PCDATA)>
   <!ELEMENT Activity (#PCDATA)>
   <!ELEMENT Question (#PCDATA)>
   <!ELEMENT Exposition (#PCDATA)>
   <!ELEMENT Instruction (#PCDATA)>
   <!ELEMENT Arrangement (#PCDATA)>
  ]
>
```

Figure 2. LessonML

XML Attritudes are deliberately avoided in our language to cater for a variety of applications. Furthermore, the design is not only relevant to the HKIEd's environment, the language is very suitable for the general public as the cardinality operators for the elements are specially considered. To illustrate this, a very brief lesson plan with minimal tags for teaching "Electronic Mail" is shown below:

```
<LessonPlan>
  <Header>
    <Teacher>Ho Shuk Fong</Teacher>
    <Level><Primary>4</Primary></Level>
    <Subject>Information Technology</Subject>
    <Topic>Electronic Mail</Topic>
    <Time><Minute>45</Minute></Time>
  </Header>

  <LearningObjective>
    <LOItem>Be able to tell what is e-mail</LOItem>
    <LOItem>Recognize e-mail address</LOItem>
    <LOItem>Apply a free email account on the Web</LOItem>
    <LOItem>Login and logout the email system</LOItem>
    <LOItem>Read and send one email message</LOItem>
  </LearningObjective>

  <TeachingAid>
    <TAItem>Browser with Internet connection</TAItem>
    <TAItem>Pamphlet from Post Office</TAItem>
  </TeachingAid>

  <Lesson>
    <Introduction>
      <Minute>2</Minute>
      <Question>Have experience writing letters to friends and relatives?</Question>
      <Question>Take how long to reach?</Question>
      <Arrangement>Show students the pamphlet from Post Office for the estimate time of a destination.</Arrangement>
    </Introduction>
    <Motivation>
      <Minute>3</Minute>
      <Question>Any faster way to send letters? Take how long?</Question>
      <Exposition>Demonstrate what is an e-mail system.</Exposition>
    </Motivation>
    <Development>
      <Minute>25</Minute>
      <Exposition>Explain the composition of an e-mail address</Exposition>
      <Instruction>Apply a free email account using Yahoo</Instruction>
      <Arrangement>Students follow the teacher step-by-step on applying an account.</Arrangement>
      <Instruction>Login the email system with the newly applied email account</Instruction>
      <Instruction>Read the Inbox for the first email from Yahoo</Instruction>
      <Instruction>Compose and send an email message to the teacher</Instruction>
      <Instruction>Logout (Sign Out) from Yahoo</Instruction>
    </Development>
    <Consolidation>
      <Minute>15</Minute>
      <Activity>Game</Activity>
      <Arrangement>Three students in a group and relay a secret email message in circle using compose and send (i.e. from A->B-
>C->A ).</Arrangement>
    </Consolidation>
  </Lesson>
</LessonPlan>
```

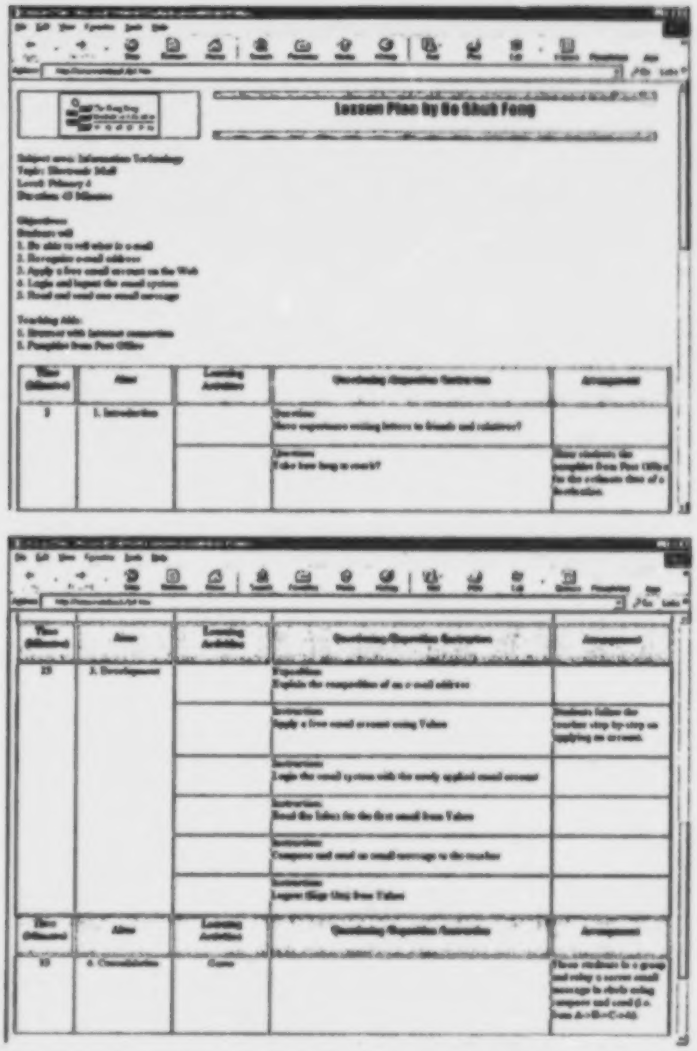
LessonML Applications

The language provides a framework for lesson plans to be used in many applications. One obvious application is to generate Web pages for the structured lesson plans. By separating the data model and the display format, one can have a number of styles and different content emphases. Figure 3 shows a particular design for displaying the content of the above lesson plan using XSL technology.

Conclusion and Future Work

The proposed markup language facilitates a standardized framework to represent and exchange lesson plans among applications. The structured data model provides a formal mechanism for our students to effectively store and retrieve lesson plans.

Currently, a small project is undertaking to organize lesson plans in HKIEd. The markup language described in this paper provides an important foundation to the project. Lastly, like many standards and languages, LessonML will be expanded continuously to enhance its elements.



Lesson Plan by Ho Shuk Fong

Figure 3. Using XSL to Display the "Electronic Mail" Lesson Plan

References

AskEric (2002). *AskEric Lesson Plans*, Retrieved May 4th 2002, from http://www.askeric.org/Virtual/Lessons

Buyens, J. (2000). *Web Database Development Step by Step*, Redmond, WA: Microsoft Press.

Hunter, D. (2000). *Beginning XML*, Birmingham UK: Wrox Press.

Loeck, B. (2002). *Lesson Plans Teacher's Page*. Retrieved May 1st 2002, from University of Alberta Libraries, http://www.library.ualberta.ca/subject/education/k12/lessonplans/index.cfm

LessonPlansPage (2002) Retrieved May 4th 2002, from http://www.lessonplanspage.com

Pang, K.C. (1992). *Lesson Planning*, Hong Kong: Longman.

Wyke, R.A., Rehman, S. & Leupen, B. (2002). *XML Programming (Core Reference)*, Redmond, WA: Microsoft Press.

Young, M.J. (2000). *XML Step by Step*, Redmond, WA: Microsoft Press.

BEST COPY AVAILABLE

Designing Attractive Virtual Spaces for E-Learning

Marion R Finley, Jr., Yuki Sogabe
Multimedia Laboratory
Asahi University
Hozumi-cho, Gifu Prefecture
501-02, Japan
{finley, ysogabe}@alice.asahi-u.ac.jp

Abstract: The work in progress described in this paper extends previously reported work on the construction and testing of virtual communications spaces for use in creating *attractive* Internet/Web-based environments, that is, virtual spaces, for e-learning. Such spaces, or, more precisely, the underlying Internet/Web-based systems that support these spaces, are related to human factors via utility functions, such as "willingness-to-pay," "user satisfaction," and the like. These functions are functions of internal system parameters. Optimal values of such functions then would correspond to "attractive" virtual spaces. An M^2COTS ("mass-market components off-the-shelf") approach is adopted. A formal characterization is given which will allow precise definitions of experiments to be performed to determine criteria for the construction of such spaces.

Introduction and Objectives

The basic *leitmotif* of the work being conducted by the authors is to determine a set of operational criteria for the design of Internet/Web-based virtual spaces that will be both "attractive" as well as "effective." This work extends work previously reported by the authors (Sogabe *et al* 2000). The keywords, "attractive" and "virtual space" have rather precise and limited meanings that will be given in some detail in this paper. Intuitively, however, they refer to a kind of environment, a specialised cyberspace or virtual reality (Beier 2000, Jensen 1999, Webopedia) one might say, created by computers, peripherals, and networks, that appeals to the intended users to the extent that the latter will be attracted to it and be willing to pay for access to it. These spaces are being applied initially to create e-learning environments to be used in graduate and undergraduate education in Japan (Finley 1999). The implications of the terms "attractive" and "effective" are simply that, for the first, the spaces must attract and hold the attention of the targeted users, in this case, potential graduate and undergraduate students in Japan, and, for the second, that they will achieve economic and pedagogical goals set by the institution, that is, they will be "effective" in realizing such goals. To simplify the terminology, in this paper the term "attractive" will be used to include the implications of both of these terms and, by extension, they will be applied to the e-learning system as a whole. In the work performed so far, the emphasis has been less on course content per se as opposed to the system infrastructures (Fernandez *et al* 2001) that render the virtual spaces produced "attractive." Therefore, at this phase of this work, courseware as such is not the immediate object of concern. In the work reported here, continuing the approach of previously reported work, an M^2COTS (Mass Market Components Off-the-Shelf) approach (Sterling *et al* 1999) to the design of experimental e-learning systems is being followed as much as is possible, therefore essentially restricting the designers to the use of to readily available and affordable off-the-shelf hardware and software. An initial definition of "attractive virtual space" has been given in previously reported work and is refined and extended in this paper. This definition appeals to the concept of topological spaces over which a utility measure (Deardorff 2001) is defined that relates internal system parameters to human-oriented parameters, for example, "willingness-to-pay" (Akimaru *et al* 1999, Yamori 1999) as a function of such system parameters as line bitrate, the various characteristics of display devices, etc. Optimizing a utility function yields an attractive space, using as criterion for "attractive" an optimal value of the function. Such a utility function may be constructed experimentally using human subjects and studying their reactions, for example, by carefully formulated questionnaires. The resulting functions may then optimized by using methods such as genetic algorithms Goldberg (1989) or others that are suitable for such cases, that is, functions of several variables whose optimum values may be difficult to obtain by the usual optimization techniques. The UML (unified modeling language) (Page-Jones 2000) is used to express the system architecture: hence the basic approach to the design is object-oriented.

The underlying intention of the authors' work is to attack a fundamental vexatious issue plaguing the computer and telecommunications field; namely, how to predict the intended customers' acceptance of a new telecommunications service or a new computer or telecommunications product. E-learning forms a special category of computer and telecommunications systems, one that, in the authors' opinion, merits careful study as far as the design of the environment ("space") which the students and professors of the future must inhabit for learning and teaching. If the authors are successful in their effort, they will be able to offer specific design criteria to e-learning designers that will render the resulting environments "attractive."

"Attractive" Virtual Spaces

The term virtual space has seen many uses and the authors have been influenced by such as (Fernandez *et al* 2001) and (Jensen 1999). For the moment, a virtual space, ***V***, will be informally characterized as a quadruple consisting of a collection of objects, ***O***, a collection of points, ***P***, a topological space, ***T***, over these points, and a metric, ***m***, over T. ***R*** is a set of *protocols* relating the objects among themselves. These are, in the terminology of the Open Systems Interconnection (OSI) reference model, application layer protocols. That is, $V = \{O, P, T, R, m\}$. The objects are primitives that will be associated with the points, or collections of points, of the topological space. As examples of points, one might consider such things as URL's, IP addresses, MAC addresses, etc. Objects may be pieces of equipment, human users, or software constructs. Generally, objects will be defined using a language such as the UML (Unified Modelling Language) (Page-Jones 2000). Compound objects will be sets of objects with specified relations between the objects. A topology is essentially a connection diagram relating points and objects to each other. A metric will be some measure over the elements of this connection diagram, for example, the total packet delay between two points. That is, in a virtual space, the concept of distance is related to the passage of time, and not necessarily of geometrical distance. Of course, ***m*** may be a function whose independent variables include time and geometric distance measures. The *dimensionality* of a virtual space implies at least the four dimensions of space-time and perhaps other dimensions as well, for examples, dimensions that include human behaviour. This is a complex issue and will not be considered further in this paper. The *specification* of a virtual space, ***V***, may be made a various levels of granularity, depending upon the aspects of the space upon which one wishes to concentrate. For present purposes, the emphasis is at a coarse level. It should be noticed that this characterization of virtual space does not specifically isolate real-world external objects, for example, the human users or physical devices, from objects that are software constructs, for example, avatars or other objects displayed on the user's screen. Moreover, some objects may span the external real-world and the world of software constructs, for example, the blending of some physically displayed object with objects in the physical environment. Rather, what counts is, that, in an object-oriented fashion, every object of the space will be characterized by a set of attributes and behaviours. Therefore, the frontier between what exists in the external real world and what exists solely in the system becomes blurred and now "reality" entails objects and relationships that exist in a man-made system ... and in the mind of the user. A virtual space, however, is supported by a multimedia communications system infrastructure as well as physical objects such as rooms, chairs, etc. While the specification of a virtual space may not explicitly define these objects, yet they can be included at a higher level of granularity. In this work, we shall be interested in the relationships between certain key internal system parameters and some aspects of human behaviour and shall content ourselves with just enough granularity to cover these.

In industry, the term *human factors* refers to aspects of human behaviour, both physical and psychological, that relate to particular environments, products, or services. The word *ergonomics* is used in the same sense. There is the specific implication that human factors may be reduced to measurable quantities. Human factors are used to study the possible acceptance of a new product or service by the targeted users or consumers. Human factors studies play a crucial role in the development of new products or services and help determine how human beings react to the technical aspects of these products as well as to new types of products and services.

In the present study, the purpose is to identify those human factors that determine the level of attractiveness of a given virtual space and then to relate these factors to key parameters of the virtual space. This may be done by using a kind of objective function termed *utility function* (Deardorff 2001). In economics, these are functions that specify the *utility* (well being) of a consumer for all combinations of goods consumed (and sometimes other considerations). Such functions capture critical aspects of the consumer's attitudes towards the goods being proposed to him. In this work, they will capture attitudes towards new proposed telecommunications products or services. Examples of utility include *willingness-to-pay*, *user satisfaction*, and so on (Webopedia). Such utlities may then be related to key parameters of the virtual spaces being considered, for example, screen definition, transmission delays, and so on.

As for the concept of "attractive," this, of course, intuitively simply means "capable of attracting, intriguing, and holding the interest of members of a target population," in the case of the authors' work, the potential candidates for using the e-learning services they are developing. Attractive virtual spaces in the context of e-learning would then tend to attract and maintain interest in the target student population. Utility functions may be used to measure the attractiveness of a given virtual space. Using skillfully designed questionnaires to poll users attitudes as function of key system parameters, as indicated above, one may identify the factors that make a virtual space attractive to the intended users and build empirically the corresponding utility functions. More precisely, results of the polling will give values of the utility as function of the system parameters of interest. Then, by using standard curve-fitting techniques, one may derive functions for the utility. Optimal values of these functions may then be obtained by optimization techniques such as genetic algorithms (Goldberg 1989). If $\mathbf{u} = \mathbf{u}(\mathbf{p}_1, \ldots, \mathbf{p}_n)$ is a utility function of parameters $\mathbf{p}_1, \ldots, \mathbf{p}_n$ where the $\mathbf{p}_i$ are the critical parameters of interest for a given virtual space *V*, then we say that *V* is *attractive with respect to the* p_i *of a given utility u* if, for values $\mathbf{v}_0, \ldots, \mathbf{v}_n$, $\mathbf{u}(\mathbf{v}_0, \ldots, \mathbf{v}_n)$ is a maximal value of **u**. The word *maximal* is used here rather loosely to mean a relative maximum that will satisfy the needs of the modeler at the moment. Since **u** may be an ill-behaved function for maximization purposes, in practice a relative maximum may be sufficient and such a relative maximum will be called a maximal value. The concept of attractive virtual space then is defined relative to some form of utility and some system parameters. This corresponds to our intuitive idea of the concept "attractive" as being a subjective evaluation according to various criteria. In the case of human beings, these criteria often are difficult to render explicit, hence the need for human factors studies as mentioned above.

Design and Testing of Attractive Virtual Spaces

With the aid of the concepts and mechanisms presented on the previous sections, the strategy of the authors then is to attempt to build experimental virtual spaces, subject these to testing with human participants, study their reactions using various polling and interviewing techniques, then attempt to derive meaningful utility measures. The latter then will be used as a basis for further development and experimentation. Thus, there will be an alternation between experimental work on the one hand and theoretical developments on the other. A crucial matter is the specification of the set of protocols ***R*** mentioned above in the definition of *V*.

In the conceptualization of that which constitutes *attractive*, the seminal work of (Norman 1990), and (Shneiderman 1998) are being found in the search for the qualities that might render an object, here a virtual space, attractive. At this time, these and related work and ideas are being explored in the quest to derive meaningful criteria for attractiveness as well as to find viable utility functions. Up to this point, attractiveness criteria have been sought by strictly intuitive reasoning, which, all the same, has proven to be effective in the design of several experimental virtual spaces in the context of tele-learning. These spaces were used in several trials in real classroom situations. In these initial trials, as previously reported (Sogabe et al 2000), initial results were very encouraging, but the formalism developed above was not yet available and no formal utility functions were used.

Conclusions

A crucial step in the process of attempting to find practical design criteria for attractive virtual spaces has been taken. Namely, it is now possible to characterize exactly what is meant by such spaces for a given application. This, in turn, leads to a precise way of defining meaningful experiments with such spaces and real human subjects. This in turn will allow the building of relevant utility functions and the optimization of the latter. The optimized results will then yield, for the given application, an "attractive" space or communications environment.

References

Akimaru, H.,Yamori, K., Finley, M.R., Dimensioning of Video Conferencing Systems in ATM Networks, *ICCC*, T11-2, Tokyo, Sep 1999.

Beier, K.-P., Virtual Reality: A Short Introduction, http://www-vrl.umich.edu/intro/index.html, February 28, 2000.

Deardorff, A.V., *Deardorff's Glossary of International Economics*, http://www-personal.umich.edu/~alandear/glossary/, 2001.

Fernandez, D. *et al*, Multimedia services for Distant Work and Education in an IP/ATM Environment, *IEEE Multimedia, Vol.8, No.3*, pp 68-77, July-September 2001.

Finley, M.R., Tele-Learning in Graduate Education, *NTT OpenLab Symposium*, November 12, 1999, NTT Musashino Laboratories, Tokyo, Japan.

Goldberg, D., *Genetic Algorithms in Search, Optimikzation, and Machine Learning, Addison-Wesley*, 1989.

Jensen, J.F., "3D Inhabited Virtual Worlds - Interactivity and Interaction between Avatars, Autonomous Agents, and Users", *Proc. WebNet 99*, pp19-26, Honolulu, October 24-30, 1999.

Miller, B.A. and C. Bisdikian, *Bluetooth Revealed*, Prentice-Hall PTR, Prentice-Hall Inc., 2001.

Norman, D.A., *The Design of Everyday Things*, Doubleday Edition, 1990.

Page-Jones, M., *Fundamentals of Object-Oriented Design*, Dorset House Publishing, Addison-Wesley, New York, 2000.

Shneiderman, B., *Designing the User Interface*, 3rd edition, Addison-Wesley Longman, 1998.

Sogabe, Y., Mase, H., and M.R..Finley Jr., "Virtual Spaces Applied to Tele-Learning - An M^2COTS Approach," *Proc. WebNet 2000*, pp 941-942 , San Antonio, Texas, October 30 - November 4, 2000.

Sterling, T.L., Salmon, J., Becker, F.J., and D.F. Savarese, *How to Build a Beowulf*, MIT Press, Cambridge, Massachusetts, 1999.

TechTarget.com, Inc, http://searchwebmanagement.techtarget.com/sDefinition/0,,sid27_gci214386,00.html

Webopedia (on-line dictionary of Web terms), http://webopedia.internet.com/TERM/v/virtual_reality.html

Yamori, K., *Utility and Signal Speed in Video Conferencing Systems - In the Context of Tele-Learning*, Doctoral Thesis, Asahi University, Information Management Sciences, December 1999 (in Japanese).

Acknowledgment

The authors wish to acknowledge the support of the National Science Foundation of the Ministry of Education and Sciences, Government of Japan

Web based Training on Radiographic Testing

ABSTRACT

The purpose of the creation research were to construct the Web Based Training on Radiograph Testing, to evaluate the package efficiency and to determine the students achievement of gaining by using this package.

Thirty students participated in the experiment. These students were the second year of Production Engineer from King Mongkut's University of Technology Thonburi. Prestest and posttest were conducted.

The research found that the Web Based Training had the efficiency of 83.86/85.64 which was slightly above criteria 80/80. The comparison between pretest and posttest performance of student was statistically significant different at 0.01 level. This result of comparison indicated the Web Based Training on Radiograph Testing, was enable learner gaining high achievement.

1. Introduction

In some ways, there are many types of learning system such as class conduction learning which is conducted by teacher, self-learning from various type of mediums, printed matter, video, for instances. But nowadays computer communication technology has become one of an important implement in teaching. In order to assist instructor and, in some cases, to be in place of teacher, the technology has been applied in teaching system by construction lesson in form of CD-ROM. Although the CD-ROM lesson is very beneficial to the learners but there are still some limitations to learners because learning through CD-ROM is not suitable for group participants.

In order to eradicate the problem, project constructors have applied the advanced computer technology, which is well-known called Internet, into the computer assisted instruction system. In this development respect, learners are able to study the constructed lesson pleasurably either studying individually or in group participants. Due to the advantage is the constructed lesson is written to perform on website that means if there is a computer connected to the internet system, learners can study the lesson throughout.

Reasoning to Radiographic Testing subject has never been written its web based context before, so that project constructors have chosen the subject to construct its web based context. In this respect, the project constructors have bore the fundamental of Interactive Multi-Media Computer Assisted Instruction (IMMCAI) system as its principle.

2. Objective

1. To construct a web based computer assisted instruction for Radiographic Testing subject.
2. To increase learning efficiency to the Radiographic Testing subject.
3. To examine the lesson effectiveness and the learner's learning efficiency.

3. Expected Benefit

3.1 For learning : learners can study the lesson at any time, any where as they see fit.
3.2 For teaching :
    3.2.1 To decrease time consuming in tools preparation.
    3.2.2 To be a learner-center instruction lesson.
    3.2.3 To be a web based e-learning instruction.

4. Project Hypothesis

4.1 The constructed web based computer assisted instruction bear effective standard at 80/80.

4.2 The constructed web based computer assisted instruction provides more learning efficiency to the learners.

5. Research Direction

- People and Group of Samplers

1. People : Students of bachelor degree level of the Engineering Faculty of Engineering Department of Production Engineering who had registered to take class of Radiographic Testing subject.
2. Group of Samplers : Students of bachelor degree level of the Engineering Faculty of Engineering Department of Production Engineering who had registered to take class of Radiographic Testing subject. The group had been divided into sub-groups as follows :-

2.1 The group for evaluation the effectiveness of the test. The group consisted of 30 students for evaluation the certainty and easy-and-difficulty of the tests.

2.2 The group for evaluation the effectiveness and efficiency of the lesson. The group consisted of 30 students.

- Tools of The Studying

1. Computer assisted instruction of Radiographic Testing subject.

2. Regular tests of the subjected credit and regular lessons test which were 4 choices tests. The tests were consisted of 300 questions and were divided into 3 sections which were pre-study test, interval-study test and finished-study test.

- Evaluation of lesson effectiveness and efficiency of learning

Evaluated with group of samplers who were 9 of the sophomore of the students of the Engineering Faculty of Engineering Department of Production Engineering and never studied the Radiographic Testing subject prior to the test. The test had been carried out step by step as stated below.

Step 1. Pre-study test was for recording points prior to studying the subject for making evaluation.

Step 2. Interval-study test was to evaluate the learners.

Step 3. Evaluate the learners after finishing the study.

- Data Examination

Divided the interval-study testing points and finished-study testing points into percentile. Then, compared the percentile with the average standard to find an acceptable result. The standard was set at 80/80. The result revealed details as follows:

1. The result of learning effectiveness

Based on non-relation of the group of samplers, by testing to find t-test point, the result of assumption of the 2 different groups of points averages and the points were pre-study test points and finished-study test point, the result after examination demonstrated that average of finished-study test points was 258.00 which was higher than the average of pre-study test points which was 80.78. It apparently reveals that the constructed computer assisted instruction accomplishes more knowledge to the learners.

2. Result of Field Testing

The test was experimented with 30 students who never studied the Radiographic Testing subject prior to the test. The result revealed the learning effectiveness was at 83.86 per cent and the lesson effectiveness of changing student's behavior was at 85.64 per cent. Therefore, the effectiveness of the lesson was 83.86/85.64 which is significantly higher than the standard.

6. Summary

The study shown that the constructed computer assisted instruction possesses higher effectiveness that the standard. In order to strengthen the difference, t-test had been carried out. The result of t-test revealed that the difference was so important as of statistically meaning at 0.01. Conclusively, the constructed computer assisted instruction makes more compressive effectiveness learning to the learners. And it can be a tool to educate general people who are interested in the Radiographic Testing subject.

7. Revelation

Because of bearing the 16 steps of the principle of IMMCAI, and the property of the constructed web based lesson is multimedia system, it makes the construction of computer assisted instruction for the Radiographic Testing subject brings more effectiveness and efficiency to learning of the relevant subject. And it is the web based lesson that makes an interesting interactive with the learners. Moreover the lesson provides a choice in choosing to learn individually or in group participants because it performs on website which no specific time learning requirement.

Multimode Virtual Consulting (MVC) Environment as an Alternative to Faculty Office Hours: A Work-in-Progress Report

Peter Soreanu
Department of Software Engineering
ORT Braude Engineering College
Karmiel, Israel
speter@actcom.co.il

Abstract: This paper is a preliminary report of a work-in-progress study. The research was done on the use of asynchronous and synchronous internet-based tools as a virtual academic consulting environment. Only partial qualitative results were obtained and they are presented in the paper. The main results confirm that there is a need for more than one tool and that the most efficient synchronous and semi-synchronous sessions are those that are well structured. Rigorous statistical analysis will be done at the end of the study, after continuing the experiment for two more semesters.

Introduction

The paper reports the preliminary results of an ongoing research on the use of virtual environments as tools that support students during the course delivery. The target population consists of more than 120 third year Software Engineering students. Their previous computer-related experience is expected to significantly reduce the novelty effect on their behavior. The research will span over a 3-semester period. The presented results were obtained after the first semester.

The course delivered in the first semester is an introductory course in Computer Networks. It is an in-person attendance required course, not intended for remote electronic delivery in an e-learning environment. The course is, however, well supported by Web-based materials: slides, short notes, video on demand, review questions, glossary, automatic assignments checker and more. It will be followed by 2 more courses on advanced networking topics. For every aforementioned activity, professional advice and administrative support is required. During the experiment, the existing office hours were not suspended or reduced, but merely supplemented by several virtual communication and/or collaborative tools.

Technologies Involved

The MVC environment comprised the following tools: forum, e-mail, virtual briefcase, Web-based conferencing. Such settings and their educational use are extensively described in (Wolz et al. 1997).

The forum was intended primarily as a discussion environment, facilitating communication among students, but also with daily monitoring and active participation of the teacher. It is tightly integrated with the course delivery, being an important part of the Virtual Classroom (Hiltz & Wellman 1997). The sporadic utilization of the forum for not course-connected matters was tolerated, but not stimulated. Students not only asked questions and raised problems, but also posted recommended relevant links that they thought would help others. The access to the forum was restricted to students who took the course.

The use of e-mail (see Khrishnamurthi 1999) was confined mostly to personal questions posed by students. The teacher also used e-mail for feedback on assignments, on his own initiative. There were occasions when a question posted publicly in the forum was answered directly by e-mail, according to the teacher's decision.

A virtual Web-based briefcase was also opened, to facilitate the collaborative work between students. The teacher didn't participate, but the students' activities there were monitored.

In order to add tools that permit more complex interactions, a synchronous Web-based conferencing system was also set up. The software is described at http://www.interwise.com.

Custom software was also developed for the experiment's purpose, permitting to associate students' name with their thumbnail photography and other personal data. This add-on feature contributed to a more personalized approach while interacting with the students. Special care was dedicated to the computer-human interface (Soreanu 1998)

Research's Aim

The research's goal was to study the comparative use of those tools, related to their adequacy for various tasks. Ultimately, they would result in recommendations to other faculty, concerning the most suitable environment. The expected results were based on an extension of Spiro's Cognitive Flexibility Learning Theory (see Spiro, Coulson, Feltovich & Anderson, 1988; Spiro, Feltovich, Jacobson & Coulson, 1992; Jacobson & Spiro, 1995) to what we defined as an MVC environment.

The first hypothesis: Solutions to complex tasks are correlated with the number of used communication tools.

The second hypothesis: The complexity of the task to be resolved is proportional to the sum of the complexity of each tool.

The third hypothesis: The use of the MVC environment is correlated with a positive change of attitude of the students toward themselves and the teacher.

Research Methodology

The tools utilized for the research were questionnaires, interviews and observation. The person-to-person contacts between teacher and students in this period were also logged and possible correlations investigated. The students were explicitly asked to use the MVC extensively, but that was not one of the course's requirements.

The forum was used in two distinct ways. The first is a non-moderated environment, where the threads were proposed by students and the teacher merely intervened to clarify recitation and homework issues. The forum was also used as a semi-synchronous tool, with the teacher present at previously announced hours. Those hours were posted periodically, and changed according to schedule constraint and students need. The frequency of these semi-synchronous sessions was increased during examination preparation periods.

The later use of the forum was decidedly a structured one. Although this use was quite widely researched recently (see Farnham et al. 2000; Churchill et al. 2000; Thirunarayanan & Perez-Prado 2001), we felt that more investigation is needed to better explore this path.

For the Web-based conferencing, we used only the structured approach, i.e. the subject was announced in due time and was of interest to most of the students. The teacher used PowerPoint slides from the course recitation combined with graphic tablet and audio input. The students used text and audio input. In order to reduce the bandwidth requirements, no video was allowed. The environment permitted object and application sharing.

The e-mails were analyzed according to the content.

The virtual Web-based briefcase was used by students to interchange documents. A singular attempt to use it for homework cheating was promptly rebuked.

We logged and analyzed the utilization patterns of students when using the MVC. For the conferencing system, we also identified an important group of inactive participants, the "lurkers" (see Nonnecke & Preece 2000).

We classified the complexity of the problems according to Bloom's taxonomy for categorizing the level of abstraction of problems that students rose when using the MVC. We classified each of the Multiple Choice Questions that the students were asked to answer. We used for this purpose a methodology elaborated at Cape Town University, South Africa (see http://www.uct.ac.za/projects/cbe/mcqman/mcqappc.html). We classified all the problems and questions that occurred while using the MVC, including organizational ones.

To check the user satisfaction, we used a paper and pencil questionnaire. For this purpose, an attitude instrument was developed, using a Likert scale. We applied the Cronbach's Alpha Reliability and obtained alpha = 82.

These results were corroborated with the communication pattern among the students.

Preliminary Findings

After using the devised MVC for one semester only, we have not gathered enough data to unequivocally confirm/reject the first two hypotheses. The results seem, however, to support them. We will continue the experiment for two more semesters, with the same students and teacher.

However, we have drawn some preliminary conclusions about the use of MVC, the research methodology and user satisfaction.

All tools were used quite intensively and have their place in the MVC environment. We have found that the best use for the semi-synchronous sessions is to support self-learning assignments that are required items for the final exam. In this case, the user participation was very high, most of the students were active and the subsequently administrated user satisfaction questionnaire confirmed the usefulness of the session.

The most valued use of the conferencing system was its use for 6 consecutive days before the term examination. As expected, the lack of video channel was not resented and the audio media (see Ackerman et al. 1997) was preferred vs. the textual one. There were a few technical problems, as connecting the microphone or downloading the slides. Their number was low and the students solved them relatively quickly. An interesting pattern emerged, groups of 34 students participating from the same computer. Having them using the same username was quite confusing and we work to upgrade the custom software containing their photos and data to allow for *ad hoc* grouping.

Anyway, the most successful on-line sessions were those that were well structured, dedicated mostly to a single subject and supported by additional course data.

The next stage of the study will further refine the research methodology. Aspects that yielded no significant results in the first semester will be investigated from a new perspective. Task vs. tools matching will also be studied.

The used MVC environment will continue to be used as an experimental test bed for virtual teacher-students interactions intended for academic consulting purposes.

References

1. Ackerman, M. S., Hindus, D., Mainwaring, S. D., Starr, B.Hanging on the 'Wire: A Field Study of an Audio-Only Media Space. (1997). *ACM Transactions on Computer-Human Interaction*, 4(1), 39-66.
2. Churchill, E.F., Trevor, J., Bly, S., Nelson, L., Cubranic, D. (2000). Anchored Conversations: Chatting in the Context of a Document. *CHI '00 ACM Conference*, The Hague, Amsterdam, CHI Letters, 2(1), 454-461.
3. Farnham, S., Chesley, H. R., McGhee, D. E., Kawal, R. (2000). Structured Online Interactions: Improving the Decision-Making of Small Discussion Groups. Computer-Supported Collaborative Work ACM Conference, Philadelphia, PA, 299-308
4. Hiltz, S. R., & Wellman, B. (1997). Asynchronous Learning Networks as a Virtual Classroom. *Communications of the ACM*, 40(9), 44-49.
5. Jacobson, M.J., Spiro, R.J. (1995). Hypertext learning Environments, Cognitive Flexibility, and the Transfer of Complex Knowledge: An Empirical Investigation. *Journal of Educational Computing Rresearch*, 12 (4), 301-333
6. Khrishnamurthi, M.(1999). Integrating e-mail in a programming class-implications for teaching programming. *Symposium on Applied Computing, 1999*, ACM, San Antonio, Texas, 26-131.
7. Nonnecke, B., Preece, J. (2000). Lurker demographics: Counting the silent. *CHI '00 ACM Conference*, The Hague, Amsterdam, CHI Letters, 2(1), 73-80.

8. Soreanu, P. (1998). What is Wrong with Computer-Mediated Communication (CMC) – An Educator's Point of View. *CHI'98 ACM Conference*, Los Angeles, CA, 46-47.
9. Spiro, R.J., Coulson, R.L., Feltovich, P.J., & Anderson, D. (1988). Cognitive flexibility theory: Advanced knowledge acquisition in ill-structured domains. In V. Patel (Ed), *Proceedings of the 10th Annual Conference of the Cognitive Science Society*. Hillside, NJ: Lawrence Erlbaum. [Reprinted in Ruddell, R.B. & Ruddell, M.R. (1994). Theoretical Models and Processes of Reading (4th Ed.). Newark, DE: International Reading Association.]
10. Spiro, R.J., Feltovich, P.J., Jacobson, M.J. & Coulson, R.L. (1992). Knowledge representation, content, specification, and the development of skill in situation-specific knowledge assembly: Some constructivist issues as they relate to cognitive flexibility theory and hypertext. In Duffy, T.M. & Jonassen, D.H. (Eds.), *Constructivism and the technology of instruction: A conversation*. Hillside, NJ: Lawrence Erlbaum.
11. Thirunarayanan, M. O., Perez-Prado, A. (2000) Structured Chat. *Ubiquity ACM IT On-Line Magazine*, 1(45), at http://www.acm.org/ubiquity/views/m_thirunarayanan_2.html
12. Wolz, U. et al. (1997). Computer-mediated communication in collaborative educational settings. *ITiCSE Working Group Reports and Supplemental Proceedings, 1997*, ACM, Uppsala, Sweden, 51-69.

Acknowledgements

The study is partially funded by a grant of the Council for Higher Education in Israel

LABORARY©: a Library of Lab Set-ups

Hugo Bohets, Tor-Björn Johansson, Herbert Peremans, Karel Soudan, Laurent Van Haverbeke
Faculty of Applied Economic Science UFSIA-RUCA
University of Antwerp
Belgium
Karel.Soudan@ua.ac.be

Abstract: The LABORARY© concept is designed to allow students to perform real experiments at any given time in a similar way students consult books in a library. For this, lab-instructions and material are configured to give both free access and autonomous use, while students are released from tedious and distracting tasks. The concept is demonstrated by case studies in Chemistry and Electromagnetism in which all three pillars of autonomous real labs have been successfully applied: 1) Intuitive user-lab interface, 2) interactive and bi-directional guidance, 3) Emphasised focus on main topic. Success results are shown by student questionnaire. Further developments will include both local and remote real lab exercises in the overall concept.

Introduction

Laboratory classes have become a necessary part in the teaching of science and technology as real life experiments and demonstrations provide a great enhancement of the understanding of theoretically discussed topics. While the expenses to install and operate these laboratory classes represent a growing part of the available funds for educational activities the achieved educational benefits of traditional lab classes are however sometimes very poor. The reason for this must be found in the way a traditional lab is configured: the same type of experiment has often to be carried out by a relatively large group of students at the same moment. The students are then forced to carry out experiments they may not be interested in, at time slots that may not fit into their individual work scheme. In many cases, they come to the laboratory uninterested and poorly prepared and they carry out the experiment solely by following the recipe. The pursued goal of aiding them to understand the underlying theoretical principles can hardly be achieved in this situation.

Developments in electronic media offer an opportunity to perform this task through the integrated use of telecommunication, network technology and multimedia computer systems. Computer-assisted multi-medial instruction is generally accepted as the preferred platform for individualised instruction: repetitive tasks can be partly taken over from supervising personnel, allowing them to perform more creative tasks and to tailor their activities to more dedicated assistance to the students. On top of this, knowledge and teaching aids can be shared through networking, telecommunication and teleconferencing, allowing a more widespread use of the existing means.

LABORARY©

By using electronic media the LABORARY© concept helps to find adequate solutions for the above problems of traditional laboratory education. The LABORARY© is seen as a laboratory that can function in the same way as a library. A relatively large number of different lab set-ups is available to the students to be consulted if the experiment is not being carried out by someone else, at any time slot they choose within reasonable working hours, in fact in a similar way students consult a book or a CD in a library.

A student or a team of students selects from the list of available labs, associated with the course he is attending, which one(s) he or she is interested in, and looks for a time slot that fits into his personal schedule to carry out the experiment. At the chosen time slot, he checks into the LABORARY©, carries out the experiment and makes up the lab report to be delivered within the indicated deadline. Because the student has to take the initiative to choose both the kind of experiment and the time slot to carry it out, he is much more involved in the experiment. Enquiries with the students and analysis of the lab reports indeed show that they are much more interested in the experiment and that they obtained a much deeper insight in the underlying theory of the experiment.

On top of this the whole or at least part of the laboratory work can be done on a distance by proper use of communication technology integrated in the lab set-ups, creating a proper environment for real remote lab exercises.

Library of real lab set-ups

To function properly, the LABORARY© must contain autonomously consultable lab set-ups, which means that the experiment itself can be carried out with virtually no interaction from teaching assistants. Repetitive tasks can be taken over from supervising personnel, allowing them to focus more on insight discussions.

Using a combination of a multimedia PC, LabVIEW™ and internet-like interfaces, computer controlled lab set-ups were created in which students are both monitored and guided by the interface software. Figure 1 to 4 illustrate the several parts ('pages') of a typical LABORARY© exercise:

- In a login page students identify themselves as individuals or by group.
- A second page informs about the current lab exercise and guides the student through the related expected prior knowledge and the theory that is to be explored in the experiment. The student may be prompted to a few questions and can only proceed after giving correct answers. (fig.1)
- A third page provides practical instructions on the actual experimental activities and measurements. (fig. 2)
- The next page is handling the real interaction of the actual measurements and the displaying of the results. (fig. 3)
- The last page overviews the results of the experiment, allowing the student to print them or/and transfer them to his own computer account to prepare an individual lab report. (fig. 4)

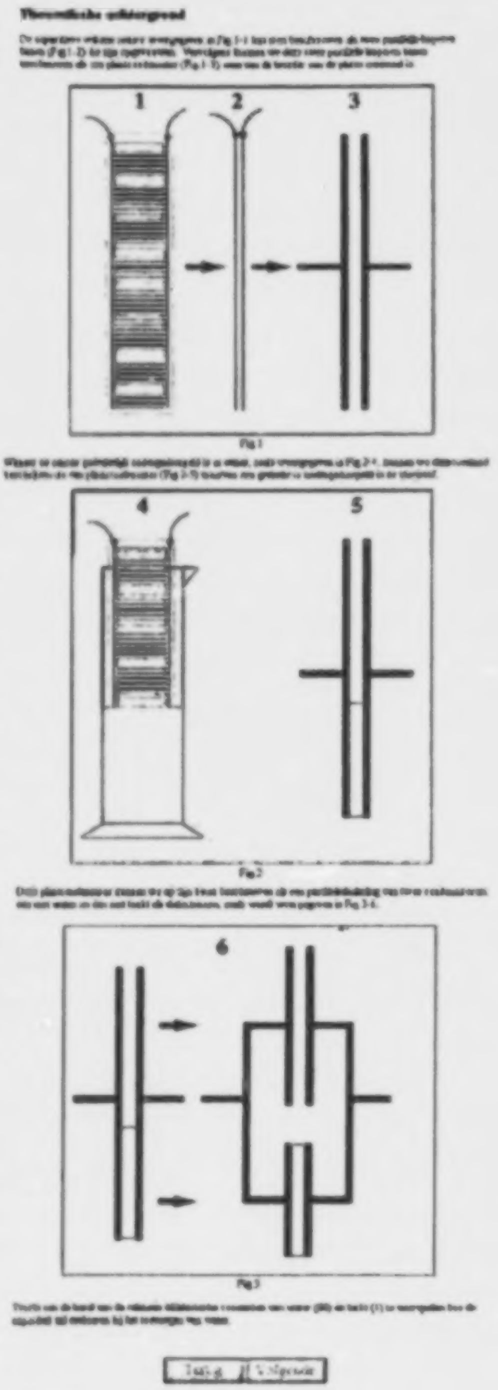


Figure 1: Instruction page

BEST COPY AVAILABLE

Discussion and results

Several set-ups - related to chemistry and electromagnetism courses - are already designed in such a way that they incorporate and even stimulate self-learning, creativity and personal initiative of the student. Each experiment goes beyond pure demonstration of the theoretical background concerned and contains an active and/or interactive component and allows creative inputs of the student.

From the development phase following didactic and practical improvements (as compared to the traditional lab approach) can be concluded.

The LABORARY© concept:

- allows the student to choose his/her own pace
- improves the possibilities for the student to repeat parts of the lab exercise which to him/her were less clear
- reduces overhead, i.e. connecting and configuring devices, when these activities are not the purpose of the lab exercise
- improves student involvement through enabling a choice of lab exercises, e.g. 3 out of 5
- stimulates the student to work and solve problems independently
- enables assisting personnel to spend more time on guiding the students in the interpretation process rather then the execution of the lab exercise itself
- makes it possible for students to choose the date and time when they carry out the lab exercise
- improves the maintainability and further development of the lab exercises

From a survey among the participating students we can conclude as follows on the proposed statements in the survey:

- *The information supplied by PC is ample to perform the practical aspects of the experimental set-up*: agreement.
- *I find it necessary that the lab supervisor assists me with the practical aspects of the lab exercise*: limited agreement.
- *I am able to perform these lab exercises in the lab with very limited assistance from the lab supervisor*: satisfying agreement.
- *If the necessary facilities were offered to me, I would consider performing these lab exercises at home*: no clear answer.
- *I find it important to discuss the results with the lab supervisor before I write my lab report*: agreement.
- *From this series of lab exercises I have enlarged my knowledge and understanding*: agreement.

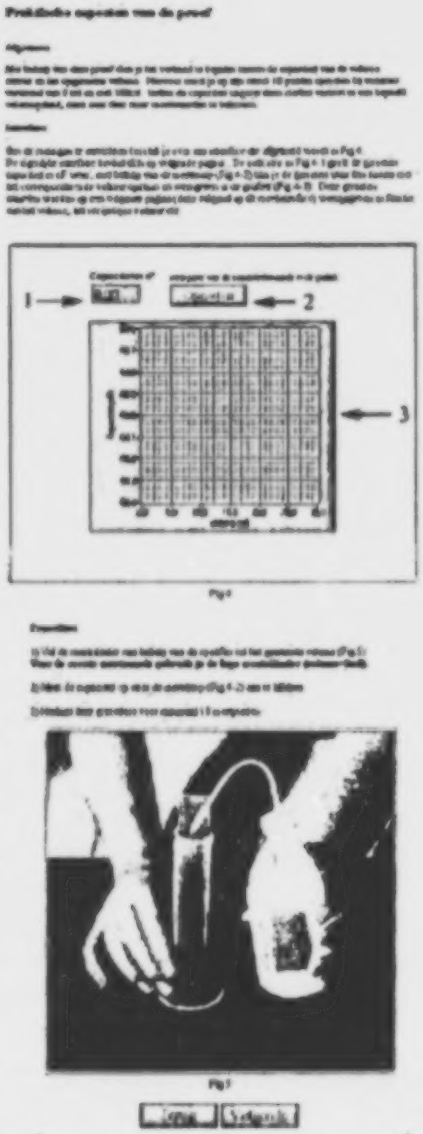


Figure 2: practical handling

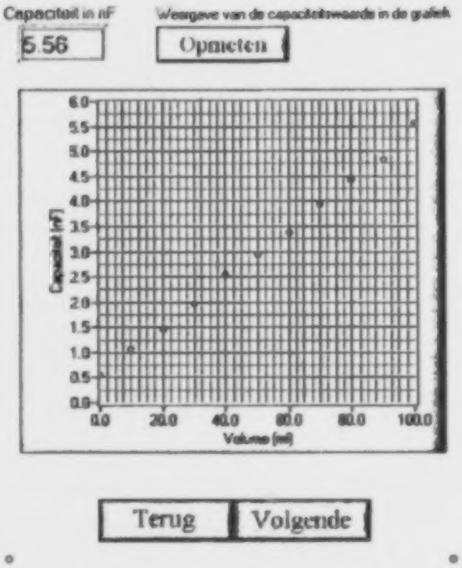
BEST COPY AVAILABLE

Conclusions for future developments

The combination of LabVIEW™ and multimedia PCs results not only in a cost-efficient and easy to use measurement systems. It also provides a pedagogical sound electronic assistant, provides the possibility to reduce overhead and puts emphasis on the main topic. From the results of the survey its clear that computer assisted lab exercises can work efficiently if a sound experimental set-up is chosen. Furthermore it is shown that the computer interface provides enough information and is easy to use. However there is still a demand for support for the theoretical aspects of the lab.

The ever-increasing possibilities of performing useful activities remotely, in particularly via Internet, suggest that also lab exercises as well could be one of these activities. However, from our survey we conclude that the lack of social interaction discourages students performing their lab exercises from home. A query among students following individual education as distance education might give a different result. Especially since this type of education almost always lacks lab exercises.

Two other important reasons for wanting to perform lab exercises remotely are cost and safety. The possibilities for two institutions to share in the use, and hence the cost, of sophisticated equipment is strongly limited by geographical distance. Remotely executed lab exercises could be an opportunity to share time and hence the cost of such equipment. Ultimately, using appropriate time scheduling, the same set-up can then be used by students from different institutions. If several institutions develop complementary lab exercises based on the same principle, they may end up with an offering of a multiple of the experimental set-ups they have in their own laboratories. Lab exercises that requires toxic or radioactive substances or any other lab exercise with increased hazards as high voltage and high power machinery could also preferably be done remotely. That remotely executed lab exercises would be possible if required is clear from examples as remotely performed surgery.



Capaciteit in nF: 5.56

Figure 3: Measurements

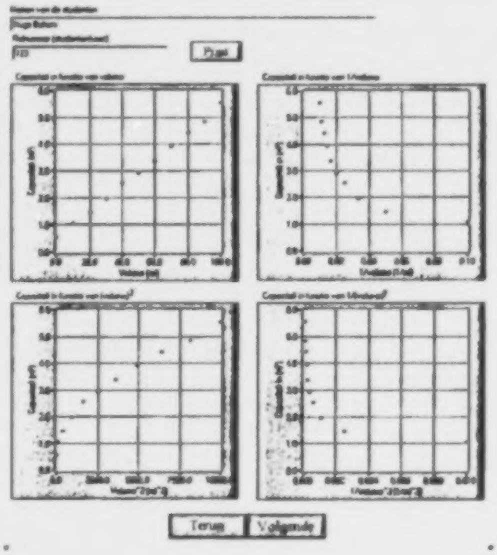


Figure 4: Overview - report

References

Bohets, H., van Haverbeke, L., Soudan, K. (2001). De inzetbaarheid van multimediale computer-ondersteuning, netwerk- en telecommunicatie-technologie in practicumonderwijs, *UA-dag onderwijsinnovatie,* Antwerpen.

Bohets, H., Johansson, T., Peremans, H., Soudan, K., van Haverbeke, L. (2002). *LABORARY©: A library of labs. Autonomous consultable lab set-ups in engineering education.* Proceedings of the PTEE2002 conference, Leuven.

BEST COPY AVAILABLE

EduBITE- Educating Business and Information Technologies

Claudia Steinberger, Universität Klagenfurt, claudia.steinberger@uni-klu.ac.at,
Judit Bajnai, Universität Wien, judit@dke.univie.ac.at,
Wolfgang Ortner,FH Joanneum, wolfgang.ortner@fh-joanneum.at,
Michael Schuh, FH Wiener Neustadt, michael.schuh@fhwn.ac.at,
Manfred Vogt, FH Vorarlberg, mv@fh-vorarlberg.ac.at
AUSTRIA

Abstract: The development of multimedia learning materials is expensive and very time consuming. In spite of these high production costs most materials are reusable only to a very small extent. Project results are often lost in obscurity. This paper demonstrates a cooperative approach of several Austrian universities and polytechnics to produce, configure and reuse multimedia content in the field of Integrated Business Information Systems. A recently founded association called "AKIT" may be used to distribute this content on a nationwide scale.

Introduction

Knowledge concerning "Integrated Business Information Systems" (IBIS) is focused in most computer science studies and spans a variety of topics from the conceptual business process modeling to the implementation details using various Enterprise Resource Planning (ERP) Systems. This knowledge is also currently taught at several universities and polytechnics in Austria focusing on different aspects of IBIS. Learning takes place exclusively in the form of face-to-face courses using individual teaching and learning materials (slides, books, scripts, exercises). Thus far the continuous use of case studies and the connection of background knowledge to such case studies have rarely been practiced in order to understand the universe of discourse. Overtaxing individual teachers' time to prepare sophisticated (multimedia) course materials and the costs of staying up to date with current software versions are the main reasons for this.

A group of university teachers realized this gap and in April 2001 joined an association called *AKIT (Akademische IT Lehr- und Lernplattform*, see also (AKIT)) spanning more than 12 Austrian universities and polytechnics. The main objective of AKIT is to benefit from the synergies available within this network in the teaching process. AKIT members discovered that their teaching objectives in the area of IBIS are mostly similar and they aimed to reuse teaching materials and jointly develop virtual courses based on well prepared case studies. This task, however, could not be achieved immediately. Teaching and learning materials as well as case studies were inhomogeneous, too strongly coupled or demonstrated a lack of continuity. Multimedia materials were not available at all, the way towards virtual classrooms was not feasible.

Having this background five AKIT members, among them universities and polytechnics, designed a project called EduBITE (Educating Business and Information Technologies) to overcome these problems and build up a common repository of multimedia IBIS materials as well as an environment for the customizable usage of these materials in different courses. They chose a situate learning approach focusing on a manufacturing case study enterprise called DeBITE (Demo for Educating Business and Information Technologies). EduBITE started in summer 2002 and has a running time of two years. It is funded by the Austrian Federal Ministry for Education, Science and Culture (bm:bwk).

Project Objectives

EduBITE tries to compensate the deficits mentioned above in the following respects:

- *Teaching Materials:*

Topics relating to 'Integrated Business Information Systems' such as conceptual business engineering, enterprise modeling, the support of business processes implementation or the customization of Enterprise Resource Planning (ERP) systems are prepared for multimedia use based on a case study enterprise (DeBITE). The produced learning modules focus on computer science students as well as business administration students. They cover a four hour/week conventional course in the field of IBIS and will be evaluated over one semester in at least two courses at two different universities or polytechnics.

- *Instruments:*

Instruments are developed to categorize developed materials according to the IEEE international metadata standard. The meta-indexed learning objects can so be used to construct specific lessons according to special target groups or certain learning processes. Instruments for the configuration of course materials using learning process models are also developed. These guarantee adaptation, enhancement and interoperability of the developed multimedia material.

- *Communication Platform:*

The output of the project is aimed to increase the reuse of available multimedia materials in the IBIS context. The AKIT association mentioned above will be the framework to gain access to the multimedia materials and to improve and enhance them. Its members also constitute the market for the sustained use of the project products.

Project Content

EduBITE develops multimedia material using business processes as a basis for the business information system, investigating business process properties, their co-operation on various levels and their technological support. Often students are not able to bridge the gap between complex business processes in reality and the abstract information systems supporting them. But particularly abstraction mechanisms should be comprehensible for students. Using the case study enterprise DeBITE, this process of abstraction should become clearer and more comprehensible, while at the same time making much basic background knowledge accessible. The target group for using the multimedia IBIS material in the first stage comprises about 2200 students per annum.

The following topics are to be dealt with in depth in EduBITE:

- The case study manufacturing enterprise DeBITE
- Business Engineering and Enterprise Modeling
- Architecture of Business Information Systems
- The architecture of ERP Systems, including related topics such as customizing and integration
- Sales and Distribution
- Materials Management
- Production Planning
- Financial Management and Controlling

Usability is guaranteed using specific style guides focused on by the EduBITE partner from Vorarlberg. Students will learn in the use case context of DeBITE, which enables a situate learning approach.

Students' learning objectives as well as their prior knowledge differ from course to course. Accordingly, learning processes and the required learning materials vary (e.g. for computer science students, business administration students, high school students, etc.). EduBITE develops a tool that enables to define metadata for learning objects, to declare learning processes and to configure individual multimedia course materials based on the learning object repository according to learning processes. This EduBITE-*Configurator* also allows the export of course materials according to a learning standard (see also (LOM), (SCORM), (IMS)), guaranteeing interoperability with various learning management systems.

The EduBITE Configurator will be realized by the EduBITE project partner from the University of Vienna which has just completed substantial preparatory work in this tool area. The Configurator will contain a modeling component in order to graphically describe the learning processes. The allocation of smallest learning units to the according part of the training process will be supported. With it's functionalities training processes can be easily modeled and training material can be professionally managed, but the main focus of the Configurator is the individual course production based on the idea of Learning on Demand. A specially designed interactive questionnaire will capture the actual knowledge demand of the focused target group. Based on this information the Configurator will automatically, based on reference processes, compose the required course. The course description will be in a standardized metadata format in order to assure compatibility to learning management systems through export/import interfaces.
One of the main questions coming up in this context is the warrantee of pedagogically right provision of course materials. To deliver a solution to the question of automatically building of courses from "instant" learning units and still having didactically right learning processes will be one of the biggest challenges of this project beside the technical realization of the Configurator.

During the end phase of the project the developed multimedia materials will be evaluated twice in typical project partner IBIS courses. WebCT will be used as the learning management system for these evaluations. Blended learning will be realized. Interaction and communication elements as well as group work will encourage learning during online phases.

After the evaluation, a rollout of project results to interested AKIT members is planned using the association as a multiplicator for the project results.

Project Architecture

The project architecture can be sketched as follows in figure 1. It also allows a continuous extension and update of the business process models of DeBITE by incorporating case studies from other enterprises as well as by adding further basic knowledge. Through meta description of the learning units the Configurator can always pick up and bond the demanded contents to a multimedia course. The use of other learning management systems besides WebCT is also possible as far as learning object standards are supported.

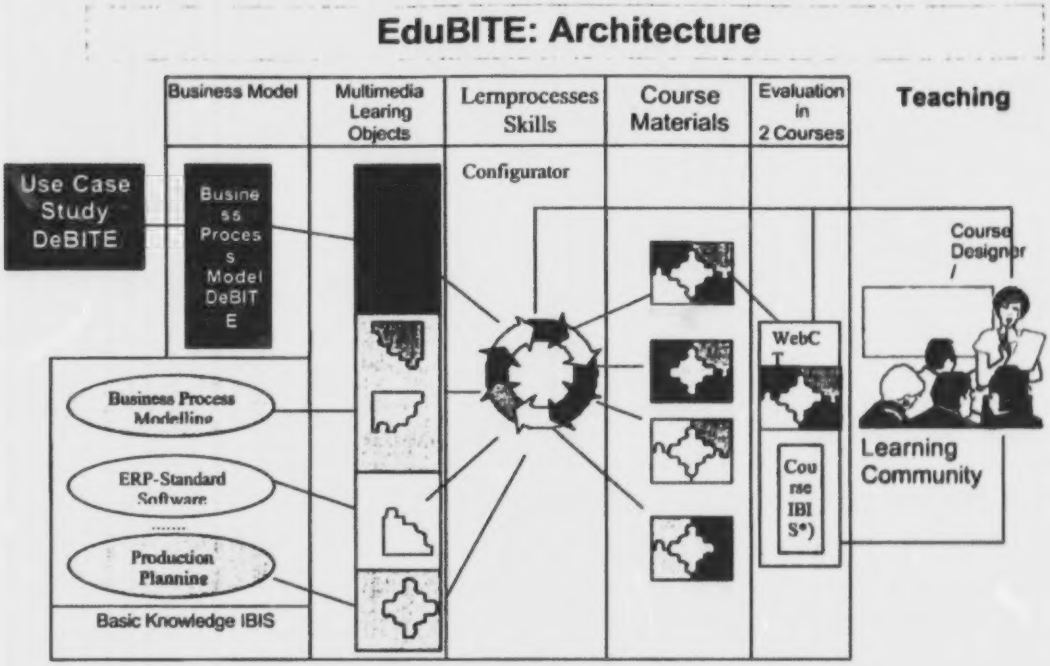

EduBITE: Architecture
Business Model
Multimedia Learing Objects
Lernprocesses Skills
Course Materials
Evaluation in 2 Courses
Teaching
Use Case Study DeBITE
Business Process Model DeBITE
Configurator
Course Designer
WebCT
Course IBIS*)
Learning Community
Business Process Modelling
ERP-Standard Software
....
Production Planning
Basic Knowledge IBIS

Figure 1: EduBITE Architecture

Resume

The production of didactically well designed modular learning materials is an important precondition for a successful application in virtual learning. But this mostly goes beyond the capacity of individual teachers, and thorough learning object engineering is not enough to assure project success. EduBITE adds to the engineering process also a circumstanced approach using the extensive case study example DeBITE. It enables individual course configuration and also places the produced multimedia learning material in a co-operative environment. The AKIT association thus guarantees that the multimedia material outlives the duration of the project as well as it encourages future expansion and extension.

References

AKIT Akademische IT Lehr und Lernplattform, www.akit.ac.at
bm:bwk see www.nml.at
SCORM see http://www.adlnet.org/index.cfm?fuseaction=scormabt
IMS see http://www.imsproject.org/
LOM see http://ltsc.ieee.org/wg12/

BEST COPY AVAILABLE

A user-oriented information system for Teleservice in trouble shooting of mobile construction machines

Achim Streit, Klaus Henning, Arne Simon

Centre for Learning and Knowledge Management and Department of Computer Science in Mechanical Engineering (ZLW/IMA), University of Technology (RWTH Aachen), Germany,
streit@zlw-ima.rwth-aachen.de, henning@zlw-ima.rwth-aachen.de, simon@zlw-ima.rwth-aachen.de

Abstract: The Teleservice information system describes a realisable alternative which is especially focused on the support of service technicians during the process of trouble shooting. The system transmits the relevant data to a browser whose lay-out design supports efficiently the mutual flow of information between the service close of the customer and close of the manufacturer. The thin-client-three-tier-architecture, the JAVA implementation of the System-Clients and the Application-Server and the physical data independence of the relational DBMS enable the adaptation of the information system to the needs of the user and the companies involved in the service process.

Keywords: Teleservice, information system, Java, relational DBMS, Design

1. Introduction

Due to the increasing pressure in competition the manufacturers of construction machines face the requirement to distinguish from the competitors by innovative product-related services. Technical communication across borders of nations and continents has become part of everyday life in industry and service. About all enterprises are stretching out their business into global activities. These would be "global players" need to develop and implement their own networks for their own staff as well as for their business partners world-wide, with different degrees of data access and communication requirements. Hence different layers of Intranet structures are to be implemented, integrating the different user groups in different ways, corresponding to their tasks within business co-operation.

2. Characteristics for Teleservice in civil engineering

Mobile construction machines in civil engineering (e. g. cranes, diggers, open cast mining machines or concrete and tarmac casting equipment) perform the most important functions on construction sites. In order to improve performance world-wide for the manufacturers the servicing of their mobile construction machines has to be efficient, reliable and first of all low in cost. Critical factors are the availability of spare parts and the quality and speed of diagnosis in case of machine failure.

The main problem in repair and maintenance, however, is decentralised technical information, involving different departments and people in the service process, different technical standards of the machines and insufficient maintenance infrastructure world-wide. Therefore an information system is needed which enables the variety of machine users and servicing staff to find the necessary information through one system. In order to develop a prototype for an user-oriented Teleservice information system (TeSIS) the required information for this service was structured and the involved persons and companies were identified and the work flow of an exemplary service process was described.

If a failure at a construction machine is determined by the machine operator or during an inspection, then usually the workers on customer side try to find the error. If the customer on the construction side is unable to repair the damage locally, he informs a service organisation oriented closer to the manufacturer. The reasons for this are often the lacking experience of the local technicians with the existing technology or missing information, e.g. the faulted construction unit is not sufficiently described in the service documentation (Henning et al., 2000).

The responsible service organisation decides, whether the manufacturer service must be contacted or to what extent they are able to solve the problem themselves. If the producers service is informed, the service has now the task to identify the problem. Usually there is no prescribed or firm operational sequence for a failure report. The service technician of the construction machine manufacturer tries to locate the error and arrange the necessary steps by remote diagnostics via telephone and fax.

Central term of the design field humans-technology is the man-machine interface. It contains all elements of the (information-) technical system, with which the user in its work activity acts or interacts. The overall system humans, organisation and technology describes the context of utilisation of a software for a special application area, the technical customer service at construction machines. The context of utilisation itself covers the handling of the humans with the technology, the integration of humans and technology in the organisation and the resulting task structure. The emphasis of this paper lies in the design of an information system for the customer service of a construction machine manufacturer.

3. Requirements

The requirements of a TeSIS, resulting from the process of the trouble shooting at mobile construction machines and the organisations which take part in it, can be illustrated in the application area. Fig. 1 summarises the requirements to the TeSIS. Under the term of task accomplishment requirements, which devoted from the task ($T_{T1..n}$) and requirements of the users ($T_{U1..n}$) itself are quoted. Requirements of the functionality of the information system result on the one hand from the task ($F_{T1..n}$) and on the other hand in connection with the application system ($F_{S1..n}$), which can be used. Usability means both requirements to the design of the application system ($U_{S1..n}$) and the needs of the users ($U_{U1..n}$).

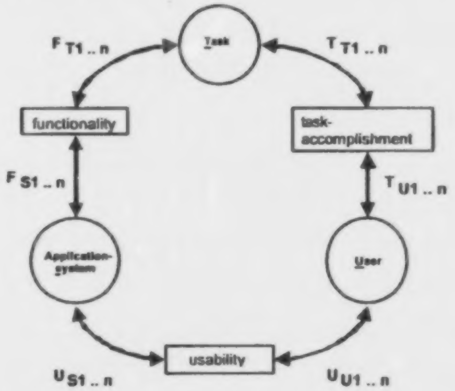


Figure 1: Requirements to a information system

4. Realisation

The presence of a person with service specialised knowledge at the machine is thus presupposed. The Teleservice information system realises an early manufacturer support for service-relevant problems. An overview of the Web-based TeSIS shows fig. 2. The TeSIS integrates two well-known Client server systems: InterNet and/or Www Client/Server, Java Client/Server and data base Client with the appending DBMS (Dickens, 1997). The user calls the needed application in form of an applet. Since the applet is merged in a HTML document, the Java-Client is also the Www-Client at the same time and in summary called System-Client. The Java-Server merges with the Database-Client into the Application-Server. Since the Application-Server is implemented not as an applet, but as a Java-Application, the middleware possesses the rights of a application and can arbitrary access resources of the data base management system (DBMS). The Application-Server controls the data base connection or the selection and a preparing of data from the DBMS. Both the System-Client and the Application-server of the TeSIS are realised in Java technology (Streit, 2002).

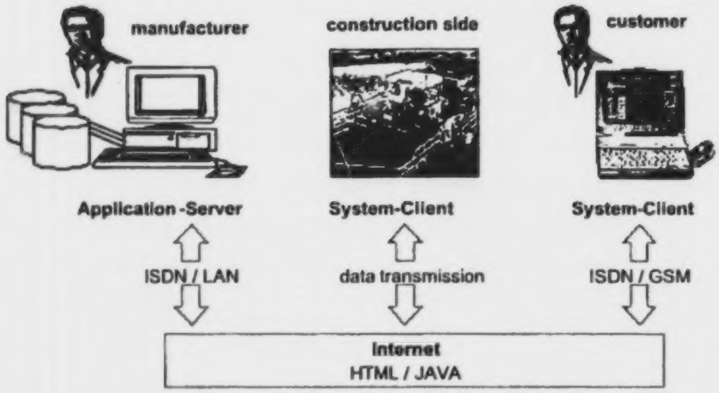


Figure 2: Teleservice information system

The consideration of the application range set the basis for the requirements to a TeSIS concerning the support of performance, the functionality and the usability. The whole design process has been performed in very close co-operation and involvement of the future users. The themes and issues to be called up by the system have been structured based on a cluster analysis made by the maintenance staff and technicians of the machines manufacturers. This early integration of the future users leads to a double advantage: Firstly, the acceptance of the software system by the future users is increased, because they see their wishes and thoughts about the design and structure of the user interface are integrated into the final layout. Secondly, the user integration has helped to prevent failures in the development of the application in the first phases of the project. It has lowered the costs and minimised the development time. By the integration of the users in all phases of the design process the TeSIS is adapted to the needs of the different user groups.

The user interface has to assist users with different native languages because the machines are in use around the world. Secondly the controls of the application have to be readable even under bad sight conditions e.g. on a laptop at the construction site. Thirdly there is no standardised strategy of trouble-shooting, every technician follows his individual strategy. Most of the technicians have worked for a long time in their jobs. These different individual problem solving strategies have to be supported by the application but it implies also that the users have to change elements of their own strategies.

Finally the acceptance of the user interface by the technicians is a specific problem in Teleservice: the computer knowledge of the world-wide users varies very strongly. Many of them have little or no experience with computers which makes it necessary to develop an easy-to-understand interface without limiting the efficiency of working with the system for the experienced user. In order to solve these problems, two different approaches have been used to develop the new interfaces.

Firstly a set of new simple icons has been designed which are fully self-explanatory for the technicians in civil engineering (see fig. 3, set of icons). Six main clusters of data have been identified to be the content of the database (Raue et al., 1999). They have been chosen according to their similarity of their sets of characteristics:

- online data of the machine (e. g. hydraulic pressure)
- producer information about the machines (e. g. product family catalogues, internal design drawings)
- forms (e. g. failure reports, order lists)
- maintenance and repair information for diagnosis (e. g. checklists, failure identification)
- job lists
- additional information (e. g. route maps, hotel lists, web-sites)

These clusters have been derived in very close communication and exchange of observations with the maintenance staff and the machine users. Subsequently they helped to structure the new www-based information system to support the service of these machines.

Secondly, the hierarchical structure of the application has been kept extremely simple and transparent. On each level, only a very small number of options is being offered to the user in order to make the path to the wanted information a sequence of easy-to-remember decisions based on the new simple icons (see fig. 3).

BEST COPY AVAILABLE

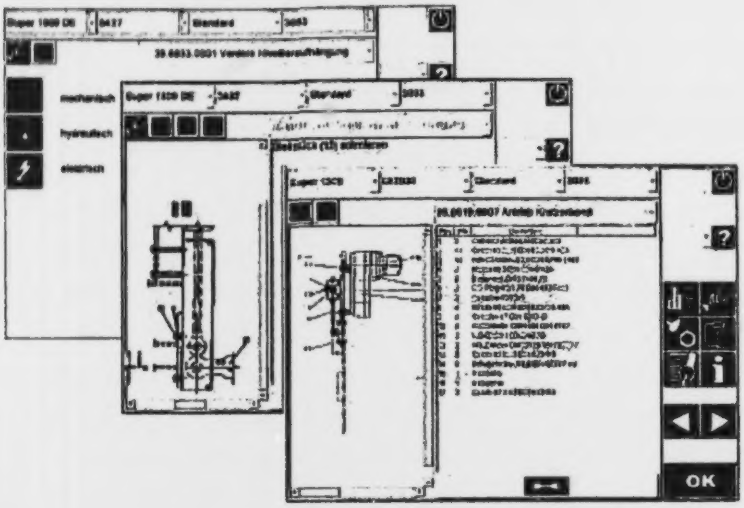


Figure 3: Computer Interfaces for the Teleservice of Civil Engineering Machines

For the unique identifier of the machine e.g. only the input of the type of machine, the machine number, the type of plank and the plank number is necessary. The surface offers now different ways of diagnosis to the service technician. With respect to the diagnostic support, an error search tree and a symptom list rank, mechanical, hydraulic and electrical causes are included. In the second level the parts lists is displayed in combination with the spare part drawing. On the third and fourth level methodologies for remedy are suggested by symptoms and cause.

5. Conclusion

The prototype of a TeSIS provides a basis for a successful integration of new services in the traditional product portfolio of manufacturers of construction machines. The system developed can be considered an example of how Intranet structures can be implemented within the existing Internet. Through easy access regulations and organisational agreements a large group of machine users world-wide can become integrated into enterprise Intranet in order to make best use of the available knowledge of the enterprise. Since the TeSIS can be integrated in the existing intranet, it offers furthermore the possibility to the manufacturers to make information of the service department internally also available to departments like development, production or training. This increases the utility of the product for the customer and enables the company to gather advantage in knowledge over the competitors.

6. References

Henning, K., & Grobel, K., & Streit, A., & Raue, I. (2000). Teleservice-Informationssystem im Serviceprozeß *Teleservice für mobile Maschinen und Anlagen – TeSMA*, Frankfurt am Main.

Raue, I., & Streit, A., & Grobel, K. (1999). Designing user friendly informationsystems to support the worldwide servicing of civil engineering machines, *Human Computer Interaction 1999*, München.

Streit, A. (2002). *Ein nutzerorientiertes Teleservice-Informationssystem für die Fehlerbehebung an mobilen Baumaschinen*, PhD-Thesis RWTH Aachen. (to be published).

Veldkamp, G. (1996). *Auswirkungen und Gestaltung informationstechnologischer Netzwerke im Hinblick auf die Handlungsfähigkeit des Menschen in komplexen Problemlöseprozessen*, PhD-Thesis RWTH Aachen. Augustinus-Verlag Aachen.

Dickens, H. (1997). *JDBC - Internet-Datenbankanbindung mit Java*. Bonn.

BEST COPY AVAILABLE

Automatic Videoing a Normal Classroom for a Distant Lecture with a Recording Function of a Blackboard

Akira Suganuma Shuichiro Nishigori*

Depertment of Intelligent Systems,
Kyushu University
Kasuga, 816–8580, Japan
E-mail: suga@limu.is.kyushu-u.ac.jp

Abstract: When lecture scenes are videoed for the distant lecture, a camera-person usually controls a camera to take suitable shots; alternatively, the camera is static and captures the same location all the time. Both of them, however, have some defects. It is necessary to control a camera automatically. We are developing ACE (Automatic Camera control system for Education) with computer vision techniques. The early version of ACE captures the lecture focusing on the latest object written on the blackboard. When noting something written on it or thinking over them, however, students may not always want to watch the latest object. We designed a recording function of the scene captured by ACE before for one of the solutions of this problem.

1 Introduction

The growth of a communication network technology enables people to take part in distant lectures. There are mainly two kinds of method to held a distant lecture. One is an web-page-based method and the other is a method of sending visual and audio of lecture scenes. We are studying a camera control system for the distant lecture held by the method of sending visual of lecture scenes[Suganuma 1997a, Suganuma 1997b]. We call it "ACE" (Automatic Camera control system for Education)[Suganuma 2002].

A traditional style lecture held in a normal classroom is the target videoed by ACE. Figure 1 illustrates the distant lecture we envisage. A teacher teaches his students in an ordinary classroom. There is a blackboard in the room. A teacher writes and explains something on it. Some video cameras are setting in the room in order to capture a lecture scene. The scene is sent to a distant room and projected on a screen. Students in the room take part in the lecture by watching the scene on the screen.

Nowadays, some teachers use an OHP and/or other visual facilities in his lecture. Indeed many lectures such as in the information technology or the programming are frequently held by using visual facilities or computers in many universities b But there are still many traditional style lectures, in which a teacher explains something with a blackboard. It seems that such lectures will not disappear in the future although they will hold by combining the blackboard and a visual facility such as an OHP or Power Point software. We are, consequently, developing ACE for the distant lecture with videoing the traditional lecture.

When a lecture screen is videoed, a camera-person usually controls a camera to take suitable shots; alternatively, the camera is static and captures the same location all the time. However, it is not easy to employ a camera-person for every occasion. And the scene videoed by a steady camera hardly gives us a feeling of the live lecture. It is necessary to control a camera automatically. ACE enables people to do it for taking suitable shots for a distant lecture. Receiving a scene from a camera, ACE analyses it and recognizes the complexion on the lecture. ACE judges an important thing in the scene and effectively controls the camera to focus on it.

The early version of ACE captured a lecture scene focusing on the latest object written on the blackboard. When noting something written on it or thinking over them, however, students may not always want to watch the latest object. We designed a function recording the scene captured by ACE before as one of the solutions of this problem.

In this paper, section 2 presents design of ACE and our strategy of a camera control and a recording function. Section 3 describes an implementation of the recording function and section 4 describes an evaluation of ACE. Finally, concluding remarks are given in section 5.

---

*Currently, Sony Corporation, Japan

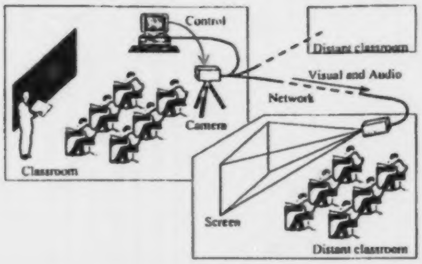

Control
Distant classroom
Visual and Audio
Network
Camera
Classroom
Screen
Distant classroom

Figure 1: A form of the distant lecture by videoing the normal classroom

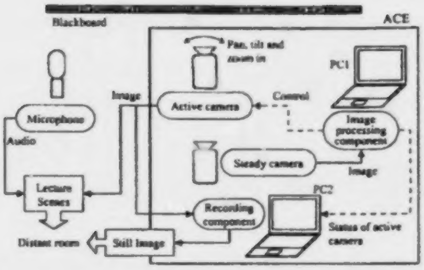

Blackboard
ACE
Pan, tilt and zoom in
PC1
Image
Active camera
Control
Microphone
Image processing component
Audio
Steady camera
Image
PC2
Lecture Scenes
Recording component
Status of active camera
Distant room
Still Image

Figure 2: An Overview of ACE

2 Overview of ACE

2.1 Design

When we designed ACE, which is an application based on Computer Vision Technique, we assumed the following:

- A teacher teaches his students by using only a blackboard.
- Students aren't reflected in the scenes captured by the camera.
- A teacher doesn't give ACE a special cue.
- Each student in the distant room are assigned a PC to refer what he wants.

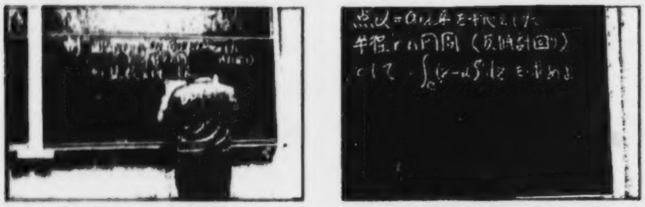
The first three assumptions are made when we designed the early version of ACE. The first assumption means the lecture captured by ACE is a traditional one, the second is assumed to decrease processing costs, and the third denotes a teacher is able to concentrate his attention on his teaching. These are realistic assumptions and the early version of ACE have been developed on them. The last assumption may not satisfy in same classroom. But ACE needs an interface to detect a student's demand and to display the requested scene. We adopted an Web browser as the interface. We make the browser run on the PC assigned to each student and supply the scenes as Web pages consisting of a still image.

An overview of ACE is shown in Figure 2. ACE requires two cameras. One is a steady camera and the other is a active one. The steady one captures a whole blackboard at a constant angle. The captured image is sent to an image processing component of ACE running on PC1 over an IEEE-1394 protocol. The component analyzes the sent image and decide how to control the active camera according to a camera control strategy shown in section 2.2. The control signals are sent to the active camera over an RS-232C protocol. The active camera, hereby, takes a suitable shot. ACE has a recording component which generates effective still image files from the scene captured by the active camera. It runs on PC2 because the procedure of the image processing component requires high CPU power. It receives a status of the active camera from the image processing component, analyzes the scene sent from the active camera and makes a decision whether to generate a still image file or not. A visual captured by the active camera and an audio picked up by a microphone are sent to the distant room. Students in the distant classroom watch and listen to them.

2.2 A camera control strategy

What does ACE capture? It is a very important thing for the system such as ACE. One solution is to take the scenes that students want to watch, but in this case many scenes are probably requested by many students at the same time. Although this solution needs the consensus of all students, it is very difficult to make it. We adopted, therefore, a strategy that ACE captures something explained by a teacher. However to extract directly what a teacher explains is very difficult. Consequently, we made an assumption that the latest object written on the blackboard closely

BEST COPY AVAILABLE



(a) An ordinary shot

(b) A key shot

Figure 3: Sample shots of a lecture scene captured by ACE

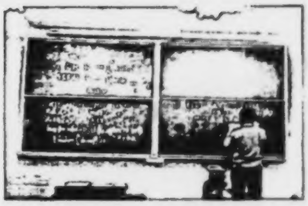


Figure 4: A sample shot captured by a steady camera

parallel something explained by a teacher because he frequently explains the latest object. ACE captures the latest object written on the blackboard.

It is important that students can easily read contents on the blackboard. A sample shot captured by ACE is shown in Figure 3. ACE usually takes a shot containing the latest object and a region near it in a discernible size. The blackboard often consists of four or six small boards like a picture of Figure 4 and a teacher frequently writes relational objects within one board. Now, ACE takes a shot by the small board such as Figure 3-(a). ACE takes a shot zoomed in on the latest object such as Figure 3-(b) after the teacher has written it. After a-few-second zooming, ACE takes an ordinary shot again. On the other hand, if we take a scene by a steady camera, the shot may be like a shot in Figure 4. In this case, the characters in this shot are too small for students to read because the camera must capture the whole blackboard. The shot of ACE is superior to that of the steady camera.

2.3 A recording strategy

Indeed ACE captures the objects explained by a teacher, but some students probably want to watch another object. ACE has a recording function of the scene captured by the active camera before. Objects on the blackboard doesn't change when once a teacher writes or erases them. If a object is updated, it is detect as the latest object again. This is reason why a still image is good enough for sending information. We decided that the ordinary shot, which consists of a small board containing the latest object in a discernible size, was recorded because a teacher often wrote a meaningful object on one small board.

A sample of a interface to students is shown in Figure 5. This Web page has two frames. In the left one, some still images of a small board are placed in order of generating, and in the right one, the images are placed in its position. When clicking each image, students can watch its enlarged image.

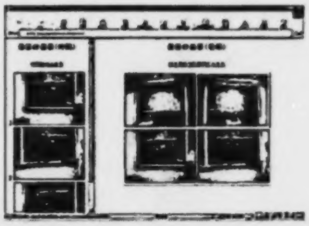


Figure 5: A sample of displaying small boards on which a teacher wrote some objects

3 Implementation of ACE

ACE has two components: an image processing component and a recording component. The image processing component extracts the latest object on a blackboard with some CV techniques and detects the timing of zooming in. For detailed implementation of the image processing, please see [Suganuma 2002].

The recording component of ACE gets the status of the active camera from the image processing component. ACE can easily generate an image from the ordinary shot according to the status. The ordinary shot, however, is not always suitable for the stored image. ACE have to estimate whether the objects on the small board is the same as that in the image which has been stored already. The image does not have to be stored if it has been already stored. The component checks it whenever the status of the active camera changes from a key shot into an ordinary shot.

Contents on the blackboard in the stored image have to be clear. A teacher sometimes occludes the contents in the ordinary shots. Then, the recording component also has to check whether he does not occlude the contents on

BEST COPY AVAILABLE

the blackboard. The image processing component detects a teacher's region with the subsection image between two successive frames. The technique, however, sometimes extracts only a part of teacher's body or sometimes misses a teacher. So the position of the teacher sent from the image processing component is not good enough.

The recording component detects a teacher in the image captured by the active camera. The ordinary shot contains the whole small board, so four edges of the board appears a complete rectangle in the image. If the teacher is in front of the board, the bottom edge is divided into two pieces. When the edge is completely connected, the component guesses that a teacher does not occlude the board, and stores the shot from the active camera.

4 Evaluation

We evaluated the videoing strategy of ACE with a real lecture from a point of view that students could made a note. In our experiment, we didn't use our recording function because we couldn't use a classroom where there are PCs assigned to our students. Before the lecture, we informed the students that we would collect their notes after the lecture and check them. We precomposed a master note and wrote the all contents of it on the blackboard. After the lecture, we collected their notes, compared them with the master note, and counted their missing in each note. 36% of all the students can perfectly copy the contents from the shots captured by ACE and 45% of the students make only one mistake. Almost all students make not more than three mistakes. Some small characters such as the index of formulas caused almost all mistakes. As the results of this estimation, almost all students can make a note correctly enough to learn it. The shots of ACE seem good enough.

We also evaluated ACE separately in terms of the size of character in the still image, the timing of storing the image and the occlusion. The characters in almost all (98%) images are large enough for students to read. Those of 1.5% images are too small because they contain very small alphabets such as the index of formulas, which are originally written small by the teacher. Indeed mis-storing sometimes occurs because the image processing component miss the latest object, but almost all still images are worth recording.

5 Conclusion

ACE takes a suitable shot if the teacher explains the object as soon as he writes on the board. It cannot take, however, a suitable shot when he explains something in front of it and when he explains something written before. In the former case, he has to change his position because his students even in the local classroom can not watch them. In the latter case, the teacher usually teaches his students pointing the object which he wants them to look at. We will get ACE to interpret teacher's action and/or posture and to capture more suitable scene. We assumed that a teacher teaches his students with only a blackboard. But he sometimes also uses with a visual facility. We will also get ACE to apply to such a situation.

Acknowledgment

This research was partly supported by a Grant-in-Aid for Scientific Research (Category C) from Japan Society for the Promotion of Science(JSPS), No.14580224, 2002–2004.

References

[Suganuma 1997a] A. Suganuma, S. Kuranari, N. Tsuruta, and R. Taniguchi, "An Automatic Camera System for Distant Lecturing System," Proc. of Conference on Image Processing and Its Applications, Vol.2, pp.566–570, 1997.

[Suganuma 1997b] A. Suganuma, S. Kuranari, N. Tsuruta, and R. Taniguchi, "Examination of an Automatic Camera Control System for Lecturing Scenes with CV Techniques," Proc. of Korea-Japan Joint Workshop on Computer Vision, pp.172–177, 1997.

[Suganuma 2002] A. Suganuma and S. Nishigori, "Automatic Camera Control System for a Distant Lecture with Videoing a Normal Classroom," Proc. of World Conference on Educational Multimedia, Hypermedia & Telecommunications, 2002.

Linux and the Rise of Open Source Software: the Indian Perspective

Yogesh Suman, Scientist, NISTADS, K.S.Krishnan Marg, Pusa, New Delhi-12, India.
Email geetyogesh@yahoo.com

Abstract: The paper describes the concept of open source software with reference to Linux. It describes the consequences of closed source software strategy followed by commercial companies. Discusses the strengths of Linux operating system. Gives the roadblocks in popularization of Linux. It also gives the global market standings of Linux. Gives Indian perspective of the Linux, how it can be helpful in solving the problems faced by poor countries like India in implementation of information technology for development

Introduction

Information Technology is currently a major concern of developing countries. It is a technology vital for development but the cost is high and implementation not easily achieved. A related issue is that of copyright and illegal copying of software. Complying with international standards means ending widespread copying of software endemic in most developing countries and the prospect of very high and recurrent software costs. Other problematic issues are security and virus problems. A recent development, which is attracting much interest, especially in developing countries, is that of open source software and the Linux operating system in particular. This type of software goes a long way in helping to resolve the issues mentioned above. The most basic definition of open source software (OSS) is software for which the source code is distributed along with the executable program, and which includes a license allowing anyone to modify and redistribute the software. Source code is the human readable set of instructions which programmers write to create a piece of software. But once a program has been "compiled" into a machine-readable form its source code is irretrievable. It is practically impossible to make changes to a program without having a copy of its source code. If a program's license includes the right to modify the program, this right is meaningless unless the source code is readily available. It is at this point open source software differs from other software which is not open source. Almost all the commercial software companies distribute their software products in machine-readable form only. By doing so they maintain a monopoly on improving their software by adding features or fixing bugs. This power encourages them to behave the way monopolists often do: bugs do not get fixed unless this brings a profit, and upgrades become expensive because there are no competitors.This is how, many experts believe that large commercial software companies have gained monopolistic market share of the strategic system and application software for personal computers. According to them the strategy of these companies include predatory pricing (cutting prices to drive rivals out of business); cross-subsidies (using one part of a large company to underwrite loss-making activities in another); and technological predation (using inside knowledge of the operating system to make rival's programs run badly). Browsers' war (the war between Microsoft's Internet explorer (IE) and Netscape navigator) can be a good example. In this Microsoft was at advantage in the sense that it controlled the source code of Windows operating system. Since both IE and Netscape Navigator were to run under Windows. It was easier for Microsoft to develop Window based Internet browser than any other company.These strategies adopted by commercial software companies, has given rise to unhealthy dependence on proprietary software, huge expenditure on licensing fee, growth of gray market in pirated software, troublesome environment in local software industries and most importantly discouraged innovation in the software industry at global level. The freedom of innovation offered by Linux has to be understood against this background.Although the concept of open source software started to attract people's attention in eighties, it gained real momentum in 1990s with the rise of Linux, which is emerging as powerful OS for enterprises as well as private use.

Strengths of Linux

The inputs from tens of thousands of independent developers ensure that highly creative, innovative development is constantly happening. The race to outdo each other ultimately benefits Linux and customer. Apart from being free Linux has following technical features:

- **Robust**: Need to reboot the system after making Operating System (OS) level changes is reduced.
- **Secure**: The very fact that every line of code is analyzed by thousands of people of open source community, means that no hacker has a chance to slip in anything unnoticed. It is widely seen that Linux has had no high-level security defect remain open for more than 48 hours. That's an achievement that no single company hopes to emulate easily.
- **Scalable**: Linux runs on almost all hardware platforms, from a wristwatch to a mainframe. Such scalability is not even available to an OS running on limited platforms.
- **Manageable**: Linux is essentially self-maintaining. Turn it on, configure it and forget about it.
- **Cost-effective**: Linux is free to use, free to copy and free to redistribute. No licensing required.
- **Can replace windows:** For every proprietary, licensed software there exists a practicable free Linux alternative.
- **Multitasking capability:** Linux is one of the few operating systems apart from Win NT, which does preemptive multitasking. Win 3.1, Win 95 and Mac OS all do cooperative Multitasking.
- **Integration with existing LAN**: It has support for all the popular protocols so setting it up to access the Internet is a really simple and quick task.
- **Gaining popularity as the number one server solution:** The global economic recession may actually provide competitive advantage to Linux. A recession will simply drive enterprises as well as private users to seek more cost-effective solutions. Indian customers are interested in Linux because of the price/performance advantage of open-source software running on commodity servers.
- **Range of users:** Linux has gained so much popularity in the past two years that there are actually few corporations left that are not using it.
- **Services offered:** Linux offers such a vide range of services that almost every single Linux server installed on low-end PCs lands up being the most mission-critical system in the entire organization.

Indian perspective

India is talent-rich, resource-poor powerhouse of immense software skills. But it also finds itself ironically unable to afford the prices of 'legal' software that it very badly needs for itself. If legal software becomes mandatory, most people would cease to use computers and usage would go down harming us more. On the other hand, if India continues to pirate software, the country gets a bad name in the intellectual property corridors worldwide. So given that piracy is no long-term solution this availability of Linux for no cost is specially important for Indians who are squeezed between astronomical software prices, the falling value of the rupee, and allegations that those who cannot afford to pay are 'pirates'. For India Linux represents generous scientific altruism over exclusive, profit-driven business compulsions. So far the growth of Indian IT has remained US centric and the domestic sector has been completely neglected this has resulted in extremely weak domestic sector. The current IT slowdown in the country is a direct result of the slowdown in US economy. On the other hand countries like China has been able to sustain the growth despite the global slowdown only because of the strong domestic sector. Now the question comes how to make domestic sector strong in India. In order to make Indian IT strong at domestic front the mass penetration of PC has to be increased. The main hurdles, which India is faced with, are the following:

- Most people can't afford to buy a PC.
- Most people can't afford to buy legal software.
- Almost 90% of people in the country can't understand English, which is the main language, used in software products.

Linux can go a long way in solving the problems mentioned above.

Cost Effective PCs: Linux can help in developing cost effective PCs in India because of the support it has for obsolete hardware and it's ability to be used as embedded OS in small hardware applications. Indian Institute of Sciences Bangalore has developed simputer, a small hand held device that runs on Linux operating system and can be used for checking and sending emails without being confined to a single point. More importantly it can operate in local language as well.

Language hurdle: Linux is available with the source code, which means the basic Kernel making the software can be easily customized to local languages and local language version of Linux can be easily developed. Indian Institute of Technology (Chennai, India) has already started developing the local language version of Linux so that people who don't understand English can also operate computers. This kind of solution can go a long way in realizing the dream of IT for all.

Impact on education: Free software available with source code allows teachers and students to look into the software and not just treat it as a mystical black box. Just as children like to play with things, tear them apart and put things back. Free software encourages such exploration, allows interaction with other users & developers, and learns to understand large complex programs.

Linux in indigenous supercomputer: C-DAC (Center for Development of Advanced Computing, Pune, India) has proposed to develop a Supercomputer based on cluster computing with PCs using Linux as a starting point. The combination of Linux and the PC will enable these clusters to be available readily and cheaply.

Linux Roadblocks

Support availability and cost: This has been the weakest part of Linux ever since the beginning. Many potential Linux users are waiting for a reliable support infrastructure to arrive. That's why 24/7 service providers are wary of switching to Linux. Windows NT or Unix users are assured of support at a call. This is a remote possibility in Linux today. One can't expect people to log onto the Net, shoot off a query and wait for a reply. Most businesses don't want to pay for support, least of all when the support is for a free solution. Yet this is precisely the revenue model that Linux distributors have adopted. And mainstream corporate IT users tend to be more comfortable with fixed costs than with variable costs. Though the support is available, it remains to be seen how the users take to its costs.

Away from desktop: Linux is still at some distance from desktop systems. Until the operating system manages to come up with a body of applications to compare with the tens of thousands available for Windows, it will not be able to match it. Windows has the advantage of being preinstalled on most personal computers being shipped by big firms, and that is not likely to change in the near future.

Global Standings:

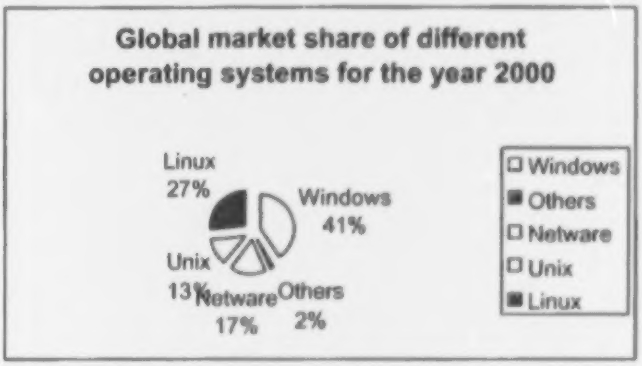


Table 1: Based on research done by IDC (International data corporation)

Linux grew by 24 % as against 20 % growth registered by Microsoft Windows in the year 2000. Current Linux usage in Indian corporate stands at 5 %, which is likely to reach 9% in 2002.

Conclusion

Free operating systems like Linux represents great opportunity for poor countries like India both in terms of low cost and availability of source code. It can really increase the affordability of computers. Easy customization of Linux can help in destroying language barriers in understanding the software products. By doing so it can really increase the mass penetration of IT in countries like India thereby making the benefits if IT available for all.

References

1. Jayadev, K.; & Srinivas, R (2001). Linux: Now we turn 10. *Computers Today*. 35-45.
2. Menon Sandeep(2001) Betting your future on Linux.
3. Noronha, Fredrick(2002). Open source lures talent rich, resource poor south Asians. *http://www.linux-india.org/articles/fred.shtml*.
4. What is the future of Linux *http://www.znetindia.com/techzone/linuxcentre/stories/42160.html*
5. About Linux India. *http://www.linux-india.org/about.shtml*.
6. Bhargava,Kishore(2001).General linuxFAQ *http://www.pcquest.com/content/search/showarticle.asp?artid=7125*

Exploring Tools and Methods for Work-Integrated Learning

Lars Svensson[a], Ulrika Lundh-Snis[b], Carsten Sørensen[c], Kerstin Grundén[d],
Thomas Lindroth[e], Stefan Nilsson[f], Pia Stahl-Falck[g], Christian Östlund[h]

{lars.svensson[a], ulrika.snis[b], carsten.sorensen[c], kerstin.grunden[d], tomas.lindroth[e],
stefan.nilsson[f], pia.stahl-falck[g], christian.ostlund[h]}@htu.se
Laboratorium for Interaction Technology
Department of Informatics and Mathematics
University of Trollhättan Uddevalla
Sweden

Abstract
Most organizations have high hopes regarding the potential for eLearning to address the increasing demands for constant learning that characterizes life in a knowledge society. However, most existing designs are strongly influenced by traditional classroom-based education, and are consequently poorly adapted to the situated conditions of real work practices. This paper aim at framing a research domain labeled *work-integrated learning*, where focus is set on developing innovative tools and methods for technology-mediated learning rooted in understanding of the specific conditions for various organizational settings. The paper proposes a four-level stage model as a framework for both analysis of organizations and design of new tools and methods for eLearning.

1. Introduction

Today's organizations are experiencing an increasing challenge of adapting to the potential of new generations of information and communication technologies (ICT) (Bra et al. 2000; Dahlbom & Ljungberg 1998). This challenge encompasses a complex web of interrelated problems such as competencies in buying, implementing, and maintaining ICT systems aiming at supporting collaboration, communication, work and learning processes. This background reveals a paradoxical conflict between the extending faith in the potential of ICT as a mean for effective change of the organization, and the problems that arise when this potential is going to be realized in the organization. There is a lack of knowledge about what factors and mechanisms actually cause this paradox between vision and practice in the adaptation of ICT. A second paradox lies in the fact that technological innovations significantly contribute to a growing need for employees to continuously learn of new tools, skills and acquire competencies (Magnusson et al. 2000), while at the same time there is a tendency to turn to these technologies when looking for new ways to address the problem of increased need for learning (Svensson 2002). Computer mediated education in various forms, often referred to as elearning, has rapidly manifested itself as an area of great interest within this context. However, traditional educational concepts are poorly adapted to these problems. There is a need for innovative methods and models that are anchored in the real work settings that organizations are experiencing. Learning in an organizational setting must not only be understood in terms of organized forms of training and education, but also as informal processes of sharing, creating and disseminating knowledge throughout the organization (Brown & Duguid, 1991; Sørensen & Snis, 2001).

2. Work-Integrated Learning

The term work integrated learning is proposed as a concept stressing that learning is situated in the work practice of the learner. Learning should accordingly not be perceived as an activity separated from other work activities, but rather as a constantly present part of all work (Lave & Wenger 1991; Brown & Duguid

1991). Organized education and informal knowledge management processes are inseparable from and integrated with the everyday work practice that constitutes a context for the learner's reflections, self or together with others (Cook & Brown 1999). Studying work integrated learning from an Informatics-perspective means highlighting the use of technology. In the context of work and learning technology is far from uncomplicated. When interaction in a community is mediated by ICT, dissonance with respect to how the individual members perceives and makes sense of the technology can seriously obstruct communication and learning, (Orlikowski, 1992). Other aspects that could affect the conditions for learning are availability, access, and problems related to information and interaction overload (Ljungberg & Sørensen, 2000).

3. Research Agenda

The project introduces a research focus that involves social, cultural, technological and pedagogical dimensions. The overall research objective is to explore and understand these dimensions and how they interact, in order to arrive at a knowledge platform that could constitute the base for design of ICT systems that supports communities of work integrated learning. Adopting a holistic approach to work integrated learning that encompasses organized and formal, as well as spontaneous and informal activities, and treating knowledge and learning as processes of social construct rather than objects, implies a collaborative constructivist view on ICT and learning. (See for example, Fjuk 1998; Nuldén 1999). Furthermore, focusing on the situatedness and the social dimensions of learning suggest that Lave and Wenger (1991) and their theory of legitimate peripheral participation could constitute a fruitful analytical lens. Studying communities of work integrated learning should involve workplace case studies where the unit of analysis could be the individual learner as well as groups of collaborating learners (Luff et al. 2000). The empirical approach will be dominated by ethnographical methods such as participant observations, semi-structured interviews and document analysis (see for ex. McCracken 1988). The element of design that is incorporated in the research agenda suggests an action-oriented approach, such as the action-case (Braa & Vidgen 2000)

4. Research Context

This paper report from an ongoing longitudinal research project aimed at exploring the landscape of distributed electronic work-integrated learning (WIL). The project involves two parallel, yet interwoven, research approaches: (1) Extracting the conditions for WIL through exploration of typified organizational work settings, thereby acknowledging the situated nature of work and learning. (2) Designing innovative tools and methods for WIL through action-oriented trials and field experiments. The project is divided into two typified abstract cases each representing a cluster of questions and organizational characteristics. (1) The e-learn case is directed towards formal and organized forms of computer-mediated education conducted in both small and large organizations, and (2) the prof-net (professional networks) case focuses on informal and emergent online-learning communities.

5. Preliminary Results

During the first six months of 2002, two pilot studies have been launched within the eLearn frame. The first study focuses on small enterprises with 2-15 employees, all customers to the same Swedish bank. The research was triggered by the perceived difficulties of training computer illiterate customers in computer usage. Earlier efforts used traditional classroom-based concepts, with poor performance and high drop out rates as a result. Therefore the bank initiated an action-based project with the aim to explore new methods for developing the competence of its small business customers. The second study is conducted in collaboration with a large organization in the public sector. The aim is to create a "web-academy" where professionals in specialized areas from various regions of Sweden can use Internet technologies to facilitate training as well as creation and sharing of new domain knowledge. The preliminary findings underscore the importance of methods and application being adapted to the individual and situated conditions. The initial experiences from the exploratory ethnographical studies leads us to propose a maturity stage model for work-integrated learning (Fig. 1). The model could serve as both a framework for analysis of the maturity of an organization, and as a design space for educational concepts and ICT tools.

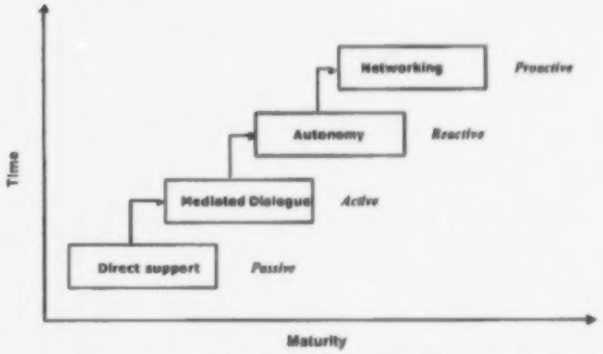


Figure 1: A maturity stage model for Work-Integrated Learning

The stage model suggests that each learner must mature through underlying levels before being receptive to educational concepts on a certain level. Even though the model is primarily constructed to inspire innovation of new designs, it is also possible to map traditional and widespread methods and tools into the framework. The two first stages are grounded in the empirical findings from the pilot studies, the subsequent stages will be tested and evaluated in further research. Each stage of the model is briefly outlined in the following subsections.

5.1. Support

This represents a stage where users are computer illiterate, and consequently cannot address technical problem or posses the language to communicate their shortcomings. They are typically extremely short of time (and motivation) for learning. The focus is strongly directed to urgent short time problems, which needs immediate attention. Learning is best facilitated through direct face-to-face or remote control-based support concerning real work-related problems.

5.2. Dialogue

When IT-skills increase learners were found to respond well to computer-mediated tutoring, using asynchronous and synchronous web-tools, such as threaded discussion forums (Svensson, 2002) and chat rooms. These learners were also found to be more active in trying to solve their problems. However, the focus is still primarily directed towards urgent needs.

5.3. Autonomy

This stage is suggested to describe a user who is mature enough to reactively use the Internet and other online resources for his/hers learning. The autonomy stage is also believed to be characterized by users with a more visionary long-term business focus. This stage comprises most traditional elearning concepts that are dominated by hypermedia user-content interaction (Moore, 1993).

5.4. Networking

Finally autonomous users can participate in existing, or form emergent, online-communities (Svensson, 2002) corresponding to their learning objectives. Learning within such communities is highly collaborative and knowledge is constructed through processes of mutual engagement (Wenger, 1998; Swan et al. 1999). Innovative knowledge creation on the level of the learning community makes this stage potentially proactive with regards to the business strategy of each participating individual.

6. Further Work

The next phase of the project aims at evaluating and developing the framework through a combination of exploratory analysis and design trials within the elearn and profnet case-programs. During the spring of 2003 a large study directed towards the emergent use-patterns of a new corporate Intranet designed for organizational learning and knowledge creation will be launched.

7. References

Braa, K & Sørensen, C & Dahlbom, B (2000) *The Planet Internet*, Studentlitteratur, Lund, Sweden

Braa, K. & Vidgen, R. (2000), Research: From observation to intervention, In *Planet Internet*, ed. Kristin Braa, Carsten Sorensen, and Bo Dahlbom. Lund: Studentlitteratur

Brown, J. S. & Duguid, P. (1991) Organizational Learning and Communities-of-Practice: Toward a unified view of Working, Learning and Innovation, *Organization Science*, Vol 2. No.1 Feb 91, USA

Cook, S. & Brown, J. S. (1999): Bridging Epistemologies: The Generative Dance Between Organizational Knowledge and Organizational Knowing. *Organization Science*, vol. 10, no. 4, pp. 381-400.

Dahlbom, Bo & Ljunberg, Fredrik, (1998), Mobile Informatics, *Scandinavian Journal of Information Systems*, Vol 10 (1&2), pp 227-233, IRIS Association, Gothenburg, Sweden

Fjuk, A. (1998) *Computer Support for Distributed Collaborative Learning, Exploring a Complex Problem Area*, Phd Dissertation No 5, University of Oslo, Norway.

Lave, J & Wenger, E (1991) *Situated Learning: Legitimate peripheral participation*. Cambridge University Press, UK

Ljungberg, F & Sørensen, C (2000): Overload: From transaction to interaction. In *Planet Internet*, ed. K. Braa, C. Sørensen, and B. Dahlbom. Lund, Sweden: Studentlitteratur.

Luff, P. & Hindemarsh, J. & Heath, C. ed. (2000): *Workplace Studies*. United Kingdom: Cambridge University Press.

Moore, M. G (1993) Three types of interaction. Distance *Education: New Perspectives* edited by Harry, Keegan and John– New York: Routledges

Magnusson, M, & Stahl-Falck, P. & Svensson, L. & Sørensen, C. (2000): Know-how when No Time: Forming a distributed community of practice. In *Knowledge Management Conference*, February 21-22, 2000, Warwick University, ed. H. Scarbrough and J. Swan. Business Process Resource Centre at Warwick Manufacturing Group.

Magnusson, M. & Svensson, L., (2000) Studying how students study, *Proceedings of IRIS 23*, Svensson et al. (eds.) University of Trollhättan Uddevalla, Sweden

McCracken, G. (1988), *The Long Interview*, SAGE Publications, London, United Kingdom.

Nuldén, U. (1999) *e-ducation*, Gothenburg Studies in Informatics, Report 15, University of Gotenburg, Sweden

Orlikowski, W.J. (1992). Learning from Notes: organizational issues in groupware implementation, *In Proceeding of Computer Supported Co-ordinated Work 1992*. Toronto, Canada, 362-369.

Svensson, L. (2002) Interaction Repertoire in a Distance Education Community, *DVD-proceedings of CSCL 2002*, Boulder, Colorado, USA

Swan, J. & Newell, S. & Scarbrough, H. & Hislop, D. (1999): Knowledge management and innovation: networks and networking. *Journal of Knowledge Management*, vol. 3, no. 3, pp. 262-275

Sørensen, C. & Snis, U. (2001) Innovation Through Knowledge Codification. *Jl. of Information Technology*, vol. 16 .

Wenger, E. (1998) *Communities of Practice: Learning, Meaning and Identity*, Cambridge University Press, NY, USA

Acknowledgements

The research presented in this paper is sponsored by the LearnIT program of the Swedish Knowledge Foundation.

Facilitating on iTV: A Call for Broadcast Communication Style & Voice Management

Sharifah Nur Anthasha btc. Syed Ahmad
Centre for Innovative Education
Faculty of Creative Multimedia
Multimedia University
Malaysia
anthasha@mmu.edu.my

Abstract: This paper is a study of radio and television delivery-skills, the communication style and voice management of the electronic medium; and how they are adapted to the needs and requirements of iTV facilitators, forming a module or guide, if not a set of qualifying standards. Interviews with facilitators and broadcast presenters and trainers, surveys on educators and learners in traditional and virtual classrooms, and self-experiences in vocal management training and television presentation, mainly form the basis for recommendations and conclusions. Findings indicate that facilitators must be content-adept, technology-conscious, and practicing communication principles to be effective, good broadcast communication style and voice management, having had sound knowledge on voice quality, speech personality and physical delivery

Introduction

A lot has been reported on the convenience and technological successes of the virtual mode of delivering knowledge, but not much attention has been paid on the act of delivery itself. This is based on the assumption that "…iTV teaching does not require modifications in teaching style and that a teacher can continue to teach just as he or she has in the traditional classroom…" (Hobbs & Christianson, 1997, pp. 184). So, how do teachers deliver structured knowledge in an environment strikingly different from the traditional classroom? How is it comfortable or significant to talk to an "audience-less" classroom that is void of students' familiar non-verbal cues or body language confirming comprehension or indicating otherwise? How do you substitute your own body language to emphasise and support your communicated message of knowledge in the electronic environment? Fortunately "…iTV educators have recently realised that they may have been short-sighted in adopting the goal of duplicating the traditional classroom and are now using technology as an opportunity to modify their teaching techniques" (Hobbs & Christianson, 1997, pp. 184).

Delivery, obviously, is an important component of teaching and learning that needs undivided attention and consideration as we take education into the virtual realm. In this time and age, being content-confident alone is insufficient for the educator to be effective. This unprecedented role is indeed crucial to the success of virtual learning, besides justifying the sophistication of technology. Thus, it is important to have a talented and effective facilitator as he/she "... plays a key part of the virtual classroom model, controlling content, and facilitating interaction with and among students in a resource-rich environment. The absence of an instructor or facilitator is the key reason why the world's best multimedia courseware, Web site, or instructional CD-ROM will not, by itself, be as effective as a virtual classroom" (Bernstein, O'Keefe, Usluel, Wilson 1997).

The Study

With delivery in focus, this research looks into the facilitator's communication style and voice management in facilitating the virtual classroom. Broadcast presentation skills of both radio and television have been proposed given their nature of communication that is designed for the absent audience, with listenable properties intentionally built into it, through the electronic medium. We look at television especially for on-camera performance and, on how to gain tele-presence; we also look at both radio and television for communication style and voice management – speech characteristics, non-verbal communication, vocal projection and control suited to the target audience. These are essential, as many distance-learning technologies actually demands a presentation personality, which requires more energy, smoothness in delivery, and projection of gestures and voice than presentations made within a classroom. Because distance-learning sessions may be taped, the quality of the presentation should be uniformly high for every session (Porter, 1997, pp.201).

The adoption of television delivery-skills for iTV facilitating could appear to be an obvious choice. Nevertheless, not much thought has been put into it, given lack of, if not at all, source of references or guides in preparing educators for the screen. iTV in any format is primarily a visual medium where verbal and non-verbal presentations are most important.

Interviews conducted with radio and television presenters cover issues, among others, of how communication or speaking style on radio and television is similar to or different from that of face-to-face communication, what is it like speaking to a camera, what are the techniques adopted to appear natural in front of the camera, how important is non-verbal communication in radio and television presentation, to what extent does it enhance verbal communication, how does good voice management affect presentation. Also questioned were workshop facilitators and motivators on, among others, what the role of a facilitator defines, what it takes to be a good facilitator, how to hold learner's interest and keep the motivation level up all the time, how much importance is given to voice production and expression, non-verbal communication, and how to gauge learner's understanding especially when he/she is physically remote.

Traditional and virtual classroom observations are conducted to identify and understand teacher and facilitator's, as well as learner's limitations in the process of knowledge transfer. Aspects taken into consideration are teacher and facilitator's level of confidence in the subject matter, competence in the English language (standard delivery language), adjustment to the physical/virtual setting, and medium preference. Learners are asked on their understanding of the subject matter, their level of satisfaction on the way it is delivered, the lecturer and facilitator's verbal and non-verbal communication, and medium preference.

Findings

Knowing how to communicate effectively with non-verbal expressions may be more important than what is said. What more when communication has been suggested to be 75% non-verbal and iTV in any format is a visual medium that exaggerates all of an educator's best features. Knowing what makes him/her special in terms of how he/she looks, sounds, and moves will enhance an educator's teaching abilities (www.zianet.com). In this regards, this research also serves to provide an opportunity to identify the educator's special features. Thus, it is obvious that the major challenge in video-based tele-learning for the instructor involved is also how to perform on camera. The instructor must learn how to be more than a talking head, which is both a matter of television-handling skill and pedagogical insight (Collis, 1996).

Meanwhile, Frenkel (1995 in Collis, 1996) places the emphasis on educator's tele-presence, "...while the core of the correspondence-stream of distance education is the assumption that the lesson-presentation skills of the teacher can be represented through well-designed print materials, the core of the "video" stream of distance education is to use technologies and pedagogical techniques to make it seem as much as possible that the distant student is sitting in the face-to-face classroom of the teacher. This can be called *tele-presence: Being there while being here* or *being there without having to.* Thus 'teaching' in the familiar ways of lesson presentation by the instructor, questioning, and feedback-giving exchanges with students during the lesson, is to be maintained. Interactive television and two-way video make this most directly possible, providing some immediate opportunity for the questioning and student-instructor interaction to occur."

It must not be overlooked that educators in reality, though appearing virtually to learners, are motivators as well. Keller (1983) in Hobbs & Christianson, 1997, pp. 186, stated 4 elements of learner motivation directly applicable to the iTV-learning environment. An iTV facilitator should be able to hold learner's ***interest*** – having the ability to engage and sustain learner curiosity and attention directly impacts the degree to which commitment to learning will occur; see and state the ***relevance*** i.e. able to relate learned information and concepts to individual needs or goals is important. Instructional content should be related to the world of work, higher education expectations, or to practical skills; instil ***confidence*** among learners where they must perceive some likelihood that they will be successful; and, provide learner with ***satisfaction*** - reinforcement of the learning process is vital. By combining extrinsic rewards and intrinsic motivation, students will be more likely to pursue or continue to pursue learning goals. Speculand sums it by saying that the facilitator's role is twofold – to deliver the message and, to be conscious of how it is delivered.

In voice management, educators must develop good attitude and think positively as the voice creates character, mood, situation, and feeling within the scope of the learner's imagination. This involves proper breathing, volume, gesturing, and posture, all towards producing broadcast quality voice.

Conclusion

Because traditional classroom teaching has the advantage of having teacher's immediacy and immediate learner's feedback, it is important for virtual facilitating to be personal, enthusiastic and warm yet authoritative, and engaging non-verbally.

Complementing this is proper voice management, with pre-requisites in the knowledge of voice quality, speech personality and physical delivery. As a facilitator, one must be content-adept, technology-conscious and practicing communication principles.

References

Bernstein, Mark, O'Keefe, James, Usluel, Degerhan, Wilson, Jack, 1997, "Virtual Classroom Technologies for Distance Education: The Case for On-Line Synchronous Delivery" <www.detac.com/solution/naweb97.htm (26/06/01)>

Porter, Lynnette R., 1997, *Creating the Virtual Classroom: Distance learning with the Internet*, John Wiley & Sons, Inc., Canada

Collis, Betty, 1996, *Tele-learning in a Digital World: The Future of Distance Learning*, International Thomson Computer Press, Netherlands

Hobbs, Vicki M. & Christianson, J. Scott, 1997, *Virtual Classrooms: Educational Opportunity through Two-Way Interactive Television*, Technomic Publishing Co. Inc., Pennsylvania

http://www.zianet.com/edacyrs/skills.htm

Robin A. Speculand, Bridges Business Consultancy International, Singapore

The Use of Style Guides in the Development of Online Documentation and Computer-Based Training: A Survey

Michael Szabo, Ph.D. and David Lemiski, M.Ed.
University of Alberta
Edmonton, AB Canada
mike.Szabo@ualberta.ca

Abstract: This study examines the purpose and use of style guides in the development of corporate online documentation and computer-based training (CBT) systems. The study was also used to determine if organizations currently developing online documentation and CBT projects research, develop, and use style guides specific to the needs of their organization, and what implications the use of a style guide has had on their projects. Ten developers of online documentation and CBT projects participated in this study. Comparisons of the results of their input on a standard questionnaire showed that the development and use of a style guide assists in the overall development of an online documentation project or CBT system, and that the failure to use a formalized style guide resulted in additional time spent in redefining screen elements.

Overview

This study sought to assess the impact of style guides for computer-based materials which are delivered online. Issues and the problem statement are presented first. A review of literature is followed by the research study and results.

Issues to be Considered

Organizations have developed and adopted style guides for print documentation to ensure that all documentation produced is consistent in format and presentation. The lack of use of a style guide in the development of CBT projects has been proven to generate inconsistency in printed documents, result in a requirement for more development time (Allen 1995), and be detrimental to customer satisfaction.

Problem Statement

It was hypothesized that few corporations currently developing computer-based materials have developed internal style guides for online delivery of materials. For those organizations without a style guide for online delivery, it is hypothesized the deficiency results in more time expended in development, an inconsistent presentation, or a lack of corporate identity in the finished product.

Review of Current Literature

The developer of the instructional materials may present solid content in a clear and methodical manner, but without knowledge of design and layout principles, the learning situation can be less positive. For example, poor screen design has been experimentally associated with lower completion rates and longer completion times (Szabo & Kanuka, 1999).

Many style guides in the form of texts or online documents have been published in recent years relating to the display of information on computer. These generally include a standard component of guidelines for text, graphics, colors, fonts, and animations (Deaton & Zuback, 1995; Lynch & Horton, 1997).

One category of style guide reflects guides that have been developed in response to a specific programming language. Lynch and Horton (1997) in the Yale C/AIM Web Style Guide provide suggested structures for HTML-based online documents. This is one of many style guides (Deaton & Zubak, 1995; Kidder & Harris, 1997) that is specific to a programming language based upon HTML, XGML and other markup languages.

The alternative to program language specific style guides are those that are generic in nature and address online delivery without reference to specific programming languages, platform or authoring tool (e.g., Naval Air Maintenance Group, 1997). A review of these guides finds that recommendations are made for most screen elements including fonts, colours, margins, placement of graphics, and animations.

Corporate-specific style guides contain specific guidelines for the development of online materials to meet the needs of individual corporations and be applied to all projects developed by the corporation. In addition to the base elements that make up the screen, the corporate style guide provides specific recommendations for the use of corporate logos, company specific terminology, acronyms, hyperlinks, etc.

In the academic world, selection of individuals to carry out the development of a CBT project often have as a primary requirement a background in instructional technology and curriculum development. The creators of the online documentation or the CBT materials for the corporate world often do not have formal qualifications in the development of online materials. The development of a style guide has the benefit of providing these individuals with suitable guidelines for the development of the materials.

Development and Maintenance of the Style Guide

The reasons for developing a corporate style guide include adding consistency to online documentation and CBT projects and providing guidelines for corporate usage of logos and terminology. The development of a style guide for the project illustrates a concern for quality and effectiveness in the development of the project. Adapting the staged process outlined by Woolever and Loeb (1994) for the development of the style guide for computer-based delivery projects would include examining the online documentation CBT development needs, the user groups, and the delivery technology, and then researching and defining the required screen elements. To this Hackos (1994) adds usability testing of the finished online product and regular updating of the recommendations in the style guide.

A Fortune 500 respondent located in Edmonton, Alberta indicated approximately 300 hours were spent in the initial development of a style guide for online documentation and CBT materials. An additional 20 hours a month was spent by the documentation and training team to regularly review and update the style guide.

Problem Statement and Research Methodology

The research conducted for this paper explored the hypothesis that few corporations currently developing computer-based training or online documentation have developed internal style guides relating to materials that are intended for online delivery.

Ten volunteers from the corporate training sector were solicited through the Vancouver Chapter of the International Society for Performance Improvement (ISPI), the Alberta Chapter of the Society of Technical Communication (STC) and through the bit.listserv.techwr-l newsgroup and completed the questionnaire via email, or telephone interview.

The survey asked the individual to select one specific project to refer to with respect to the survey. The questions on the survey were formulated to obtain information regarding: 1) the participant's background in online documentation and CBT development; 2) the scope and parameters of the specific project under consideration; 3) the existence of and extent of the use of a style guide for the specific project; 4) how screen elements were selected for the project; and 5) the impacts of having or not having a style guide in place at the start of the project.

Findings

Of the responses, six projects involved the creation of online documentation. Four projects involved the creation of CBT materials. In all cases, the participants were involved in the project from initial planning to implementation. Job titles were equally divided between those who classified themselves as instructional designers or technical communicators. Several individuals had project management responsibilities. Respondents were asked to classify their experience in their current position. In a number of cases the individuals worked as independent.

Two individuals were trained in a vocational/technical program (communications or urban planning), five attained the bachelor degree in English, and three achieved the graduate degree (two in curriculum design and one in instructional technology). Examination of the education backgrounds suggests that within the corporate world the need to have a documentation or CBT product delivered outweighs the requirement to have the most qualified individuals completing the work. Three respondents participated in the development of more than ten projects each, four of the respondents stated the project discussed in the survey was their first online project. Two individuals had completed two projects, and one individual had completed four projects.

Usability Testing

Usability testing identifies deficiencies existing in the projects prior to their release and is carried out with typical target population users to ensure that the materials are easy and efficient to use, understandable and achieve the desired goal. Only one online documentation project had a formal usability testing process that was carried out on a prototype. One of the CBT projects had informal reviews of the screen layout and structure that was carried out by the members of the development team. Of those projects that did not have usability testing processes in place, seven had reviews of content for validity by subject matter experts but none for screen structure or presentation elements. The most common reason for a lack of usability testing in the cases of the online documentation was the assumption that the defaults from the RoboHelp ™ authoring tool would be adequate. One project claimed that the corporate demands were such that the project had to be developed and put online as soon as possible. In this case, there was no allowance made for testing even after the projected was made available within the corporation.

Development Teams and Tools

Seven were developed with a team structure and three were developed by individuals. Five projects had the actual coding for the online documentation or CBT carried out by programmers, and all of these projects were developed in the team environment. In the remaining five projects, the instructional designer or technical communicator, whether part of a team or working individually, was also responsible for the coding to create the online system. In four cases out of the five from this later group, the coding was done with an authoring tool.

Use of Style Guides

Only four had projects that followed formal style guides; one was a general corporate style guide for both online and paper-based projects, and three were specific to online projects. With respect to length, the four guides were approximately 16, 40, 60, and 180 pages respectively. The most extensive guide was contributed by the Nasdaq 50 company and included sections for layout and stylistic elements (50 pages), as well as for word usage, grammar, and in-house terminology and acronyms. All four style guides contained guidelines for common structural elements such as font type, style, and size, screen margins, text and background colours, how to incorporate graphics, placement of text versus graphics on screen, and general screen layout. The shortest guide contained only guidelines for screen conventions and elements, and did not include guidelines for construction of text.

Impact of Style Guide Use

Overall, those projects that developed and used a style guide did not report significant revisions to screen elements after development had begun. In three cases, the style guide was adhered to and there were no revisions to screen elements after the project was underway or after implementation. One project that used a style guide reported approximately 15 days out of total development time of approximately 1,000 days was spent revising the navigational paths. However, in this case there was no modification necessary for the screen elements. In one corporation approximately 15 percent of the total time of two programmers who did the development of the HTML-based CBT system was spent in revisions to screen elements such as margins, fonts, and navigational elements. The revisions were due to the programmers' lack of adherence to the corporate style guide.

Six projects were completed without a style guide. Four were online system documentation. The remaining two projects which did not use a style guide were CBT projects. In both cases the development took place with a team of instructional designers who researched and developed content, and programmers who produced the HTML-based CBT products. Both projects reported a substantial amount of rework of the screen elements including font type, style, and size, background colour, placement of controls and buttons, size of graphics, animation of graphics, and screen transitions. Costly animations were removed after project implementation as they only increased file size and download times, while adding no real value.

One respondent reported the revisions to screen elements amounted to fifteen percent of the programmers' time, amounting to approximately 7.5 weeks of time during development and implementation. The other project without a style guide that did not use authoring tool defaults reported that approximately ten percent of the programmer's time was spend doing usability related revisions, or 4 days, $3,500 in cost.

Conclusions

The research explored the hypothesis that few organizations have developed internal style guides relating to materials that are intended for online delivery. Results indicate that \style guides in the corporate world for the development of online documentation and CBT materials is limited. The use of style guides in these projects results in a reduction in effort spent revising screen elements. This substantiates the findings of Allen (1995) that a lack of a style guide increases the development time of projects. In two projects that did not use a style guide, ten and fifteen percent of the revision time was required in the overall programming time. Four projects did not indicate that significant time was spent on revisions after implementation.

This research revealed a number of items related to the field of instructional technology that may be indicative of these projects in the corporate world. These include using individuals who have no academic background in instructional technology to develop online projects, a lack of usability testing for corporate online projects, and the unqualified acceptance of authoring tool defaults in the absence of any formalized style guide.

Only one project included a formal usability test due to corporate demands to complete the project and make it available; there was no time for formal testing at the completion of the development. Several projects initially undertook informal testing, but the testing was done by the project development team. This raises questions of impartiality and objectivity. Only one of ten projects included a testing phase. This lack of usability testing may indicate that some corporations view the documentation or CBT that accompany their products as a necessary component, but one where expenses can be saved as it is not the main product that a customer is purchasing.

This exploratory research has found that there are a great number of style guides available publicly, intended for general use and for specific purposes. Additionally, a number of corporations have developed their own in-house style guides with the intent of standardizing the development of and ensuring that there is consistency between online publications. However, there is a large percentage of corporations that do not follow a specific style guide, and allow the developers of online documentation and CBT projects the freedom to design based upon their personal preferences.

References

Allen, P.R. (1995). Save Money with a Corporate Style Guide. *Technical Communication 42*, 284-289.

Allen, P.R. (1996). User Attitudes Toward Corporate Style Guides; A Survey. *Technical Communication 43*, 237-243.

Cisco Systems Corporate Style Guide. (1999). San Jose, CA.

Deaton, M. & Zubak, C. (1995). *Designing Windows 95 Help. A Guide to Creating Online Documents*. Indianapolis: Que Corporation.

Hackos, J. T. (1994). *Managing your Documentation Projects*. NY: John Wiley & Sons, Inc.

Kidder, G. & Harris, (1997). *Official HTML Publishing for Netscape*. (2nd ed.). Research Triangle Park, NC: Ventana Communications Group.

Lynch, P. & Horton, W. (1997). Yale C/AIM Web Style Guide. URL: http://info.med.yale.edu/caim/manual/

Naval Air Maintenance Training Group. (March 1997). *CBT Conventions & Standards*. Pensacola, FL: Department of the Navy.

Parker, R. C. (1997). *Looking Good in Print*. Research Triangle Park, NC: Ventana Communications Group.

Publication Manual of the American Psychological Association. (4th ed.). (1994). Washington D.C.: American Psychological Association.

Szabo, M. & Kanuka, H. (1999). Effects of violating screen design principles of balance, unity, and focus on recall learning, study time and completion rates. *Journal of Educational Multimedia and Hypermedia*. *8*, 23-42.

Woolever, K. & Loeb, H. (1994). *Writing for the computer industry*. Englewood Cliffs, NJ: Educational Technology Publications.

Teaching In An E-Classroom: How To Be An Effective Teacher To E-Learners

By
Fataneh Taghaboni-Dutta, Ph.D.
Associate Professor – Operations Management
School of management
University of Michigan – Flint

And
Betty Velthouse, Ph.D.
Associate Professor
Organizational Behavior and Communication
School of Management
University of Michigan – Flint

Abstract

Recognizing the recent and expected growth of e-learning, this paper explores the responsibilities of the e-teacher to excite students, develop a learning community, individualize the experience, provide meaningful feedback, provide adequate control and flexibility, and demonstrate expertise. The authors describe, based on their experience with e-learning, best practices that fulfill these responsibilities.

Introduction

Many reports point to exponential growth of online learning and teaching activities both in educational and corporate settings (Bonk and Essex 2000). This growth is due, in part, to advances in technology that have made e-learning possible. The advent of e-learning has revolutionized our thinking about teaching and learning.

However there are other reasons, aside from technology, which have contributed to the growth of e-learning. First, rapidly changing environments, technologies, a world market (to name just a few factors) demand that our workforce continually upgrade their skills. The anywhere and anytime flexibility provided by e-learning (Pantazis, 2002) make this imminently more possible; an organization can create a certification program, make it available to all of their supervisory personnel, and allow participants to complete the program according to their individual best schedule. This fosters both uniformity of learning and individual accommodation. Second, e-learning has the potential to narrow, if not eliminate, the skill gap that exists between homemakers (woman who are primary care givers of their families, stay-at-home-moms), disabled persons, older and working adults (whose formal education is out-of-date) and traditional college students. Thus, one can conclude that the growth in this area, although rapid, has not nearly reached its peak and will not plateau anytime soon.

Universities are well aware of this trend and most have implicitly or explicitly put pressure on their faculty to engage in online teaching. For most university instructors this is a new domain, one that offers many exciting challenges but also invokes much anxiety (Bonk and Essex 2000). Ideally, the translation of a traditional classroom class into an on-line modality is facilitated by a 'development team' in conjunction with the faculty member. However, the ideal is not always available and often the faculty member is both the creator of content *and* the developer of the modality. In this paper we will discuss our experiences and insights in online teaching and share some of our best practices. Both authors have taught many web-enabled courses (either entirely online or in a blended setting). The courses taught span a wide range of domains from quantitative subjects (such as Management Science/Operations Research) to more qualitative subject matters (such as Communication and Interpersonal Skills). Through our experience, we have developed/discovered many strategies that help e-learners succeed as well as make e-teaching manageable and rewarding for us.

E-Teaching Strategies

A common misconception about e-learning is that all the teacher needs to do is to create a web-page. Effective e-teaching is much more than putting your notes, problem solutions, and assignments to a web-site. E-learning also goes beyond simply asking your students to work their way through an interactive CD-ROM. These approaches simply replace the medium of a traditional "correspondence course" from paper and postage to digital format. On the other hand, effective e-learning requires the creation and promotion of a rich, collaborative, flexible, and exciting learning environment. The challenge is to do all this in absence of face-to-face interaction.

Faculty members find that some of their tried and true approaches do not work in this new medium; we need new 'tricks of the trade'. Specifically, we need new ways of creating excitement within the student, we need new approaches to developing the learning community, we need to individualize the learning experience, we need to develop new ways of providing effective feedback, and we need to provide structure and control while maintaining the flexibility that makes e-learning so attractive.

Exciting the Students:

BEST COPY AVAILABLE

Most traditional classroom instructors use their personality to make the *topic content* exciting, memorable, and applicable. They use the interpersonal connection with the students to entice the students' interest. They use non-verbal as well as verbal cues to interpret student distress, interest, confusion, and boredom. The richness of the face-to-face modality allows the instructor to use those inputs from students to spontaneously revise their lecture, to add an example, to ask a question, to interpose an experiential exercise, to alter the timing, tone, sequence, cadence of the lecture, and sometimes to use humor to engage the students.

The technology of e-learning removes many of these feedback cues given by the students. Further, the interactions and discussions that have been habitually used to create a *culture of effective learning* need revision.

In an online environment, we can arouse student's emotion about a topic by incorporating real-life examples into the process – we can reinforce the connection between theory and practice, between class and work. Specifically it is effective to ask students to post comments on a discussion board and also to *make them* relate topics in the news to the content being used.

Well-designed assignments can also be used to foster enthusiasm and make the content meaningful. An assignment that asks the student to "assess" their own organization is very useful for them and it is content-intriguing. Assigning students to "actively listen" to their spouses/significant others (some have completed this assignment with their moms) for 20 minutes is not only an effective way of making material relevant, it also endears the teacher to the spouses/significant others.

Creating a Community:

The greatest drawback of on-line education is, by far, the sense of isolation experienced by the students. On-line students frequently comment that they miss the synergy generated in traditional classes. While the best lecture and content organization will not prevent this, it is possible to create and support a collegial atmosphere. Our goal was to create a culture that engaged, motivated, inspired, and connected students – we wanted them to experience membership in a true learning community. Out best-practices include:

- Contact the students as soon as possible. In our case, since the course web-site is not available until the official start of semester, we contact our students in advance with a letter using "old-technology" of paper and postage stamp. This prepares the students for early engagement.

- Conduct a chat room during the first week of class. Assign students to specific times, a half hour is enough, so they get familiar with the how-tos of 'chatting' and they interact with some of their classmates. It is a good idea to have additional chat rooms (change the assigned mix of individuals) later in the term to enlarge their 'community'.

- Arrange for a face-to-face session if possible. We arrange for an "on-campus" orientation session for the students. [For those who cannot attend, we arrange for a phone conversation.] This single session has been very effective in relaxing the students and promoting a strong student-to-student and student-to -instructor bonding.

- Create an on-line "get-to-know-me" session. Introduce yourself and provide relevant information about yourself, include some of your interests/hobbies. This will allow the student to get to know you better and gain confidence in your expertise. Ask everyone else to do the same. This helps students to get to know each other too. It is also advantageous to have a section in your on-line syllabus that describes the teacher; I label mine – "About your instructor". This includes pet peeves (on-line assignments that do not include the student's name), expectations about communication (label your email), and preference for theory-based learning.

- Recognize and rescue the lost students. The fact of the matter is that some students DO feel lost. Whether they are insecure about the technology, they are less disciplined than they should be, or they have simply fallen behind/lost momentum without the face-to-face reinforcement, they need to be rescued. Technology should not be allowed to be a barrier to their successful participation. A brief assessment of the students' technical skill level at the beginning of class will identify vulnerable students. Rescue, when needed, can be achieved by providing additional help with those who may need help with technology; we are fortunate to have a 'computer consultant' who will work with them and our IT support department will also provide telephone coaching. On an on-going basis, it requires that instructors pay attention to patterns and quality of output of each student and that they get in-touch with a student when his/her communication or the quality of work starts to diminish.

- Promote interaction. Research has identified four types of interactions: learner-teacher, learner-content, learner-learner, and leaner-interface interaction (Hillman 1994). The course design should provide an opportunity for all four types. Chat rooms and Discussion boards enable these interactions and help promote a sense of community among the members of the class. Making team assignments also facilitates (forces) a sense of community. The technology exists that makes it easy to create chat rooms, email lists, and other communication possibilities for select memberships. However all interactions need not, and one could argue, should not, be in a form that requires the student to be in front of the computer. E-learning provides a unique opportunity for the instructor and the student to *expand* the learning community. When students are asked to examine their organization, to describe their work relationships, or to videotape a work presentation, the learning community expands to include colleagues, bosses, and family members (at least). In short, the activity involves others and the impact of the education grows. It has been gratifying to note the (more frequent) occasions when students have said "I was talking with my boss" or "I asked the people I work with…".

Individualizing the Learning Experience:

BEST COPY AVAILABLE

When developing content and activities for your course, keep in mind that students learn differently, and you must include activities that will appeal to a wide range of learning styles. Kolb (1976) suggests that people prefer to learn in one of four different ways. Some people prefer to learn through concrete experiences, others prefer observation and reflection, others prefer the formation of abstract concepts and generalizations, and still others prefer testing implications of concepts in new situations.

Many instructors see their role as the content provider, preparing and presenting 'lecture notes'; this would appeal to students who learn best through 'forming abstract concepts and generalizations'. However, even lecture notes can be modified so that they appeal to a larger group of learners. For example, in an Operations Management class when teaching a topic that requires a lot of mathematical manipulation to demonstrate a concept, students can click on various models to start an animation that will take them through the steps. However, if the student grasps the topic by just reading he/she doesn't have to go through the animation. The key is to design the notes in such a way that students have control over how to receive the information.

For the student who prefers to learn through 'concrete experience' or 'observation and reflection', appropriate links can be provided so the student can take a "Virtual Plant Tour". Some companies have live cams that stream video over the Internet; this allows the students to see how everything is being done. Other companies provide high quality animation of their processes. These "plant-tours " engage the learner who has a more tactical style of learning.

For the student who prefers to learn through 'testing implications in new situations', assignments must relate the theoretical to the practical. Creating a real business plan has this result; acting as a (would-be) consultant to one's own organization makes the material relevant in a new situation; and solving a school districting problem in an Operation's Management class uses this approach well.

Internet provides a rich environment for learning and it is important to incorporate this richness into the learning process.

Providing Meaningful Feedback:

Rich feedback is as important to the e-learner as it is to the traditional student - in some ways, perhaps more so. Since they do not have face-to-face contact with the teacher, the teacher's reactions to their work carry more weight and are used more heavily by the student to judge their competence and their sense of mastery of the material. It also keeps students actively engaged in the class; providing timely feedback is an important factor for helping students remain active in the process (Bischoff 2000). For effective teaching, it is important to provide feedback in a timely fashion and to provide it often.

Instructors should strive to provide feedback as swiftly as possible and it should be feedback that is useful to the student (i.e. not just a grade). Certain e-learning technologies make is easier than others to provide comments on student's work. When there is a 'feedback box' (e-college), use it to comment; where it is possible to type in your comments on a paper (in a different colored type), do that. When it is NOT easy to give feedback, this author has printed the material, written comments in the margin, and returned the material via snail mail – this extra effort was greatly appreciated by the students. It is also possible to simply email each student with your comments or reactions on their work, or engage in a chat room or an individualized threaded discussion to discuss the merits of their work.

It should be understood that giving students useful feedback is very time-consuming in e-learning; it is also one of the key variables in making the learning worthwhile and permanent. It is a very important element in establishing the learning environment and maintaining a learning community. Prompt, thorough, and thoughtful feedback not only allows learners to know how they are doing, it also keeps them aware of teacher's presence.

Initiating Structure and Control:

One of the true benefits of e-learning is the fact that it is self-paced and therefore flexible to the learner's needs. However, one of the dilemmas for the teacher is *howmuch* control to give to the learners. We experimented with a completely self-paced curriculum and, while it was not a total disaster, it certainly got out of hand. Some of the students procrastinated, some sped ahead through the course, and some paced themselves and took the material one module at a time - the instructor ended up grading all 7 modules at the same time and the learning community was seriously compromised.

We have found that paced systems work well; this is also supported by research (Vrasidus 2000). A course that is broken into individual modules with clear objectives, structure, and assignments is the most viable. The pace at which the modules are opened (and closed) to learners is controlled by the instructor and all activities within a module must be completed by a date provided by the instructor. [In the communications class, students are automatically granted a week's grace period past any given due date – while this is cumbersome to the instructor, it does acknowledge that the students travel a lot and their schedules are not as predictable as they (or the instructor) would like.] This allows some flexibility; while at the same time it encourages students to interact (via chat room or threaded discussion) as they deal with common curriculum content (i.e. they are all reading and reacting to Albert Ellis's fallacies during the same week).

Another way of giving some control to learners is by allowing them to choose their activities. In one of the courses taught, we gave the students a "superset" (a smorgasbord) of activities to choose from, each activity was assigned a certain number of points (more points for more complex activities), and students were given the point system used for assigning letter grades. Based on their learning goals, intellectual interest, and commitment to grade point, students then chose which activities they would complete. In essence, they created their own portfolio of assignments. This course set-up has been offered several times and receives very positive feedback from the students.

Students experience greater control when assignments are easy to manage. Assignments should be easy to find, easy to follow and easy to interpret. Even though, in an e-learning environment, students can do their work anywhere/any time, we have found that providing a

BEST COPY AVAILABLE

predictable pattern is an attractive option for our students. If you have an entire curriculum delivered by e-learning, it is a good idea for all faculty members to use the same style of syllabus, to have their assignments in the same place, and to coordinate their activities. For example, in our cohort mixed-mode program, students take two courses simultaneously – one instructor requires homework on Mondays, the other instructor requires homework on Thursdays. It is also advantageous to create standard operating procedures, i.e. all homework assignments are to be posted in the 'drop box" (Blackboard), all 'announcements' will be available for a 2 week period, chat rooms will not have over 10 persons at a time, etc. This routinizing is helpful to the students and eliminates the need for each instructor to re-create a wheel.

Proving your Expertise:

In the traditional classroom, instructors often share their experiences as supplemental examples to their lecture. E-learning lecture notes are often more sterile than live lectures so some of the personality, expertise, and experience of the instructor is not as obvious. Instructors need to find ways by which to share their expertise and demonstrate their professional contributions. Using chat rooms to chat about specific topics (not as office hours), contributing to threaded discussions, asking provocative questions, drawing attention (via announcements) to relevant news items, drawing attention to hot topics and emerging trends are all ways of making you a multifaceted person in their eyes. The quality of feedback you provide to the students is another way of communicating your expertise.

Conclusion

E-learning exist because technology enables it to and because it fills a need on the educational landscape. It would be a mistake for educators to think that this new modality could take their place; that by itself, a technology could create and maintain a learning environment. That part of education still belongs to the teacher. It is still the responsibility (and for most of us the joy) of the teacher to excite the student, to develop the learning community, to provide structure to the learning, to show off our expertise, to value the individual learner, and to give feedback that enables the student to grow. Some of the techniques needed for these tasks in e-learning are completely new, some are a slight adaptation from a traditional approach, and some are essentially the same as those employed in the traditional classroom. This paper suggested and highlighted a few new ideas and some variations on older approaches that have worked for the authors.

References

Bischoff, A. (2000), The elements of Effective Online Teaching: Overcoming the Barriers to Success. K. White and B. White (Ed.), *The Online Teaching Guide: A Handbook of Attitudes, Strategies, and Techniques for the Virtual Classroom*. Needham Heights, MA: Allyan and Bacon.

Bonk, C.J. and C. Essex (2001), Stating the State of E-learning: Surveys in College and Corporate Training Settings, *Proceedings 17th Annual Conference on Distance Teaching and Learning*, pp. 61-66, August 8-10, Madison, Wisconsin.

Hillman, D.C., Willis, D. J. and Gunawardena C. N. (1994), Learner Interface Interaction in distance education: An extension of Contemporary Models and Strategies for Practitioners. *The American Journal of Distance Education*, 8(2), pp. 30-42.

Kolb, David A. (1984). *Experiential Learning: Experience as the Source of Learning and Development.* Upper Saddle River, NJ: Prentice-Hall.

Pantazis, C. (2002), Maximizing e-learning to train 21st century workforce, *Public Personnel Management*, 31 (1), pp. 21-26.

Vrasidas, C. (2000). Constructivism versus Objectivism: Implications for Interaction, Course Design, and Evaluation in Distance Education. *International Journal of Telecommunications*, 6(4), pp. 339-362.

Web-based Supplementary Material to Complement Classroom Teaching - A Case Study

Toshitaka TAMURA, Shinichi FUJITA, Akiko SWAN, Toshiko HOSAKA, Ming YIN, Seinosuke NARITA
Waseda University
3-4-1, Okubo, Shinjuku-ku, Tokyo, Japan
tamura@moegi.waseda.jp

Abstract: The authors are developing an effective, practical computer-aided instruction (CAI) system for use in class, consisting of three parts: web-based teaching material, a learning evaluation and management system, and a support system for editing the web-based teaching material. The web-based teaching material is based on the textbook "Total Japanese", which is used to teach Japanese as a foreign language. It is important that any CAI system used in class is designed to suit individual styles of teaching, since each teacher has their own approach. When the authors began to develop a suitable CAI system using existing courseware authoring tools, the authors found many problems, because these tools were not designed for use by teachers. This paper discusses the need for teachers and engineers to co-operate in the design and development of better CAI systems.

1. Introduction

There is an increasing demand among teachers for computer-aided instruction (CAI) systems that make use of advanced information technology. Such systems are expected to improve student motivation and understanding. To meet this demand, a number of support systems have been developed to facilitate the design of CAI systems. The authors have been developing a CAI system to teach mastery of the Japanese language in accompaniment with the textbook "Total Japanese", which is used in Japanese language classes.

The authors soon found that courseware authoring tools such as WebCT [3] and HotPotatoes [4] did not meet teachers' needs. These tools are designed for use by many users, but a CAI system should be customized to meet individual teachers' specific needs. Moreover, a customized CAI system improves speed, cost, and ease of use [5].

Involving teachers in the development of CAI systems increases the likelihood of developing practical systems, since teachers know what is needed and are aware of effective ways of teaching. However, they may not know whether it is possible to design a system with the capabilities that they desire, given the present state of information technology. Consequently, they may be unable to complete the system until what they want becomes available, even if they manage to conceptualize it. By contrast, if engineers develop a CAI system on their own, they may produce a novel, advanced system because they are aware of the available technology, but it might not be what active teachers really want. Therefore, The authors concluded that teachers and engineers should co-operate in order to develop an effective CAI system for classroom use. The authors tried to make the best use of current information technology to produce an effective and practical CAI system to assist in teaching Japanese.

2.The CAI system

In designing the details of the system, it is important that teachers and engineers work together. Teachers have many ideas about functions that they would like to incorporate in the CAI system, but are not likely to know whether they can be realized given the present technology. By contrast, it will be necessary for engineers to conceptualize these functions and then produce the actual interface. The engineers will have to tell the teachers what functions are possible. In addition, they must be able to suggest alternatives for the functions that they cannot realize. The teachers will need to tell the engineers specifics of the design, such as where the answer field or buttons should be in the teaching material and what kind of images to display.

(1) Partial development of the system

The CAI system is still in the process of development; the authors are currently testing the parts that have already been completed. This has been made possible by dividing the entire system into several components, so that the authors can analyze, design, develop, and test each component. This is the "round trip" model of development, which is a flexible development style. In this way, the authors can obtain feedback on the system and teaching material from teachers and students almost immediately, allowing us to make improvements at any time.

(2) Sharing information

Feedback from teachers and students is via e-mail and at meetings held at least once a month. In addition, any problem that arises in development is reported to all the teachers and engineers via e-mail, even if it is only small. In this way, the authors can constantly confirm whether there are any differences between the teachers' requirements and the system's abilities while the system is still under development.

(3) The system suits classes

In order to make an effective system, it is necessary that the system developed is as close to teachers' requirements as possible. It is important to determine which functions in the system are appropriate. For instance, useful user interfaces are needed, while a CAI system that incorporates AI (artificial intelligence) functions is unnecessary, because teachers fill that role in the classroom.

3. System outline

Our system is an integrated CAI system that consists of three components:

1. Web-based teaching material
2. A learning evaluation and management system
3. An editing support system

Using these components, teachers can edit the teaching material and manage their students' progress. This system is a web-based educational system. Only teachers have access to the editing support system.

(1) Web-based teaching material

The teaching material is based on the textbook "Total Japanese" published by the Center for International Education at Waseda University. This textbook is intended for foreign students studying in Japan, but students studying in universities all over the world use "Total Japanese" as a Japanese language textbook. The students are expected to develop a comprehensive understanding of the rules of conversation, reading, and writing. The authors used Macromedia Director 8J as the authoring software to create this material.

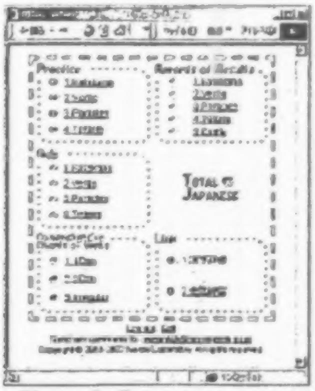


Figure 2. Top menu.

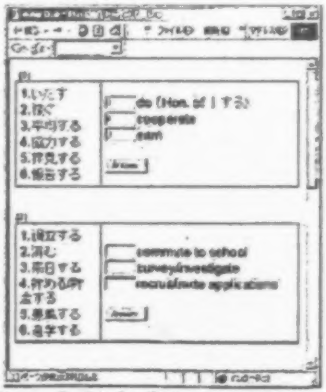


Figure 3. Verbs Quiz.

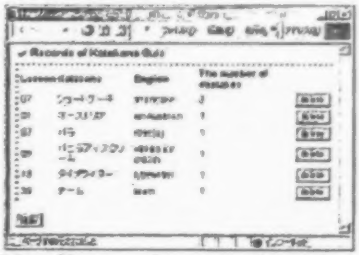


Figure 4. List of incorrectly answered questions.

BEST COPY AVAILABLE

(2) The learning evaluation and management system

In self-directed learning, development of a system and material that allow the student to recognize and solve individual problems is indispensable. Such a system must analyze each student's weaknesses and their leaning progress, so that teachers can provide more effective lessons. This system allows teachers and students to determine the following:

a. The questions answered incorrectly by each student;
b. The percentage of questions answered correctly and examples of wrong answers (Figure 5); and
c. The login history of each user.

Each student can review their list of incorrectly answered questions (Figure 4). This function displays the lesson number, each question and answer, and the number of mistakes, allowing students to recognize problem areas. They can also study the questions that they have answered incorrectly by pushing the "Review" button. When students think that they have mastered a question, they can delete it from their lists.

(3) The editing support system

Teachers can edit the teaching material data in accordance with students' abilities. Teachers know how well the students understand the textbook from the data obtained from the learning evaluation and management system. If most students don't understand the content of a lesson or part of a lesson, the teacher can change the questions or answers. This is a very handy function if it can be done easily. The authors use Microsoft Access 2000 as the database and Active Server Pages (ASP below) as the Web application technology. The authors constructed the system so that teachers can edit the database on the server from their browser, using ASP. In this way, teachers can operate the database on the Internet, simply and without expertise. This is a versatile system that allows teachers to customize the material (Figure 6).

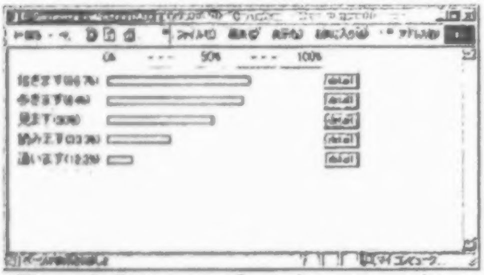


Figure 5. Percentage of questions answered correctly

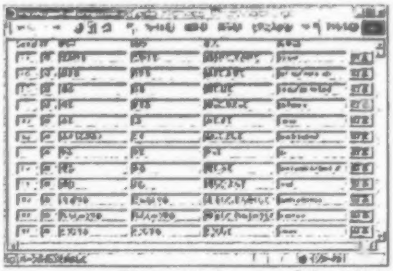


Figure 6. Image of the editing support system

4. Evaluation

Students studying at the Center for International Education at Waseda University, Japan have been learning Japanese using this system. On January 1st 2002, 117 students were registered on this system. The authors surveyed 16 students and asked them how the system had contributed to their study of Japanese. The response to each item on the survey was given on a scale of 1 to 5. The survey questions and results are listed in Table 1.

The items in the survey were based on the ARCS [6] model, which is considered a barometer of student motivation. The ARCS model consists of four factors: Attention (Q.1 - Q.2), Relevance (Q.3 – Q.5), Confidence (Q.6 – Q.7), and Satisfaction (Q.8 – Q.9). The first two questions (Attention) show that most of the students find this system attractive. For Relevance, there were some negative responses to Q.3 and Q.5, but the best response in the survey was to Q.4 "Relevance to learning Japanese". Fifteen (94%) students found this material valuable and that the system was very relevant to their learning Japanese. The material used was based on the teachers' input and this result confirmed its effectiveness. The responses to the Confidence questions indicate the high quality of the system and teaching material. Nevertheless, much still needs to be done to change students' stereotypical views of Japanese language. The Satisfaction responses show that this system was valued for the most part, although some improvements could be made.

BEST COPY AVAILABLE

	Question	Score
Q.1	Studying on the Total Japanese website is: 1. Not interesting at all – 5. Very interesting	3.875
Q.2	The Total Japanese supplementary materials are: 1. Not interesting at all – 5. Very interesting	3.875
Q.3	Do the TJ supplementary materials motivate you to study on your own? 1. Not at all – 5. Definitely	3.25
Q.4	Studying the Total Japanese supplementary material: 1. Is not relevant to your learning Japanese. – 5. Is very relevant to your learning Japanese.	4.3125
Q.5	Studying the Total Japanese supplementary material: 1. Is not relevant to your daily life in Japan. – 5. Is very relevant to your daily life in Japan.	3.75
Q.6	Using the Total Japanese supplementary material is: 1. Not rewarding at all – 5. Very rewarding	3.75
Q.7	After using the supplementary material, you came to feel that learning Japanese is: 1. Very difficult – 5. Very easy	3.0
Q.8	Using the supplementary material is: 1. Very boring – 5. Very enjoyable	3.6875
Q.9	Using the supplementary material is: 1. Totally unsatisfactory – 5. Very satisfactory	3.6875
	Average	3.6875

Table 1. The questions used in the student survey

5. Conclusion

The authors have developed this CAI system through the joint efforts of teachers and engineers. As the survey shows, the authors are developing a practical CAI system that satisfies teachers and helps with difficulties in teaching Japanese, as determined by active teachers. This system is still under development. The authors plan to enhance the teaching material so that the system can be used by students at many different levels of learning. In addition, the authors are also thinking about enabling student access to the system via cell phone or PDA (personal digital assistants), so that they can use this system anywhere, anytime. Finally, to incorporate CSCL (computer-supported cooperative learning) in this system, the authors will allow students to input quizzes.

6. References

[1] Shinichi Fujita (2002). Computer Assisted Language Learning in Multimedia and Network Environment - A Case Study on Japanese Language Education for Foreigners - (pp. 113 - 138). Dissertation paper for Ph.D., Waseda University, Japan

[2] Toshitaka Tamura (2001). A Learning Information Analysis System for Teaching Japanese as a Foreign Language. (pp. 1 - 4). WebNet2001

[3] WebCT. http://www.webct.com/

[4] Half-Baked Software. Hot Potatoes. http://web.uvic.ca/hrd/halfbaked/

[5] Mark McMahon, Joe Luca (1999). Courseware Management Tools and Customized Web Pages: Rationale, Comparisons and Evaluation. (p. 4). ED-MEDIA 1999

[6] Keller, J.M., & Suzuki, K. (1988) Use of the ARCS motivation model in courseware design. In D.H. Jonassen (Ed.), Instructional designs for microcomputer courseware. Lawrence Erlbaum Associates, USA

Bridging Theory and Practice Through IT: The case of On-Line Trading in Corporate Finance.

Ivy Tan
Centre for Instructional Technology
National University of Singapore
Singapore
cittani@nus.edu.sg

Yew Kee Ho
School of Business
National University of Singapore
Singapore
bizhoyk@nus.edu.sg

Abstract: The National University Of Singapore School of Business and the Centre for Instructional Technology have jointly design and developed a student online share trading system. The system enables students working in groups to select a portfolio of shares from those listed in the Stock Exchange of Singapore and track their portfolio value on a daily basis. The main purpose of the system is to simulate a stock market environment where students can invest in real stocks and track real prices. Students have gaps in their knowledge in terms of the practical application of the Capital Asset Pricing Model to real world companies, a trading system will allow students to apply what they have learnt and determine if the theories are applicable in real life. The system is linked to a forum and course materials found on the learning management system of the university. This paper describes the system, reports on students' feedback, discusses system weaknesses and future developments.

Introduction

The National University of Singapore, School of Business, Corporate Finance course (BZ3301) aims to provide students with in-depth understanding of how finance managers utilize and steward their financial resources to achieve maximum returns to shareholders. Students are exposed to key financial issues like risk and return trade-off, how the equity market works, the various financial analysis tools and capital structure of firms. The course covers both conceptual issues relating to the management of financial resources and the practical applications of those theories in a real business setting.

Students' Term Projects

Students have to complete two projects in this course. The first project is the application of the capital asset pricing model (CAPM) in the selection of stocks which students can invest in. This first project provides a bridge between theory and practice. A second project tests the analytical skills of the students as they apply the theories and knowledge gained in the course to a case study.

The online trading system and the term project.

The first project resulted in the development of an online trading system with the purpose of integrating IT into knowledge delivery to the students. Traditionally, CAPM has been taught as a mathematical model for the pricing of stocks. Students are not able to connect the theories with real world practice because it is not clear if the theory really works in the real world. Before using the online trading system, students analyze the stocks by applying the theories they learnt in class, they then proceed to apply their knowledge by selecting stocks in a created stock market environment.

Real world, internet based, action learning projects stimulate interest and motivates students. A hands-on approach to learning investment strategies is more meaningful than traditional teaching methods thus resulting in greater retention of new knowledge. (Curcio, 2000). The idea of online trading is not new. Several universities around the world have simulated trading rooms. Many high school students in the US are familiar with online trading. Several companies provide free online trading services to students. Such activities motivate students to monitor current news and market trends, apply math skills and stimulate interest in economics. (Lopus & Placone 2002). The National University of Singapore decided to build its own system because the trading rules are unique and customized to meet course project requirements. Moreover, the lecturers wanted students to analyze and invest in stocks listed on the Stock Exchange of Singapore rather than other exchanges.

Three lecturers, one hundred and sixty students from five lecture groups, divided into twenty-eight project groups are currently involved in this project. Each group of student is given an initial virtual amount of S$100,000 to invest in equity stocks listed in the main board of the Stock Exchange of Singapore. Each group must select 10 companies to invest this money. Students log into the system and select the stocks. The program tracks daily price movements of stocks and updates the groups' portfolio value on a daily basis. Students are able to monitor their portfolio performance in an accurate, secure and reliable environment. Students can also view the performance of other groups. They are however not able to view the detailed portfolios of the other groups. They are encouraged to discuss and share their group's portfolio performance in the forum. The better groups give pointers to those groups who are not performing as well and students can defend their choice of stock pickings. It is hoped that this will encourage communication and sharing between the different lecture groups. This project propagates knowledge assimilation and learning since students can observe the results of their decisions as the companies which they analyzed and trade in are real companies. In addition, the competitive pressure between groups' performance creates excitement so as to deliver maximum learning impact and the congruence between theory and real world practice. The winning team receives a lunch treat from the lecturers.

The design of the trading system: Administrators' section

The administrator's section allows the instructor to set variables such as start and end date of the activity, initial capital outlay, number of companies to select, deadline for making a final buying decision, view all groups' detailed portfolio, view a summary of group performance and view stock listings. The administrator can also access the course materials and discussion forum created using the university's learning management system.

Registration of students

Students are currently registered by the programmer and put in groups. Students are registered based on their university user ID and password. However, in the next phase of the project, the instructors will be able to register student groups from the administrator's section and this system will be able to extract student group information from the university's learning management system.

Students' section

Students log into the website using their university user id and password. They have already been registered into their respective groups. From the students' section, they can purchase stocks, track their portfolio over the period of the project, view details of their group portfolio, view a summary of other groups' portfolio, access the course forum and course materials and view stock listings. Note that students are not able to view detailed portfolios of other groups. Due to certain constraints which are discussed later in this paper and course project requirements, students are not allowed to buy and sell stocks during the lifetime of the project. Students have access to the forum and course materials on the university's LMS.

Data source and technology

Stock prices from the stock exchange of Singapore main board are supplied by Datastream. They reflect the previous day's closing price. Data from Datastream is extracted into an Excel spreadsheet, rearranged and transferred to an Access database. Since Datastream does not supply real time data, the prices are one day behind. ASP programs are written to post portfolio prices online based on student groups.

Students' reaction and feedback

142 student survey forms where collected in an attempt to evaluate students' reaction to this new system. The survey measured students' perception about the usefulness of the system in bridging the gap between theory and practice.

72.5% of students agreed that they are more enthusiastic about their project when they use the trading system. 85.9% thought that such a trading system is necessary in the course. 83.8% of students agreed that this is a more convenient way of tracking portfolio performance. In the past, students recorded each day's profit or loss on paper. The method is inefficient because it was prone to human error and deliberate mistakes were possible. 85.2% agreed that the prices and numbers were reported accurately. The inaccuracies were due to bug fixes during the first week when the project was launched. Technical problems have since been rectified. It is interesting that 76% of students felt it is important for their team to select the right stocks because group performances are now made public through the system. 68% of students felt motivated to further analyze the movement of certain stock prices while 60% of students agreed that such a system gives them an opportunity to apply the theories they learnt. Since the groups are not able to see the details of other groups' portfolios, 79% of students were curious about the stock pickings of the winning team. It is not surprising that only 30% of students found the forum useful because the instructors did not encourage the use of the forum. Despite curiosity about other group's detailed portfolio, only 19% of students discussed price movements and exchanged views with students from other groups.

Students wanted the system to update prices by the minute instead of daily. They want to be able to buy and sell stocks during the project. One student requested for charting features for portfolio performances of various groups.

System weaknesses

All system weaknesses were identified in the student feedback. Prices are updated on a daily basis instead of real time because Datastream does not supply real time data like Reuters or Bloomberg. Datastream reports previous day's closing prices. It should be emphasized that the corporate finance course aims to train finance managers and not speculators, students are expected to analyze the medium and long term financial health of a company. Minute by minute spot trading or speculation is discouraged. Students must be able to select the right shares, hold these shares over a period of time and make a profit. Therefore, real time data is actually not a necessity. However, to simulate the real world, students should be allowed to buy and sell during the project. Without real time data, students cannot be allowed to buy and sell in between the project as they can obtain before hand information and trade accordingly to make a profit.

Second phase of the project

The second phase of the project will be launched in the new term starting July 2002. There will be charting features where students will view a line graph of their portfolio performance in comparison with other groups' performance. This will make comparison much easier and create a bigger impact. To make the system more realistic, a commission rate, to be set by the instructor will be included in the calculation of profit and loss. Student registration and groupings will be managed by the instructors and at this point, the developers are seriously considering using real time data so that students can buy and sell stocks during the project. The design of the trading system follows closely those designed and developed in the real world. Students will be encouraged to use the discussion forum and discuss price movements with other groups.

In the long run, it is hoped that real time bid and asking prices can be used. Project guidelines must discourage speculation by setting the maximum number of buying and selling transactions within the project period. Students should also defend these actions and all transactions should be tracked.

Conclusion

In addition to providing market reports and analysis, the internet makes it possible for students to have direct hands on experience with financial markets. This encourages students to connect economic concepts to the real world. When combined with active learning-teaching strategies, students will find corporate finance more relevant and this will in turn improve learning. (Scott, 1999). The results of the survey show that students are kept motivated and interested in the course. Most students felt that such a project is necessary and wanted a real time trading system where they can buy and sell shares anytime. Improvements will be made in the second phase of the project to address some system weaknesses. The team will work towards developing an environment that would give students a feel of real time online trading and at the same time meet the unique teaching and learning requirements of the course.

References

Curcio, Richard, J. (2000). *An Innovative Approach to Teaching Investments Using Information Technology*. In: Borghans, L, Gijselaers, W.H, Milton, R.G and Stinson, J.E (Ed). Educational Innovation in Economics and Business V. Business Education for the Changing Workplace. Dordrecht, The Netherlands: Kluwer Academic Publishers.

Lopus J, Placone D. (2002)*Online Stock Market Games for High Schools*.
Available [On-Line] : http://people.clemson.edu/~dlplc/stockmarketgames.htm

Scott, P.S. (1999). Promoting Active Learning Using the World Wide Web in Economics Courses. *The Journal of Economic Education. Summer 1999, Volume 30, Number 3*.

The selection and implementation of computer mediated communication software for virtual peer collaboration. Lessons learnt.

Ivy Tan
Centre for Instructional Technology
National University of Singapore
cittani@nus.edu.sg

Sharin Bin Mohamad Sani
Centre for Instructional Technology
National University of Singapore
citsbms@nus.edu.sg

Melvyn Song
Centre for Instructional Technology
National University of Singapore
citsongm@nus.edu.sg

Abstract: The National University of Singapore, Centre for Instructional Technology implemented a campus wide pilot project to test the use of a computer mediated communications tool intended for students' project collaboration. The application known as Groove v1.3 was made available for download. The tool was widely publicized as a virtual space for students to discuss their term projects. The project team also identified two focus groups of students whose instructors agreed to participate in the study. Students found the initial registration and logging on into Groove difficult. The tool was selected based on features such as, a user friendly interface and a full set of features which allowed for full team collaboration. However, the team did not realize that the initial registration of group members into the shared space could cause such difficulties. This article is a report on the pilot project and lessons learnt from it.

Introduction

In January of 2002, The National University of Singapore, Centre for Instructional Technology implemented a trial version of Groove, a peer to peer networked computer mediated communications tool. The purpose of this tool was to facilitate student virtual project collaborations. An evaluation was designed to determine if students benefited from the use of this tool and to determine its usability. The trial uses the free version of Groove 1.3. The university would decide whether to purchase licenses after this trial. All features of a CMC application are available in the trial version except for server support and roles management. The application was selected because of its peer to peer technology, complete set of collaborative features and friendly user interface.

Implementation

Groove.exe was placed on a website for students to download. The website had online tutorials, a self help section and a forum. Groove was very well publicized across campus as a virtual space for peer project collaborations. The team did not foresee the need to conduct extensive training because our students are known to be tech savvy. Faculty members were not expected to be involved in this project because this was a students' project collaboration tool.

Focus groups.

A part time MBA class consisting of eighteen students and an undergraduate Finance class of thirty students were identified as focus groups. There was training, free installation CDs, round the clock help via telephone or email and the lecturers agreed to be involved in group discussions.

The MBA focus group attended a 3 hour hands-on training session in a laboratory on-campus. The class was made up of working professionals and some international students. During the training, students created a shared space for their class. While working from their own home computers, they encountered difficulties in entering that shared project space using the same account they created during class. The concept of creating a shared space and inviting group members into the space was alien to many. The users did not like the practice of using a diskette to store log in information when logging in using another computer. Some users could not remember their passwords. In order for invitations to the shared space to be successful, at least one computer with the shared space must be active. If a student is trying to invite another, both students must be online. This created problems as not all group members are online at the same time. The logging-in interface of the application caused confusion: If a different computer is used, both new and existing users have to click on "New Account" in order to log in. The lecturer withdrew from the project. She found the tool unnecessary. The undergraduate focus group did not have any incentive to use the tool because by then, the lecturer of that class was no longer keen on participating in the project. He also did not see the need of such a tool. Initially, the team had designed an elaborate evaluation study to collect data from the two focus groups. However, due to the failure of these groups to get started with Groove, the evaluation was not carried out. A separate survey was designed to collect data from the non focus group.

Non focus groups

About 400 students out of an enrollment of 28,000 downloaded Groove on their own initiative during the trial period from January to April 2002. Only 12 feedback forms were received from those who successfully downloaded, installed and used the application. These 12 students had no serious complaints about the tool although one student who collaborated with his peer in India reported that the network speed was slow over long distances. These students were able to use the tool for project collaboration. All are students from technical disciplines. There were 3 women out of the 12. Six other students and 1 faculty member emailed the team to complain about technical problems. The faculty member from the School of Computing thought that the LMS of the university could serve his purpose because it was already widely used. Students are familiar with the interface of the LMS. Students did not know how the shared space in Groove worked. 56k modem users complained that the 17.7MB application is impossible to download. They gave up after waiting for more than half an hour. Some students complained they had no friends to collaborate with since their friends did not successfully install Groove. One user complained that the applications slowed her computer. There was no support from Groove.net in this part of the world. The university decided not to purchase Groove but to enhance the LMS for online project collaborations.

Lessons learnt

When selecting a CMC tool for group collaboration, we need to take into consideration the process of group member registration in addition to the standard set of tools such as file sharing, applications sharing, forum etc. While Groove has an easy to use interface and a full set of features, the registration process was not easily understood by most people. First time users need intensive training and technical support. "Even if the software is relatively simple to install and use, and is accompanied by a good clear manual, many students (and tutors) will still need additional help in getting on-line for the first time." (Bates, 1995).

Faculty members must be involved in encouraging the use of such a tool because when left on their own, students from non technical disciplines will be less likely to use such a tool than those in the technical discipline. From our experience, this problem arose because the 17.7 MB application was not easy to download, install and use. Students from technical disciplines were more willing to spend time to make the application work. There is indication that without faculty push, there will be more male users than female users. The small number of response in our pilot study makes it difficult to generalize this possibility, but it is consistent with the widely held believe that CMC has been a male dominated domain. (Savicki, V. 1996)

Student and staff training are necessary because online collaboration of projects is not a common practice in Singapore and the idea requires a paradigm shift. Learning culture favors highly structured instructor lead, face to face lectures. (Lamb. 2002) Singapore is about 632 square kilometers in area and it has an excellent transportation infrastructure. Hence, travel and distance have never been an issue for most people. This was why some students and staff did not see the need for the tool. Students and staff must be shown the potential benefits of online collaborations both within Singapore and across borders. The implementation must be guided by pedagogy. A demonstration of features and how they can enhance peer project collaborations is needed.

The vendor should be involved in user support and be willing to customize to the needs of the university. The lack of vendor participation and support is the main reason why the university decided not to purchase licenses for the application.

A CMC tool should be selected based on its ability to meet learner needs and not because it employs some cutting edge technology such as peer to peer networks. If a LMS is available and widely used in the university, there should be integration between the LMS and the CMC software. Students and faculty should only use a single UserID and password to access the LMS and the CMC tool. In our experience, users did not understand why a separate application should be created when the chat room of the LMS can be developed to meet such needs.

Future Plans

The team is now working to enhance the LMS chat features to support web based virtual group collaborations. In addition to the standard collaboration features, the new application, when completed will be an integral part of the university's LMS. Students will be able to group themselves easily because information is extracted from the university's main registration database. Students can use their existing UserIDs and Passwords. Administrators have full control over the server and log files. Faculty members can also group students and visit the groups. Both staff and students can continue to work in a virtual environment which is familiar to all. Moreover, students are not likely to use the application for leisure chat or social activities since the university is able to track usage. The team remains very positive that our student population will be receptive to the new technology and the new idea of virtual teams. Given the right tools, some encouragement and training, students will discuss projects online.

References

Bates, A.W. (1995). *Technology, Open Learning and Distance Education*. London. Routledge.

Lambe, P. (2002). E-*learning Adoption Factors in Asia Pacific*. A white paper by Straits Knowledge. May.

Savicki, V. (1996) Gender Language Style and Group Composition in Internet Discussion Groups. *Journal of Computer Mediated Communications Volume 3 No 3 December 1996..*
Available [On_Line]: http://www.ascusc.org/jcmc/vol2/issue3/oldsavicki.html

Effects of Collaborative and e-Learning on Skill Acquisition and Retention for Computer-based Cognitive Tasks

Kuo-Hao Tang
Department of Industrial Engineering
Feng Chia University
Taiwan
khtang@fcu.edu.tw.

Abstract: Based on a training program using a production system simulation software designed for the Theory of Constraint (TOC), the effects of collaborative training and after-training feedback representation method on skill acquisition and skill retention are investigated. An experiment with two training protocol, individual and triplet; two methods to present after-training lecture, face-to-face with the instructor and digitized video image; and three skill retention levels, immediately upon the completion of the training, after one week, and after one month were conducted. The results show that training protocol affects both training performance and skill retention ($p<0.01$) while methods to present after-training lecture affect training performance ($p<0.05$). In compared to the traditional face-to-face approach, the e-learning approach that conveying lecture materials solely through digitized video and slides without any post processing, not only decreases participants' attention but also reduces the time of eye contact between instructor and trainees.

Introduction

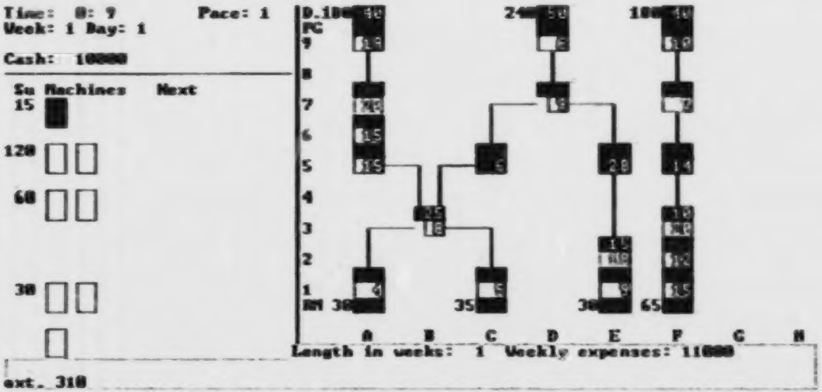
In the knowledge economic epoch, the lifelong learning through Internet or computer-based training programs has become an important learning means in many higher education institutes and industries. Such learning paradigm is generally lack of interactions between instructors and learners compared to conventional classroom training, the learning effect is questionable without proper design of the training program such as issues regarding courseware development, instruction mode, and training environment. However, many issues about how to design distance learning systems remain open. "Specifically, it must be determined what level of interaction is needed between trainees and instructors. Moreover, the nature of such interaction must be specified. For example, do instructors need to see trainees in order to conduct effective instruction? Do trainees need to see instructors or is it better for them to view other material? ... These and other questions must be addressed as a basis to develop sound distance-training systems." (Saias, 2001, p. 482)

In addition to e-learning, group learning, or, collaborative learning is one of the most frequently cited instructional modes and its importance has been widely acknowledged (Shebilske et al., 1998; Scanlon, 1995). Many studies have demonstrated that in many situations where learners work in groups, they outperform those who work alone (e.g., Lazarowitz et al., 1994). Cognitive theory tries to explain why group learning works. It emphasizes that the interaction among members increases the critical concept learning by itself (Damon, 1984). For cognitive-based problem solving tasks, cognitive elaboration states that the effect of group learning is due to the extensive elaboration of materials by group members to other group members. Since higher achievers have more opportunities to explain the system/task to lower achievers, they reinforce their knowledge and therefore learn more (Webb, 1989).

To evaluate the success of a training program, the skill acquisition rate is most frequently used performance measure. In addition, skill retention and skill transfer need to be measured and are traditionally investigated by manipulating feedback, practice intervals, reinforcement schedules, and other conditions during learning process (Schmidt and Bjork, 1992; Ghodsian et al., 1997). This study is to investigate how the nature of the interactions between trainees and instructor ("going-to" training or distance training) as well as training protocol (individual or group) affect learning efficacy and skill retention for a simulation-based training program.

Method

Simulation continues to be a popular method for delivery training and simulators are widely used in business, education, and the military (Jacobs and Dempsey 1993). A shop floor control simulation software was used for this research. This simulator was first developed by Goldratt (1996) to promote the Theory of Constraints (TOC), a production control theory that emphasizes bottleneck identification and buffer management in front of production bottlenecks. Figure 1 shows a screen printout of the simulator. The simulator is actually a small virtual manufacturing plant producing some products with certain manufacturing processes. The manufacturing routings are shown at the right side of the screen. In this case, there are 4 types of raw materials (RM) listed at the bottom of the screen that can be fabricated into three types of finished goods (FG) at the top of the screen. The number at the left of each RM and FG means the cost of the raw material and sale price of finished goods, respectively. On each manufacturing routing, colored rectangles represent manufacturing processes and black rectangles represent the buffer for work-in-process. The number on each process rectangle means the processing time.



Time: 0: 9 Pace: 1
Week: 1 Day: 1
Cash: 10000
Length in weeks: 1 Weekly expenses: 11000
ext. 310

Figure 1: Screen printout from the TOC simulator. (Avraham Y. Goldratt Institute©, 1996.)

The layout of the plant is shown at the left side of the screen and the colored rectangles represent the machines, corresponding to the manufacturing processes in matching colors at the right side of the screen. The number beside each machine represents the machine setup time. The capacity of each machine is fixed and the profit of selling each finished product to market is given. In order to increase net profit for a company, the goal is to identify and control the bottlenecks on the shop floor and reconcile conflicts among resources in order to maximize throughput within a fixed period of time. All the necessary information for running the production control tasks, such as the kinds of costs and demands, are shown on the screen and are updated as the simulation continues. The simulation ends after one week of simulation time. The performance measure for this production control task is the net profit measured in dollars.

Procedure

Sixty participants were randomly assigned into two training protocol, individual (IG) and triplet (TG), to proceed with the training. After a 30-minute introduction session to be familiar to the operation of the simulation software, a one-and-a-half hour of training session followed to finish three TOC problems. After the training session, a lecture was provided as feedback for learning TOC principles. The feedback was presented by an instructor using PowerPoint presentation. There were two types of interactions between trainees and instructor, one was "going-to" training (FTF) that was face-to-face with the instructor and the other was distance training (VDO) that a digitized video image was used to present the feedback lecture. Fifteen participants were randomly selected from IG and TG and were assigned to FTF. The rest of the participants were assigned to VDO. During the 30-minute feedback lecture, participants were video taped and their eye focus locations were categorized into three types, namely, focusing on the instructor, focusing on the PowerPoint slides, and other locations. After the lecture, training performance was evaluated immediately upon the completion of the training, after one week, and

BEST COPY AVAILABLE

after one month to observe skill retention. During the evaluation, each participant was tested individually regardless of training protocol and feedback presentation method. The test problem was different from training sessions but was based on the same TOC principles and used the same simulator.

Results

Table 1 shows the average performances for individuals (IG) and triplet groups (TG) over the three training sessions. During training sessions, higher achievers in a group usually led the discussion and operated the simulator. In other words, the scores obtained from group settings in training sessions were more affected by the higher achievers in that group. Therefore, it was not surprising to find that TG outperformed IG during the two training sessions ($p<0.001$) throughout three sessions.

Table 1: Mean performance measured during three training sessions and their standard deviations (in parenthesis) for different training protocols.

Training protocol	1st Session	2nd Session	3rd Session
IG	-2103(2350)	-75(2435)	2075(1854)
TG	402(1452)	1534(1087)	4024(943)

Table 2: During feedback lecture, the average time (min) that participants focus on different locations and their percentages (in parenthesis).

Feedback representation	Instructor	PowerPoint slide	Other
FTF	17(57)	9(30)	4(13)
VDO	7(23)	14(47)	9(30)

Table 3: Mean cubic root of net profit measured in dollars for the different levels of three main effects and their standard deviations (in parenthesis)

Factor	Level		
Skill Retention	Immediately	After one week	After one month
	13.53 (3.52)	13.46 (3.89)	10.55 (6.16)
Training Protocol	Triplet (TG)	Individual (IG)	
	13.79 (2.57)	11.23 (6.11)	
Feedback Representation	Face to face (FTF)	Video (VDO)	
	13.59 (3.78)	11.44 (5.53)	

The average time of participants' eye focus locations is shown on Table 2. Although the data were not subject to statistical analysis due to small sample size (4 samples for each feedback representation), it can be shown on Table 2 that the eye focus locations are quite different for the FTF and VDO cases, particular when contrast between time on instructor and time on PowerPoint slides. This result seems to suggest that different ways of presenting lecture divert trainees' attention to varied locations.

The focus of the analysis is the individual performance after training. In order to satisfy the "homogeneity of variance" assumption for analysis of variance, the performance measure, net profit measured in dollars, a data transformation using cubic root was performed. An ANOVA on the cubic

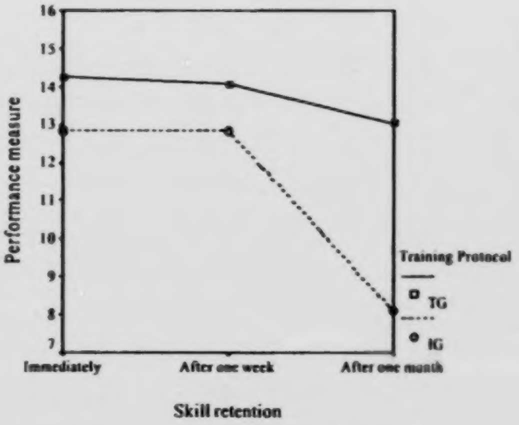


Figure 2. The mean performance for training protocol and skill retention

root of net profit measured in dollars revealed three significant main effects: training protocol, $F(1, 56)=9.55$, $p<0.01$; feedback representation, $F(1, 56)=6.77$, $p<0.05$; and skill retention, $F(2, 112)=13.27$, $p<0.001$. Table 3 presents the mean cubic root of net profit for the different levels of these three main effects and their standard deviations. It can be shown that FTF outperforms VDO case and TG group outperforms IG group, while testing immediately and after one week outperforms testing after one month as revealed by Tukey test ($p<0.05$). Among all the two-way and three-way interaction terms, only one two-way interaction term, training protocol and skill retention is significant as shown on Figure 2.

Conclusions

This paper investigates how training protocol and feedback representation affect skill acquisition and retention. The results suggest that collaborative training facilitates skill retention more than skill acquisition. In fact, the performance measured immediately upon the completion of the training is not significant ($F(1, 56)=2.63$, $p>0.1$). However, the difference increases after one week ($F(1, 56)=3.73$, $p>0.05$) and is significant after one month ($F(1, 56)=9.55$, $p<0.01$) that can be shown on Figure 2. It has been suggested that for using simulators as learning media, the verbal interactions among group members facilitate higher-order thinking (Sherwood, 1990), and therefore may reinforce learned skill. This may provide a reason why collaborative training has better performance in skill retention. Although the two way interaction term feedback representation and skill retention is not significant ($F(2,112)=0.51$, $p>0.6$), which means feedback representation has no effects on skill retention. Feedback representation, however, is significant in terms of overall performance. Considering the after-training lecture is only 30 minutes and the only difference is the way the lecture was presented, the effects can not be neglect. Video tape analysis also suggests that the e-learning approach that conveying lecture materials solely through digitized video and slides without any post processing, not only decreases participants' attention but also reduces the time of eye contact between instructor and trainees. This difference may explain why using video stream has worse performance than conventional classroom training. Overall, the results suggest the media selection and instruction representation need to be carefully designed for e-learning environment. Directly transplant the courseware used for conventional face-to-face environment may cause underachievement at training.

References

Damon, W. (1984). Peer education: the untapped potential. *Journal of Applied Developmental Psychology*, 5, 331-343.

Ghodsian D, Bjork R, & Benjamin A.(1997). Evaluating training during training: obstacles and opportunities. In Quinones MA and Ehrenstein A. (Eds) Training for a Rapidly Changing Workplace: Applications of Psychological Research.

Goldratt, E.M. (1996). *Production the TOC Way*. Avraham Y Goldratt Institute, CT.

Jacobs J.W., & Dempsey J.V. (1993). Simulation and gaming: fidelity, feedback, and motivation. In Interactive Instruction and Feedback, ed. JV Dempsey, GC Sales, pp. 197-229. Englewood Cliffs, NJ.

Lazarowitz, R., Hertz- Lazarowitz, R., & Baired, J. H. (1994). Learning science in a cooperative setting: Academic achievement and affective outcomes. *Journal of Research in Science Teaching*, 31(10), 1121-1131.

Salas, E. (2001). The science of training: A decade of progress. *Annual Review of Psychology*, 52, 471-499.

Scanlon, E. (1995). Collaboration and problem solving in science using information technology. *British Journal of Educational Technology*, 26, 227-228.

Schmidt RA, & Bjork RA. (1992). New conceptualizations of practice: Common principles in three paradigms suggest new concepts for training. *Psychol. Sci.*, 3, 207-217.

Shebiliske, W.L., Goetti, B., & Regian, J.W. (1998). Individual and team protocols for training complex skills in laboratory and applied settings. In: Gopher, D., Koriat, A. (Eds.), *Attention and Performance XVII: Cognitive Regulation of Performance: Interaction of Theory and Application*. Erlbaum, Hilisdale, NJ. 401-432.

Sherwood, C. (1990). Computers and higher order thinking skills. In: McDougall, A., Dowing, C. (Eds.), *Computers in Education. Proceedings of the IFIP TC3 Fifth World Conference*. Elsevier Science, Amsterdam. 1081-1086.

Webb, N.M. (1989). Peer interaction and learning in small groups. *International Journal of Educational Research*, 13, 21-39.

Using the Knowledge Modeling Approach to Assess Effectiveness of Electronic Learning

Stephen Gilbert Taylor
Biology Department
Champlain Regional College
St-Lambert, Quebec, Canada
steveta@alumni.concordia.ca

Abstract: In designing and implementing a learning experience, it is useful to establish a model of the intended outcomes. The knowledge modeling approach provides a method for developing such a model. Once a model is developed it can be subsequently revised and, then can serve as a basis for evaluating the relative effectiveness of the instructional program. This brief paper introduces the methodology of the knowledge modeling approach and provides an example of how the author has applied this approach to the development of an instructional system.

The computer can be a powerful tool when deployed effectively to promote learning. In the age of the internet, we have the opportunity to deliver quality instruction aimed at particular target audiences and individuals. It is important, therefore, that we build useful programs and to do this there is a need to assess their impacts on the learners to be sure that we are meeting our objectives. The knowledge modeling approach is a representation of the learning process that has been developed to assist in the design of computer aided instruction. Using this approach requires that the instructional designer move through an iterative process to build, assess, and remodel the instructional product. It was applied to the development and testing of a tutoring system that is presented here as an example of how the process was carried out.

The knowledge modeling approach is based on a constructivist view of learning and posits that students build, test, and revise mental models of a subject matter as they participate in a learning environment. This means that there are two tracks through such an environment. The student's track must provide an adequate opportunity for model building and model testing. At the end of this track we should be able to observe distinct and predictable changes in the student's behaviours that will allow us to infer that learning has occurred. The parallel track is that of the instructor or designer of instruction. This individual must develop the environment and provide suitable activities for the learner to accomplish the objectives. Suitable feedback must be provided along both tracks to stimulate revision and adaptation. The feedback can come about as a result of an assessment process and is considered to be formative assessment when it is promoting revision and change. At the end of the tracks, a summative assessment determines the overall accomplishment of the learning objectives and the relative value of the program.

A major aspect of the knowledge modeling approach is that its first requirement is to determine the general goals and specific objectives to be attained through the learning environment. Although there are several ways of determining these, the author has developed a procedure using sticky paper (Post-It Notes). The desired concepts and skills to be learned are listed by writing these on to the sticky papers and placing them on a larger sheet of paper or wall. These notes can be easily moved, and re-organized to generate a large map or model of the desired outcomes of the instructional package. While making this *sticky paper knowledge web*, it is also useful to define the standards of performance that will be required at the end of the instruction. From this model, the objectives and consequent specifications of the instructional package are set down in writing. The knowledge web, objectives, and specifications are then used to develop the learning environment and test it to provide the formative assessment necessary for the designer track.

Production of computer aided instruction must progress to a certain point before it can be assess by sample groups of users. In addition to assessing the relative value of the various subsections of the program, several other issues should be studied. One should determine how attitudes are affected. These include attitude to the subject matter of the program as well as attitudes towards computer aided instruction in general. It is also important to ask students to assess technical aspects of the software, such as the interface design, use of colour, fonts and type sizes, usefulness of graphics and the quality an opportunity for feedback about their progress as they use the program.

The Virtual Tutee program was developed by the author for the major purpose of putting the student user into the role of a tutor rather than being a tutee. This was based on the commonplace notion that "to teach is to learn". There is considerable evidence from the literature on peer tutoring that the tutor always gains in these situations. The subject matter for this learning package was photosynthesis, a relatively complex topic in introductory college biology. The author developed the models of the subject matter using sticky paper as described above. Tests of subject matter competence and standards of performance were compiled early in the design phase. As the materials were being produced, small groups of individuals were asked to test various components and to comment on the interface design. Finally, all the materials were pilot tested on a small group of student users before the final revision and the summative testing took place. This provided the feedback to the designer-producer that allowed improvements to be made.

The tutoring environment consists of a printed study guide, very similar to a chapter in a college textbook, and a computer program constructed using Hypercard, a Macintosh hypertext program. In this program, Jack, the virtual tutee asks questions of the student user. The student composes answers using a menu of items which must be built into a meaningful paragraph. Jack then replies by commenting, and or asking another question. The user can also ask Jack questions and is expected to reply to these. The conversation between the virtual tutee and the real student tutor proceeds through the various levels of the subject matter, from the simple to the more complex approaches to this topic.

In the summative evaluation of the software, fifty college students participated in the testing, and were randomly assigned to four groups as they entered the computer laboratory. Groups A and B used the virtual tutoring approach, while groups C and D used a text with study questions strategy. In this way one could comment on the effectiveness of the computer simulation of tutoring. Groups A and C took a pre-test of the subject matter in order to rule out the possibility of pre-test bias. All students were asked about their attitudes towards computer aided instruction and background study of biology.

The impact of the two formats on the cognitive domain was determined by conventional multiple choice tests of subject matter competence. Both the computer users and the readers attained a benefit from their study of the topics. In fact, there was no statistical difference between the four groups on the tests of subject matter competence. While the inventor of a novel teaching method would like to see a superior result over the more conventional strategy, the test results supported the premise that students learn through teaching and provide encouragement for the development of other environments based on this type of strategy. In an evaluation of attitudes towards computer aided instruction, there was actually a slight dampening of enthusiasm after the use of the program. This was probably the result of having to learn how to use the interface. Students, however, were generally positive in their assessment of the technical aspects and enjoyed their experience. We could not ask the readers the same questions. However, almost all of them were unhappy to have to use the conventional approach and would have preferred to use the computer program. A Turing test of the conversational software revealed that students were willing to consider that Jack was a real person conversing with them through the use of a computer. Students expressed positive sentiments towards the computer program and the accompanying materials. There were no bugs or computer crashes while the program was running.

Obviously, there are limitations to the effectiveness of any evaluation. The tests of competence may include questions which are either not valid or not useful in testing the possible outcomes. Attitude questionnaires can inadvertently bias the respondent to give a desired answer. The sample group of users may not be typical of a larger population for which the software has been designed. It is also possible that the Hawthorne effect will be the reason for the positive evaluation when a novel teaching method is introduced. There is still a lack of standards and procedures for determining such things as screen design, font and size, and use of colour although certain conventions are becoming established. However, these limitations should not impede the use of more evaluation and assessment of the instructional package.

Good instructional design includes developing the goals and objectives, building an effective environment for learning, testing and revising the environment as real users pass through it, and providing the evidence that the environment has been effective. Through the use of methods proposed by the knowledge modeling approach, it would seem that the designers and producers of instructional materials can improve and refine their products as well as demonstrate their relative value.

Standard Assessment Components For E-Learning Materials

Dimiter Tenev
Department of Computer Science
Technical University of Sofia,
ditenev@lark.vmei.acad.bg

Vasil Vasilev
Department of Electronics
Technical University of Sofia,
vvasilev@lark.vmei.acad.bg

Tania Vassileva
Department of Electronics
Technical University of Sofia,
tkv@vmei.acad.bg

Vassiliy Tchoumatchenko
Department of Electronics
Technical University of Sofia,
vpt@vmei.acad.bg

Abstract: The paper describes a set of reusable software components appropriate for Web based tests design. All tests are developed as general-purpose components and are easily customized via XML files and/or XML data from a database. The tests are implemented as Java servlets, Java server pages (JSP) and Java applets. The communication between test components and Learning Management Systems follows AICC/CMI guidelines for Web-based CMI Systems. The proposed test components can be used to include assessment capability to any web-based learning material. They are appropriate for knowledge evaluation, for estimating achieved level of comprehension and problem-solving capabilities of the learners as well as for verifying their ability to apply obtained knowledge.

Introduction

Currently an increasing demand for web-based training on all levels, universities, continued education, training within organization and companies is observed. Supporting self-directed learning process needs appropriate mechanisms for evaluation learners' progress and learning achievements.

Tests are an important element of learning and remain an essential ingredient for gauging a learner's progress. Different test procedures for self-assessment and knowledge evaluation from a distance are recognized. The web provides an effective yet inexpensive way to test knowledge, skills, and attitudes. Most of today's available Web based educational courses are intended mainly to learning or include simple single choice tests without appropriate feed back to the learner. Well-designed tests should (Horton, 2000):

- Let learners estimate progress toward their goals
- Emphasize what is important and thereby motivate learners to focus on it
- Let learners apply what they have been learning-and thereby learn it more deeply
- Monitor success of parts of the course so that the instructor and designers can improve it.
- Certify that learners have mastered certain knowledge or skills to meet a legal or licensing requirement.

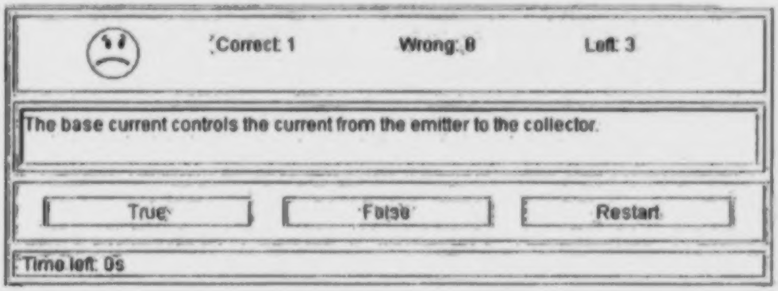
To answer market demands for knowledge testing in e-learning products and to facilitate tests design for different subjects our goal is to build generic software components that implement most widely used question types. The paper describes a set of reusable software components developed to fulfill requirements to Web based tests design. These components have to be easily customizable in order to be reused in test designs for different subjects. They should ensure adapting system to an organization's corporate identity as well as multilingual support. Another important requirement is their possibility to interface with Learning Management Systems (LMS) in order to keep assessment results in a centralized repository. For many kinds of tests, answers can be scored and result recorded automatically. Learning management needs statistics and reports, personalized curriculum and accesses, as well as multiple trainer and tutor support.

General-purpose Test Components

The most common used test types are the multiple-choice test, quiz, discovery test (discovery difference, discovery mistake), problem solving test, ordering test (sequencing or construction test), matching test, true or false test, fill in blank test etc. The paper describes functional specification and implementation of several test type questions. All tests types are developed as general-purpose components usable in different subjects, by different tutors and different language.

True/False Questions

True/false questions require learners to decide between two alternatives, typically saying whether a statement is true or false. This type of questions is organized as a time limited quiz. The idea is to emphasize what is important in learning material and thereby motivate learners to focus on it. Fig. 1 shows user interface of such test component. Scoring each question as the learners answer it provides immediate feedback, makes tests more fun and prevents misconceptions.



Correct: 1 Wrong: 0 Left: 3

The base current controls the current from the emitter to the collector.

Time left: 0s

Figure 1: True/False test with indicated incorrect answer

Multiple choice questions

Multiple-choice questions display a list of answers for learners to choose from. There are two main types of multiple-choice questions: *pick-one and pick-multiple*. The first type asks the learner to pick just one item from a list. The second type lets the learner answer by clicking one, some, all or none of the alternatives.

Fig. 2 shows a user interface of developed multiple-choice test. It allows more sophisticated questions than are possible with single-answer or true-false tests. They require making a series of related judgments. Scoring is performed after learners have answered all questions. Check facility marks correct and incorrect answers with different icons and delivers feedback to the students by summarizing results.

Multiple-choice questions are convenient for estimating learners' progress. They are easy to construct and easy to understand, but they do tempt some learners to guess rather than think.

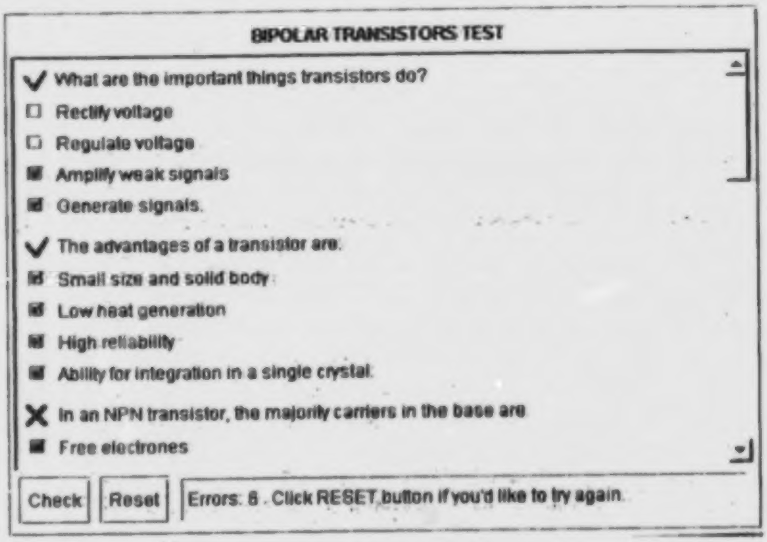
Drag and drop questions

Drag and drop questions require learners to move icons or images to specific location on the screen.

BEST COPY AVAILABLE

Drag and drop questions test the ability to assign the correct category or to arrange the parts of a system into a whole. They are used in several cases to test learner's ability to:

- Name things by dragging names into them
- Classify things by dragging them into boxes representing the categories
- Rank things by dragging them into position along a scale
- Assemble the pieces of a whole
- Show relationships among a family objects.



BIPOLAR TRANSISTORS TEST

✓ What are the important things transistors do?

☐ Rectify voltage

☐ Regulate voltage

☑ Amplify weak signals

☑ Generate signals.

✓ The advantages of a transistor are.

☑ Small size and solid body

☑ Low heat generation

☑ High reliability

☑ Ability for integration in a single crystal.

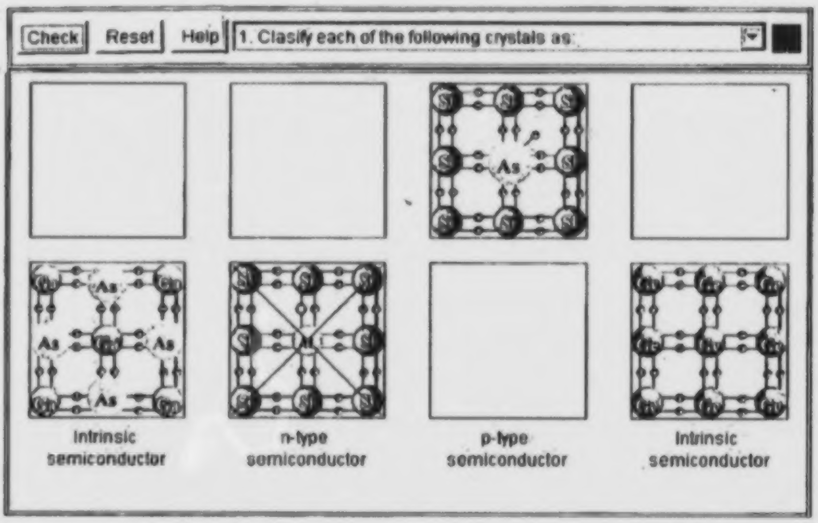
✗ In an NPN transistor, the majority carriers in the base are

☑ Free electrones

Errors: 8 . Click RESET button if you'd like to try again.

Check
Reset

Figure 2: Multiple-choice test with marked result



1. Clasify each of the following crystals as:

Check
Reset
Help
Si
As
Ge
Intrinsic semiconductor
n-type semiconductor
p-type semiconductor
Intrinsic semiconductor

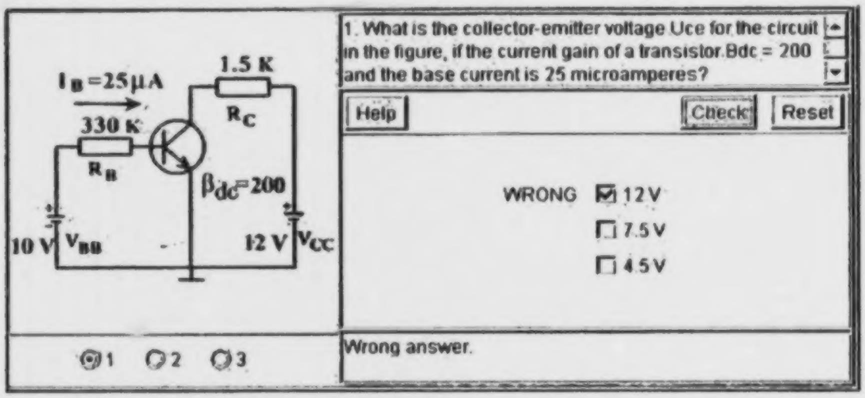
Figure 3: Matching image to text example

BEST COPY AVAILABLE

Fig. 3 shows an example of matching drag and drop test. It is used to test level of comprehension achieved by the learners and ask student to classify type of crystals non-considered before in the lesson.

Problem-solving questions

Problem -solving test (Fig. 4) verify learners' capabilities to apply obtained knowledge and check their ability to resolve problems not considered before.



1. What is the collector-emitter voltage Uce for the circuit in the figure, if the current gain of a transistor Bdc = 200 and the base current is 25 microamperes?

WRONG ☑ 12 V
☐ 7.5 V
☐ 4.5 V

Wrong answer.

Figure 4: Problem solving test

Tests Components Implementation and Customization

The test components are implemented as Java servlets, Java server pages (JSP) and Java applets. The communication between test components and LMS follows AICC/ CMI guidelines for Web-based CMI Systems.

All tests are developed as general-purpose components. To promote the widest possible adoption they are easily customized via XML files and/or XML data from a database. XML is a powerful, flexible, industry standard markup language used to encode data models for Internet-enabled and distributed applications. The XML structure conforms to LMS Question & Test Interoperability Specification. A custom java application named *Test Assembler* is developed to simplify the customization of test components.

Conclusion

The paper describes a set of reusable software components appropriate for Web based tests design. The functional specification of these components is outlined. The multiple-choice test, quiz, problem-solving test, construction test, matching test, true or false test are considered. The test components are implemented as Java servlets, Java server pages (JSP) and Java applets, which ensure platform independency. They are:

- General-purpose for using in different subject
- Platform independent and applicable to any hardware and software environment.
- Easy customizable for any subject and any language
- Compatible with Learning Management Systems (LMS) and support any language.

The proposed test components can be used to include assessment capability to any web-based learning material. They are appropriate for knowledge evaluation, for estimating achieved level of comprehension and problem-solving capabilities of the learners as well as for verifying their ability to apply obtained knowledge.

References

Horton, W. (2000), *Designing Web-based Training*, John Wiley & Sons, pp.273

BEST COPY AVAILABLE

KEY STEPS FOR DEVELOPING E-LEARNING EVENTS – INTERACTIVE COURSEWARE DEVELOPMENT

Ms. Tenku Norishah Tenku Shariman
Head of Internet-based Degree Programmes Unit (IBDU)
Multimedia University, Malaysia
tengku.norishah@mmu.edu.my

Abstract: This paper will discuss and demonstrate (from initiation to completion and with real examples) the key steps, which are based on sound instructional design principles, for developing an interactive web-based e-learning courseware. The courseware that has been developed uses the web as the main interaction platform. Active learning is realized through cooperative and collaborative learning techniques which are integrated within the courseware. Support rendered includes the availability of rich learning resources, electronic workspaces and teacher presence (via on-line). The following sections will discuss the elements of the development process and how these elements have been translated into a web-based learning environment.

I. INTRODUCTION

Technology has revolutionized business; now it must revolutionize learning.
"We need to bring learning to people instead of bringing people to learning." (The Maisie Centre, Tech Learn 1999)

Powerful new technologies continue to create new possibilities for innovative delivery systems and creative learning outcomes. The broad definition of technology in education will probably continue to change and evolve in the foreseeable future. The application of new technologies to improve teaching and learning will necessarily follow ongping invention and development of new hard and soft technologies. For example, fast computers, the popularity and accessibility of the Internet, and the wide bandwidth of communication networks are together revolutionizing the traditional educational process. But merely allowing learners access to computers and networking them to the Internet, however, represent no 'real' advance. Improving students' learning in a digital environment requires the availability of powerful and insightful content. It is important to remember that the emphasis here is on LEARNERS, NOT on the TECHNOLOGY.

Successful e-learning may take place when learners are given the opportunity to experience free exploration of information as well as within strictly controlled environment. Educators should take into account the various learning styles before deciding to develop a learning activity. Instructional technology provides a vast array of media for us to choose from. Therefore it is important that a great emphasis on human needs and human characteristics is given.

II. INTERACTIVE E-LEARNING CONTENT

What does interactivity mean?
Interactivity means engaging and rewarding the learner during the e-learning event, not by leading them through page after page of theories only but giving them opportunities to explore, to practice (to fail even) and to emerge better equipped to tackle the tasks they face.

- Frequency of interaction
- Complexity of interaction
- Feedback Content and Quality
- Balancing Comprehension and Significance
- Learner Control

How can we produce interactive e-learning content or e-learning event?
Certain things we should always remember when we are designing e-learning event:
The learning events should

- emphasize on practical and meaningful learner involvement
  should connect solidly to instructional objectives
- encourage self-exploration
- take into account and respect existing knowledge
- focus on individual learners as fully human beings

- always emphasize on a democratic form of teaching because it would bring out strong individual effort in most learners.
- design activities that promote active learning

In essence, the e-learning event should be developed in such a way that learners are able to have a sense of focus and task orientation without feeling brutally forced to do work.

III. THE KEY STEPS (based on Instructional Design Principles)

The key steps are:

- Analysis of the setting and learner needs
- Design of a set of specifications for an effective, efficient, and relevant learning environment
- Development of all learner and management materials
- Evaluation of the results of development both formatively and summatively.

1. Analysis

- To analyze the problem areas that give rise to the learner's need for the learning event
- To analyze strategies which could make the learning experience more motivating and effective for the audience.
- To analyze how the various sections of the learning event will fit together:
  - Define learning objectives of learning event
  - List topics to be included in the learning event
  - List the pre- or co-requisites needed by the learners.
  - How many minutes/hours of study will be included in the event?
  - How is the event going to be delivered to the learner?

2. Design

- To design learning materials which are appropriate for the learner
- To design the structure for the content of the learning materials
- To design effective instructional strategies which include all three of the following components:
  - i. presentation to learners of new information related to the learning objectives
  - ii. activities by learners that require them to process the information and to provide a response
  - iii. assessment items which matched desired learning objectives
  - iv. feedback to learners to provide reinforcement for desirable responses and remediation for undesirable ones

  (Barritt, Lewis, Wieseler, 1999)
- Thiagarajan (1993) suggests three types of knowledge with specific instructional strategies:
  - Factual information
  - Conceptual
  - Procedural
- Content Design may the following e-learning activities:
  - simulation, case studies/problem solving, asynchronous discussion, debates and e-seminars or games with ample opportunity for online skills practice, testing and feedback.

3. Development

- Developing a navigation flowchart
  - The structure of a learning event -- a map showing the relationships between the pages/individual screens that together form the learning event
  - In order to navigate through a e-learning event successfully, learners need to answer the following questions:
    - i. Where am I?
    - ii. How did I get here?
    - iii. What can I do here?
    - iv. Where can I go?
    - v. How do I go there?
- Developing a storyboard
  - A storyboard is a pictorial and/or written synopsis of text, graphics, videos and animations, shown in the order they will appear in the finished presentation. A storyboard is one method which allows you to plan out in a simple fashion:

        i. How the major sections of the narrative look
        ii. In what succession they appear
        iii. The relationship between them
    - To create a strong, consistent visual design, where important elements are emphasized, and content is organized logically and predictably.
    - Components of a storyboard

- Developing the GUI (graphic user interface) and the various screen templates
    - The GUI identifies the learning event for the learners and provides them with an interface between themselves and the materials developed for the event.
- The graphics MUST:
    - Convey and illustrate the message/ content when the content is not explanatory enough
    - Enhance the message when the message is already clear in the text
    - Support the message when the message is already clear in the text
    - Allow interaction between the learners and the content.
- Screen templates help learners understand how the materials are structured because screen templates forms a mental map. Screen templates can include the following:
    - Topic menus
    - Introduction and topic summary screens
    - Materials discussion screens
    - Learner assessment screens
    - Event information screens
    - Materials presentation screens
    - Additional resource screens
    - Advanced organizer screen

4. Evaluation

- As part of the design and development process, you will have to complete a formative or ongoing review of the project to determine the appropriateness and overall effectiveness of learning materials
    - Using a formative evaluation procedure where learning materials are systematically examined to ensure they are meeting the goals and objectives set for the event as well as meeting the overall standards set out for the project.
    - Using a summative evaluation for material improvement prior to the material being delivered for the first time.

IV. OTHER IMPORTANT ISSUES

Learning Standards Compliant for Content Development

- To comply to International Learning Standards (for example: SCORM) content for e-learning should be designed as reusable learning objects.
- Definition of a learning object:
    - "Assignable units" for a learning management system
    - The smallest unit that a LMS assigns and tracks
    - A meaningful division of learning that is accomplished by a student in a continuous effort – that is one sitting (Jordan, Mann, Regalado, 2000)

Utilizing LCMS for delivery of e-learning content

The Virtual University Portal, which integrates Multimedia University's Learning Content Management System, provides a supportive web-based learning environment for students. The courseware developed fully utilizes this supportive environment to provide an active and interactive learning experience for learners.
Supported by the LCMS, the learning events within the courseware include cooperative and collaborative activities which "enable learners in a group to harness each others ability, skill and knowledge and thus, enabling learners to 'govern themselves' (Bruffee, 1998).

V. CONCLUSION

Whatever development environment, tools and technologies are used, sound instructional design will remain important. The combination of thoughtful planning with intelligent deployment of advanced authoring tools will result in myriad benefits for both content developers and learners. The most successful e-learning content should not only provide interactive e-learning events, but also relevant and meaningful context, which are able to grasp and retain the attention of learners as well as effectively guide learners to achieve the desired learning objectives.

THANK YOU

Note: Examples will be given for each key-step of the courseware development process and finally, the paper will end with a demo of a completely developed courseware.

REFERENCES

Barritt, C., Lewis, D., & Wieseler, W. (1999). *Cisco systems reusable information object strategy. Version 3.0* Cisco Systems, Inc. Retrieved October 20, 2001 from the World Wide Web: http://www.peer3.com/text/knowledge/ke_whitepapers.html

Kemp, JE and Smellie, DC (1994). *Planning, producing and using instructional technologies*. (7th edition) New York: Harper Collins.

Jordan, D. H., Mann, J., & Regalado, U. (April 25, 2000). An instructional design perspective: Implementing the shareable courseware object reference model. White Paper, Booz-Allen & Hamilton Inc. Retrieved August 22, 2001, from the World Wide Web: http://www.peer3.com/text/knowledge/ke_whitepapers.html

Maggs, A., McMillan, K., Moore, J., Mulligan, I., and O'Brien, P. (1990). *Instructional design - a systems approach*. Sydney: SRA.

M. David Merrill (1999). Instructional Transaction Theory (ITT): Instructional Design Based on Knowledge Objects. In Charles M. Reigeluth (Ed.). *Instructional Design Theories and Models: A New Paradigm of Instructional Technology.* Lawrence Erlbaum Associates. This chapter describes the IDVisualizer.

Reigluth, C.M., & Schwartz, E. (1989). An instructional theory for the design of computer-based simulations. Journal of Computer-Based Instruction, 16, 1-10.

Thiagarajan, S. (1993) Rapid Instructional Design. In G.M.Piskurich. (Ed.) ASTD *handbook of Instructional Technology.* New York: Mc Graw Hill Inc. Retrieved February 31, 2002 from the World Wide Web: http://www.thiagi.com/article-rid.html

Towards a total learning environment for the distanced adult learner

Sarah Teo Siew Chin
ICUS Pte Ltd
sarah@icus.net

Abstract: With the advent of the web-technology, learning at a distance takes a different form from the way many adults are used to in their earlier days in school. Considering how a distanced adult would have to learn and taking account of the traditional way in which he is familiar with, a holistic on-line learning environment is suggested in this paper. The learning environment includes the instructive environment, the situating and constructive environment, the supportive environment, the communicative environment, the collaborative environment, and the evaluative environment. Activities for learner participation are recommended for each environment.

The distanced adult learner

From the works of three researchers, C. Rogers, P. Cross and M. Knowles, we draw common principles for learning that are applicable to adults. Significant learning takes place when the subject matter is relevant to the personal interests of the learner. Adult learning programs should capitalize on the experience of participants. There is a need to explain why specific things are being taught. Adults need to be involved in the planning and evaluation of their instruction. Experience (including mistakes) provides the basis for learning activities. Adults are most interested in learning subjects that have immediate relevance to their job or personal life. Adult learning is problem-centered rather than content-oriented.

In addition to that, we also identify the requirements of an adult learner when he learns from a distance. The distanced adult trainee is isolated and he has many commitments besides work in the office. The element of motivation is thus a crucial issue. Major issues that face the distanced learner would be the lack of face-to-face communications with fellow classmates and teacher and the lack of immediate response that he gets when he was in a physical classroom. To ensure that learning is meaningful and focused, and that the learner "sticks to the course", he needs to become and stay responsible for themselves. The self-esteem of learner must be maintained and increased as he takes the on-line course. Opportunities are provided for the learners to interact with one another. Support is provided when needed in the course of their learning.

The total learning environment

The on-line environment should emulate the current traditional method that the learner is most familiar with. We consider the holistic environment that the adult learner has in a school / campus / home. We attempt to bring the various classroom/corner/library/study room into the total learning environment for the working adults, all at a distance, physically away from the teacher, from his classmates.

The total learning environment consists of sub-environments put together to ensure a meaningful and memorable learning experience. Learning does not happen from only one specific source. It happens through various means, from different persons. In a holistic learning environment, the following components are essential: the instructive environment, the situating and constructive environment, the supportive environment, the communicative environment, the collaborative environment, and the evaluative environment

The instructive environment

"Content is king" – it was said. The basic element in learning is the content, developed based on specific learning needs and objectives. This can be developed on print-based material, videotapes, workbook, posters and multi-media computer based training courseware, web-based on-line learning materials. These are domain knowledge and instructional strategies put together to ensure that learners learn. These instructions would answer to knowledge, comprehension and at most application level in Bloom's taxonomy.

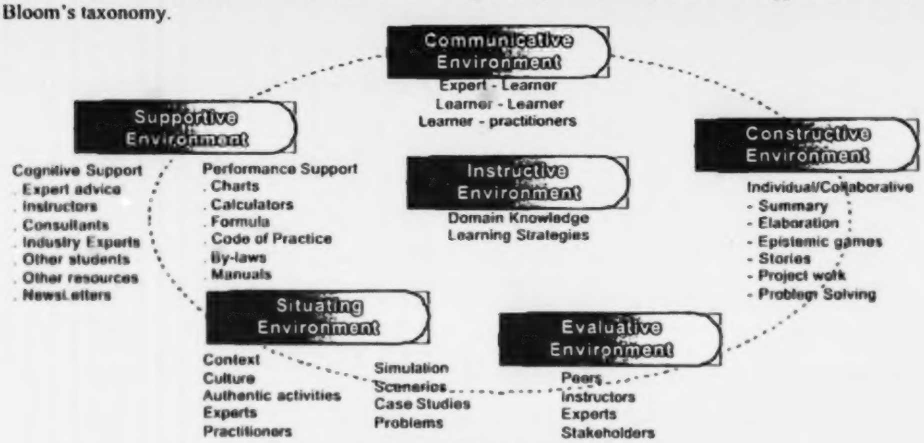

Communicative Environment
Expert - Learner
Learner - Learner
Learner - practitioners
Supportive Environment
Cognitive Support
. Expert advice
. Instructors
. Consultants
. Industry Experts
. Other students
. Other resources
. NewsLetters
Performance Support
. Charts
. Calculators
. Formula
. Code of Practice
. By-laws
. Manuals
Instructive Environment
Domain Knowledge
Learning Strategies
Constructive Environment
Individual/Collaborative
- Summary
- Elaboration
- Epistemic games
- Stories
- Project work
- Problem Solving
Situating Environment
Context
Culture
Authentic activities
Experts
Practitioners
Simulation
Scenarios
Case Studies
Problems
Evaluative Environment
Peers
Instructors
Experts
Stakeholders

Figure 1: The total learning environment

Content with achievable objectives, essential components of a lesson – including introduction, body content, conclusion and practice and self-evaluation. The attainment of objectives provides learning satisfaction, which acts as a motivation for moving on to the next segment of the lesson, adding up to the whole module. For the very busy working person, every short period of recess from their work can be used for the attainment of new knowledge. In addition, the learner should be able to pick up the information quickly and easily as and when it is needed.

Situating Environment

Learning content should not be treated as a self-sufficient substance that is separate and independent of the situations in which it is learned and used. The activity and context in which learning occurs is in fact an integral part of what is learnt, instead of being regarded as separable from or ancillary to learning. Essentially, there should not be a separation between 'knowing what' and 'knowing how'.

John Seely Brown, Allan Collins and Paul Duguid said that learning must involve activity, content and culture as they are interdependent. The model of situated cognition is based upon the notion that knowledge is contextually situated and is fundamentally influenced by the activity, context, and culture in which it is used. Learners need more than abstract concepts & self-contained examples - they need full-blooded, authentic activity. Authentic activities refer to the practices of the culture. The authentic activities include the breakdown from task to operations to actions that the learner needs to take for solving a problem. Such situating aids in initiating the learners into the working practices and culture of the real world as well as transferring the learnt knowledge to the authentic situations.

Transfer of knowledge from the instructive environment to the real-life environment is made concrete through situating the learner in their environment of their own culture, context and with authentic activities rather than merely providing the knowledge in the instructive environment. Learners should be required to perform tasks and solve problems in an environment that exposes them to the multiple uses to which they can apply their knowledge in future. Thus, the emphasis is on the use of conceptual, factual, procedural and principle knowledge to solve problems that are situated in the contexts of these knowledge. Learners will then develop a deeper understanding of the meanings of the knowledge, as they are able to develop memorable associations between knowledge and problem solving contexts.

By providing the learner a situation around an environment that he would encounter in his workplace, we provide the additional link to familiarity before he even meets the situation. This is preferred to a cold-start to the actual application of the learning.

The Constructive environment

The instructive environment that holds the content, remains the central part of the learning environment. It would start from the approach of posting the domain knowledge to the learner, in various

BEST COPY AVAILABLE

forms. As the learner picks up the knowledge, construct his own knowledge from it, he returns the newly constructed knowledge back to the system, adding up to the knowledge base. (CK Looi, 1998/9)

Learners should not be passive receptacles of knowledge. Papert (1990) distinguishes between constructionism and instructionism, arguing in favour of a constructivist model of learning where the learner will construct his own knowledge instead of relying on the teacher.

Collins and Ferguson (1993) proposed epistemic tools as the basic building blocks for knowledge construction to help learners to recognize, judge and organise patterns of information, engaging learners in constructive inquiry. Epistemic forms are "target structures" that guide inquiry.

In designing and developing simulated scenarios, there is requirement to provide various situations. As suggested by Situated Cognition supporters, situations should be varied and practice multiple, so as to prevent over-situating. As we develop the system for adults, we aim to capitalise on the vast experience of the adults. We allow them to share their experience, success and failure stories of projects, their encounters in war scenes, their experience in surviving in the jungle. These sharing are used as resources for designing of context-rich simulated scenarios and case studies.

The instructive environment, situating and constructive environment should be brought together in each lesson. This provides a proper seamless flow from learning new knowledge to practicing new knowledge and finally, to transferring new knowledge to the learner's own culture, context and activities.

Supportive Environment

There are two forms of support that the learner needs in the accomplishment of learning outcomes: performance support and cognitive support. Performance support comes in the form of tools for the performance of certain tasks that are required for the achieving of certain specific objectives, specific to the lesson or general to the course. Examples of these are cost-calculation tools, project scheduling tool that are required in a management course. Maps, coordinating instructions, compass, calculators, table of formulae are some performance support tools used in simulated military mission exercises.

Cognitive Support is provided by people who would be able to provide the coaching, molding, scaffolding and feedback to the learner, so that his knowledge is built up and eventually, he may reach an expert level to join in as an expert providing similar cognitive apprenticeship to others. We learn from many different groups of people. In this pedagogical framework, people where knowledge lays generally are identified: the learner himself, his peers, his instructor and the industry experts. Industry experts can be employed on a contract basis to provide the industry expertise, through published papers on related topics, newsletters, answering to specific queries, providing consultancy to specific projects, sharing of industry trends. Eventually, these questions and answers are kept in the FAQ (Frequently Asked Questions) section. And used as part of the content in the instructive environment.

Communicative environment

Learning on-line has the disadvantage of "hermit learning", i.e. learning on your own, in your own shell, without having to leave the home, without having to meet anyone. This goes against the human need of socialising, of having the sense of belonging. The communicative environment is essential to providing the learner with a sense of being with someone in the same pursuit. This need is even more acute for the not-so-independent learners, especially those who are used to learning with others. Communication must be encouraged in any distanced courses. The communicative environment is supported by the way the lesson is written and proper communication approach in face-to-face sessions. "Talking" tone should be used throughout the textual lesson to ensure learner of a personal, approachable teacher, not unlike that which he is familiar with in his earlier days in school.

The use of email, threaded discussion, echat, video conferencing, and audio-conferencing are some ways to encourage communication amongst the community of learners. However, while these tools may be amply provided, it requires the active participation of all involved. Feedback or replies need to be timely and constructive. Learners need to be assured of the receipt of assignment submitted to the instructor. Evaluation of the submitted assignment must be provided to the learners soonest so that learning of the following lessons will not be hampered. When learners are actively communicating and interacting with experts for the purpose of solving problems and performing tasks in a domain, a culture of expert practice that helps situate and support learning is created.

Collaborative environment

Working collaboratively allows one to view objects with varied perspective, providing a richer learning environment. Groups are not just a convenient way to accumulate the individual knowledge of their members. They give rise synergistically to insights and solutions that would not come about without them. This mode of problem solving is therefore an additional source of scaffolding for the learners as the knowledge is distributed throughout the group of learners.

Learners are given the situated opportunity to develop skills needed for collaborative work. With the collaborative nature of today's workplace, knowing how to learn and work collaboratively is increasingly important. Assignments and projects should be designed to promote collaboration among the learners. The social aspect in learning is catered for, as teamwork is required in completing the assignments or projects.

Evaluative Environment

Evaluation is concerned with judgements of worth. Different people who have legitimate interests in the evaluation data collected should be involved in evaluation. These stakeholders are the learners, peers of the learner, the instructor himself, the experts and those who manage and sponsor the course.

Evaluation focuses on two main aspects: learning effectiveness and training efficiency. Learning effectiveness is concerned with the assessment of worth within the training event. It addresses questions such as 'How much has been learned' or 'Have the methods selected worked well'. On the other hand, training efficiency assesses the value of training event in terms of operational indices (e.g. wastage rates, quality), financial indices (e.g. increased output from given resources) and personnel indices (e.g. work punctuality).

Different stakeholders employ different criteria of worth to evaluate the success of a program. For instance, sponsors of the training program would be more concerned with measuring the efficiency of training to determine if there is a reasonable rate of return on the resources expended on the training program. Adult learners would place emphasis on learning effectiveness to ensure that what is learnt will be of immediate relevance to their job or personal life. Self-evaluation should be provided for each module. This provides for the learner his progress in the course. Remedial action can be taken to ensure pre-requisites before the next level or chunk of knowledge is provided for him

Conclusion

On a distanced mode, it is critical that the adult learner is provided with a holistic environment in which knowledge is presented in an authentic context with the settings and applications that would be of immediate relevance to him. In this environment, learning is acquired through opportunities for reflection, active construction of knowledge as well as by means of social interaction and collaboration. Careful and deliberate consideration is required in planning and designing the learning events so that the various sub-environments are integrated and blended for a meaningful and memorable learning experience, leading to a synergistic impact on learning.

References

Brown, J.S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher. 18(1)*, 32 - 34.

Collins, A. & Ferguson, W. (1993). *Epistemic forms and epistemic games: Structures and strategies to guide inquiry*. Educational Psychologist.

Knowles, M. (1984). *Andragogy in Action*. San Francisco: Jossey-Bass.

Looi, C. K. (1998/9) *Interactive Learning Environments for promoting inquiry learning*. Journal of educational technology systems. Baywood Publishing Company, Inc.

Papert, S. (1990) Introduction, in Constructionist Learning, I. Harel (ed.), MIT Laboratory, Boston.

Rogers, C.R. & Freiberg, H.J. (1994). Freedom to Learn (3rd Ed). Columbus, OH: Merrill/Macmillan.

CD-ROM Enabled Web Sites

by
Dr. Thane Terrill
Teachers College, Columbia University

Conceptual Overview

This paper will examine how to incorporate CD-ROM media with a web server in such a way as to maximize the sophistication of content while minimizing bandwidth constraints. Distance learning courses are frequently forced to accommodate the lowest common denominator amongst students. The limiting factor is almost always bandwidth. Given that most distance learning courses have their materials prepared before the course starts, it makes sense to transfer the materials to the students on a CD-ROM before the course begins.

Internet Bandwidth Inequalities and Limitations

It is easy to take the frequent announcements of the Internet's triumph as proof of its ubiquity. Unfortunately, this is little more than preaching to the choir. Those not enjoying the benefits of the Internet are, by their absence, prevented from disagreeing. Examining maps of Internet connectivity like *An Atlas of Cyperspaces*,[1] one discovers that Internet access is completely unavailable in many parts of the world and unevenly distributed everywhere else. The unpleasant reality is that even a highly motivated student may find it impossible to obtain the connectivity required for an Internet-based course.

In a distance-learning course, where participation is mandatory, instructors are often forced to remove desirable features from their web sites so that none of their students can claim they are unable to participate in the course.

Even within North America, the average connection speed is approximately 35kb[2]. While this speed is sufficient for browsing web pages that are mostly textual, this speed is not enough for good quality video streaming or for opening documents with numerous graphics.

Integrating the CD-ROM

The method by which a web site can be "CD-ROM enabled" is actually fairly straightforward. The instructor places all the course materials on the web server. The same content is then placed on a CD-ROM, which is mailed to all students enrolled in the course. While a static web server can be used with a CD-ROM, the project works far better with a dynamically built web site that builds a new page whenever it is accessed.

The key is that the user logs into the server and in his or her preferences tells the server the location of the CD-ROM drive. So, for example, on a standard PC, the CD-ROM would most likely be in drive "D" or "E." When the web server builds a page or produces a search engine listing, it is able to draw the content from either the web server or from the CD-ROM. Naturally, loading content from the CD-ROM would be equivalent to loading from the fastest Internet connection.

While the author is unaware of anyone having developed a "CD-ROM enabled" web site like the one just described, the basic concept is actually quite common. Most of the largest Internet sites, like Yahoo! and CNN, dynamically adjust the location of the content so as to make for faster delivery. Usually, these large sites contract with content distributors, like Akamai (http://www.akamai.com) and Digital Island (http://www.digitalisland.net), to position content in multiple servers strategically located. When a visitor comes to a web site, the content distribution system sends all or part of the content from the server closest to the visitor. By finding the fastest path through the Internet, the user has the fastest possible download and the provider has off-loaded traffic to remote servers. Drawing content from a CD-ROM on the users own computer is just one more application of the principles of content distribution.

Technical Aspects

Naturally, any system that requires a high level of complexity can be seen as solving one problem at the cost of creating another problem. This project is fairly simple for anyone already familiar with creating a database-based web site.

The core of the system is the database. In a database-based system a record in the database, whether it be a Word document, an HTML page or a streaming video file, references every content object. To "CD-ROM enable" the site, the database must have an additional field indicating that the content object is on the CD-ROM. If there is more than one CD-

ROM or there are multiple editions, additional fields may be required. The database also needs to have an additional field in the user preference database. The most important new field is the one that designates the location of the user's CD-ROM drive. More fields may be required for more complex requirements.

The code that builds web pages and displays the results of on-line searches needs to be augmented so as to offer an auxiliary link when content is known to be on the user's CD-ROM. This activity may take two essential forms: 1. the web page may be automatically loaded from the CD-ROM and the user is not offered an option; and,2. the dynamically built web page may display links that are both on the server and on the CD-ROM.

In some situations, additional steps may be required. For instance, in a situation where a document has been updated but must retain the same filename and location, the system would have to be told to ignore the version on the CD-ROM. The simplest way to accomplish this by clearing the field that indicates the file is on the CD-ROM. However, with very large documents, it may make sense to allow the user to pick the file from the CD-ROM with some sort of indicator that there is a newer version. This would be a desirable option for someone in a poor bandwidth situation with a large document or video file when the differences between the CD-ROM version and the version on the web site are trivial.

Requirements for Successful CD-ROM Deployment

Not every Internet project can benefit from the use of CD-ROMs. The content to be delivered must be specific enough to be containable within the 700 mega-byte limit of a CD-ROM. Multiple CD-ROMs are possible, but may be unwieldy. DVD disks are natural successors to CD-ROM, but are not yet in wide enough use to be considered at this point. When DVDs become common, the use of high quality video becomes realistic.

While courses that have fairly static content are best served by having a CD-ROM, these CD-ROMs can be used in situations where new documents are being added or old documents are modified. New documents simply will not have an accompanying link for the CD-ROM. Modified documents will be marked in the web server's database as not being on the CD-ROM. Naturally, if the volume of new and modified documents are substantial, the instructor may consider sending out a second CD-ROM. In fact, the database can easily determine what to present on the web page based on which CD-ROM the student has in his or her possession.

Concluding Remarks

The integration of CD-ROM media with web servers gives the distance-learning instructor the freedom to design for the student's needs without consideration of bandwidth limitations. At some point in the future, the Internet will live up to its advertising and work-arounds, like the use of CD-ROMs to augment web servers, will be superfluous.

Bibliography

Taylor, Robert P. *Finding the Right Medium: Identifying the attribute of a medium that addresses a specific, well defined learning problem*, Delivered at the Second National Conference on Computing and Education, Athens, Greece, Nov 12, 1994.

Terrill, Thane B. *Human Rights Education CD-ROM.* Bahá'í International Community United Nations Office, New York, New York, January 5, 2000.

---

[1] CyberGeography, *An Atlas of Cyberspaces*, www.cybergeography.org

[2] Nua Internet Survey (http://www.nua.net/surveys/how_many_online/index.html)

Extending Distance Learning Courses with CD-ROM Media

by

Dr. Thane Terrill

Teachers College, Columbia University

Submitted to E -Learn 2002
October 15, 2002

Conceptual Overview

This paper explores how CD-ROM technology can provide a very effective way to overcome some of the Internet's extensive bandwidth and connectivity problems for distributing large volumes of static multimedia information to globally distributed users, particularly those users outside the high-technology areas of the world. The concepts explored came out of an actual project undertaken by the author in his capacity as Network Administrator for a religious Non-governmental Organization.

The Internet is unquestionably the most exciting medium for the delivery of educational content today. One of the principle beneficiaries of the Internet's global reach is the distance-learning instructor. While distance learning has expanded rapidly due to the development of the Internet, there are factors built into the Internet as it now functions that clearly limit the richness and depth of what a distance-learning instructor can offer students.

Limitations of technical proficiency on the part of instructors and students can be overcome with training. Other limitations, however, are harder to circumvent. One of the most significant is the limitation in access and transmission speeds on connections outside regions like North America. Universities in these better-connected regions of the world frequently have much better connectivity to the Internet than do many of their distance-learning students in other regions of the world. One result of this disparity is that the instructor must either reduce the sophistication and amount of the material distributed via the Internet or accept the loss of some percentage of prospective students. Unfortunately, the students left behind are usually the very ones most bereft of educational alternatives and most in need of distance education.

This paper argues that CD-ROM technology, when used as a means for storing and sharing data, can ameliorate the current limitations on distance-learning courses resulting from poor Internet connectivity.

Frequently, CD-ROMs, as a content delivery medium, are viewed only as a competitor to the Internet. This view is perhaps based on the differences between both the content creation tools and the type of content normally associated with each medium. While CD-ROM production is normally the realm of professional content creators using complex tools, like Macromedia's Director[1], the Internet has developed as a medium for which almost anyone can create content. Over time, the public has confused the properties of the content normally associated with CD-ROMs with the properties of CD-ROMs as a delivery vehicle. It is the author's contention that, when CD-ROMs are used to deliver content made by tools used primarily for the Internet, the resulting hybrid has properties very advantageous to the distance-learning instructor.

CD-ROMs can be viewed in Internet terms as packaged bandwidth delivered at ultra-high speeds. Clearly, CD-ROMs cannot replace all the interactivity of an Internet-based course nor can the content be updated in real-time. On the other hand, most content in a distance-learning course remains static for the duration of the course.

When viewed in terms of the poor connections available in most countries of the world, CD-ROMs become an attractive method for transporting static information, particularly if it is voluminous. As a complimentary method of delivering content worldwide, the CD-ROM is more than a convenience in many parts of the world; it may be the only realistic means by which Internet-based courses can be made fully available.

This paper will survey the current limitations of the Internet as a content delivery vehicle and will suggest how CD-ROMs can be used to work around these limitations. The author will then briefly describe the hybrid CD-ROM/Internet project that inspired the model described in this paper.

Internet Bandwidth Inequalities and Limitations

It is easy to take the frequent announcements of the Internet's triumph as proof of its ubiquity. Unfortunately, this is little more than sermonizing to the converted. The far more numerous but silent groups not enjoying the benefits of the Internet are, by circumstances, prevented from disagreeing. Examining maps of Internet connectivity like *An Atlas of Cyberspaces*,[2] one discovers that Internet access is completely unavailable in many parts of the world and uneven in its distribution everywhere else. The unpleasant reality is that even a highly motivated student may find it impossible to obtain the connectivity required for an Internet-based course.

In addition to these physical constraints, students may have other obstacles imposed on them. For example, students connecting to the Internet from their places of work may find that company firewalls forbid certain types of connections. Even when there are no apparent obstacles, Internet connections can prove fragile. On November 20, 2000, Australia lost a major sea cable to sharks,[3] and on February 9, 2000, China lost a major connection to the Internet to a fishing trawler.[4] In both cases, repairs took weeks. One need not look to the oceans to find significant outages. In August of 1999, MCI cut off a large segment of Chicago's largest firms in what MCI called a "meltdown of the network."[5]

Determining the Internet Value of CD-ROM Distribution

Internet usage in North America and Western Europe is well above that of other parts of the world. While Internet providers are creating new services to take advantage of the increasing number of high-bandwidth users in the Northern hemisphere, the needs of other markets are ignored. Reports from overseas suggest that, even when Internet access is available and dependable, users often limit their time to a few hours a month because of cost considerations.

When one looks at CD-ROMs as stored Internet bandwidth, it is logical to consider the cost of that bandwidth in terms of Internet transmission fees. In Zimbabwe, for example, a user with 14k baud modem would require approximately $170 USD to retrieve the 650 megabytes of information stored on a CD-ROM. A 56k baud user in Finland would pay approximately $25 USD. CD-ROMs typically cost from $0.50 to $1.50 USD each to produce.

Significant Advantages of the Distributing Static Content via CD-ROM

Using the common Internet formats (i.e. HTML, PDF[6], Real Audio, etc.), instead of the standard tools used to develop CD-ROM-based content, CD-ROMs become both easier to develop and easier to use. Not only does using common Internet formats benefit the content developer, it also reduces training time for the user, because he or she may already be familiar with Internet browsers. The learning curve is reduced further when the content creator follows commonly used Internet user interfaces. Traditional CD-ROMs frequently have non-standard user interfaces that make them hard to learn. While the Internet also has user interface issues, the use of a standard browser provides a basic level of consistency. Support concerns are lessened by the fact that the programs used are being used by millions of other users.

Additionally, the use of programs like Real Audio Player[7] or Apple's QuickTime player[8] make it possible to distribute video content without concern for conflicting video transmission standards (i.e. NTSC, SECAM, PAL) found with VHS video tapes. While streaming video over the Internet also circumvents this constraint, bandwidth demands for streaming video are often prohibitive. A nice side benefit of distributing content via CD-ROM is that the content creator does not need an expensive stream server, since the video is running from the CD-ROM. Moreover, in the author's experience, the quality of a video played from a CD-ROM is almost always better than the quality offered by an Internet connection.

Using a CD-ROM does not preclude the complimentary use of the Internet; it merely provides an alternate vehicle for the transmission of static content. Valuable Internet features not found in CD-ROM technology, like e-mail and discussion groups, can be allocated at available bandwidths.

To use a CD-ROM, the student need not own a computer, though access to a computer is essential. Fortunately, access to computers can often be found at schools, libraries, work places, Internet Cafes, and the homes of friends. One of the advantages of using an Internet-based CD-ROM is that it can be used without installing any new programs on the host computer. This is an important attribute, given that public computers are often set up to forbid the installation of software.

As long as the computer has an Internet browser, data can be read directly from a CD-ROM, as if it were a web site. Since the computer does not have to be connected to the Internet while a CD-ROM is being used, the user does not need to worry about accumulating charges or taking a telephone line out of service.

Concluding Remarks

The fragile and expensive international Internet connections that make CD-ROMs interesting as substitute bandwidth will probably continue well into the future. With the advent and broad distribution of reasonably priced DVD technology, the reasons for using "stored bandwidth" will be even stronger. In fact, DVD technology will allow for the inclusion of high quality video and other resources that go beyond the capabilities of the current Internet.

BIBLIOGRAPHY

Taylor, Robert P. *Finding the Right Medium: Identifying the attribute of a medium that addresses a specific, well defined learning problem*, Delivered at the Second National Conference on Computing and Education, Athens, Greece, Nov 12, 1994.

Terrill, Thane B. *Human Rights Education CD-ROM.* Bahá'í International Community United Nations Office, New York, New York, January 5, 2000.

FOOTNOTES

---

[1] Macromedia, *Director*, http://www.macromedia.com/software/director/

[2] CyberGeography, *An Atlas of Cyperspaces*, www.cybergeography.org

[3] Kiong, Lim Kok, *SEA-ME-WE3 Break Cuts Off Australia*, Singapore.Internet.com, November 21, 2000.

[4] Lemos, Robert, *Not found! China's Net access disconnected*, February 9, 20001.

[5] Rendleman, John, *MCI WorldCom outage cripples Chicago Board of Trade*, eWeek, August 11, 1999.

[6] Adobe, *Acrobat*, http://www.adobe.com

[7] Real Networks, *Real Player*, http://www.real.com

[8] Apple Computer, QuickTime Player, http://www.apple.com/quicktime/

The University of London eUniversity Project: Collaboration and Cultural Change in a Complex Institution

Cate Thomas
Virtual Campus Project Manager
Teaching and Learning Technologies Team
University of London External Programme
United Kingdom
cate.thomas@lon.ac.uk

Abstract: The University of London External Programme is developing an e-university to enhance its international distance learning programme, which currently has 30,000 students. London is a collegiate university and so this requires collaborative development between stakeholders in the Colleges and in the departments of the central University, all of which have their own distinct identity and culture. The aim is to create a virtual university of which all partners have ownership and in which all participate in designing, building, maintaining and further developing. The challenge of bringing this about, working with academics, technologists and administrators to bridge cultural, institutional and occupational divides has meant forging new ways of working. Change is being managed using a 'from the ground up' cross institutional approach and using existing technologies innovatively, to build the community essential to successfully grounding our project in the organisational culture.

Introduction

The University of London's External Programme has been providing distance learning opportunities for over 150 years. It currently has 30,000 students in more than 180 countries worldwide engaged in over 80 programmes of study. To enhance provis ion to students it is now developing eUniversity functionality. London is a Federal University, so the eUniversity provision is being developed as a collaborative project between the eighteen diverse Colleges and Institutes of London, and the central University. The project is led by the External Programme Teaching and Learning Technologies Team.

This paper will outline what this eUniversity project seeks to achieve and discuss the challenges and opportunities involved in implementing this within a large, complex institution.

What is the eUniversity for London?

There are three phases to this project. Phase one was completed in spring 2002 and involved building a portal website (http://www.londonexternal.ac.uk/.) The site provides potential students with a wealth of in-depth information and pre-course guidance about study opportunities. They can, for example, download prospectuses, get detailed advice about eligibility, access study resources about distance learning, find out about the specific College offering their programme and 'meet' ex-students. Current students on the first three e-learning pilot programmes can use the portal to: access resources specific to their studies through the online library; contact other students using the student-to-student mail network; download previous sessions' exam questions; work through online tutorials; and access up-to-the-minute news about their programme of study. All of this enables the University to provide a faster, improved and more comprehensive delivery of service to students and potential students. With around 70,000 hits on the site per day, the take-up rate for this first stage is encouraging.

Phase two involves the delivery of a Virtual Learning Environment (VLE) using Lotus Domino technology, which will provide fully functional online courses for students. Importantly, it contains a function to keep telecommunication costs down for the student, in that by hitting the 'offline' button the student can access all the tutorials, seminars and other materials and activities available without being connected to the internet for long periods of time. They can then hook back up when they wish to post a message. The London VLE offers a flexible, adaptable environment which course leaders can use to construct a wide range of differing learning experiences. It has been piloted with two courses and will go live with Finance and Management courses in August 2002. Other programmes will be introduced throughout 2003.

Phase three will involve students being able carry out a range of activities, such as application for courses and payment of fees, online. This will vastly improve the turnaround time for students' interaction with the University - a factor which is vitally important for a distance learner.

Developing Virtual Community

The Colleges and Institutes of the University are spread throughout London and the surrounding area, and each has its own distinct culture and identity. For those at the centre co-ordinating this development the challenge is to create a network where academics, learning technologists and administrators from all the Colleges can work collaboratively to create a shared, distance-learning, eUniversity which all can own and participate in. A 'from the ground up' approach is being taken by creating an interdepartmental, and intercollegiate network of early adopters. A significant challenge has been to find mechanisms to facilitate this network, given that those involved are geographically dispersed throughout a large city, are varied in their occupations and institutional approaches to network building, have differing levels of experience of e-learning and need to manage their involvement in this project on top of their already demanding workloads. A range of communication solutions has been trialed for implementing this, which have had varying degrees of success. So far we have found: that networks are more likely to work if they are initiated with a face to face meeting; that solutions which rely on participants initiating action such visiting a particular webpage regularly tend not to encourage active participation, even if the participants are prompted; that specific, highly focussed networks, linked to carefully selected resources have been far more successful than more generalised fora; and that solutions which push information to participants are more likely to result in active involvement.

Collaborating on technical solutions - the challenge of a shared VLE

Each College has its own distinct organisational culture, each provides a very different range of subjects, and approaches to teaching and learning vary right across the spectrum. How then could it be possible for the centre to provide an Institutional VLE that would not only meet such a diverse set of needs, but would also be sufficiently flexible to cope with unforeseeable future developments and, additionally, would meet the needs of our International student market?

A range of market leading 'off-the-peg' VLEs were trialed with early adopters in a number of Colleges. The conclusion was reached was that, although this was not necessarily explicit, each VLE has, to some extent, a built in pedagogical approach, which might be suitable for some courses but not for others. Additionally, investing in a VLE would mean being tied to that particular product because exporting content between VLEs was generally not a trivial task. From a business viewpoint this was not ideal, as any given software product does not have an assured future - it may be decommissioned or it may become marginal within the market. In order to futureproof development another kind of choice had to be made.

An additional important deciding factor was the need to provide an affordable service for students. The University of London External Programme 30,000 student body is International and there is no control over the speed of data transfer or cost of connectivity students might have when using the online materials. It was important that students should be able to take the Learning Environment offline and still have access to all the materials available in the online Environment. None of the standard VLEs available at the point when the platform was chosen were able to offer this.

The solution adopted was to use the existing functionality of Lotus Domino to create a wide range of different VLE tools. Course leaders can then choose from these and have them customised to meet the needs of their individual courses. This means that academics can participate in creating a Learning Environment where they can choose the teaching and learning approach that best fits their discipline. Additionally, the look and feel can be altered to meet Colleges' individual 'corporate' identities. Domino outputs HTML, so should the decision be made to change to another platform some years down the line, or should there be a need to work with more than one platform, the fact that the content is held in this reasonably 'neutral' format would be advantageous. Finally, in terms of offline access, an Environment build using Domino has the advantage of the domino offline services (DOLS) function which enables the full offline replication necessary for use by geographically dispersed distance learners.

Cultural Transformation

As an organisation, the External Programme of the University has long established and successful ways of working. The eUniversity development means that we will need to further develop the way we work in order to accommodate an electronic dimension, whilst at the same time continuing to run our existing business. This will be a complex process, requiring a sophisticated range of change management activities to be collaboratively developed to suit our needs. It is envisaged that the eUniversity functions will become embedded the way that the University's distance learning provision works. Rather than being a separate and distinct activity, as some commentators have anticipated the so called 'e-learning revolution' as being, they will merge with and complement more traditional modes of provision, enabling London to develop its 'e-university' in an evolutionary manner. One example of this is the organisation-wide Web User Group. This is facilitated by the Teaching and Learning Technologies Team and comprises delegates from all nine administrative departments. It's aim is to agree policy and strategy for the portal website, working hand in hand with operational aspects of all departments and integrating the availability of web based information with print based. Most participants are new to web development, but are very knowledgeable about their own specific area. What has evolved is a dynamic and creative group, which not only assists the appropriate development of the portal site, but also reflects back on other activities and processes of the organisation from the perspective of web site development. Thus adjustments are made, and the focus of the organisations work practice shifted by informed, collaborative discussion and activity.

Conclusion

The lessons that have been learned from this activity across London form our evolving model for a collaborative approach to supporting HE providers' virtual community building for e-learning. We believe that this essentially practical and workable model which is effective even in a such a large, diverse and traditional organisation, offers the wider HE community a window into an effective, time and task efficient method of building collaborative community across the divides of occupation, experience, culture and institution.

Smart E-Classrooms, Traditional Classrooms and Critical Thinking

Jennifer D. E. Thomas, Ph.D.
School of Computer Science and Information Systems

Jean F. Coppola, B.S., M.S., M.S., Ph.D.(c)
Information Technology

Barbara A. Thomas, R.N., M.A., M.S., F.N.P.
Lienhard School of Nursing

Pace University, 1 Pace Plaza, NY, NY, 10038
Email Contact: jthomas@pace.edu

Abstract

This paper presents the results of a study conducted to examine the impact on critical thinking of a traditional classroom versus a "smart e-classroom". Preliminary results compiled from data collected via the California Critical Thinking Skills Test instrument (Facione, 1998) indicate a moderate increase over a fourteen-week semester for graduate students. In addition, student perception results indicate that those in the smart e-classroom perceived more support for problem solving, critical thinking, and creative idea generation in the execution of their course activities, and by the textbook, than those in the traditional classroom. Strangely, they perceived conducting research to be better supported in the traditional classroom than in the smart e-classroom. There was no difference in the grades achieved. Student satisfaction surveys indicate students sustained or increased in satisfaction with the technology and its use in the classroom.

Introduction

The "smart e-classroom" is a classroom equipped with an array of high-end technologies designed to assist in the teaching and learning process. In our context, the smart e-classroom is defined as "an interactive multimedia electronic classroom networked to the Internet and housing a video/ audio/ keyboard/ mouse broadcast-on-demand system". (Coppola & B. Thomas, 2000) This system permits computers to be used individually or in teams. In team-mode, students can take control of each other's screens and keyboards and iteratively augment each other's work. Screens can also be projected to one or more stations and instructors can scan and intervene in the activities taking place on the various stations. These classrooms have the promise of contributing substantially to the education of students. (Branzburg, 2001; McDermott, 1998; Shneiderman, et.al., 1998; Soules & Adams, 1998). As such, we were interested in whether these classrooms have an impact on important learning skills, such as critical thinking (Facione, et.al., 1998). To this end, we conducted a study to compare the traditional classroom with the smart e-classroom, the results of which are presented here.

The Study

There were two sections of the same graduate introductory information systems course taught by one of the authors. One section was taught in a traditional classroom, with moveable chairs and the other in the smart e-classroom. The course was designed with a view to developing various aspects of critical thinking, including problem solving, conducting research, and creative idea generation, within a team-based approach. Course activities involved students working in teams at each class meeting, analyzing various aspects of a case, called Healthlite (Laudon & Laudon, 1999). At the end of the course, they analyzed a major case from the same textbook, called Ginormous, also in teams. Grades for these activities were recorded and analyzed along with the data collected via the California Critical Thinking Skills Test instrument (CCTST). Students' perceptions of the support offered to the acquisition of the critical thinking, problem-solving, conducting research, and creative idea generation were also collected, as was their perceptions of various aspects of technology's usefulness.

Results

Demographics:

There were 32 students in the traditional classroom section (TC), and 21 in the electronic classroom (EC). Most students were in the 20-29 age category (68% and 66%, respectively) and had moderate computer experience (50% and 67%, respectively). (See Table 1, below).

Table 1: Demographics

%		Gender		Age				Computer Experience		
	N	Male	Female	<20	20-29	30-39	39+	Min	Mod	Ext
TC	32	69	31	3	68	29	0	12	50	38
EC	21	52	48	0	66	29	5	9	67	24

CCTST Scores:

There were four fewer students taking the post-test than there were taking the pre-test in the traditional classroom and two few from pre- to post-test in the electronic classroom. There was relatively little change in the California Critical Thinking Test mean and mode scores for those in the traditional classroom from pre- to post-test. The mean went from 12.8 to 13.4 and the mode from 13 to 13.5. In the electronic classroom, however, the change was larger, from a mean of 11 to 14.5 and a mode of 10 to 14.5. In the traditional classroom, the median was higher on the post-test, 15, compared with 11 on the pre-test. It was about the same in the electronic classroom, nine on the pre-test and 8 on the post-test. (See Table 2, below).

Table 2: CCTST Scores

	Traditional Classroom		Electronic Classroom	
	PRE	POST	PRE	POST
N	30	26	22	20
Mean	12.8	13.4	11	14.5
Mode	13	13.5	10	14.5
Median	11	15	9	8
Std. Dev.	3.6	4.6	3.5	5.5

Performance:

There was no difference in performance on either of the cases. For the Healthlite case, the average grade was 78% in the traditional classroom and 80% in the electronic classroom. The average grade of the students in both classrooms, on the Ginormous case, was 78%. (See Table 3, below).

Table 3: Performance

%	Traditional Classroom	Electronic Classroom
Healthlite	78	80
Ginormous	78	78

Perceptions: Critical Thinking Skills Acquisition

Those in the traditional classroom perceived more support for conducting research (53%), than those in the electronic classroom (43%), in performing course activities related to the Healthlite and Ginormous cases.

(See Table 4, below). This result is strange as the electronic classroom permits access out to the Internet for research purposes. The electronic classroom was perceived to provide more support of problem solving, critical thinking and creative idea generation (Healthlite – 57%, 71%, 57%, respectively; Ginormous – 67%, 76%, 62%, respectively) than the traditional classroom (Healthlite – 53%, 66%, 53%, respectively; Ginormous – 56%, 59%, 50%, respectively), which is more in keeping with what was expected.

Table 4: Critical Thinking Skills Perceptions

	Traditional Classroom	Electronic Classroom
Healthlite		
-Conducting Research	53	43
-Problem Solving	53	57
-Critical Thinking	66	71
-Creative Ideas	53	57
Ginormous		
-Conducting Research	25	19
-Problem Solving	56	67
-Critical Thinking	59	76
-Creative Ideas	50	62

Conclusion

The results indicate a need for a more extensive study. While the CCTST scores showed a greater improvement from pre-to post-test for those in the electronic classroom compared to the traditional classroom, the performance scores showed no differences. In addition, the perceptions of the students did not match expectations with respect to conducting research wherein traditional classroom students perceived greater support than electronic classroom students, notwithstanding their ready access to Internet resources. The electronic classroom students did perceive better support of problem-solving, critical thinking, and creative idea generation than the traditional classroom students as was expected. Additional faculty teaching two sections of a course both in the traditional setting and in an e-classroom is important to understand relationship between final grades, the CCTST scores, and their own perception. The students' perception of the event did not match the action the faculty was able to witness in the classroom. Since the students register for a section of a course the selection to the e-classroom is random. We are not able at this time to see if a student changes sections based on their learning needs, (visual, auditory) to fit the environment. A more rigorous instrument needs to be developed which would address the pre- and post-student perceptions of the impact of the various technologies.

References

Branzburg, J. (2001, February). How well is it working? Customizing your technology assessment. Technology & Learning, 24-35.

Coppola, J.F., & Thomas, B.A. (2000). Beyond 'chalk and talk': A model for e-classroom design. *T.H.E. (Technological Horizons in Education) Journal*, 27 (6).

Facione, P.A. (1998). *Critical Thinking: What it is and Why it Counts.* Millbrae, CA: California Academic Press.

Facione, P.A., Facione, N.C., & Giancarlo, C.A. (1998). *Professional Judgement and the Disposition Toward Critical Thinking.* Millbrae, CA: California Academic Press.

Laudon, K.C. and Laudon, J.P. Essentials of Management Information Systems, 3rd Edition. NJ: Prentice Hall, 1999.

McDermott, I. (1998, January). Solitaire confinement: The impact of the physical environment on computer training. *Computers in Libraries,* 18 (1), 22, 24-27. Retrieved August 20, 1998, from the World Wide Web: http://www.infotoday.com/cilmag/jan/story1.htm

Shneiderman, B., Borkowski, E.Y., Alvai, M., & Norman, K. (1998). Emergent patterns of teaching/learning. *Educational Technology Research and Development,* 46 (4), 23-42.

Soules, A., & Adams, E. (1998). Classroom technology: A view from the trenches. *Educom Review,* 33 (3), 50.

USING WEB-BASED SOFTWARE IN TEACHER EDUCATION COURSES

Kelli Thomas
Department of Teaching and Leadership
The University of Kansas
United States
kthomas@ku.edu

Matthew Thomas
Department of Curriculum and Instruction
Central Missouri State University
United States
mthomas@cmsu1.cmsu.edu

David Hofmeister
Department of Curriculum, Instruction, and Media Technology
Indiana State University
eshofmei@isugw.indstate.edu

Andrew King
Department of Curriculum and Instruction
Central Missouri State University
United States
aking@cmsu1.cmsu.edu

Abstract: This brief report is part of an on-going research study that examines the use of web-based software and services in pre-service teacher education classes. Through the study, the researchers investigated questions related to improving teacher candidate and faculty use of web-based resources as well as teacher candidate and faculty perceptions regarding benefits of using web-based software. Quantitative data was collected and analyzed regarding teacher candidate perceptions of the use of technology. Qualitative data was generated regarding student and faculty perception of benefits for using a web-based software product, in this case LiveText (www.college.livetext.com).

Background and Rationale

Web-based software has the potential to positively impact the professional development of teacher candidates and practicing teachers by increasing professional interaction, collaboration, and enhancing the utilization of time. One such software, LiveText (www.college.livetext.com), is a potentially powerful resource for use in classroom teaching, electronic portfolio development, and ongoing professional development for teachers following graduation. At the initiation of the study, the researchers were all faculty at a mid-western university considering the use of LiveText software for student electronic portfolio requirements. The rationale for undertaking this research was to investigate teacher candidates' attitudes toward technology and to attempt to determine how effective the use of LiveText software would be in teacher education courses, particularly as a platform for the creation of student portfolios. The original intent of the study was to also investigate the impact of web-based software on improving the complexity of teacher candidate interactions and collaboration in teacher education courses. However, as the study evolved the data collected did not support this latter examination.

Research Questions

The research questions examined in this report are as follows:

1. What are teacher candidates' self-perceptions of their abilities to use web-based and common computer technology?
2. What are the teacher candidate and faculty perceptions of the benefits of using web-based software in teacher education programs?

Method

Subjects

The subjects in this study were approximately 36 undergraduate students in pre-service teacher education courses at a regional university in the mid-west. Approximately half of the students were drawn from one section of a course entitled "Models of Teaching," taught by one of the researchers. The Models of Teaching course is one of the entry level courses in the university's teacher education program. The remaining subject population was drawn from a section of a course entitled "Teaching Reading in the Content Fields," taught by another one of the researchers. Teaching Reading in the Content Fields is a mid-level course in the university's teacher education program. It should be noted that originally a control group was also established to pursue control group comparisons, but the data from this group was deemed incomplete by the researchers due to the relatively low final number of participants (approximately eight) and the relative lack of significant intervention or treatment with the other 36 participants in the "Treatment Group."

Treatment and Procedures

All students willing to participate in the study, near the beginning of the study, were asked to complete a survey designed to measure student attitudes toward using technology (Hofmeister, 2001). The students (called the "Treatment Group") who used the web-based software in the study received a free subscription for the use of LiveText software. The use of this software was integrated through small sections of the courses to complete portions of the course activities. The students received little training in the use of the software, but instead were given directions for logging on to the web-based platform and were asked to investigate its capacity on their own as they completed various course activities. Near the end of the study, the participants were once again asked to complete the technology attitudes survey as a posttest measure. These students were also asked for brief written feedback regarding their perception of the value of using LiveText software in the course. Data regarding faculty perceptions of the efficacy of web-based software was also generated from the researchers in this study.

Variables and Instrumentation

There are three general variables in this study evaluated with qualitative and quantitative assessment approaches and instruments. Table 1 delineates the variables and the assessment/instrumentation used for each.

Table 1: Variables and Instrumentation

Variable	Assessment/Instrumentation
1. Attitudes toward technology	*Discussion Board Basic Skills Profile* (Hofmeister, 2001)
2. Student perceptions of LiveText	Simple writing prompt
3. Faculty perceptions of LiveText	Simple writing prompt

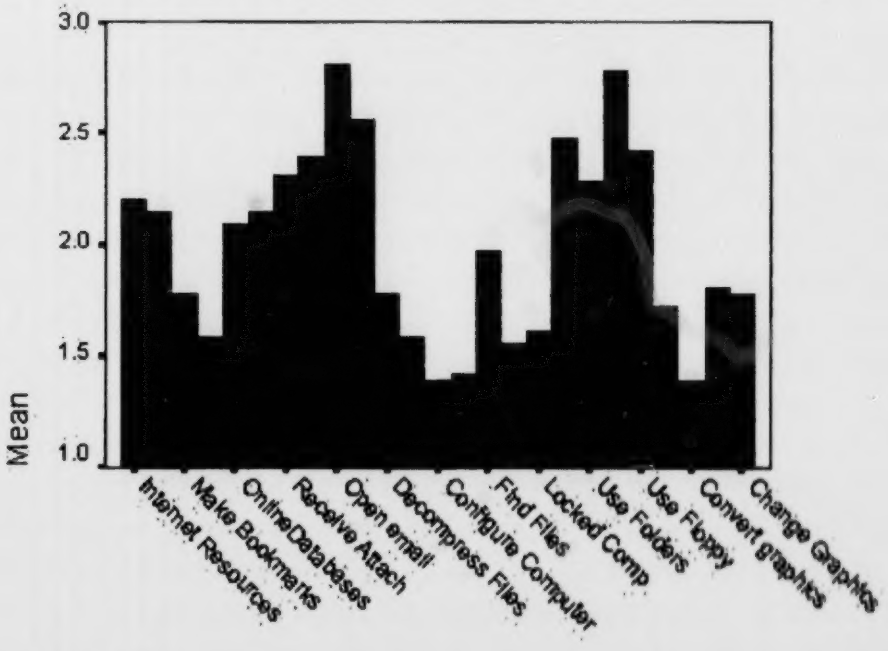
Research Design

This study was an evaluation study (Krathwohl, 1993) to provide the researchers with knowledge regarding pre-service teachers' attitudes and comfort with technological applications. The results of the study will guide future development of learning environments for pre-service teachers.

Results

The results of the attitudes toward technology survey, *Discussion Board Basic Skills Profile* (Hofmeister, 2001), are presented in Figure 1. This data represents the mean of all the scores (a mixture of pre and post-tests) entered by participants in the "Treatment Group" who used the LiveText software, along with the scores of one of the faculty researchers who also completed the survey. A review of these scores indicates that in general the pre-service teachers in this study are quite comfortable with and have positive attitudes toward applications related to email, the use of floppy disks, and the organization of saved documents through the use of folders. The scores indicate that the use of Internet resources, on-line data bases, and the organization of on-line resources through bookmarks represent areas in which the pre-service teachers in this study were less confident. The scores further indicate that pre-service teachers in this study have little confidence in their abilities to configure computers, decompress files, and utilize graphic applications.

Figure 1: Treatment Group Mean Scores



N=36

Qualitative analysis of the writing prompt to discuss perceptions of the use of web-based software led to the emergence of two major themes. Nearly all pre-service teacher participants expressed the view that web-based software such as LiveText has high potential to simplify the process of creating materials to support teaching, such as lesson plans and the creation of evaluative portfolios, as well as to ease he alignment of educational standards with education materials. The second theme that emerged was viewed as a disadvantage to the pre-service teachers. A majority of the participants seemed to feel that their lack of familiarity with the software left them at a disadvantage for utilizing the software to its full potential. The faculty researchers came to similar conclusions based on informal observations and discussions with the pre-service teachers as the web-based software was used in the two courses; to more fully utilize the potential of the web-based software, additional training and support would be needed.

BEST COPY AVAILABLE

Discussion

The results of this evaluation study can help provide teacher educators with knowledge of potential areas of strength and weakness related to pre-service teachers' abilities to utilize technological applications. Although the results can not confidently be generalized to a broader population, the study does identify areas in which pre-service teachers may have classroom-technology-related weaknesses and strengths. The ability to utilize applications related to word processing and e-mail seem to be well with in the established skill set of a majority of pre-service teachers. However, the results also indicate that, particularly without further training and support, full utilization of web-based software and Internet resources for educational purposes is not part of a majority of pre-service teachers' repertoire of technical skill. These results lead to the researchers to the conclusion that additional time in teacher education courses should be devoted to using web-based software and resources to increase pre-service teacher confidence and ability to utilize more aspects of web-based tools, particularly of cutting-edge applications such as LiveText; without proper support and training, these powerful technology tools may be unable to serve their designed purposes. Further research in this area is warranted to determine the impact of time, instruction, and variety of use on pre-service teachers abilities to use web-based software and resources with confidence.

References

Hofmeister, D. (2001). *Discussion Board Basic Skills Profile* (http://profiler.hprtec.org).

Krathwohl, D. R. (1993). *Methods of educational and social science research: An integrated approach.* White Plains, NY: Longman.

Thomas, M.M., & Hofmeister, D. (2001). *Writing and cognitive complexity discussion board rating scale.* Manuscript in preparation, Central Missouri State University, Warrensburg.

Introducing Blended Learning to the South West of England

Dafydd Thorne – Exeter College, England

Exeter College is situated in the South West of England. In this region, a sparse and widely separated population along with poor communication systems make for a prime market for e learning.

One section of that market is made up of management staff in the 'Voluntary Sector'. That is to say people in management roles in the wide range of organisations in the 'not for profit' sector; charities, old peoples' homes, hospices, animal sanctuaries, cultural agencies, support groups etc. Typically, many of these organisations are small, independent bodies with very few full time employees most of whom are performing management roles in respect of teams of volunteer or very low paid part time staff. Such managers are often well educated in their own right but, almost invariably, in discipline a long way from the demands of their current roles. Even those with Business or even Management qualifications acquired their degrees or diplomas in contexts far removed from their current employment. Learning geared to the demands of specialist roles in national or even international corporations is scarcely apposite in organisations where there is often only one full time member of staff whose responsibilities encompass the full range from accounting and financial control via marketing and advertising right through to human resources and employment legislation. Acquiring and maintaining a consistent funding stream alone demands a very specific set of skills, political awareness, knowledge and expertise.

Equally, due to the small scale and limited resources of their organisations, little resource to support management development or training is available. This is in part due to budgetary constraints, but is also a function of the smallness of organisations which cannot afford to release their key staff on anything approaching a regular basis. Even where the organisation is situated close to a conurbation with a further or higher education establishment, it is unlikely that any directly relevant educational opportunities will be available.

Most surprising of all perhaps, is that, in an area renowned for tourism and agriculture, the voluntary sector comprises the single largest type of employment.

In 2000, Exeter College in conjunction with Plymouth University and the Exeter Council for Voluntary Services recognised the needs of the sector and set out to develop a qualification that would be relevant to managers in the sector.

The first stage of this process was to obtain validation for a 'Foundation Degree'. This qualification, new to the UK, is a two year 'sub degree' which deliberately combines the academic with the vocational. It is intended to be sufficiently academically rigorous to enable the successful learner to acquire a full Bachelors Degree after only one more year's study on an Honours programme, while at the same time being sufficiently vocational to represent a real contribution to the learner's current employment or future employability. A Foundation degree differs from a conventional undergraduate programme in a number of ways, most notably in the emphasis that is placed on the development of skills, both those relating directly to a profession, to be acquired in work or on work placement, and those more generic capacities identified as desirable by employers more widely. The qualification is also entirely modularised, less common in the UK perhaps than elsewhere, and can also include accredited elements of professional diplomas or certificates relevant to the area of study.

This choice of qualification was driven by a number of requirements. Firstly, it had to be sufficiently modular and flexible to be attractive to learners with many demands on their time. Secondly, it had to offer something both to those looking for personal or academic development, and to those simply looking for job related training. Thirdly, it had to be structured in a way that would enable those with existing degree, or even masters, level

BEST COPY AVAILABLE

qualifications to obtain credit for their previous learning while still offering them the specific learning that they desired.

Having developed a relevant qualification, the next hurdle was to develop a means of delivering learning and assessment that would be accessible to a market that was poorly resourced, geographically spread, and vocationally disparate.

It was clear from an early stage that conventional methods of study – day release, evening classes, and even intensive block release – were inappropriate. It was inconceivable that students spread across the south west peninsula (some 150 mile long with slow rail links and dubious roads) would be able to congregate on a regular basis to pursue their studies. The demands of their jobs alone, notwithstanding domestic or financial constraints, meant that opportunities to meet together would be at a premium.

The obvious solution lay in some kind of distance learning approach, and initially we debated the possibility of a straightforward web based e learning programme. This would be accessed by individuals from home or from their places of work and would offer all the benefits of asynchronicity that their circumstances might demand.

However, while this appeared an ideal solution in many ways, it overlooked two key factors that had already been evident from pilot work with this particular student group. Firstly, managers in the voluntary sector do not necessarily have either sophisticated computer skills or even access to reliable computer equipment. Secondly, experience to date had shown that, perhaps because of their relative isolation, managers in the sector reported huge personal and professional benefits from being able to meet together to discuss common issues and share experiences. Indeed, where training had been provided by Exeter Council for Voluntary Services in the past, participants often reported as much benefit arising from the opportunity of making contact with their counterparts as they did from the immediately intended outcomes of the programme.

The decision was therefore taken that the needs of this particular group would be best met by means of a blended learning approach. This would enable us to offer a mix of delivery methods suited to these managers:

- A small number of intensive 'all course' sessions to cover induction, technical training, and key issues
- A greater number of smaller group localised 'tutorials' which would enable learners to meet together to share experiences, discuss progress, debate specific topics and to receive personalised feedback
- A variety of web based learning and assessment opportunities accessible at times to suit the learners' individual circumstances
- Ongoing access to e moderated tutorial support and bulletin board discussions
- Localised technical support to facilitate both the learning and the use of IT in the learners' own organisations

However, there were two significant barriers still to be overcome before such a system could be put in place.

Firstly, the financial demands of developing and implementing such a programme far exceeded the normal resource available to a state funded provider of higher education, particularly where it was unlikely that the learners themselves, or their employers, would be in a position to subsidise the process.

Secondly, there was little pre-existing experience or expertise within the participating educational organisations to support such a development. In many parts of the UK, the idea of VLEs and MLEs, while they might feature in a College or University's five year strategic plan, are still a long way from full implementation.

As a consequence, we put in a bid to the European Social Fund for support in developing the programme. Such additional funds would enable us to:

- Develop appropriate web based materials
- Train staff to facilitate blended learning
- Subsidise the initial cohorts of learners in terms of fees, travel, childcare, technical support and even hardware
- Market, monitor and fully evaluate the work

Fortunately, the bid was successful and we are about to embark on the training and development stage of the programme with a view to running an induction event in early summer with the full programme set to commence in the autumn.

The remainder of this paper will therefore focus on the development of this 'work in progress'.

Significant issues will certainly include:

Developing staff expertise sufficient to deliver learning in a, for them, entirely novel way. Key questions here will certainly include the level of technical expertise that they feel they need, the question of e pedagogy, the extent to which critical thought and analysis can be assessed on line, and the demands of 'e moderating' or 'e tutoring'. Some staff will certainly be enrolled on 'Embedding Learning Technologies' a mainly online Masters programme at the University of Plymouth on the basis that the experience of learning on line themselves will give them an insight into the issues that their learners might themselves encounter.

The experiences of building a team drawn from both conventional higher education and 'voluntary sector' experts from a training background. While this will be essential to the success of the project if the learners are to receive an appropriate blend of generic and specialised instruction, it is something of a rarity in education in the UK. Experience to date shows that such collaboration can be very fruitful, but equally it throws up a number of issues around planning cycles, ideas of quality, levels of achievement etc

Introducing or inducting learners into what will be, for them, a wholly new form of learning. It is clearly evident from the literature that the quality of the learner's initial contact with the technology has a major impact on subsequent motivation and achievement.

Agreeing a solution to the more technical debate over the most appropriate 'online learning' environment for learners with limited technical skills and equally limited hardware. Current thinking is that it would be better to ensure easy access through using some simple website based HTML model even if this at the expense of the level of interactivity offered by the proprietary brands such as WebCT, Blackboard etc.

The Potential of Virtual Reality to Improve Education About Psychosis

Dr Jennifer Tichon,

Virtual Reality (VR) techniques are increasingly being used in healthcare education. A project at the University of Queensland constructed a number of three dimensional demonstration models of the phenomena seen in psychosis. Symptoms of psychosis reproduced include delusions, hallucinations and thought disorder. Auditory hallucinations have also been included, consisting of voices ranging from muffled whispers to a cacophony of voices. This paper reports on the methods and tools currently being utilized to educate psychiatry and mental health students about schizophrenia and psychosis, the expectations of both Lecturers and students of introducing VR in the classroom in terms of potential increased understanding of psychosis and the software program development to date. The next phase of the research examining the impact of VR on learning and pedagogy in the topic of schizophrenia has commenced. Preliminary results indicate the use of Virtual Reality in healthcare education has enormous potential significance in psychiatry and other mental health teaching programs.

Introduction

The recent success of the film "A Beautiful Mind" has highlighted schizophrenia, a debilitating mental illness which affects 1–2% of the population at some point in their lives. It is estimated 12–16% of hospital beds in Australia are taken up with patients with schizophrenia. Tragically, suicide is more common among sufferers of this illness, which often strikes people in their prime. At present, patients with schizophrenia have to describe their symptoms to their therapists and there is no objective way for therapists to evaluate these experiences. Many patients suffer from various forms of hallucinations, auditory and visual, and these can often be extremely terrifying for them. Patients may feel misunderstood and find it difficult to communicate the exact nature of their psychosis. Similarly, therapists find it extremely difficulty to learn and to fully understand this illness because they themselves have no personal experience with it. Pivotal to professional understanding are the methods currently being used to teach about schizophrenia in higher education institutions. Are the methods and tools currently being utilized to educate mental health students about schizophrenia sufficiently adequate to provide students with a true understanding of what these patients experience and does the use of virtual reality in the classroom have the potential to improve this?

Virtual Reality and Health Care

Recent developments in the use of Virtual Reality (VR) to help improve patient care in the form of advanced educational tools and therapeutic options have shown to be highly successful (Zajtchuk & Satava, 1997). VR techniques, involving 3-dimensional imaging and surround sound, are increasingly being used in healthcare education and research. For example, VR has been used to perform surgery-related applications and to provide medical education in training people to deal with catastrophic emergencies such as earthquakes, plane crashes, fires and so on (Waterworth, 1999). VR has also been used to treat phobias such as fear of heights, flying, spiders and treatment of post-traumatic stress disorder (Hodges et al., 2001). Another related area is using VR to simulate the effects of stroke (UMEA University VR Lab, 1999). The benefit of simulating the difficulties faced by stroke patients with everyday physical tasks such as, getting a glass of water or wearing a shirt, is the facilitation of a greater understanding and empathy for caregivers or other helpers who may not be fully aware of some of the difficulties recovering stroke patients go through.

Current Teaching Methods in the Field of Schizophrenia

VR has not previously been used to teach in the field of schizophrenia. The teaching methods and/or tools currently being utilized to educate psychiatry and psychology students about schizophrenia and psychosis in many universities and training centers consist predominantly of abnormal psychology textbooks. The specific aim for many of these textbooks is to provide students with a clear understanding of the history, the etiology and the various diagnostic classifications used for schizophrenia and psychosis. For example, many textbooks devote at least a section to demonstrate an example of the diagnostic criteria for schizophrenia used in the DSM-IV (Diagnostic and statistical manual of mental disorders- Fourth edition) (American Psychiatric Association, 2000).

Many of the textbooks examined included anecdotal case reports of patients' experiences with schizophrenia and psychosis. Many of these case reports provide a personal account of what the patients themselves experience during their illness. These case studies are an attempt to engage students to feel and to experience patients' symptoms at a more basic level (Beumont and Hampshire, 1989; Oltmanns and Emery, 2001; Rosenham and Seligman, 1984; Van Hasselt and Hersen, 2001) and acknowledge the importance of student's '*experiencing*' an illness. However, despite this, there are limited availability of teaching tools that include the use of multi-media to facilitate experiential learning.

Experiential Learning

Experiential learning, prior to the advent of advanced technologies, often took the simple form of role-play. In essence, students were required to "step into the patients' shoes" and act out the part of a person with schizophrenia. Role-play functions not only as a teaching tool but also provides a vehicle for students to experience as close as possible what it feels like to have schizophrenia and/or psychosis. A program designed to evaluate a training program for occupational therapy students found that the majority of students responded most favorably to the field experience and role-play phase of the curriculum (Patterson & Davidshofer, 1972). Role-play has long had important implications for educational planners. The need is to design curriculums that not only provide students with the required intellectual knowledge on a specific subject but to also provide as much experiential learning as possible.

Unfortunately, most of the abnormal psychology textbooks seldom discuss or use role-play as part of the text exercises. Many include numerous reference guides for students and lecturers including self -help books for patients. These books focus on the psychological experiences of patients with schizophrenia and the impact this has on patients' family and friends (Hurlburt, 1989; Sattler, et al., 1998). However, although detailed these texts do not provide any opportunity for students to personally *experience* the illness. Without more direct encounters can students ever fully understand the auditory and visual hallucinations experienced by patients with schizophrenia?

Virtual Reality and Teaching About Schizophrenia

An important recommendation for students in the mental health profession suggests that, in addition to the traditional lecture and textbook mode of teaching, educational planners must investigate other less traditional methods of teaching such as multi-media to increase student's experience of an illness (MacPherson & Keppell, 1998; Teevan & Gabel, 1978). VR has been used successfully in education to provide a more interactive learning experience for students (MacPherson & Keppe4ll, 1998).

The use of VR can provide students with first hand knowledge of what hallucinations "feel" like. It is expected the use of the specifically designed VR software will provide a greater understanding on the exact nature of psychosis and will develop in students a greater sense of empathy for the mentally ill, leading to greater positive attitudes. The research is exploring the reactions and responses from lecturers and students about the use, the effect and the problems using VR as part of the teaching technique in an educational setting.

Interviews with lecturers have been conducted and surveys have been distributed to students in two postgraduate and three undergraduate Australian mental health training programs. The interviews and surveys occur in two phases:

Phase 1: Pre VR

Prior to the implementation of the VR software the focus is on student/lecturer expectations of introducing VR in the classroom, in terms of potential increased understanding of psychosis and improved educational outcomes. Other questions relate to usability of the application and interaction design.

Phase 2: Post VR

Post the implementation of the VR software the focus is evaluation at lecturer and student levels. A close examination and documentation of how lecturers and students adapt, use and report on VR will contribute to our understanding of the effectiveness of this innovation. The data gathered during the post-VR phase will be compared to data gathered in the pre-VR phase of the research with the aim of demonstrating the implications of VR technology for university education.

The Software

As this research is highly technical from the information technology perspective, yet qualitative from a clinical viewpoint, it is very unusual and there are few other groups, if any, working worldwide in this area. An initial pilot program demonstrated that the clinical and technical skills are available to create the various models of the phenomena of psychosis. A model of an everyday environment, in this case, a living room, was developed. This room contains standard furniture, including a sofa, coffee table, dining table, chairs, and bookshelf, as well as a number of objects which tend to exacerbate patients' symptoms, such as TV, radio, and pictures.

In this model, a small number of hallucinations were modelled to demonstrate the concept of virtual psychosis. Techniques such as morphing and 3D enhancement of objects are used to reflect the types of illusions that patients with psychosis might experience. Visual illusions modelled include the morphing of the face in the portrait frame into another person and back again, modelling the feeling of claustrophobia, caused by the walls of the room appearing to contract, and the TV and radio switching on and off of their own accord. Patients have been employed as consultants on the project and ultimately a "library" of psychotic symptoms, built from the patients' perspective, will be created. The Living Room Model can be viewed and interacted with through the curved screen immersive environment of the ViSAC laboratory at the University of Queensland.

The software development is being carried out using the Vega software environment for real-time simulation and virtual reality applications. Virtual Reality Modeling Language (VRML) was designed to allow 3D "worlds" to be delivered over the World Wide Web (www). VRML files are analogous to Hypertext Markup Language (HTML) files in that they are standard text files which are interpreted by browsers. Like HTML, VRML has been designed to be platform independent and to work over low bandwidth connections. VRML files describes a 3D space, or 'world' and using a VRML browser the user can explore this world, zooming in and out, moving around and interacting with the virtual environment. This allows fairly complex 3D graphics to be transmitted across networks without the very high bandwidth that would be necessary if the files were transmitted as standard graphic files. The aim is to use VRML to web enable these scenarios so they can be accessed easily and efficiently over the web.

Conclusion

The high quality infrastructure available at the University of Queensland provides a unique opportunity in Australia to undertake this collaborative project. The project has enormous potential significance in mental health e-learn field.

References

American Psychiatric Association. (2000). *Diagnostic and Statistical Manual of Mental Disorders*, 4th Edition, Text Revision. Washington, DC: American Psychiatric Association.

Beumont, P.J., & Hampshire, R.B. (1989). *Textbook of Psychiatry*. Melbourne: Blackwell Scientific Publications.

Hodges, L., Anderson, P., Burdea, G., Hoffman, H., & Rothbaum, B.(2001) Treating psychological and physical disorders with VR. *IEEE Computer Graphics and Applications*, Nov/Dec 2001, 25-33.

Hurlburt, R.T. (1989). *Sampling Normal and Schizophrenic Inner Experience*. New York: Plenum Press.

MacPherson, C. & Keppell, M. (1998) Virtual Reality: What is the state of play in education? *Australian Journal of Educational Technology*, 14, 60-74.

Oltmanns, T.F., & Emery, R.E. (2001). *Abnormal Psychology*, 3rd Edition. Upper Saddle River, NJ: Prentice Hall.

Patterson, T.W., & Davidshofer, C.O. (1972). A counseling and training program for occupational therapy students. *The American Journal of Occupational Therapy*, 26, 419-423.

Rosenhan, D.L., & Seligman, M.E.P. (1984). *Abnormal Psychology*. New York: W.W. Norton and Company.

Sattler, D.N., Shabatay, V., & Kramer, G.P. (1998). *Abnormal Psychology in Context*. New York: Houghton Mifflin Company.

UMEA University VR Lab. (1999).Empathy as evoked by virtual reality technology progress report: *Phase I, Technical Report*, Aug 1999.

Van Hasselt, V.B., & Hersen, M. (2001). *Advanced Abnormal Psychology*. New York: Plenum Press.

Waterworth, J.A. (1999). *Virtual reality in medicine: A survey of the state of the art*. July 1999: http://www.informatik.umu.se/~iwworth/medpage.html.

Zajtchuk, R., & Satava, R.M. (1997). Medical application of virtual reality. *Communications of the ACM*, 40(9), 63-65.

E-Learning that Adapts to the Learner

Introduction

Most learners and educators would agree that the ideal educational environment has at its core one-on-one teaching that is closely customized to the needs of the individual learner. In all current educational sectors, one-on-one teaching is very rare. Learners must make-do with instruction geared toward the average student or the perceived norm. This leads to a large segment of marginalized students who do not fit the norm. They may differ in their background knowledge, level of understanding of the topic, learning outcome goals, learning approach, learning skills and accessibility needs.

One of the opportunities afforded by dynamic web technologies and broadband networks is the ability to serve educational content and environments that are tailored to the individual learner or learning context and thereby deliver the approximation of one-on-one teaching. Broadband networks open the communication channel in both directions, enabling educational servers that can respond to each individual learner and learning context in a timely manner. Thus the on-line educational environment can be responsive to a number of learner needs and preferences. These preferences can be general learning preferences or preferences related to a particular learning session.

Personal Preferences

A learner may have individual needs or preferences regarding a variety of parameters. Some of these are:

1. Styling preferences: This includes the information layout, the font size, and the colours used on the page. For someone with low vision this may make the difference between illegible and legible content.
2. Depth of Navigation Tree: Some learners prefer to have all possible links shown on one page while others prefer to have top level links with lower level links appearing on subsequent linked-to pages.
3. Classification or Sorting Preferences: Mail archives frequently offer the choice of sorting by sender, date, subject, priority level among others. Other sorting criteria could include level of difficulty, match with expressed learning outcome goals and teaching style.
4. Access Requirements: Learners with disabilities frequently require alternative access strategies such as screen reading for people who blind, or on-screen keyboards for people who cannot use a mouse or keyboard. The preferences can address both the type of alternative access technology and the preference settings for the access technology (e.g., voice rate and pitch, key size and spacing)
5. Equivalent Content Requirements: Learners with sensory impairments require streaming auditory or visual information to be provided in another modality but synchronized to the primary content. The system can provide the requested type of equivalent content (captioning, ASL, video description) delivered according to the user's preference (styling, layout, reading level, etc.).
6. Testing Equivalents: Learners with disabilities or language constraints are unable to answer certain kinds of test questions. These individuals require test questions in an accessible modality that are equivalent in the skills or knowledge being tested.

7. Language: The learner may have an alternative language requirement, or may wish the content to be displayed in two languages to support better comprehension.
8. Content Density: Some learners prefer to master on overview of the content and then learn the specifics of each subtopic, while others prefer to move sequentially through all the details of the topic.
9. Content Views (Image intensive, text intensive): Some learners are best supported through visual illustrations of the content, while graphics and images may be distracting or inaccessible to other learners.
10. Learner Scaffolding types: Learners require individualized learner supports. Some learners benefit from readily available definitions of terms, others benefit from exercises or illustrations of concepts, while still others require peer interaction to fully integrate a concept.

Preferences that relate to a specific learning session include:

1. Learner Outcome Goals: Learners approach learning content with different outcome goals. A system that organizes content in support of the outcome goal and assists the user in tracking their progression toward the goal may assist in achieving the learning outcome.
2. Topic Exclusions: In some instances, less is more. A filter to exclude content that is not of interest or is already learned may help the learner to focus on the target content.
3. Placeholders, Annotation and Knowledge Review: Progression through specific learning content would be supported by allowing the learner to create placeholders, personal annotations and by creating a synopsis or review of the previous session.
4. Facilitation of Communities of Interest. Learners vary regarding their preference for the frequency and timing of peer interaction in support of learning.

Interoperability Standards

Several standards or common specification efforts are underway to capture and communicate learner or user preferences for learning content and user interfaces. Among these is the IMS Learner Information Package (LIP) specification. The IMS Global Learning Project Accessibility Working Group is attempting to extend and harmonize these schemas into a common specification that will form part of LIP specification. This new extended specification will include elements that express learner preferences that relate to accessibility needs and personal learning approach preferences.

Agents that Act Upon Preferences

Once the learner has expressed his or her preferences or needs, either by using a preference tool, or an integrated preference dialogue within a learning management environment, there are a number of agents that can act upon the stated preferences. The Learning Management System or browser can adapt the user interface, the presentation of the content, and the presentation of the content structure. The learning object repository can use the preference as a guide to refine and constrain the learning objects retrieved and the aggregation of the learning objects. For example a video learning object may be aggregated with a synchronized text caption file as well as an illustrative exercise for a learner who is deaf or with a structured outline in text for a learner who prefers this navigational aid.

Authoring and Instructional Design Support

A core assumption of learner-centric courseware delivery, whether it is simply providing device independent information or full learning-style accommodation, is that the content delivery medium can be independent of the content while still achieving a consistent learning outcome. This requires a dramatic shift in instructional design that most educators are not cognizant of when designing learning material for the web. It requires a deconstruction of teaching and a new set of authoring tools and supports. Most web-authoring tool features concentrate on the specific visual presentation of the material. They do not assist the author in extracting the content and structure and determining whether it transforms gracefully while still retaining the intended learning message. Most educators devote a great deal of attention to designing the presentation of the learning content at the expense of refining the content and its structure. New instructional design methodologies and authoring tools are needed to support the type of adaptability envisioned here.

Application 1

The Adaptive Technology Resource Centre of the University of Toronto and eight partner institutions have developed a learning environment that allows the adaptive personalization of video based curriculum. The Barrierfree project includes a process, a set of tools, and teaching practices that allow the creation and delivery of inclusive, video-based, interactive learning content. The Barrierfree environment gives each learner the opportunity to access the learner scaffolding they require and to navigate through the content in a fashion that best suits their learning needs. Tools and processes developed include: authoring tools that support educators in creating accessible content; a preference wizard that allows learners to specify their learning preferences; a player/browser that responds to the learner preferences and allows flexible navigation through the content, and a repository that serves content according to the learner preferences.

Application 2

In another implementation of the Personal Preference Specification the ATRC is investigating the implementation of the specification in personal web portal technologies. Thus the personal preference schema will be used to also configure the navigation tools, content organization, content presentation, personal bookmarks, and the content retrieval algorithm within a portal. This will be implemented using uPortal, an open source portal initiative and used in post-secondary and government portals.

Conclusion

We may finally have available to us the tools needed to create learner-centric educational environments. This development is critical to any learner or learning context that does not fit the model of the typical student and their environment. This includes learners with disabilities, learners with unique learning styles, learners using atypical client devices, students learning in unusual environments and learners approaching the topic from different perspectives or knowledge backgrounds. In order to achieve this level of adaptability we need to create tools and system architectures that allow interface and content transformation, but more importantly we need to dramatically shift our approach to teaching.

References

11. IMS Global Learning Consortium, http://www.imsproject.org
12. The Barrierfree Project, http://www.barrierfree.ca
13. Industry Canada, http://web-4-all.ca.
14. uPortal http://www.ja-sig.org/.

Using Electronic Portfolios in Teacher Performance Assessment

Burcu Tunca
The George Washington University
btunca@gwu.edu

Abstract: Portfolios have been used for a long time in various fields especially in graphic arts to show the quality of work. In early 1990s educators adopted portfolios for determining grades and to show students' performance to parents. In late 1990s portfolios have become powerful tools for teacher professional development. In late 90s format of portfolios has changed from paper form to electronic form which gives opportunity for more creativity and portability. This paper will be talking about using digital portfolios in teacher performance assessment, suggesting ways of using electronic portfolios in teacher performance assessment and showing some examples of electronic digital portfolios prepared by teachers.

Introduction

A hundred years ago, in order to become a teacher, morality and some level of literacy was enough. In today's age, besides having morality and good character, good education is vital since teacher performance has gained a lot of importance and become significant in institutions. Today's teachers are expected to be highly competent in their content and understand their society. They also have to be competent in pedagogy, technology and subjects to be taught. Moreover, teachers have to meet the state standards as well. Based on the standards, teachers have to know the expected learner outcomes, meet the expected level of teaching performance as well as meet the vision of the institution that they perform at.

In order to find out if teachers meet the standards, institutions design teacher performance assessments. The focus of these performance assessments is to see if teachers are up to date. In order to be up to date, teachers have to keep up with technology and with the latest trends in their fields. Another focus is to see if teachers have improved themselves when compared to previous years and if they can implement the new information and techniques that are introduced. In order to make sure that teachers perform at their utmost, institutions organize formal courses, seminars, workshops, and send them to degree programs. Managers at these institutions also make sure that teachers reflect on their day-to-day work and learn from these experiences as well. Besides these professional development activities, organizations may use some traditional methods like class observations, checking lesson plans and use course evaluations filled in by students.

A new method for teacher performance assessment: Using electronic portfolios

Portfolios have been used for a long time in various fields especially in graphic arts to show the quality of work (Campbell, 2000). In early 1990s, educators adopted portfolios for determining grades and to show students' performance to their parents (Linn & Gronlound, 2000). In late 1990s, portfolios have become powerful tools for teacher professional development (Wolf, 1999; Burke, 1997). In education, portfolio can be defined as a purposeful collection of teacher work that exhibits his/her efforts, progress and achievements in one or more areas (Barrett, 1990). Portfolios give a richer picture of teacher work than can be gained from more traditional, objective forms of assessment. Traditional portfolios are stored in three ring binders or folders with physical dividers between sections. A portfolio consists of: teaching philosophy, classroom management philosophy (optional), a resume, curriculum plans, student evaluations, administrative evaluations, meetings and workshops log, observation reports, peer critiques, professional development plans, professional projects, research papers, self assessment experiences teacher prepared materials and some artifacts. The artifacts can be: anecdotal records, sample lesson plans, video taped class teaching, test samples, awards and certificates, pictures and photographs, sample student portfolios. The items above can be eliminated according to the purpose of the portfolio and the audience that is going to evaluate it.

Electronic Portfolios:

An electronic portfolio consists of technologies and that allow the portfolio developer to collect and organize artifacts in many media types like audio, video, graphics and text (Barrett, 2000). According to Barrett, "what differentiates an electronic portfolio from a digital scrapbook or an online resume is the organization of the portfolio around a set of standards or learning goals, plus the learner's reflections, both on their achievement of the standards, and the rationale for selecting specific artifacts, as well as an overall reflection on the portfolio as a whole (2000)." There are also technical advantages of creating electronic portfolios. It is easy to store and allows easy access to information as well as being portable and having a long shelf life. It is possible to have multiple copies at a very low cost and can be more presentable as it consists of multimedia and hypertexts that can be linked to standards if desired.

Barret, mentions about some important reasons for creating about electronic portfolios (1998). She states that documents are already created on computers and then printed to form paper based portfolios. The use of hypertext links allows clear connections between standards and portfolio artifacts. It has been observed that creating electronic portfolios can develop skills in using multimedia technology. It can be more motivating and easier to manage the portfolio development process. When all these advantages are taken into consideration, using electronic portfolios in teacher performance assessment sounds radical but very effective.

In order to use electronic portfolios as a tool to assess teacher performance, an implementation plan needs to be developed to give a framework to the teachers so that they can use as a guide in the process of developing their own portfolios. In this type of a portfolio, teachers need to include *samples of work* as a general outline in which they demonstrate *personal growth*, *professional growth* and attention to *various instructional initiatives*. These key words describe the parts of the process and portfolio products. In the process, teachers select the contents as well as the best means of presentation (Kimeldorf, 2000)

After selecting the artifacts and deciding on the means of presentation, teachers have to arrange the design and get assistance from more technology savvy colleagues or staff. Once institutions start implement assessing teachers' performance using electronic portfolios, both the teachers and the institutions will see the benefits to it. They will see that electronic portfolios are a more objective way of assessing teacher performance as video taped teaching can be assessed by various people and the ease of documentation. Moreover, they are great tools to see the personal development and gaps which can lead in planning professional development activites.

References:

Barrett, H. http://transition.alaska.edu.www.Portfolios/bookmarks.html#k12
Hartnell-Young, Elizabeth and Morriss, Maureen (1999). *Digital Professional Portfolios for Change*. Arlington Heights: Skylight Professional Development

Herman, J. L., Aschbacher, P.R., & Winters, L. (1992). *A practical guide to alternative assessment*. Alexandria, VA: Association for Supervision and Curriculum Development

Kimeldorf, M. http://amby.com.kimedorf/portfolio/p_mk-09.html

http://www.ash.udel.edu/ash/teacher/portfolio.html
http://www.educationworld.com/a_tech/tech111.s.html

New Roles for Teachers and Learners in Higher Education

JoAnn C. Ullery
South Dakota State University
Information Technology Services
Wecota 211, PO Box 506A, Brookings, SD 57007
605-688-4682
JoAnn_Ullery@sdstate.edu

Abstract: The integration of technology in classrooms has had a positive impact on student achievement (Valdez and others 1999). But an investment of time and resources for faculty is necessary to move technology from a part-time tool to an active tool, fully integrated into the curriculum. Also, in order to provide technology in the classroom, educators must receive professional staff training on how to effectively use technology. This paper discusses the use of the web as a professional source of development and curriculum materials, and how to integrate technology into classrooms to promote learning. This session will provide suggestions for collaborative learning and group problem solving in the classroom, "just-in-time" learning, and how educators can become facilitators and coaches to students.

Introduction

Technology in Higher Education

Clark Kerr described a modern university as "a series of individual faculty entrepreneurs held together by a common grievance over parking." This humorous observation highlights a theme regarding technology in higher education in that often the only thing that will unite a diverse group of educators is a complaint over a commonly valued resource that is in short supply. At South Dakota State University we manage these valued resources and experience these complaints at a loud volume from arguments between faculty who embrace technology to those who fear technology threatens the courses they teach face-to-face.

First, in order to manage our information technology resources at SDSU and promote a shared institutional vision and sustained communication to our faculty at SDSU, our Associate Vice President of Academic Affairs was appointed as our Chief Information Technology Officer with all technology reporting to him. Even though strategic planning is uncomfortably close to an oxymoron with the life cycle for technology approximately 18 months, a strategic plan for technology was created that is tied to the primary mission and goals of the college or university. Those goals have clear objectives were agreed upon by the leadership of the campus community.

Invest in Information Technology

Academics were skeptical of the typewriter, the telephone, and the television. Each of these technologies required enormous capital investments, and we now need to invest in computer technology. Colleges and universities cannot afford to cut that which is critical to their future success if they want to continue to be relevant to students and the culture at large. Significant investments will be necessary in hardware and infrastructure if educational technology is to be effectively utilized.

SDSU's strategic plan included a major renovation ($1.5 million) to its campus network to prepare our core infrastructure for research, library, e-learning, and administrative services. The old ATM network was phased out and replaced with a Gigabit Ethernet network we enjoy today. SDSU also participates in a major Internet2 initiative through a grant from the National Science Foundation. Internet2 promises to enhance teaching and learning as faculty member's use its capabilities in Web-based courses.

Information Technology in Support of Teaching and Learning

Build it and they will come. Well, SDSU built the network infrastructure and today's generation of children have indeed arrived. These children have grown up "surfing the net", playing video games, chatting with friends, doing research, and applying to colleges and universities online and expect to use the Internet in all facets of their lives. And the most dramatic change is yet to come: it is our future students, whose elementary and middle-school children who have always had computers in their lives will enter our classrooms with expectations that will dwarf the technological capabilities we have today.

Consequently, institutions that ignore the potential for technology in teaching and learning will be left behind as students raised in a digital world enter the university with expectations of an interactive, e-learning culture. Students today are indeed driving the change in higher education and at a speed that is challenging universities to organize their faculty and develop courses online, hoping to cash in on attractive economic opportunities for "e-commerce".

Where to Begin?

It begins with professional development for faculty and educators. What I have learned in my years of working with and teaching faculty is that single meeting workshops are NOT effective. Change requires sustained faculty development over time with support as defined by the situation. The Preparing Tomorrow's Teachers to Use Technology (PT3) grants program, funded by the U.S. Department of Education, has supported various configurations of professional development at the university level. Some of the reportedly successful models include:

- **Technology Tuesdays** for workshops
- **Mentors** – SDSU has a Student Technology Fellow program
- **Model Classrooms** – A model classroom to use as a staff development center
- **Collaboration** with Universities.

Faculty need to commit to lifelong learning and that includes learning the necessary technological skills for academic productivity. Institutions need to provide faculty with incentives, expertise, resources, and human support, for them to feel confident with technology. It only makes sense that before technology can significantly improve learning, teachers must first be competent with the technology applications that facilitate their work and support student learning.

The university also needs to take a leadership role and provide faculty with he assistance of technology coordinators in their department. A coordinator can play an important role in demonstrating effective technologies in the classroom as well as coaching faculty in the effective use of technology or providing assistance in designing their online courses. When educators have questions or problems, they need immediate access or "just-in-time" assistance for effective use and application. Faculty want to be "coached" or receive personal assistance as they prepare class lessons to their specific situations. Also, faculty need to attend conferences, have periods of planning time, have staff development days, and periods when teachers can work together or brainstorm teaching and learning using technology.

Online Distance Learning

Online Distance learning has been available for many years, in different formats and now represents about 12% of higher education enrollments (Green, 1998). The California Distance Learning Project (1997) defines the following elements as key to distance learning:

- The separation of teacher and learner during at least a majority of the instructional process
- Connection through educational media
- Volitional control of the learning process resting with the learner

In 2002, it is projected that over 2.2 million "students" will participate in a distance learning course representing a 33% compound annual growth rate. (Source: IDC) The reasons for its growth include availability of particular courses, financial and time support for extended learning driven by the work environment, and the need for flexibility to support more complex lives of students and faculty. So let's discuss the specifics of an online course.

More than using PowerPoint as a delivery tool or WebCT to host a course online, the integration of technology in teaching and learning can be a powerful tool for both teachers and learners. The International Society for Technology in Education (ISTE) is an organization which promotes appropriate uses of technology to support and improve learning, teaching, and administration. They have several excellent publications, *Guidelines for the Evaluation of Instructional Technology Resources* and *National Educational Technology Standards for Teachers*. You can order it online at www.iste.org . Using the tools and resources available from ISTE will facilitate learning, and provide many suggestions, ideas, and forms for creating online courses. One method I used to assist beginning faculty to use technology was to help them move overhead transparencies to PowerPoint slides or taught them to create a course Web site. When faculty members become comfortable with this technological tool, are willing to have students assist and provide feedback, or offer new ways of doing things, e-learning will take place.

The syllabus is also a good place to start as it represents the contract between the professor and the student. It is often the most underdeveloped piece of writing a professor generates. In an era of assessment and accountability, the syllabus can provide both the cognitive map for the student and the qualitative anchor for assessment criteria (Pallof & Pratt, 1999). At a minimum the syllabus should contain course information, instructor information, course descriptions, goals and objectives, required readings, instructional methods, a calendar, classroom policies with links to university policies, grading criteria and standards, assignments tied to calendar dates, and available support services.

Class Web Site

When teaching and learning leave the classroom it is up to the instructor to create a "class in cyberspace" by posting the goals, objectives, and expected outcomes of the course, initial guidelines for participation, thoughts and questions to initiate discussion and assignments to be completed individually and/or collaboratively. Then the instructor can take a deep breath while the learners move forward with discussion and collaboration, intervening to ask questions or steer a discussion back on track.

Yes, it does take a large investment in time to produce a course Web site, but that investment, can diminish with assistance from the IT department, a faculty development center, or using FrontPage or Claris Home Page to create a Web site. Benefits include accessibility to course resources 24/7. Faculty can address the multiple learning styles of students and encourage even the less overt students to participate. Additionally, all class interaction, inside and outside of the cyber classroom, supports the development of a learning community based on the course content.

More sophisticated enhancements to a course Web site include a place for students to post their work, posted PowerPoint notes or other class materials, posting electronic quizzes, and/or using Course Management Software (CMS) such as WebCT or Blackboard that offer customization, file management, communication tools, assessment tools, and general course management. Web-based courses offer many challenges and students and faculty must accept the opportunities to become leaders and learners in facilitating change in the in the field of education.

Technical support must be available to help students log on, use the software, upload and download files, use audio and video clips, as well as help faculty who are having their own technical problems. Ideally, faculty or staff should always check for problems prior to the start of a course. Institutions, like their faculty, must engage in good planning in the delivery of online programs and courses and be willing to provide the level of support necessary to make the programs and courses work. Anything less results in frustration on the part of both students and faculty, as well as a loss of confidence in the process of distance learning on the part of both (Palloff & Pratt, 1999).

The Specifics of an Online Course

Communities – the Essence of an Online Course

Carolyn Shaffer and Kristin Anundsen (1993) talk about our human yearning for a sense of belonging, kinship, and connection to a greater purpose. Changes in the makeup of our families, neighborhoods, and towns have increased that longing, as we are not as easily able to identify with something we can call a community. Our communities today are formed around issues of identity and shared values; they are not place-based (Palloff, 1996).

So what does community have to do with online learning? Palloff and Pratt (1999) contend that in distance education, attention needs to be paid to the developing sense of community within the group of participants in order for the learning process to be successful. The learning community is the vehicle through which learning occurs online. An instructor can begin a course by posting introductions, encouraging students to look for common areas of interest, or create a "virtual café" or "Cybercafe" for students to discuss personal issues with others in the class. Also, in order to form a community of learners, everyone must participate and this requirement must be outlined in the syllabus.

During my presentation I will list specific web sites and provide handouts to guide you in building an online course, how to promote collaborative learning, suggestions for springboards to learning, developing assignments, transformative learning, opportunities to encourage reflection, and assessment and evaluation.

The Role of the Learner

Let's not forget the learner and their role. The successful learner needs to be actively engaged in learning, be responsible for actively seeking solutions to problems, view problems and questions from a number of perspectives, question assumptions, be able to critically evaluate their own learning style, gather additional resources that are pertinent to the area under study, collaborate or work together, share resources, generate a bibliography of readings, post other materials of interest, collaboratively prepare a report or work on a joint project and provide meaningful feedback to others. Also, instructors who are teaching similar courses, either at the same university, or different universities around the world, can encourage discussion among participants in those classes.

Conclusion

Higher education has been under considerable scrutiny lately and has received its share of criticism regarding technology in the classroom. Our educational systems were architected to deal with survival in a mechanistic society, where we taught people to follow instructions – and work on farms or in factories. The school based on the archaic factory model doesn't prepare students because the relevant skills and attributes that students need to be successful in this century and the next are not being addressed (Caine&Caine, 1994 p.15).

In today's knowledge-based economy, society needs people who can think critically and strategically to solve problems. Individuals must learn in a rapidly changing environment, and build knowledge taken from new sources and different perspectives. Today we must understand systems in diverse context, and collaborate locally and around the globe using tools like the Internet (Reich, 1995; Merrill Lynch, 1999).

At South Dakota State University we embrace information technology and all that it can do for us, but more important, we are devoting a great deal of our time and resources to using it to transform the way we teach and the way our students learn.

References:

California Distance Learning Project, "What is Distance Education?" 1997. [http://www.otan.dni.us/cdlp/distance/whatis.html]

Palloff, R., and Pratt, K. "Building Learning Communities in Cyberspace, San Francisco, CA, 1999.

Palloff, R. "Confronting Ghosts: Lessons in Empowerment and Action." Unpublished dissertation, Human and Organizational Systems, Fielding Institute, 1996.

Shaffer, C., and Amundsen, K. Creating Community Anywhere. NewYork: Jeremy P. Tarcher/Perigee Books, 1993

The Poor Man's Eyetracker Tool of ActiveMath

Carsten Ullrich and Erica Melis
DFKI Saarbrücken, Germany
cullrich—melis@dfki.de

Abstract

We address the problem of tracking some of the student's activities in an e-learning system to obtain data that can be used to diagnose and to react appropriately to the student's actions. In order to find out how long a student deals with a single paragraph/text-unit on a web-page we developed a poor man's eye tracker (PME) software, DFKeye. This tool can be configured for several appearances. The usage of a PME avoids the drawbacks of hardware eyetrackers that are not usable in an everyday learning environment.

1 Motivation

In empirical psychology, eyetrackers are a common tool for tracking the user's attention and for investigating design and usability features of computational systems and their user interfaces, see, e.g., [3]. These eyetracker facilities can, however, only be used in a laboratory, are difficult to adjust, and impose restrictions on the user. Therefore, their usage outside the lab, e.g., in everyday e-learning or other non-experimental activities, is impractical. Furthermore, the very detailed information of the user's visual focus which a hardware eyetracker provides is even too detailed for e-learning diagnosis purposes and has to be abstracted.

Nevertheless, for a diagnosis in an e-learning system, information about the user is required to appropriately determine the system's user-adaptive behavior and its suggestions. This information can partly be deduced or estimated from the student's learning activities. Especially the learner's performance in exercises and her navigation can be evaluated to estimate her capabilities without too much intrusion. Therefore, many intelligent systems use those activities to update the user model.

For reading and watching activities detailed information is rarely handled; some approaches measure the reading time for complete pages. These times can be compared to dynamically calculated optimal reading times, see for instance [5]. However, as the taken time refers to a complete page, it does not allow any conclusion about *parts* of a page, e.g., whether/which parts of the text have been skipped. Another disadvantage is the static nature of the observation. That is, when the student has worked on a page and goes to the cafeteria to relax before she resumes learning, then there is no way to distinguish the actual reading time from her time in the cafeteria.

We know of only one attempt that uses a finer grained measurement. That is Conati's masking interface that makes time taking for single problem solving steps possible by covering or fading the text of the steps [2]. Conati's interface is, however, implemented inside the Andes system rather than stand-alone and is not browser-based, and hence not reusable. Moreover, it has the disadvantage of hiding all the text that is outside the direct focus of attention. Since all the other steps in the worked-out example are invisible, the student no longer has an overview on the structure of the solution. The cafeteria problem arises, too.

We designed and implemented a PME that serves the learning environment ACTIVEMATH [4]. ACTIVEMATH is a generic web-based learning environment that dynamically generates interactive (mathematical) courses adapted to the student's goals, preferences, capabilities, and knowledge. The content is represented in an semantic `XML`-based format. It consists of units such as definition, example, exercise, or remark. For each user, the appropriate content is retrieved from a knowledge base and the course is generated individually according to pedagogical rules. The course is rendered to `HTML` and presented to the user via a standard web-browser. The student's interactions are used to update the user model and analyzed by a next-best suggestion mechanism that provides the user with hints about which actions to take next. The quality of the user modeling and the suggestions strongly depend on their input, that is the user's behavior. The more accurate it is tracked, the higher the quality.

Therefore, we needed and designed a browser-based time tracking facility that

- can provide the time spent on a *single* unit of a `HTML`-page rather than on the page,
- acts as a *stand-alone* module and communicates with other modules, e.g., with the user model;
- does not hide or change but *keeps and highlights the structure* of the example or document at hand,
- is *parameterizable* because different users might react differently to different PMEs, and finally
- is *dynamic* and notices when the user does not pay attention to the learning document.

To the best of our knowledge such a tool does not exist yet. In the remainder of this paper we describe this tool.

2 Poor Man's Eyetracker DFKeye

Human-computer interaction research reports experiences [1] on that and how the mouse movement follows the eye movements. Therefore, it is natural (rather than an additional effort) to expect from the learner to move the mouse as she goes along with reading a document such that the mouse location indicates the current focus of attention. However, some student do not move the mouse in an appropriate fashion and thus have to be softly forced to do so.

The information that can be expected from such a mouse movement is less detailed than the information of an eyetracker or, put differently, at a more abstract level, namely the order in which the elements have been focused and the duration of the focus. This does not harm its envisioned applications in e-learning, however.

The ability to measure the time a student takes to deal with a text-unit requires a structure of the web-presentation. This structure naturally arises from ACTIVEMATH's underlying knowledge representation that represents the content not as complete pages but as single paragraphs/units.

When ACTIVEMATH displays a page, the PME makes the text contained within a unit (slightly) unreadable. Three different variants have been implemented: *cover* (puts a black cover over the text), *fade* (changes the font color to nearly match the background color), and *zoom* (changes the font size to miniscule). If the learner focuses a unit by moving the mouse pointer on it, the PME unhides its text and starts a timer. If a unit looses the focus as the mouse pointer is moved away from it, its timer is stopped and its value is send to the DFKeye web-server.

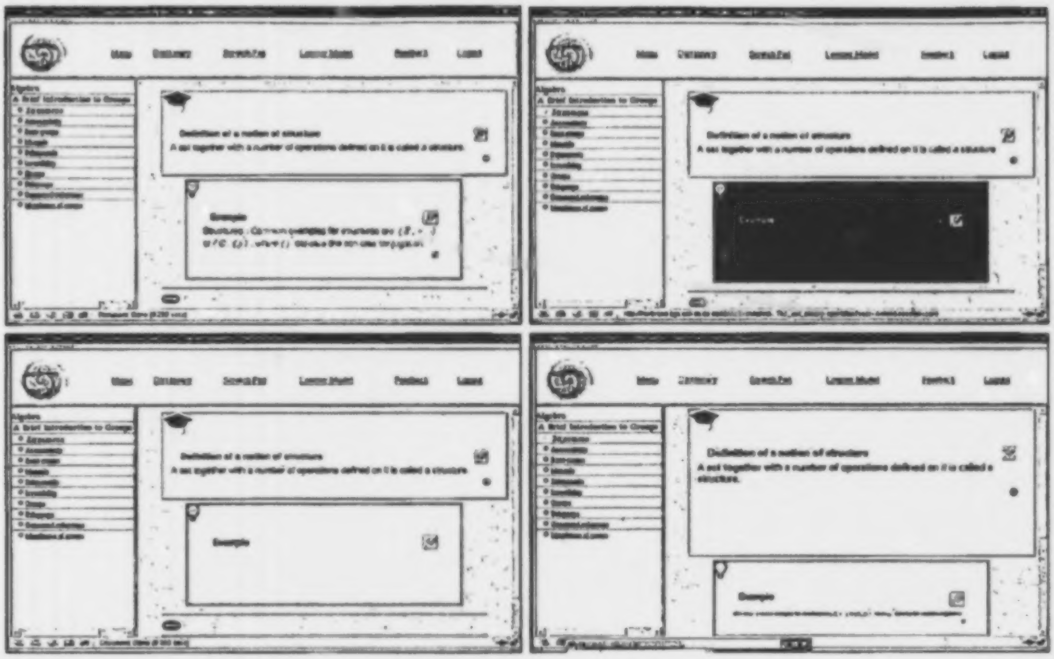


Figure 1: ACTIVEMATH eyetracker variants: none (top left), cover (top right), fade (bottom left) and zoom (bottom right)

The delay between touching the unit and focusing it is parameterizable (per default 0.7 seconds). We have chosen to not change the focus immediately as we wanted to minimize the amount of irrelevant data: often the learner moves from one unit to another one that is not directly adjacent. In this case she doe not focus on in-between units for which therefore no time information is taken. To tackle the cafeteria problem, a unit automatically looses the focus after a parameterizable delay (per default 30 seconds). If the student moves the mouse again, the unit regains the focus. Both delay times are not yet empirically confirmed.

Let's have a look at the example in Figure 1. It shows the same page in ACTIVEMATH in the different PME variants. The visual separation of the paragraphs reflects the structured representation of the content: Each paragraph corresponds to a proper unit. The learner focuses the upper unit, the definition of a mathematical concept. if no eyetracker is used, the complete page is readable (top left). Otherwise the text in the example (the paragraph below) is covered, faded (only faintly visible in the figure), or shrunken, resp. The structure of the page remains visible, though. The icon and the color scheme clearly indicate the type of a unit and its title stays readable.

Thanks to the PME, ACTIVEMATH can analyze and react to the learner's reading behavior. For instance, if the learner focuses an example over and over again and then solves an exercise correctly, ACTIVEMATH can assume that she has studied the example throughoutly and the user model strongly increases the user's application level of the concept the exercise is for. Otherwise, if the learner never touches the example and subsequently performs poorly on the exercise, ACTIVEMATH's suggestion mechanism can invite her to look at the skipped example.

Technical Realization ACTIVEMATH integrates the PME as a Javascript application. It

BEST COPY AVAILABLE

mainly uses `onMouseOver/onMouseOut` event handlers on `HTML div` elements that catch the mouse movements. The time information is send to a servlet (java server application) immediately after a unit looses the focus. The servlet sends the data to the interested modules such as the user model and a suggestion mechanism.

The PME was implemented in strict conformance to the W3C standards, and is usable in all W3C-compliant browsers (Mozilla, Netscape6) and in IE5. We implemented a PME-kit that can be easily integrated into existing web-based systems.

3 Conclusion

Although the information that a PME provides is less detailed than the information of an eyetracker, this does not harm its application in e-learning because the less detailed information corresponds to an abstraction of the common eyetracker information that is useful for e-learning diagnosis.

The tool can be used for other purposes for which the level of information provided by the PME is appropriate. For instance, we are currently conducting an experiment in which we investigate to what extend the PME can be used to evaluate design and usability issues.

The PME's implementation of ACTIVEMATH runs reliably since March 2002. A demo is available under `http://www.activemath.org/demo`. Experiments are being conducted with the different PME versions in order to find out which one is the most appropriate for a particular purpose and type of user and which is least distracting.

Acknowledgment We thank Michael Dietrich for his work for the implementation of various PM eyetrackers in ACTIVEMATH.

References

[1] M.C. Chen, J.R. Anderson, and M.H. Sohn. What can a mouse cursor tell us more? correlation of eye/mouse movements on web browsing. In *Computer Human Interaction (CHI) 2001*, pages 280–281, 2001.

[2] C. Conati and K. VanLehn. Teaching meta-cognitive skills: Implementation and evaluation of a tutoring system to guide self-explanation while learning from examples. In S.P. Lajoie and M. Vivet, editors, *Artificial Intelligence in Education*, pages 297–304. IOS Press, 1999.

[3] S. Lajoie and M. Vivet, editors. *Artificial Intelligence and Education*. IOS Press, 1999.

[4] E. Melis, J. Büdenbender, E. Andres, Adrian Frischauf, G. Goguadze, P. Libbrecht, M. Pollet, and C. Ullrich. Activemath: A generic and adaptive web-based learning environment. *Artificial Intelligence and Education*, 12(4), 2001.

[5] M. H. Ng, W. Hall, P. Maier, and R. Armstrong. Using effective reading speed to integrate adaptivity into web-based learning. In *AH 2002*, LNCS, pages 428–431. Springer, 2002.

Health Sciences Students' Perceptions of Online Problem-Based Learning

Ruta Valaitis
School of Nursing
McMaster University
Canada
valaitis@mcmaster.ca

Wendy Sword
School of Nursing
McMaster University
Canada
sword@mcmaster.ca

Bob Jones
Visualization Design Institute
Sheridan College
Canada
Bob.jones@sheridanc.on.ca

Andrea Hodges
Program, Policy and Planning
City of Hamilton, Social and Public Health Services
Canada
Andrea.hodges@learnlink.mcmaster.ca

Abstract: This paper will report on a work in progress. The research investigated senior health sciences students' perceptions of their experiences in a problem based learning (PBL) class conducted exclusively online. Nurses, midwives and graduate neonatal nurses with previous experiences in face-to-face PBL participated. Qualitative data were collected using reflections, focus groups, and interviews, which focused on participant's perceptions of the PBL process and learning in the online environment. The PBL case and resources, as well as the design of the conferences will be briefly introduced. The focus of the paper will be on the preliminary findings of students' perceptions about group process and learning in the online environment. Limitations of the research and implications for future applications of online PBL will also be addressed.

Introduction and Study Description

Little is known about conducting PBL exclusively online. This paper reports on senior health sciences students' perceptions of their experiences in a problem based learning (PBL) class conducted exclusively online. Students with previous experiences in face to face PBL self-selected to participate in the study. The three student subgroups included 7 third year undergraduate nursing students, 5 masters students in neonatal nursing, and 10 fourth year midwifery students. The three tutors were all experienced in PBL, but were novices to teaching and learning in the online environment. All students knew each other from prior face-to-face meetings and all but one student were new to online learning. The groups communicated exclusively using First Class computer-mediated communication software and participated primarily in an asynchronous mode. All groups also used chats to communicate; generally the chats happened weekly. A digital case related to fetal alcohol spectrum disorder (FASD) was developed for all groups to use as the trigger for small group learning. The case included videos, web resources, relevant documents, and case records. In addition, content experts and a legal guardian, who cares for children with FASD, were trained to communicate asynchronously with students online. The PBL experience lasted between 4 and 6 weeks and students were graded on their participation.

Qualitative data were collected using reflections, focus groups, and interviews. The questions for the reflections were modified from Stephen Brookfield's (1995) work and were completed weekly, where possible, by students throughout the online PBL intervention. At the end of the intervention, focus groups were conducted with each class; interviews were held with students who could not attend the focus group. Focus group and interview questions were focused on the PBL process and learning. For example, in what way was your online PBL experience different from your past face-to-face PBL experiences? Can you comment of the nature of your discussion in your online PBL experience compared to your past face-to-face PBL experiences? What did you like the best/ least about participating in a PBL online? The interviews and focus groups were taped, transcribed and modified after checking for errors. N-Vivo qualitative analysis software was used for analysis. Four members of the research team independently coded one focus group transcript and met to discuss similarities and differences in coding. Using consensus, a master code list was developed and applied to all the data. New codes which emerged were also discussed with researchers. All of the data were chunked into meaningful segments and first level codes were assigned. Currently, the codes continue to be arranged into pattern codes, which hold commonalities and form sub-themes. This paper represents a work in progress and reports preliminary findings of students' perceptions about group process and learning in the online environment.

Preliminary Findings

Issues

A number of problems were experienced by participants in their online PBL experience. Group decision-making was time -consuming and challenging in the asynchronous environment due to the lag time in reading and writing asynchronous postings. Chat (real -time discussion), which was a feature available but not required to be used by the group, was valued by the three groups as a strategy to overcome the problem … "I thought [chat] was a good way of bringing everybody together and providing some direction for the rest of the week in terms of what we were doing." Another student felt that "For me the chats at first they were overwhelming, but it was the only time when the group would make group decisions, and you wouldn't take a week after to decide where are we going now."

For some, the PBL online experience felt overwhelming. This was largely related to workload, which was perceived to be heavy for reading and creating notes. A sense of cognitive overload was evident which was due to multiple discussions taking place at the same time in asynchronous discussions and real-time chat. In chat, nurses felt that "it just seems so chaotic. It's like we're in a room and everyone is talking at the same time and not waiting for someone to answer, and then they'd answer later. To me it didn't work with my brain. Like, I couldn't follow it." Cognitive overload was also experienced in asynchronous communication when notes related to multiple subjects were all posted in one folder. The creation of specific folders for different topics eased this problem. "Having separate folders for me makes it not feel as overwhelming as the first layer did with only one folder for all objectives."

Most felt that online PBL took more time than face-to-face. As noted by one nurse, "this is so time-consuming!! Reading and responding to everyone takes 10 X the amount of time online than face to face." Brainstorming issues also took longer online. A midwife wrote "It took SO long! In person, we can usually brainstorm and set objectives in half an hour." Students felt an ongoing need to be frequently online. One nurse felt "perpetually guilty about not logging on enough, not posting enough e-mails, and not responding to enough postings. It was beginning to consume me and I was not happy." A midwife felt the need to log-in daily. "It really felt it was hanging over your head all the time. . .But oh,. . . you haven't been on there. You are going to miss out on all of the good stuff. The feeling was "Oh I have to get on there."

Another problem was the need to be sensitive in the creation of notes and the potential for misinterpretation of notes due to a lack of non-verbal communication. One student wrote that". . . it has been a challenge to phrase and write things, so as not to accidentally offend anyone." Information that was presented was repetitive at times and students felt a sense of pressure to show their knowledge. A midwife felt that "I find it frustrating when people post info that has already been touched upon or presented… It's almost like people think that they just need to get something down that can be graded… but it just makes it redundant and boring." This also illustrates the influence of grading on individual participation. Grading was viewed as a motivator, made students accountable, increased the time students spent online, created more stress, and influenced students to increase the amount of content they presented. Some students felt that "it would have been easy to let it slide" if PBL was not graded.

Advantages

Despite the problems, a number of important advantages were identified. Students had more time to reflect, process and analyze information through the reading and writing process. Students noted that they refined their online contributions from "barfing information on the screen" to "[focusing] research into key areas . . .[and presenting them] in a succinct way." One midwife commented that, "something I really liked about [First Class] was the depth of information that was posted. . . . It's like the academic work is actually done." A nurse felt that "you really had to synthesize it because you were putting it down on paper and words." Another felt that, "resources had to be more critically analysed, [as well as] what was posted for the content that it had, versus just coming to class and bringing something." A midwife felt that, "when we're in person we tend to go off on more tangents. . .[in]online learning, we stayed a little bit more focused, even though [our tutor] did give us the feedback – ok we need more analysis of information, not just information, but analysis of it like looking at the studies."

More time and place flexibility was another advantage of online PBL as indicated by the following comments. "I am enjoying doing it from the comfort of my own home" and, "I really liked that I could go in and do it any time because that was convenient having kids at home. I could go in when they're asleep. . ." One neonatal graduate nurse gained a new appreciation of the use of the chat feature to connect with people from a distance. She explained ". . . I was on holidays so I hadn't talked to anybody for a whole week, and then I came to the chat that night. It was like, oh, there is everybody. This is great! So maybe if you were in a distant setting and that was the only time that you came together that you might have a different view of [chat]."

Opportunity to learn at one's pace and flexibility to learn in a style that suits one's individual needs was valued by many participants. A nurse indicated that "I know it's neat to have so much available, because usually the tutor has all the information and you have to draw it out. But this way, like according to your style, or how much you wanted to know, you could just access information." Quiet group members felt able to participate more and be heard. One nurse stated, ". . . I'm usually a quieter person, but it's easier for me to sit and think about things and then post them rather than if I'm face-to-face . . . the group keeps on going... So yeah it's like doing it on your own time." In addition, peers could hear more from the quieter members and gained an appreciation of their peers' depth of thought compared to their face-to-face PBL experience.

> "I think what I really liked about the PBL online ... was that the people whose voices I don't often get to hear [in face to face classes], I did [hear] in the [online] PBL. . . The appreciation of the depth that people were at, that I don't always get to hear in class. And, I feel like sometimes that that's the downside of the PBL format. From an oral perspective, is the sort of the more outgoing or vocal or people who articulate more comfortably . . . They tend to speak whereas [with] someone on the computer, your voice is always the same.

This quote also supports the finding that there was a sense of equality among group members. A nurse explained, that "everyone was more equal, because in our group setting there [are] always more quiet members. But there were no quiet members, because everyone had to put their postings on. So, it was very equal in some respects."

Many students felt that they learned online from peers. For example, a midwife explained, "I was very proud I actually could find the SOG Website, but that's because CS's been using it. So I think what's been happening is more of a filter thing that within the class we have LD, the computer maniac, and here's filtering down to other people. And it's kind of just a little bit of a trickle thing that I'm starting to pick up." Many students also felt that they gained knowledge and skills in computers, Internet web resources, and online etiquette. One midwife stated that, "I really needed to learn computers, so this was a really good exercise personally." Another stated that "[Online PBL] has increased my confidence in computers and now I know how to do email by myself." One nurse, felt "most engaged during the research component for this class. I found out some good resources online."

Although students did not have access to simulated patients for their online PBL experience, as they typically would in a face-to-face class, they appreciated the sense of reality they felt in certain aspects of the online PBL experience. Discussions that had applications to real clinical scenarios and contact with "real" people were valued. A midwife felt it was "most engaging when other students talked about real case situations, [which] made [her] think about how to put the theories that [they] talk about into practice." One midwife noted that. ". . . having a real person with real experience [as a resource for the case] was really good, [and the resource person made] all the same spelling mistakes that we were making." Videos also helped some students feel that the case was real. They valued the modeling of the interviewer in the videos of the case scenarios.

Most students struggled to understand what was considered successful online participation. "I am still not clear [about] what the expectations are of us... I get the impression that people are trying to independently answer every objective. I was more under the impression that we are to build on what's already there." Students wanted clear expectations and feedback from both tutors and their peers. One nurse felt "[my peer] put things (group issues) into perspective and calmed my anxieties. It felt good that she acknowledged my position and reassured me that I was not alone in it. As well, today when I received [my tutor's] e-mail I felt TOTALLY affirmed. Not only did [the tutor] agree with some of the points I had raised, but also gave us guidance, suggestions and affirmation that we were ALL doing a great job."

Summary and Next Steps

Our findings are transferable to contexts which are similar to those described in this study: students and tutors new to online learning and experienced in PBL. The short time that they spent online and the high learning curve that they experienced undoubtedly influenced their perceptions. The fact that students were not true distance learners (they continued to see each other in face-to-face classes) also likely affected their communication online and their perceptions. Finally, there may have been some bias introduced if students told the researchers what they thought we wanted to hear. However, students appeared to be open to sharing their perceptions of their experiences. Future analysis of the data will include the data from online chats and posted notes to further inform us. Their ongoing reflections may identify changes in feelings over time and will also be investigated in future analysis. Although it is too soon to make recommendations from our findings, strategies to overcome the problems identified in this study require attention by online educators. On the other hand, benefits of online PBL can be supportive for health sciences students learning at a distance, as well as in hybrid (mixed face-to face and online) courses.

References

Brookfield, S.D. (1995). *Becoming a critically reflective teacher.* San Francisco: Jossey-Bass Publishers

Acknowledgements

Financial support for this project provided in part through a grant from the Office of Learning Technologies, Human Resource Development Canada, Government of Canada.

This study was also made possible through the support of PHRED, Public Health Research and Education Department, City of Hamilton, Social and Public Health Services.

How To Debit Their Scores?
An ICT Solution To Assess Accountancy Students.

Dirk Vanderbist & Jan Vanthienen
K.U.Leuven, LIRIS, Department of Applied Economics, Belgium
{dirk.vanderbist,jan.vanthienen}@econ.kuleuven.ac.be

Abstract: The introduction in 2001 of a centralized E-learning platform at K.U.Leuven brought challenging opportunities for accounting courses to engage in E-learning. This paper deals with the problems encountered in the development of electronic tests and remediation exercises. First a list of requirements, to make the exercises as realistic as possible, is presented. Then we give an overview of issues with the available ICT platform and we end with a discussion of the newly developed software.

Introduction

In 2001 K.U.Leuven chose a centralized approach (Toledo 2002) for implementing ICT to support courses and learning activities in one learning platform based on two commercial products. For electronic courses K.U.Leuven opted for BlackBoard and for electronic test and remediation exercises Question Mark Perception[1] (QM 2002) was implemented. For most of the courses at the Faculty of Economic and Applied Economic Sciences, going from paper to other media only caused minor problems. Making electronic versions of accounting exercises related to accounting courses is a lot trickier and the focus of this paper is to elaborate on how electronic test and remediation exercises were implemented (GIZEH 2002). The main problem to tackle has been the typical tabular format for accounting. Not finding any satisfying commercial product resulted in building an interface between QM and a newly developed tool. The goal was to enable students to do their tests and exercises in the same flexible way as they would be doing them on paper. The reason ICT was preferred to paper boils down to time management. Using ICT for these tests and exercises allows providing students with fast evaluation and feedback because it is generated electronically. Tutors can now focus on providing support to students really needing it without loosing time with batch correction jobs.

Requirements

First of all the exercise's representation should look as natural as possible. This limits the possibilities of multiple-choice questions to assessing the theoretic parts of the course. For exercises a representation close to the T-like scronto format or the tabular journal format is needed as these are the two formats allowed according to the Belgian's accounting standards. Another requirement was that the tool should be very flexible when dealing with inaccuracies of the student. This was realized by providing ranges for account numbers and ranges for amounts. The ranges of account numbers were to overcome the situation were one or more account number in a group is considered correct. To bypass rounding errors during calculation the ranges for amounts were provided.

Finally specific requirements to aim at for scoring questions and providing feedback were outlined. The answers will be evaluated based on two factors both worth half the exercise's score. The first part considers the correct structure, meaning the correct account numbers and corresponding account descriptions, which is either correct or incorrect resulting in null or the full marks. If the structure is correct the second part is evaluated were the accounts' amounts are looked at. Every correct account is worth the same and the score is expressed as percentage to the maximum given by the correct answer making up the score for the second part. The feedback is adapted according to the student's answer. If the student returned a blank answer he will only receive a hint indicating where in the course the answer can be found what discourages students trying to collect exercises.

---

[1] the version of QM referenced to in this paper is 2.5.0.0

When the structure was answered incorrect the student receives the correct structure as feedback and the feedback for mistakes against the accounts' amounts is the correct answer to the exercise. Every feedback should also provide a unique reference label. This label enables students to refer to specific exercises during communications with their tutors.

Challenges & Solutions

In general we found out that accounting exercises do not fit well in the features provided by E-learning ICT tools because of the lack of flexibility needed as indicated in the requirements. Initially we tried to use basic question types available in every ICT product. While multiple-choice question could be used in theoretical questions they were ruled out very quickly as accounting has nothing to do with selecting the correct answer. A second attempt was made with fill-in-the-blanks questions. Here we were able to get very close to the requirements but some semantic and syntactical problems also ruled this out in the end. Other question types were not considered useful.

Because its used principally in exercises, the tabular journal format was implemented (Figure 3). It represents the different participating accounts in one accounting transaction. In the first column the account numbers and account descriptions are shown grouped together around the ones that are debited, before the '@'-symbol, and the ones that are credited. In the following columns the amounts by which the corresponding accounts are debited, first column, or are credited, second column, are indicated. The first property laid down was the size of the table. It should allow the students to answer most, if not all, types of questions. We opted for one fixed format with four debit accounts and four credit accounts. Providing exactly as much rows as needed would give away the answer as students will start recognizing answer patterns and providing the number of row in a dynamic way has very high load times and evaluation response time because of the dynamic structure's size and complexity. The solution with the fixed table size overcomes both problems and is still very flexible. The students are allowed to enter their solution in any order, as long they respect the debit and the credit groups, irrespective of the position of unused blank space.

The things we could not do flexible enough in QM using its basic features lead to the implementation of an interface with QM. Firstly, we would like to complete the account description when the student enters an account number as every account number has a fixed description. For a student this is valuable feedback. Secondly, we like the required flexibility dealing with the way a student enters his solution. As indicated before the order and the position of accounts and blank unused lines should not play any part. Semantic problems made it impractical to implement using these basic QM features.

The semantic problems have to do with the way exercises are corrected and the way the maximum score is calculated. For correcting exercises a set of logical expressions is used. In QM logical expressions may not contain parentheses to guide the evaluation and consequently have to be serialized to overcome this. However due to combinatory explosion during the serialization process, because of the nature of accounting questions, the expressions surpassed the question size upper limit. A second semantic problem is about the way QM calculates the maximum score of a question based on a set of logical expressions. QM calculates the maximum score by adding all the scores potentially given by every expression in the set together not taking into account that some expressions might be mutually exclusive. It is possible to overcome this by intervening directly in the DB, storing the QM generated exercises, and by adapting the scripts that generate the grading reports. Since this is dependent on the QM version it was not considered an option.

QM is not optimal for representing accounting exercises directly but still used, be it through an interface, and there are some good reasons for this. First of all QM is a standard with K.U.Leuven so support is guaranteed. Second it is better for students to have a limited set of standard tools they have to work with. The last argument is that if we implement an interface with QM it is possible to use its report generator, deployment options and user management without having to implement this ourselves.

Implemented Solution

The relation between QM and the developed software is indicated in Fig. 1. The software basically consists of two parts: an authoring tool, B2QML, used by the tutors to generate the accounting exercises and a Java applet, QMB, used by the students to do their exercises. The software satisfies all the requirements previously indicated.

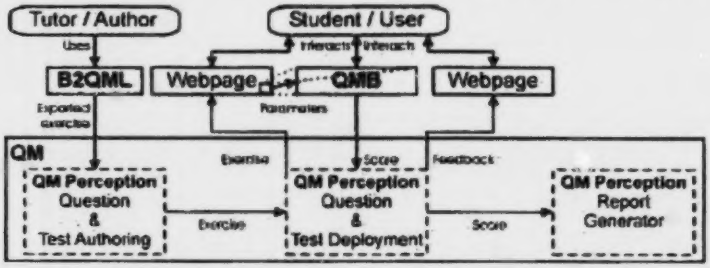

Tutor / Author
Student / User
Uses
Interacts
Interacts
B2QML
Webpage
QMB
Webpage
Exported exercise
Parameters
QM
Exercise
Score
Feedback
QM Perception Question & Test Authoring
Exercise
QM Perception Question & Test Deployment
Score
QM Perception Report Generator

Figure 1: Relationship between QM, B2QML and QMB

B2QML (screenshot in Fig. 2) is capable to export exercises in the QML import format for QM questions. B2QML checks the validity of the question and verifies the question for semantic author mistakes. Generating accounting questions directly in QM with all the evaluation aspects is very complex what makes it error prune and therefore we chose to use an authoring tool instead. Moreover HTML is used in the deployment of questions, QMB applet encrypted parameters have to be set and the logical expression for the evaluation have to be written down which was considered not to be within the typical author's range of skills.

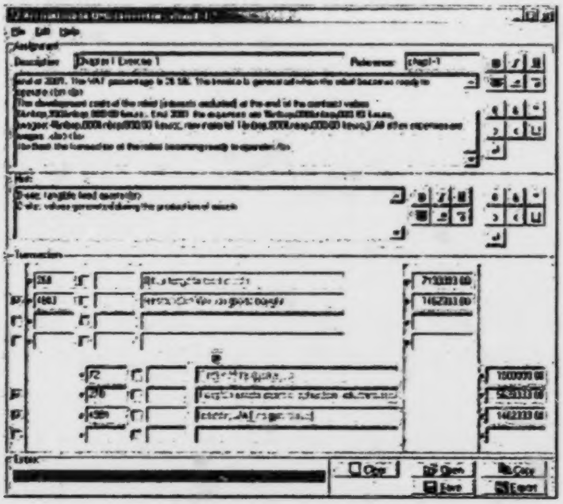


Figure 2: Screenshot B2QML

The student interacts with the QMB applet (screenshot in Fig. 3) that is embedded in a dynamic web page generated by QM. QM passes, through parameter binding, all the necessary information to the applet to enable the applet to evaluate a specific exercise. When the student submits his answer the QMB applet passes the score back to QM and the latter will generates a web page containing the feedback according to the score. Because the answer to the exercise is visible in the source of the generated web page as the parameter list of the QMB applet we apply an encryption algorithm to the parameters. The applet provides the author with an option to reveal some aspects of the answer. These parts are shown as pre-filled content fixed input zones in the QMB applet.

BEST COPY AVAILABLE

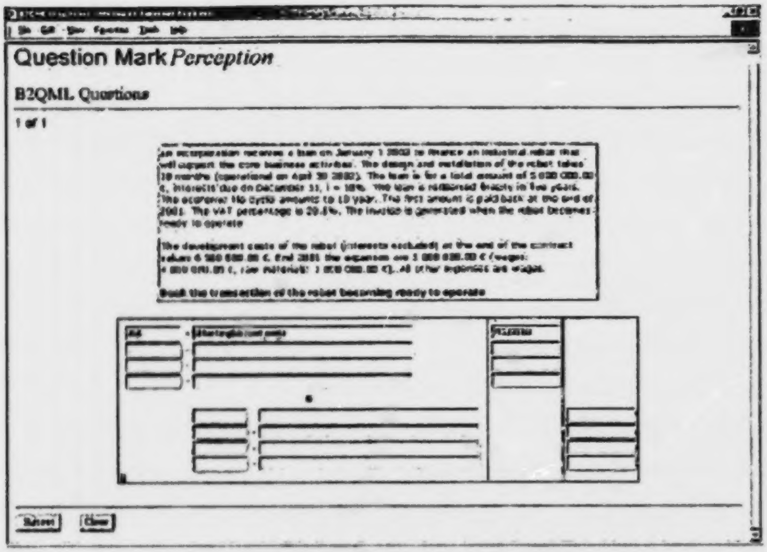


Figure 3: Screenshot QMB (first row fixed)

There are some other advantages to this approach. The QMB applet can be embedded in any web based environment as it is a stand alone piece of software. In the near future it will be used in a CD-Rom based accounting self study package implemented by means of Praktix Presentation Viewer (PPViewer 2002) which is a table based hypermedia viewer developed at K.U.Leuven. The authoring tool, B2QML, is language independent. The whole tool is based on definition tables. Only the translation of these tables is needed to implement a version of the tool in another language what makes the tool very adaptable and allows for easy maintenance.

Future Development

For the moment the solution discussed in this paper only allows accounting exercises represented as one entry transactions in the journal. Viewing them as a series of one-entry transactions and providing a QM question for each of them is the only way to support exercises having more entries. Implementing a real multi-entry exercise would make the exercises even more realistic compared to real live accounting but the trouble is the combinational explosion during evaluation of such exercises. Belgian accounting standards do not provide a fixed order and moreover it allows entries to be combined or uncombined leaving the implementation as a very complex but tempting problem for future development.

Refereneces

Toledo (2002). *K.U.Leuven Toledo project homepage:* http://toledo.kuleuven.ac.be/

GIZEH (2002). *K.U.Leuven FETEW GIZEH project homepage:* http://www.econ.kuleuven.ac.be/GIZEH/

PPViewer (2002) *K.U.Leuven Praktix Presentation Viewer homepage:* http://www.econ.kuleuven.ac.be/PPViewer/

QM (2002) *Question Mark homepage*: http://www.questionmark.com

BEST COPY AVAILABLE

An infrastructure of Possibilities: Distance Learning at the University of the Sacred Heart

Antonio Vantaggiato
Distance Learning Institute
Universidad del Sagrado Corazón, Puerto Rico
e-mail: antonio@sagrado.edu

Abstract: This article describes an academically valid and sustainable model for Distance Education that we are building at the University of the Sacred Heart. The philosophical assumptions (hybrid or blended model), the pedagogical tenets (holistic view of Web-based course creation), and the organizational structure of the model are presented. First, the importance of participation of all actors of the academic arena is stressed. Then, after describing the reasons that back our Institution's decision to use the Web as the major support and medium for Distance Education, the case is made that what we call the "infrastructure of possibilities" is a feasible model of co-creation and sharing for Web-based DE. Last, among the requirements of such an infrastructure, the need of suitable tools to use the Web's potential is described, and one such tool, LinksKeeper, is presented, that helps to create a cooperative environment to catalogue and share the Web's resources.

Introduction

Distance Education (DE) at Sacred Heart University is a transformation of possibilities in education, and therefore a highly cultural project. Though objective socioeconomic reasons impel university institutions to adopt distance education (in Puerto Rico, demographic changes, among other factors), the University of the Sacred Heart has decided to create a model of its own to help the institution to fulfill its institutional mission and to serve better its community by producing effective learning on-line strategies (Abraham 98). This article thus presents a model for distance education that is being designed at the University of the Sacred Heart, based on the participation of all the interested actors in the academic environment.

Our model has one basic tenet: it is a work in progress, a skeleton being filled and configured by all the interested parties. We started with only a few guidelines (for instance, we do not want the recreation of textbooks in a different medium (Anderson 97); instead we seek to build whole experiences around each course that use the new medium in novel ways), and let faculty and the other actors invent their own play. This way we argue it is possible (and sustainable) to foster a serious spirit of creativity while enhancing the academic-learning experience.

The Distance Learning Institute

We designed an agency that could foster such an environment and atmosphere, an agency made of faculty for the benefit of faculty. The Distance Learning Institute (InED, for its Spanish acronym) was thus born out of a necessity; its mission: to propose and foster discussion of policies; to research and develop critical applications that may help faculty and students in the new endeavor; and to research pedagogical/economical issues pertaining to distance learning. The Institute's nature is so dual: educational & technological, and in setting so, we established a primary center in Puerto Rico to work in the intersection of the two areas.

Thanks to the Web revolution, we have come to believe that DE represents an opportunity without precedents for a pedagogical-economic revolution that extends and transforms the dialogue between the main actors of the academic environment. At the same time, we think that DE allows to take care of those problems that the social changes of students present us. The Distance Learning Institute was created, therefore, to establish the institutional infrastructure to manage the ambitious objective of creating a better university.

First, to us, on-line education is equivalent to education supported by the Web, without renouncing the current physical component we consider important to maintain and refocus. This way, we do not propose on-line education like an alternative, but like an evolution of the educational paradigm, in order to center the process around the student.

An Infrastructure of Possibilities

Our infrastructure of possibilities has the following goals:

- To extend the dialogue between the actors of the academic community;
- To have information flow promptly and constantly to those who need it at the time they need it;
- To eliminate the classic educational barriers of space-time;
- To help students in the acquisition of the abilities of reading and of critical analysis of new media; so to have them overcome information overload and start producing knowledge;
- To create synergies between vital components of the internal and external university community, beginning with the assumption to use and to develop novel programming, based on open source code and nonproprietary standards (Vijay Kumar 2001) (so that students can be both producers and scholars, creators and analysts); this synergy is strongly centered in Web technologies and human resources and includes the central axes of the University's academic vision: Community Linkage & Service Learning (practice inside and for the community, development of civic sense, understanding of other people's realities), on-line Education, and the project "Language and Culture throughout the curriculum".
- To never stop to think about the project in terms of a great experiment, in which all are observant and observed simultaneously.

This experiment in the infrastructure of possibilities must adopt strategies to make this project a sustainable one. This implies the incorporation of faculty in the project from its earlier phases: we have worked on this by means of the participation of faculty in the productive debate on copyright issues, the very philosophy of DE, and its pedagogical methodologies, so that faculty can creatively evolve in the process of course design in the absolute respect of its freedom and personal creativity.

Why the Web?

Because the Web represents a revolutionary technology with a very simple interface that:

- Permits to extend the dialogue between the actors of the educational process;
- Permits to share experiences and resources, and to cancel geographic barriers: it is global, but simultaneously it emphasizes locality;
- Virtually eliminates the classic constraints of space and time: a course becomes a complete experience, even outside the class schedule and the campus;
- Ease the use of effective pedagogies based on the student as the center of the education-learning process, such as learning-by-doing, cooperative work and the linkage of studies with the necessities of the community;
- Permits the reusability, in different contexts, of didactic and nondidactic materials available around the world; this concept expands through the emerging Learning Objects standards (Wiley 2000).

The aspects mentioned above legitimize our belief that it is feasible to take advantage of the synergy that can be obtained by integrating several resources like original materials of the professor, programs and resources, articles, multimedia material and other on-line courses, all available through the Internet. We believe that this way it is possible to create more than courses, holistic on-line experiences, in touch with the world, of high quality and relatively low cost. We emphasized that we do not want a text book re-creation (Anderson 97): being it a new medium, we must give ourselves the opportunity to understand and assimilate the crucial aspects of this new technology. Only thus (that is to say, when we master the technique) will we manage to be truly creative in the production of on-line courses. We want to develop faculty able to create independently, and to master therefore the cybernetic techniques like pencil and paper.

Our model is academically valid: it encompasses three phases over one summer and two semesters: course design and creation, first methodological revision (while the course is being offered), and one second revision of contents, in order to adjust the course to the necessities and points of view of all the professors who deliver it. It is also economically sustainable since the courses' cost of development, although high initially, tends to lower when the potential of the new pedagogy centered in the student will reach maturity and be a compelling factor for faculty. Also, we think that in the mid term, the adopted approach allows professors a better control on courses and therefore a better quality of life: perhaps less time as "sage on the stage" and more in fruitful and vital discussions; time to dedicate to research or the didactic creation process. Also, the InED has plans to consolidate its activities including publishing learning objects and modules, and act like a brokerage agency between the market and the faculty interested in authoring these objects. This plan, if it is demonstrated viable, could considerably reduce the costs of future development of on-line courses.

Of course our model of an infrastructure of possibilities must develop and provide a strategy and the means so that faculty may express its creativity and maintain its academic freedom with the conscious and creative use of Web technology. The strategy to achieve this encompasses the following issues:

- Opportunities for on-line discussion and work must be constructed;
- Faculty and students are given the opportunity to learn, understand and use this technology;
- An effective capability to use the computing and Web resources in daily educational and non-educational activities is provided to faculty and students;
- Ample participation is given to faculty in all the essential questions that concern it, like distance education policies and authors' rights issues, among others; and
- Suitable tools are provided to faculty to take advantage of the Web.

LinksKeeper

The Internet was built around the idea of redundancy of paths. Nor content and its accuracy and usefulness, nor the fact that this content would eventually overwhelm the people who needed it the most was at stake (Etzioni 96). Only after the WWW was created, the inherent problems of content usage and usefulness emerged as main issues. In fact, the Web was born out of the scientific community's need to share content. However, the Web's infrastructure and protocols were not designed with these issues in mind, so we still see problems with respect to:

- Content usefulness and accuracy, and
- Information overload.

Since the Internet is all about links and sharing, we addressed these issues with a mechanism to build and share collections of useful resources out of a collaborative effort. So we designed a tool that people of a given community may use to add and catalogue their own Web resources: resources that each of them finds useful in a given context, class, research, or personal use. These common resources would be assured to be of generally high quality since they are catalogued by the very same users. We wanted also the catalogue to be annotated, because only from the annotation metadata would other people understand the usefulness of a given resource.

We implemented LinksKeeper, a cooperative client-server tool that provides users with a drag and drop interface to catalogue resources (manually) (Keller 97), (Li 99): users drag the resource they want to add (from a browser) over the catalogue item they believe the resource must be in, and drop it there. Last, they annotate it with their own considerations and comments. On the other hand, users who are in need of some specific resource will do the inverse operation, and will have no trouble in finding what they need, since the catalogue is annotated. LK is developed in Java, while the server part is developed using open source standard software such as mySQL. This application is thus fully portable across platforms, and is freely downloadable from the Internet (users need to subscribe explicitly.)

Our intention is to extend and improve the program to incorporate the creation and the storage of repositories of learning objects, using the available standards of metadata. Also, we are improving the program to discover nonfunctional links automatically and to solve the problem of how to replace them with others. Also we want to tie LinksKeeper to a Pan-Caribbean Repository of educational resources, particularly in areas of interest for the countries of the region.

Organization

It would not make much sense to have such ambitious plans without a strong organizational structure for the Institute. We believe we have achieved such a structure by:

1. Directing the Institute's work through shared responsibilities among three top positions that merge engineering, computing and pedagogy with political and communications expertise;
2. Integrating students within the day by day life of the Institute.

Students thus manage, research and develop software and Web content (a portal, various websites); they also manage our networking infrastructure. Through synergy among the Computer Science, Communications programs, the Laboratory of Artificial Intelligence and the Service Learning effort, we believe we can both use the talent of our students to produce interesting work, and transform them into co-managers and scholars. The forthcoming Master's Program in Informatics (oriented towards Internet technologies) will also help the Institute to be a practice field for all its students.

Of course, no major institution-wide project works without some hindrance or friction, especially when new units are created. Thus, management plans have to deal not only with project "evangelization" among faculty and administration, but effective action must be taken with academic and non-academic units. Thus, the highest-level commitment is of utmost importance: a paladin for the project needs to be there at all times. At the University of the Sacred Heart, our President supports wholeheartedly both this effort and the Institute.

References

1. Abraham, T. (1998): *The Interactive, Virtual Management Information Systems Classroom: Creating an Active Learning Environment on the Internet*; Proc., WebNet'98, AACE (Virginia).
2. Anderson, M. (1997): *Critical Elements of an Internet Based Asynchronous Distance Education Course*; J. Educational Technology Systems 26 (4).
3. Etzioni, O. (1996), *The World Wide Web: Quagmire or Gold Mine?*; Communications of the ACM 39, 1 (Jan. 1996).
4. Keller, R., Wolfe, S., Chen, J., Rabinowitz, J., Mathe, N. (1997), *A Bookmarking Service for Organizing and Sharing URLs*, Proc. 6th International WWW Conf.
5. Li, W.-S., Vu, Q., Agrawal, D., Hara, Y., Takano, H. (1999), *PowerBookmarks: A System for Personalizable Web Information Organization, Sharing and Management*; Proc. 8th Int'l WWW Conf.
6. Vijay Kumar, M. S., Merriman, J., Long, P. D. (2001), *Building "Open" Frameworks for Education*; EDUCAUSE Review, Nov/Dec. 2001.
7. Wiley, D. A. (Ed.) (2000): *The Instructional Use of Learning Objects: Online Version*. Retrieved 04, 01, 2002 from the World Wide Web: http://reusability.org/read/.

Acknowledgements

The work described in this paper was possible thanks to a Title V grant from the US Dept. of Education.

A Generic Platform for Presenting Learning Material:
Praktix Presentation Viewer.

Jan Vanthienen & Dirk Vanderbist
K.U.Leuven, LIRIS, Department of Applied Economics, Belgium
{jan.vanthienen, dirk.vanderbist}@econ.kuleuven.ac.be

Abstract: When developing courseware it is important to separate the learning material's content, the navigation through the content, and the content's layout in order to enable maintainability. Praktix Presentation Viewer is a generic platform to deploy course material based on this separation between content, navigation and layout. This paper discusses the concepts, features and techniques behind the generic platform.

Introduction

When the Faculty of Economics and Applied Economics at K.U.Leuven wanted to provide self-study course material on CD-Rom the option was taken to separate the learning material's content, the navigation through the content and content's layout. From the beginning it was clear that it should be possible to maintain the course material without having to use any courseware specific tools as this would make maintenance more difficult and vendor dependent. It should be possible to add, edit, delete or reorder learning material with common available tools. There have been too many examples of nice courseware lost, due to the impossibility maintaining it: hard coded navigation, vendor locked-in material, etc. A first generic platform, called Praktix, was built in IconAuthor, and was used to present course material on end user computing software. In order to apply more standard components and to increase flexibility the platform was rebuilt in Borland Delphi and renamed Praktix Presentation Viewer (PPViewer 2002). Meanwhile, the generic platform is being used successfully to deploy electronic learning material for other courses of the faculty's Information Systems Group.

Requirements

First of all some general requirements were outlined linking the platform's concepts to the E-learning principles: "learning just in time, learning just for me, learning just enough". Most of the concepts have been implemented since the first version of Praktix.

It was stated that the implementation should aspire to:

- *reusability*: decoupling the learning material's layout from the learning material's content
- *ease of maintenance*: decoupling the navigation from the presented content
- *integration*: trying to stay as much as possible within the boundaries of the platform
- *extendibility*: supporting the possibility to extend the platform for special needs
- *ease of deployment*: deploying the platform should mean no, or few very special, software components that have to be installed on the user's system
- *guaranteed continuity*: if the platform's development stops it must always be possible to recuperate the learning material's content
- *enabling independence*: for the main functionality no network connection should be needed

These requirements lead to an implementation dichotomy between the generic platform on the one side and presentations on the other side. By a presentation we mean the whole of learning material brought together for one course to be deployed electronically.

Distributing learning material for courses simply means putting the generic platform and one or more presentations on a CD-Rom. A CD-Rom is used as medium because it allows storing vast amounts of multimedia information relatively cheap. Bandwidths of networks are still a constraint as they are insufficient to support the same multimedia as streaming information at every moment of the day. If this bandwidth constraint would be lifted the implemented platform is equipped to embed streaming media and as such ready to follow this new track. In the early versions the focus was on making the presentations as network independent as possible since network connections for students were not obvious. This constraint is becoming less strict as discussed in the paragraph about future development.

Concepts & Features

In this paragraph we will discuss the features and techniques used in the learning platform according to the parts indicated in Fig. 1.

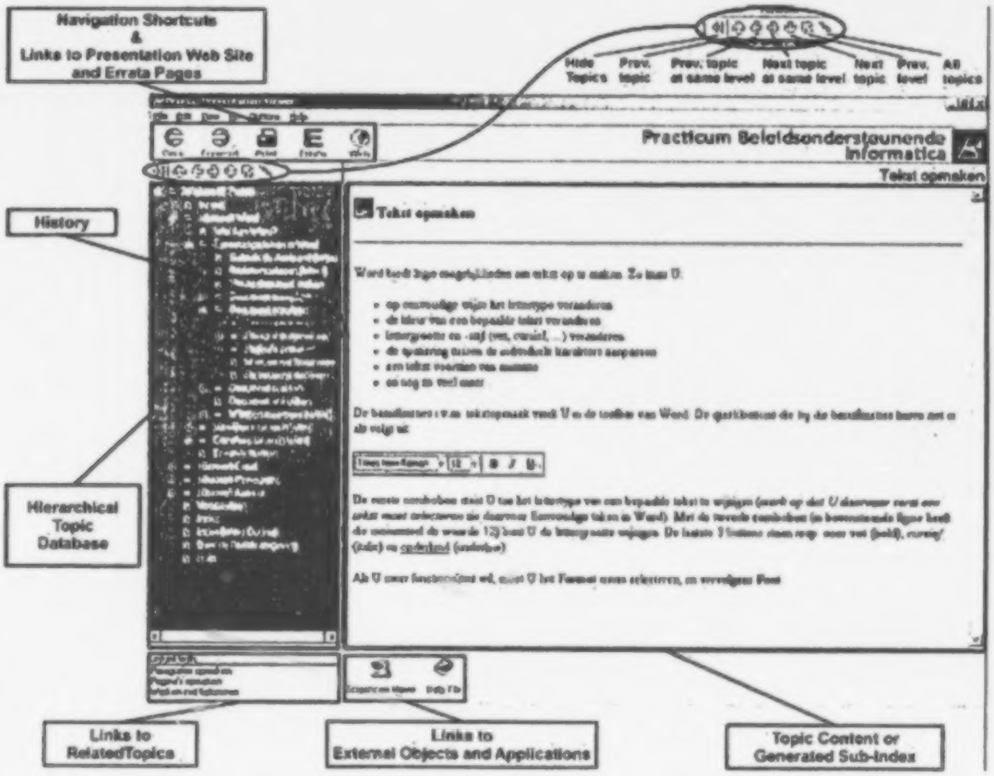

Navigation Shortcuts & Links to Presentation Web Site and Errata Pages
Hide Topics
Prev. topic
Prev. topic at same level
Next topic at same level
Next topic
Prev. level
All topics
Practicum Beleidsondersteunende Informatica
Tekst opmaken
History
Hierarchical Topic Database
Links to RelatedTopics
Links to External Objects and Applications
Topic Content or Generated Sub-Index

Figure 1: Praktix Presentation Viewer features

Hierarchical Topic Database

The topics of a presentation, presented as a hierarchical tree structure that can be expanded and collapsed, is loaded from a topic database into the topic tree as shown in Fig. 1. Every presentation has its own topic database. This topic database contains for every topic an indication of the position in the topic tree which is also used as unique topic identifier for navigation between topics. Furthermore it contains the topic title as shown in the tree

BEST COPY AVAILABLE

structure and a link to the file holding the topic's content. It is this file's content which is shown in the topic content part when the user navigates to the topic. When no link to a file is provided the application generates and shows an index table, in the content part, of the topics one level down in the topic tree. The last entries in the topic database for a topic are links to external applications, called external objects, and links to other topics, called internal objects. For performance reasons, the database is momentarily implemented as a flat text file and loaded once into the tree structure when the user opens the presentation.

History

The topic tree keeps track of the items the user visited by changing the colour of the topic titles of the visited topics in the topic tree. This history enables the user to identify the topics he already studied and the ones he still has to acquire. The history is one of the few things Praktix Presentation Viewer saves locally to a file on the hard disk but only if the user wants to save it. The other things saved locally are the default presentation to open on start up if a CD-Rom would contain more presentations and some version information that will be discussed in the paragraph dealing with future development.

Topic Contents

The topic contents are in fact web pages. We opted for the use of web pages because of the ease with which objects can be integrated: text, slideshows, figures, spreadsheets, databases, connection to other testing and learning platforms and other multimedia material. We integrate web pages at basic HTML level. The advantage of this is that it limits the required knowledge of the presentation's author as most office suits nowadays allow exporting files to HTML format. The disadvantage is that HTML can easily be used incorrectly by ignoring the advantages of XML or CSS and by hard coding file paths, ... The latest is really important. Direct links to files should not be used because of the maintenance problems. The generic platform provides an alternative by allowing references to the unique topic identifier in the topic database and providing a topic for the direct link to a file. Objects that cannot be integrated in a web page can always be provided as link to an external object.

Links to Related Topics – Internal Objects

Links to related topics act as 'also take a look at'-pointers for students by making relations between different parts of the course. They are implemented by adding the unique topic identifier to the list of related topics in the topic's entry in the topic database. The user can navigate to those related topics by just clicking on a topic in the list as shown in Fig. 1.

Links to External Application – External Objects

Objects that cannot be integrated directly in a topic's content web page can be provided by means of a link to an external object. The topic database contains a parameter list that is passed to a helper application to open the object. Examples are IBM ScreenCam movies, MS Windows help files, MS Office Wizards.

Navigation Shortcuts

The navigation shortcuts correspond to the typical web browser navigation buttons and to some navigation buttons specifically designed to enhance the topic tree navigation. Two important navigation buttons to on-line web pages were added: one to a list of errata and one to the course's website. The latest allows easy integration with other volatile course information, such as course schedules, and course related material, as presentations and papers, which would be outdated very fast when placed on CD-Rom.

Skins

Since the platform is generic this could easily lead to a high degree of sameness of the presentations because of the shared generic GUI. To overcome this the possibility to use skins was implemented. The skins allow the author of a presentation to customize colours, background images, button icons, navigation icons, titles, … In Fig. 2 a filled and an empty skin are put next to each other to show the power of this option. These skins allow authors to make something reusable, based on the content, but still unique and capable to stand out among other presentations.

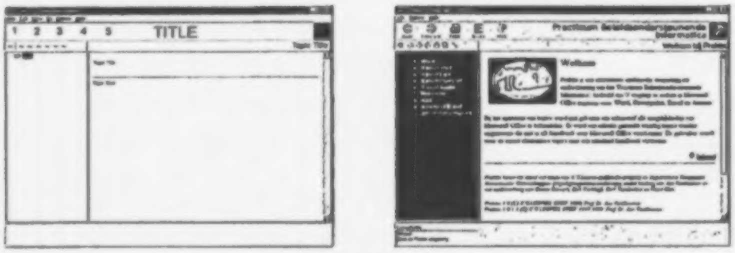


Figure 2: empty skin (left) and filled skin (right)

Implementation

For the moment two implementations make use of the Praktix Presentation Viewer. One is Praktix, the end user computing software self-study package where Praktix Presentation Viewer finds it origin. The other is a self-study package about SQL exercises. The way the presentations are organised on the CD-ROM allows them to be easily shared with other course authors by means of knowledge pools.

Future Development

For the moment Praktix Presentation Viewer is a MS Windows application. It works fine on every version of Windows: 95, 98, NT, 2000 and XP. For Windows 95 some update packages need to be installed first. To enforce this we only have to give up some minor features. We opted for the broadest compatibility possible since not all students have access to up to date and high-end computers. In the near future we hope to add Linux to the supported platforms. Since the software development environment we used also runs on Linux we expect that only minor modifications will be needed to realise this.

Furthermore we would like to add some kind of automatic upgrade facility. When the user starts the Praktix Presentation Viewer from CD-Rom it will check whether a newer version is available to download or a newer version is installed on the user's computer. If a newer version is installed this version will be used instead of the read only version on CD-Rom. If a newer version is available to download it will be installed on the user's computer replacing any outdated version. In either case the user will always be equipped with the latest version.

In the long term we are hoping to port the application to a web based application in combination with a web server that holds the presentation's content. It also solves the problem of having to store the history locally on the users' hard disk as it would be stored on the server. For the multimedia information we hope to provide everything by means of a streaming media server.

References

PPViewer (2002). *K.U.Leuven Praktix Presentation Viewer homepage:*
http://www.econ.kuleuven.ac.be/PPViewer

BEST COPY AVAILABLE

The use of open and distance education in facilitating changes in managerial development: the Mexico experience

José Gpe. Vargas Hernández, M.B.A.; Ph.D.
Posgrado e Investigación
Centro Universitario del Sur
Universidad de Guadalajara
Prol. Av. Colón SN
Cd. Guzmán, jalisco, 49000
México
Telefax: +52 341 25189, 24044
E-mail: jvargas@cusur.udg.mx

Abstract: This paper examines influences resulting in changes in managerial training and development with particular reference to the University of Guadalajara, Mexico. It starts by examining conditions at the macro and micro levels that bring about change, the nature of change, and the present and future education and training implications to increasing demands on management within diverse organizational environments that are becoming more complex and uncertain. Technology is playing an increasing role in management education and training. Through the use of open and distance education technology learners have greater flexibility of time and place of learning. In addition, where transdisciplinary approaches are used it is leading to the development of "new types of managers" with abilities, behaviors and values that better enable them to cope. Examples draw on management training institutes in Mexico.

Introduction

A sign of the current times is the continuous change, which is modifying everything. This constant change drags the transition of modern organizations toward the manifestations of posmodernity, which are expressed in individual behaviors integrated by means of technological processes in the same structures. Two new variables enter in scene to define the posmodernity of organizations: their complexity and uncertainty of environments in which they are immersed.

The pace of this dramatic organizational change accelerates exponentially every time. It leaves as a a consequence an enormous human insecurity in the face of structural rigidity of economic, social, political and cultural institutions. These institutions are unable to absorb uncertainty derived from changes, hinder instead of facilitating adaptability of people and also hinder the use of benefits. These benefits can be derived from the great wave of technological revolution of information, which has become a self-transforming movement and transformer of development opportunities and human progress. Although these opportunities are increased it is also evident the increase of threatening phenomena which deepen the feelings of human fragility and insecurity. These propitiate the uncertainty that encourages the traps and dangers of mankind survival.

In this diagram it is summarized some ways in which the future can be visualized:

MACRO	MICRO	FUTURE IMPLICATIONS
Changes in the global environment of the business community are the result of:	Impact on individual managers which leads to:	Alternative approaches to managers:

Productivity improvement of business.	Overload of information Demand for a greater continued absorption of knowledge	Local continued education/ Formal/informal distance learning
Globalization of business relations	Time compression	More concentration on personal development
Economic and technological Changes	Fast changes of leadership and organizational fluid styles	Changes in careers Early retirements
Turbulence	Change requirements for administrative staff.	Reduced activity / without movement.
	Bigger and earlier responsibilities	

The manager of the future, the future of management

The problem of that, as much the individuals as the organizations take advantage of the opportunities that provide this pace of accelerated change, it is reduced to its control and handling. It finds its foundation in the premise of planning changes, as the theoretical sustenance of organization development that aspire to the transition toward the new times marked by posmodernity. Organizational transitions respond to the current expressions of tendencies toward the globalization and internationalization of the markets. These trends have appropriated the advances that the technological-computer science revolution provides. Meanwhile, society is more active, more participating and more demanding of better conditions. There are nowadays, bigger demands for human development and quality of life, greater social justice, formation of cultures that respect diversities, propitiate its solidarity and recognize the human rights.

Professional development in management takes into consideration not only, the emphasis of traditional curricula oriented toward assimilation of knowledge in administrative technology, but also development of the abilities, skills and required competencies for instrumental implementation of changes. But above all, a professional manager development that responds efficiently with attitudes and values as a foundation of practices to face the challenges demanded and required by derived situations of an environment characterized as complex and uncertain.

Instead of developing their work –doing it better, to end up being more experts and able – the managers will have to be achievers. They will be able to look for and to command resources, to determine strategies and to break limitations for implementing them. Instead of concentrating on the consistent use of management systems, company policies and rules, and to focus on high standards, they become operative: operators with a group of values, principles and models, but operators in spite of everything, motivated by will and ability to achieve.

Is it reasonable to ask, "to achieve what"? But the answer to this rests in the future; this future that, without a doubt, will it include the means to make better use of any available resource for us, to improve the quality of life, and therefore our growth and development. The manager of the future clearly has to be, like it was said previously, a good operator, a motivated person that can obtain and to control class resources to achieve results, a highly developed administrator and highly self-confident.

This person can be among the graduate of high ranks at universities. Until universities again can teach an action theory, it cannot be found this developed human being, in such a way that it has to be developed. In other words, the development of managers will become, much more than a necessity of survival as it is now.

To speak of manager development implies a change in education, in such a way that this is the result of experiences, not training of the memory. Education will be a creative-innovative process, (that some futurologists identify as the characteristic feature of a new phase of the technological revolution that we live in our days) in which the manager is able to develop trust, ideas, communication and interaction.

The Japanese Companies take to practice the following process, according to Raymond (1988):

1) What have learned and toward where it can take this knowledge.

2) How the previous knowledge could be incorporate and to be applied to the mark of a new position.

3) How it can improve a new situation when continuing ahead.

This process should also be incorporated to our organizations, because with it not only is learning continuously, but rather also it is a process of thinking and increasing the knowledge foundations, all the time, as well as applying new knowledge to the same one, and advancing toward the leadership. The above-mentioned helps us to manifest that the education should exist for the reality and for the future.

From an organizational point of view it is necessary to have, a bigger demand of administrators who will be able to cooperate, and therefore, with abilities of leadership. From the individual point of view, the manager will have more up to date knowledge.

As it was previously signaled, it is evident the existence of unavoidable revolution in managerial practices that have global impacts and that modify all the organizational variables: behaviors, structures and technologies. The current generation of professional managers has been called to be educated in the "keyboards".

One of the many ways to increase the wealth of those administrative practices, are the learning outlines at distance which have been developing some universities and other institutions until the level where the abilities and competencies of management can be self-taught. With the use of special text materials, exercises, videotaped examples, use of electronic mail and platforms, the learning responsibility can be broadly transferred. Experiments have shown that the tutor's contact can be designated successfully outside of the programs and that the assignments of tasks can be determined in such a way that a self-assessment and self-evaluation is possible.

With implementation of telematics, education was adapted to the constant change operating in organizations, giving place in this way, that education process does not center around the previously established relationships between the teacher and the student. Thus, more emphasis is given to the link between the information that receives the student and the same student. In this form, the learning process is redefined.

Lack of personal interaction can be a deficiency, but at the same time can be replaced by more modern techniques of interactive video. This allows the student to interact in managerial events on the screen and then to ask, to explore, to answer and to make decisions watching the results of his conclusions displayed in front of him. This is similar to a flight simulator where the training pilots can prove their flight skills without risking. The manager can prove different methods in any kind of problem without being exposed, in a short period of time and space.

With distance learning education, transfer of control of teaching-learning process is given to the individual; this decides what he/she needs to know and then he/she makes the best use in the available learning resources for him.

When being developed continuous education technology it is impelled more and more and designed by the individual adapting it to his own desires and necessities, motivating this way his self-development. Some approaches of this self-development are beginning to emerge. These novel education developments at distance are operated on global bases. Education institutions at distance learning will win, when having an audience in the entire world, but they will have to continue being linked with this audience of foreign countries, by means of consultants.

Of course, one in the best ways of learning at the present time, is doing it. A little less drastic are the outlines of active learning, where the executives either manage special projects inside their own areas or in any other part as a planned process of performance. These outlines that have been with us for several years, also have the advantage of the project's value and the test of managers' audacity. These projects can involve individual action or to lead to a team project, usually of a multidisciplinary nature.

In the past, the time taken to obtain experience and maturity has made to management a field of older men whose energy and forces of creativity weakening are inevitably. One only has to look back, to see that the young men have been able to create when an opportunity has arrived to people of great talent. The executive professional youths, with an urban culture, trained in private universities, also well-known as the " yuppies ", they are those that more quickly are assimilating the technological advances and incorporating them to the directive and managerial practices of the organizations.

To be in agreement with the current changes, organizations not only should incorporate to technology but rather the individuals will have a change in mentality as a change in organizational relationships and it will be a change in the managerial style. The incorporation of technology to the directive and managerial practices and the use of the telematic, make possible that organizations structure their administrative outlines in agreement with the necessities and socioeconomic conditions of the country. With this practice, it should improve the competitive position to the international level. The above-mentioned has given as a result the linking of the administrating and managerial professionals with the productive and social sectors.

Conclusion

Concluding, the managers of the future will have to be agents of development of those organizations to which they are integrated. They will be creative and innovative leaders with clear conciousssnes and awareness of their social responsibility, with a strong discipline of work, with a high level academic development, and that they know how to appreciate cultural and social values of diverse countries.

Reference

Raymond, H. Alan (1988). "Administración en la Tercera Ola. Los Contornos Competitivos, CECSA.

Integration of Hardware Experiments in e -Learning Systems

Vasil Vasilev
Department of Electronics
Technical University of Sofia
Bulgaria
vvasilev@lark.vmei.acad.bg

Ivan Furnadziev
Department of Electronics
Technical University of Sofia
Bulgaria
ihf@vmei.acad.bg

Vassiliy Tchoumatchenko
Department of Electronics
Technical University of Sofia
Bulgaria
vpt@vmei.acad.bg

Tania Vassileva
Department of Electronics
Technical University of Sofia
Bulgaria
tkv@vmei.acad.bg

Abstract: The paper describes functionality and implementation of virtual laboratory for electronic measurement and testing based on access to real hardware instrumentation through Java developed interface. Basic principles and structure of developed software are discussed. An applet, controlling an electro-motor, is considered as an example of developed Java interface to the Lucas-Neulle Company experimentation hardware. The approach gives an opportunity easy to set necessary parameters for controlling hardware instruments, easy to perform parameters changing and to obtain graphical result from the real experiment – all through simple Web browser.

Introduction

In every engineering and technicians education experimental work is an important component for obtaining practical skills from the trainee. In many cases complexity and cost of instrumentation are obstacles to quality of training provided to the learners. The Unitr@in is a Lucas-Nuelle Company hardware device, which provides a number of virtual instruments to enable measurement and control of different electronic devices and schematics. It is composed of main module, connected to the computer and additional plug-in modules (Fig. 1) thus permitting different experiments to be organized with the same hardware device.

The main Unitr@in module provides: digital input and output, analog input and output, relays, standard 96-pin connector for plug-in modules, power indicator, high current power supply (used by the three-phase generator), low current power supply and RS232 standard connector. By virtual software instruments one can set amplitude, range, frequency and type of the signals necessary for each experiment.

Experimental work with this hardware needs guidance for giving appropriate sequences and parameters, which control the virtual instruments for each different experiment. The idea is to ensure opportunity to the learners easy to set necessary parameters for the hardware instruments, easy to perform parameters changing and to obtain graphical result from the experiment.

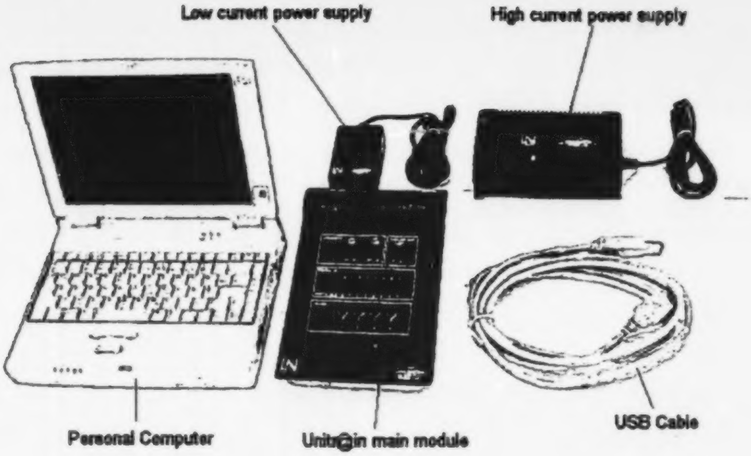


Figure 1: Unitr@in hardware

To fulfil these goals a Java-based interface to Unitr@in instruments has been developed. It permits control of Unitr@in hardware from Java applications and applets. This approach has several advantages. It permits simplified update of the training materials. Number of applets controlling hardware for each exercise can be developed. They are stored on a web server and are accessible for every student to download from the appropriate web site.

Experiments with complex systems are facilitated and some unrealisable before becomes possible. It is very important that not all of the functionality needed for the experiment must be hardware-available. Part of the system can have real hardware implementation but some more complex modules can be simulated in Java code.

Thus developed, the learning materials can run on computers working with different operating systems, as Java is platform-independent programming language. Another important feature of Java applicable to a virtual experimentation is that it can run on the server side as a servlet. This enables remote control of the Unitr@in hardware through the network. All these benefits serve as motivation for development of Java interface to Unitr@in hardware.

System Architecture

The architecture developed to facilitate Java access to the hardware device is shown in Fig. 2. Lucas-Nuelle (LN) has developed Unitr@in Interface Library, which represent an API (Application Programming Interface) for managing their hardware through USB (Universal Serial Bus) or RS232 (the green rectangle in the figure). This API is based on the developed by Microsoft distributed component system (COM), which allows for any application to load any component that is contained in the COM. The component is automatically instantiated and ready to use. Each of these components (named "Interfaces") represents an individual virtual instrument like function generator, virtual oscilloscope and etc. Each of the instruments exposes methods for managing its specific functions. For example the Functional Generator (UniFuncGen) exposes methods for setting output amplitude, type and waveform of the output signal, range of the output voltage and generated frequency.

Our goal is to map the functionality of these interfaces to Java by using the JNI (Java Native Interface) standard for loading native libraries (Sun Java Runtime Environment - part). An API has been developed (yet partially) that every Java-application may include and thus enable itself to use all functionality exposed by Unitr@in. This API has two parts: native part, which communicates with COM and Java-part, which communicates with the Java-based applications. One drawback about this architecture is that it is applicable only

BEST COPY AVAILABLE

for windows-based operating systems, as far as COM is Microsoft's standard. Any change to the COM part would affect only the native part of the mapping API, but not the Java part, and all already developed applications. This makes the problem not so drastic.

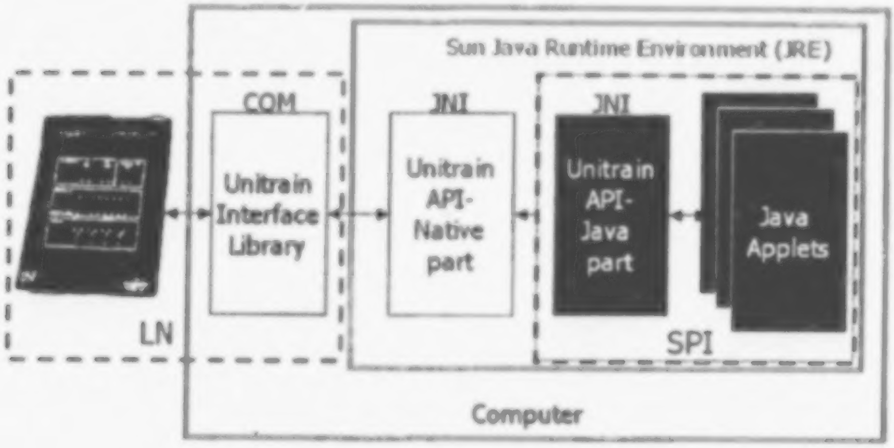

Sun Java Runtime Environment (JRE)
COM
JNI
JNI
Unitrain Interface Library
Unitrain API-Native part
Unitrain API-Java part
Java Applets
LN
SPI
Computer

Figure 2: System architecture

Example

As a proof of concept an applet, which controls the rotational speed of DC motor, is developed. The values of the DC motor supply voltage as well the measured rotational speed are drawn as function of time.

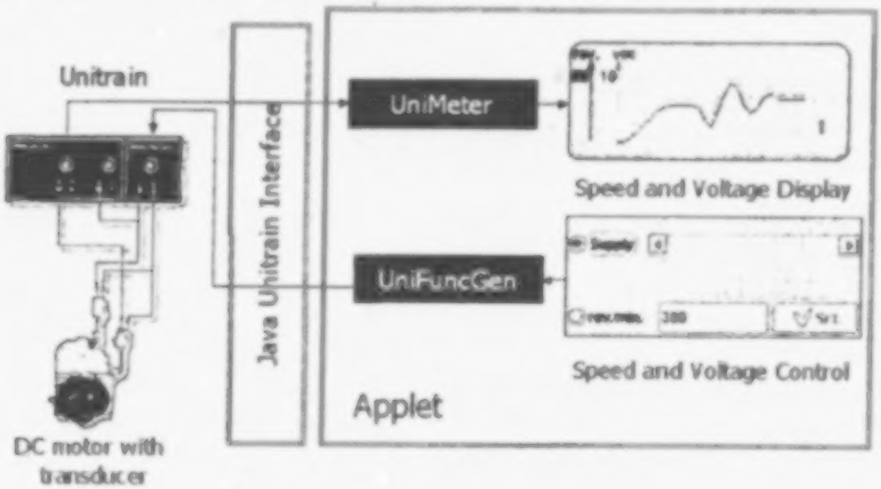

Unitrain
Java Unitrain Interface
UniMeter
UniFuncGen
Speed and Voltage Display
Speed and Voltage Control
Applet
DC motor with transducer

Figure 3: Real experiment for dc motor controlling

Fig. 3 shows a real experiment, where the applet controls the hardware and it returns a feedback of current device behavior back to the applet for graphical interpretation of the results. The idea is to control a DC motor whose rotation speed (measured by revolutions per second) depends on the voltage applied to it. The motor generates voltage proportional to its rotation speed. This permits to maintain constant revolutions never

BEST COPY AVAILABLE

mind what is the load applied to the motor. To facilitate the task the UniFuncGen and UniMeter interfaces are used. The UniFuncGen is used to set DC voltage to the motor. The revolutions of the motor (e.g. the voltages generated by the motor) are measured by UniMeter.

The applet works in two modes.

- Manual variation of the motor's speed by means of virtual potentiometer
- Setting the required speed as numeric value

In the supply mode the voltage applied to the motor is directly supplied through a applet's scrollbar. In revolutions control mode the user set the rotational speed that should be maintained from a dc motor. In this case the applet is responsible to supply the required voltage values so that the motor revolutions are exactly as already set. This is accomplished by a continuous control of the feedback voltage. The two modes can be changed through the radio-buttons. Results are visualised graphically as a function of time. Display control of the drawings is ensured through the checkboxes.

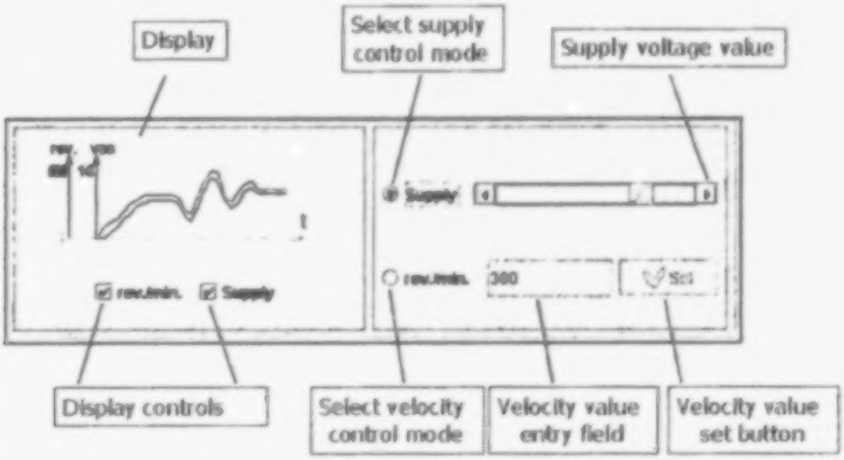

Display
Select supply control mode
Supply voltage value
rev. V00
t
● Supply
☑ rev./min.
☑ Supply
○ rev./min.
300
Set
Display controls
Select velocity control mode
Velocity value entry field
Velocity value set button

Figure 4: Example applet

Developed Java applet ensures convenient user-friendly interface (see Fig. 4) for setting parameters of the hardware instrumentation, for controlling experiment through changing some parameters and for obtaining results from the measured device or schematic. It also provides on-line graphical interpretation of measured device characteristics.

Conclusions

The proposed Java interface to Unitr@in hardware creates new opportunities for teaching materials development. These teaching materials will combine the inherent flexibility of the Web based content delivery with the unique hands-on experience of the laboratory hardware.

The approach gives opportunity easy to set necessary parameters for controlling hardware instruments, easy to perform parameters changing and to obtain graphical result from the real experiment – all through simple Web browser. Main benefits are:

- Simplified update of the training materials– they are stored on a web server instead on students' workstations;
- Simulation of complex systems – part of the system can be implemented as real hardware and the rest can be simulated in Java code;
- Platform independence – once Unitrain drivers are ported to a new platform (e.g. Linux) the Java based training software will be readily available.

The technology also permits remote control of the hardware instrumentation and thus can support learners from a distance with ability to perform practical training in case of lack of laboratory resources.

EST COPY AVAILABLE

Utilizing WebCT to Monitor Pre-Service Teachers' Professional Development

The nature of teaching is evolving. Within the last twenty years, views of exemplary teaching have broadened from strictly didactic pedagogies approaches to include constructivist and student-centered approaches. The range of effective teaching practice has mirrored changes in our understanding of the psychology of learning. There has also been an effort to reach more students in an increasingly diverse student population in public schools (NCTM, 2000; NRC, 1996, AAAS, 1984) by utilizing a greater diversity of strategies. This transition has been supported and advocated by national reform efforts in mathematics (National Council of Teachers of Mathematics [NCTM], 2000) and science (American Association for the Advancement of Science [AAAS], 1984; National Research Council [NRC], 1996).

The nature of graduate educational programs addressing the needs of pre-service and in-service education professionals has also been evolving. Efforts to include and utilize technological tools and to create partnerships between institutions of higher education and local schools has been emphasized. (AAAS, 1984; Holmes Group, 1995, Bromley & Apple, 1998)

As teaching practice and teacher preparation has become more complex, the challenges that face teacher educators have also changed. Graduate education programs can no longer focus primarily on effective lecturing strategies, classroom discipline, and educational theory. Instead, these programs must assist new teachers and in-service education professionals in developing and taking on a personal identity as a reflective practioner (Kottler & Zehm, 2000). The main premise of this approach to teacher preparation is that this personal identity, based on a developing philosophy and a growing repertoire of successful practices, enables the new teacher to make decisions and design a wide range of instructional situations that engage students in meaningful learning.

In concert with this approach, a framework for preservice teacher learning has been proposed by the author (see Figure 1). The framework assumes four stages, or views of teaching, as a developmental continuum. When preservice teachers first enter teacher preparation, they often know teaching only from a student view. That is, they have been students for many years, and can identify good and bad teaching from that experience. But, they have not seen teaching from an ends-and-means perspective. They have experienced what Lortie (1975) called an "apprenticeship of observation." Thus, the first task of teacher preparation programs might be construed as developing more realistic views of teaching, through experiences that promote analysis and critique. Once preservice teachers have begun to develop more realistic views, they should be challenged to personalize their learning by positioning themselves as a teacher, and proposing what actions, principles, and guiding values they would apply in each situation. This step is seen as transitioning from student of teaching to teacher, a critical step that requires much support and encouragement as the new teacher tries on the "identity kit" of the teacher. Then, in concert with field experiences, student teaching, and induction year teaching, the new teacher incorporates this developing "teacher identity" into more and more of his/her activity, becoming a practicing professional in the school setting.

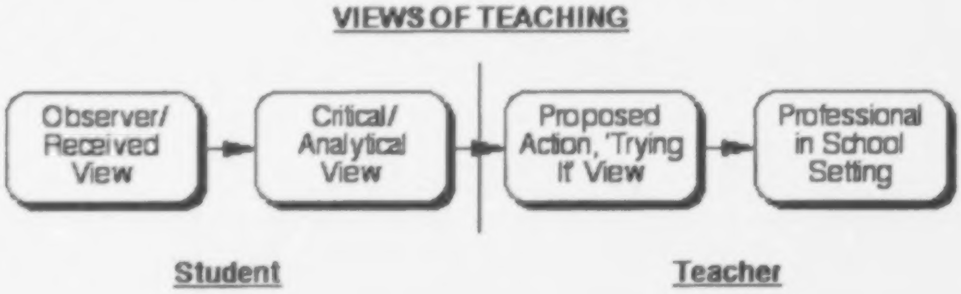

VIEWS OF TEACHING
Observer/ Received View
Critical/ Analytical View
Proposed Action, 'Trying It' View
Professional in School Setting
Student
Teacher

Figure 1: Author's framework for preservice teacher learning.

The framework is also useful in identifying in-service education professional and their professional growth as reflecting practitioners. Educational professionals who return to graduate school to pursue advanced degrees encounter novel experiences and demonstrate a transition analogous to the movement from student-centered thinking to teacher-centered thinking. Many institutions have struggled with how to gauge and document such professional development and transitions. (Holmes Group, 1995)

The focus of this research paper is upon using WebCT discussion forums as opportunities to explore professional development in pre-service teacher candidates in a graduate education program at The Ohio State University. Emphasis will be placed on how the WebCT format can augment and accurately gauge growth in pre-service teachers.

This framework underlies this paper, as we studied the development of preservice teachers and in-service education professionals pursuing advanced degrees. The majority of participants were graduate M.Ed. students in an integrated Mathematics, Science, and Technology Education teacher preparation program at a large mid-western university.

Overview

A relatively new innovation in teaching is the use of electronic educational environments to replace or supplement face-to-face, real-time instruction. Our university has recently begun to support WebCT (also known as ICT) a course environment that enables (1) management of print resources, (2) synchronous and asynchronous communication between course participants, (3) course management (such as attendance, grading, and tracking of web page) by the instructor, and (4) student presentations and posting of student work.

In this study, WebCT was utilized as a course enhancement tool for an introductory pedagogy (methods) course. This course serves both pre-service (M.Ed.) and in-service (M.A.) programs, and is seen as laying the groundwork for teacher development in these programs. Various historical, philosophical, and ethical aspects of teaching inform the course activities, and teacher participants are encouraged to develop reflective stances that will enable their learning from course experiences.

Methods and Data Sources

This study used three main data sources: participant exchanges in a WebCT threaded discussion group, teacher-created web pages (student pages) and member-checks with participants. In addition, demographic information was gathered and used to sort participants into those in the pre-service program and those who were practicing professionals.

Archived copies of the teachers' work in WebCT and (teacher-created web pages) participant interviews were examined for various features related to movement along the developmental framework.

Preliminary Results and Conclusions

The results indicated the following:

I. The WebCT forum is a viable and very helpful tool in assessing the professional development of pre-service teachers specifically for the following reasons:
   a. It allows graduate students to exchange ideas and experiences that would not be possible in other more traditional formats.
   b. It permits the instructor to monitor exchanges and the development of teacher qualities and ideas over time.
   c. Many participants, who were not vocal or expressive in class, often preferred the WebCT forum which allowed the instructors greater insight into their ideas.

2. The WebCT forum is a more authentic way of documenting changes in student thinking as they move towards the teacher "point of view."

Importance of the Study

This study has informed the use of the framework for pre-service teacher learning proposed in Figure 1 above. This study provided evidence of the difficulty of assessing professional growth along this continuum, especially in moving from student to teacher views, as well as, moving from teacher centered to student-centered practitioner. It is this shift that enables teachers to transform the way they think about teaching, from an intellectual understanding to an understanding borne of knowing by doing. This transformation is clearly complex, prematurely understood, and, by virtue of the challenge it presents, worthy of considerable careful study. If teacher educators can facilitate and support this change, they may do a better job of preparing professionals for their work in the field.

This study also explains the significance and methods college instructors of pre-service teachers may utilize the WebCT forum as a viable method of tracking professional growth that encourages and allows for the cross transmission of student experiences in their teacher preparation program.

REFERENCES

American Association for the Advancement of Science (1984). Science for all Americans: A project 2061 report on literacy goals in science, mathematics, and technology. Washington, D.C.: AAAS.

Bromley, H. and Apple, M. W., Eds. (1998). *Education / technology / power: Educational computing as a social practice.* Albany, NY: State University of New York Press.

Fenwick, D.T. (1998). Managing space, energy, and self: Junior high teachers' experiences of classroom management. Teaching and Teacher Education, 14, 619-631.

Good, T.L. & Brophy, J.E. (1984). Looking in classrooms (3rd ed). New York: Harper & Row.

Griffin, G. A. (1983). Student teaching and the commonplaces of schooling (Report No. 9038). Austin, TX: Research and Development Center for Teacher Education.

Hollingsworth, S. (1989). Prior beliefs and cognitive change in learning to teach. American Educational Research Journal, 26, 160-189.

Holmes Group (1995). Tomorrow's schools of education: A report of the Holmes Group.

Kottler, J.A., & Zehm, S.J. (2000). On being a teacher: The human dimension (2nd Ed.). Thousand Oaks, CA: Corwin Press.

Lasley, T. J. (1987). Classroom management. The Educational Forum, 51, 285-298.

Lortie, D. C. (1975). Schoolteacher: A sociological study. Chicago: University of Chicago Press.

National Research Council. (1996). *National science education standards*. Washington, D.C.: National Academy Press.

National Council of Teachers of Mathematics (NCTM), 2000. *Principles and standards for school mathematics.* Reston, VA: NCTM.

Roychoudhury, A.; Wolff, M. R.; Ebbing, J. (1993). "Becoming a Reflective Science Teacher." In Excellence in Educating Teachers of Science; Rubba, P. A.; Campbell, L. A.; Dana, T. M. (Eds.). Columbus, OH: ERIC Clearinghouse for Science, Mathematics, and Environmental Education.

Schon, D. (1983). The reflective practitioner. New York: Basic Books.

Simon, V. (1984). Perceived problems of beginning teachers. Review of Educational Research, 54, 143-178.

Woolfolk-Hoy, A. (1996). Psychology in teacher education: Appreciated, appropriated, abandoned. Newsletter for Educational Psychologists, 20(4), 11.

Aggregation and Reduction: Two Design Approaches for Reusable Instructional Materials

J. Anton Ravindran
CEO and Co Founder
Genovate Solutions Pte Ltd
Singapore
anton@genovate.com

Ranga Venkatachary
Head, Instructional Design
KnowledgeWindow Asia Pacific Pte Ltd
(A fully owned subsidy of Genovate Solutions Pte Ltd)
Singapore
ranga@genovate.com

Abstract: This brief paper argues that the concept of 'knowledge objects' can be applied to both the modular and object–based approaches within the context of online courseware design. The modular approach rests on the design principle of aggregation while the object-based approach demonstrates the principle of reduction. The impact of these differences can be seen both in the curriculum design processes and the preferred deployment methods of the courseware. The end goals of the training will be influenced by these differences as well. The points of convergence and divergence are analysed within the contextual framework of a specific subject matter domain, target audience profile and organizational structure.

Introduction

The design principles behind learning materials deployed online for corporate training purposes have been shaped by the need for modularity and reusability. This paper attempts a comparative analysis of two training solutions in terms of principles and processes of design and implementation.

Background

"If an instructional strategy does not include presentation, practice and learner guidance consistent with the knowledge and skill to be taught, then it will not teach…" (Merrill 1998). A training product, which does not teach, has no value. It is therefore reasonable to argue that a complete instructional strategy for any training product consists of a knowledge structure in line with and appropriate for the knowledge and skill being taught.

This leads us to the fact that determining **what** to teach and **how** to teach are the two most important activities of the instructional design process. Learning cannot occur if the necessary knowledge components are missing or if they are inappropriately sequenced. The instructional design process needs to focus on knowledge analysis determining the knowledge components that are necessary and appropriate for any given kind of instructional goal.

This paper uses the system of knowledge representation based on knowledge objects. (Merrill et al 1993, Merrill et al 1996). A knowledge object is a precise way to describe the subject matter content to be taught. A knowledge object is a framework for identifying necessary knowledge components. It organises a base of content resources (text, audio, video and graphics) so that a given instructional algorithm (instructional strategy) can be used to teach a variety of contents.

A knowledge object of this definition can have five major components. They are:

- The entity (module or object)
- Parts of the entity
- Properties of the entity (qualities or quantities associated with the entity)
- Activities associated with the entity (actions that a learner can perform on/with/to the entity)
- Processes associated with the entity (events triggered by an activity)

A framework for comparison

The training products, which have been taken for a comparative analysis, have the following in common:

- The instructional content is in the domain of Information Technology from the end user's point of view
- The products are deployed across the organisation – as an enterprise - wide training initiative
- Therefore the target audience for the products is heterogeneous – with diverse job roles
- The end goal of the training is a direct and positive impact towards improving performance at work.

Product Description

Product A: Excerpts from the Design Specification

Segment 1: Background
Organization X is implementing SAP in its various operational wings across the country. This effort is focused on improving their business processes in an integrated manner. There are 20,000 employees spread across the country in various functional capacities and they are expected to use SAP directly. In order to achieve this end, these employees need end-user training in the application as well as a knowledge update on the underlying business processes. E learning has been chosen as the preferred mode of training because of its flexibility (in learning time and pace) and cost-effectiveness.

Segment 2: Purpose
The purpose of the training is twofold. Firstly, a user must be able to use the SAP application software with confidence in various areas relevant to his/her job role. Secondly, the user must understand and be able to apply the underlying business processes, which drive the behaviour and components of the application software.

Segment 3: Conceptual framework
Process training focuses on descriptions of how things work. The intended learning in such contexts demonstrates in the knowledge of how things work – say, computer programmes or chemical reactions. The instructional value of process training can be summed up as follows: when an employee's work is an integral part of an organisational system, an understanding of the process offers valuable support to the performance of job tasks, motivation and overall quality of work. Process knowledge also contributes to meaningful perspectives of job roles and better application of procedures at work. The proposed solution uses this framework as a general rationale for design.

Segment 4: Instructional strategy and design parameters
Business systems depict organisational workflows. A business process consists of several stages performed by different employees or departments, which achieve an organisational goal collectively. The content in the different courses addresses the training issues in this domain in different ways.

For example, in the courses on Transactions, the smallest learning unit is a transaction. A transaction will have 'n' number of steps outlining/depicting the underlying business process. The course is the 'assignable unit' – i.e., the administrator assigns one or more courses to a user and each course consists of transactions relevant to specific job roles. In the Process Training and SAP Overview courses, the content is segmented in such a way that a course is the smallest learning unit. The content organisation structure rests on the principle of aggregation: with course as the superset with two levels of subsets – modules and transactions. The deployment rests on the 'push' strategy.

Product B: Excerpts from the Design Specifications

Segment 1: Background

Organisation X is considering the implementation of first level training in the issues relating to security issues in the handling of data/information in the electronic media formats.

Segment 2: Purpose

The purpose of the training is to create a pool of 'awareness' and knowledge base on the criticality of security related issues while handling electronic data at work. A reusable resource-base is the implicit design requirement.

Segment 3: Conceptual framework

There is no sequence evident in the information architecture. The linkages do not suggest a structural hierarchy. It is reasonable to assume therefore that the user groups may want to dip into this (information pool) resource at different times and more such information chunks may be added to the pool. An object-oriented paradigm suits this end very well. This results in the development of adaptive learning systems that can assemble content to meet the learners' needs 'on the fly'.

Segment 4: Instructional strategy and design parameters

Object –based design, which stems from a bottom up approach of reducing the instructional content to the smallest, self-contained entity.

Design parameters

- The notional learning time per object (variable)
- The logical information architecture within the object and its linkages or dependencies with other objects (much like the properties of an atom and a chaining of atoms)
- The logical structure for content organisation within the object

Object type and description:

The chosen object type for this product is Generative-instructional. In this type, the logic and structure for combining media elements or other object types (if applicable) and evaluating student interactions with these combinations support the instantiation of abstract instructional strategies. For example: 'remember and perform a series of steps' or 'understand a set of rules/policy regulations and apply them at work'. The content organisation structure rests on the principle of reduction. Each object is a self-contained instructional unit with direct or indirect or no linkages to the other objects in the domain. The deployment rests on a 'pull' strategy.

The table below summarises how the components of a knowledge object can be applied to both the products.

Component Description	*Product A*	*Product B*
The entity	Course	Object
Parts of the entity	Modules and transactions	Smallest unit with single point access
Properties of the entity (qualities or quantities associated with the entity)	One or many modules and one or many transactions	(i) Learning Objectives (outcomes-based, set at 'recall' level) (ii) Core instructional content – logical structure defined by questions such as 'How to... What is...where is..."Core content falls under the categories of facts (definitions and descriptions), Dos and don'ts etc. (iii) Questions mapping to the learning objectives. Note: A minimum of 1 and

		maximum of 'n' objectives and questions per object
Activities associated with the entity (actions that a learner can perform on/with/to the entity)	'Show and Tell' and 'Try': guided practice	Aided recall of instructional content through engaging in application-oriented tasks.
Processes associated with the entity (events triggered by an activity)	Learning by practice and aggregation	Learning by practice and selective association

Table 1: A comparative analysis of design components

Analysis

The principal differences in the design approaches described above can be categorised in terms of

- Instructional design and content organisation structures (aggregation versus reduction)
- Deployment strategy ('push' versus 'pull')
- Levels of reusability (intermediate versus absolute)

The comparative analysis demonstrates how these divergent design approaches can be employed to deliver instruction meeting different end goals despite the aspects of convergence in the subject matter and target audience profile. The manner in which the differences will be borne upon the strategic outcomes will be discussed in the presentation.

In sum, it is reasonable to argue that the more traditional, modular approach to course design is as valuable to the context of self-paced online courseware development as the more recent object-based approach. The modular approach follows a 'top down' model while the object based design draws on a 'bottom up' model in terms of curriculum design. This difference has a significant impact on the relative ease with which one can add to or modify the instructional content. This in turn is chained to the decisions of deployment.

Conclusion

The comparative analysis of two training products in the corporate training context attempts to highlight the points of convergence and divergence between the design approaches resting on the principles of aggregation and reduction respectively.

If reusability is to be viewed as a continuum the two design approaches are differentially weighted and placed. However, absolute reusability as a characteristic evident in object-based design approach is most suited to the 'pull' strategy of deployment while an intermediate level of reusability evident in a modular design structure meets the goals of a 'push' strategy of deployment. Therefore the design approaches offer mutually exclusive advantages to the training context.

References

Merrill, M. David (1993) Instructional Transaction Theory: knowledge relationships among processes, entities and activities, *Educational Technology*, 33 (4), 5 –16

Merrill, M. David and ID2 Research Team (1996), Instructional Transaction Theory: Instructional Design based on Knowledge Objects, *Educational Technology*, 36 (3), 30 – 37

Merrill, M. David, (2000) Knowledge Objects, *CBT Solutions*, March – April 1-11

ONLINE VIRTUAL TUTORIALS: INCREASING ACCESS TO PEER TO PEER TUTORING

Ray Walshe
Language and Intelligence Research Group, Department of Computing, Dublin City University, Dublin
IRELAND
E-Mail: Ray.Walshe@Computing.DCU.ie Web: http://www.computing.dcu.ie/~ray

Abstract: With the continuing increase in class sizes of undergraduate computer science degrees, it is becoming more difficult to provide additional tutoring resources on an individual basis to students. Although peer tutoring is employed in a structured timetable to aid undergraduates, some questions remained unanswered in the time allowed and a bigger problem may be that some questions are just not asked. To address this issue, a discussion forum was set up which facilitated anonymous logins where students could post questions outside of scheduled tutorials and have them answered by fellow students, tutors and lecturers. This paper describes the system and some of the results obtained.

Keywords: Peer-to-Peer Tutoring, Virtual Tutorials, Online Virtual Classroom.

1 Introduction

As class sizes increase in undergraduate computer science courses it has become more difficult to provide adequate tutorial assistance to students. In large lecture groups, individual students become anonymous and feel lost. Larger lecture sizes have led to larger tutorial classes and there is a limit to the number of full time academics and post-graduate students that are available to facilitate smaller tutorial groups. Peer tutoring has been introduced where using undergraduate tutors the tutorial group size has been reduced to 10 [1]. Using peer tutoring, second year students who have achieved excellent results are employed to provide tutorial assistance in a lab-based environment. Employment of this system over the last two years has shown a marked improvement in lab exam results. However, there still remained the case where some students felt they were not able to engage at this micro level and wished for the mask of anonymity so that they could ask questions that may be regarded as trivial or embarrassing.

2 Course Structure

The course in question is a first year Computer Architecture course that is delivered across two semesters to a lecture group size of 300+ students. Additional large tutorials are given at intervals during the semester. There are lab-based exercises which have to be performed where the labs can accommodate 45-65 students per lab to facilitate 150+ students at any one time. Within these labs of 45-65 students are sub-groups called "bays" where one peer tutor is assigned to a bay that contains at most 10 students. These laboratories are located on three different floors so just physically getting around them all during a particular lab session can be quite demanding. The discussion forum where students can air any problems that may arise at any time proves useful here as means of asking questions. Other students, tutors or staff can then answer these questions.

2.1 The Lab Tutor

The tutors come from a panel of 60 second-year students who would be those at the top of their class based on the examination results. The number is in fact, well over our requirements as a max of only 30 are required for a given session which makes for a 10:1 student to tutor ratio. Becoming a lab tutor is a significant step for second year students. It challenges them to take on a new role and responsibilities toward their fellow students that may seem strange at the outset. To help them manage the adjustment a one-day seminar is held at the beginning of the year to look at the issues arising from the job. A very important part of the lab tutor's job is the Feedback Form. This is an application developed last year in the faculty that has proved important as part of the lab tutor's work.

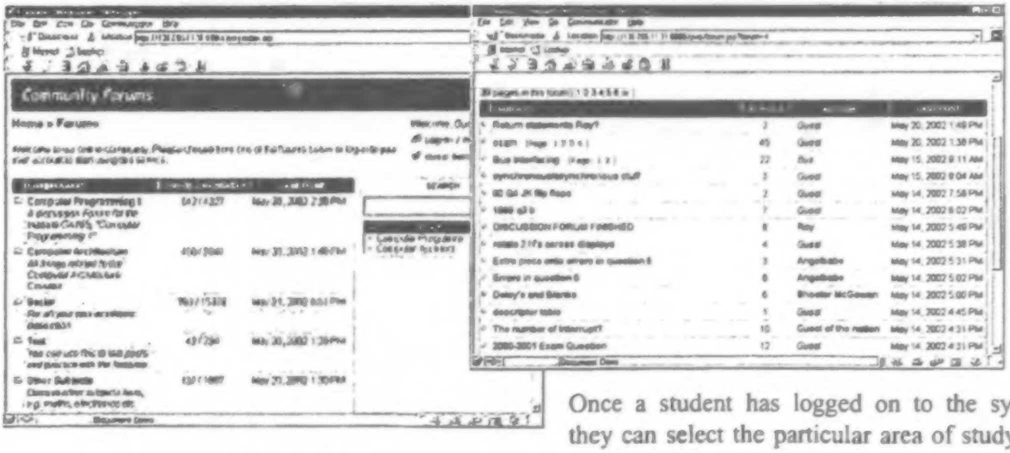
The feedback form fulfills a number of important tasks. It can help to identify problem students sooner. The 10:1 ratio means that over the course of a semester the tutor can get to know each student individually. This relationship is at the core of the success of the system so far. Many tutors begin to take a personal interest in their tutees and are delighted when they manage to do well in the exams. Conversely if a student is having trouble, the tutor can be the first to spot it and take remedial action. The feedback given by tutors is very valuable for lecturers. At the end of a lab session, a lecturer can log on immediately and read the tutors comments. This can give the lecturer a very good idea of how the material is being interpreted. The material can then be enhanced accordingly.

3 Discussion Forum System

Jive is forum software that allows dynamic, threaded discussions on web-sites. The Jive source code is open, which makes it easy to customise and integrate it into existing sites. The forum leverages the architecture of server-side Java. Jive's clean, object-oriented design is extensible, scalable, and secure. The recent widespread availability of server-side Java enabled web-servers means that it will run almost anywhere. An arbitrary number of filters can be applied at runtime to provide advanced forum services. Some filters examples include syntax highlighting of Java code, translation from one language to another, and profane language filtering.

The discussion forum is accessible through a web link on the course homepage. Students can logon to the discussion forum using a self-generated username or by signing on as guest. The guest login facilitates anonymous posting of questions/answers. The forum is running 24 hours per day and 7 days per week and is monitored periodically by staff and tutors between the hours of 8:00 a.m. and 10:00 p.m. when staff /tutors may be on campus.

The two main forums that were provided were labelled Computer Architecture and Computer Programming. Additional forums were also provided for social interaction purposes and other academic disciplines.

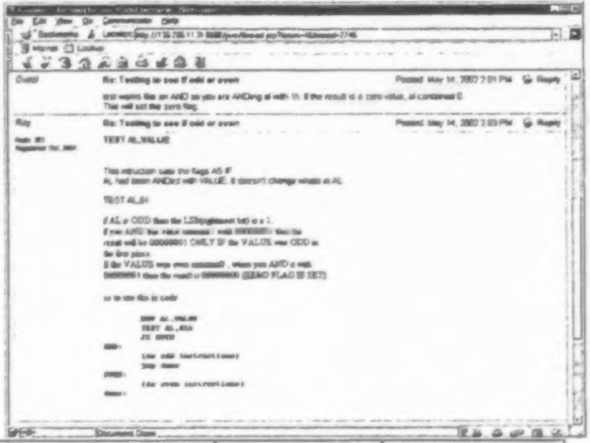


Once a student has logged on to the system they can select the particular area of study and

BEST COPY AVAILABLE

examine all topics relating to their area of study that have been posted. Once a particular topic is selected they can then view all questions and answers within that topic.

At this level questions can be asked and answered with or without anonymity.



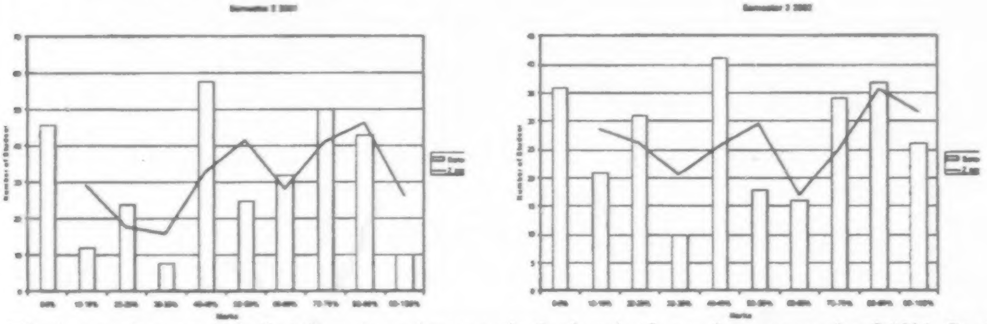
4 Results

The board has been very successful in fostering peer to peer interaction between students and tutors. The provision of a social forum encourages the students to talk about every day topics and allowed students to become familiar and comfortable with using the forums.

Usage statistics for forum

Period of Use	*Topics Created*	*Messages Posted*
Discussion Board All Year	2124	23793
Architecture Forum Semesters 1 and 2	450	2041
Architecture Forum 3 **day period**pre End-of-Term Semester 1 Exams	87	392
Architecture Forum 3 **day period**pre End-of-Term Semester 2 Exams	54	306

Exam Results 2001-2002



The interesting result is that there is an increase in the levels above the pass mark of 40%. Students are achieving higher marks on the paper although the year-on-year pass rate has only marginally increased. The increase in overall mark per student is mostly noted in the lab element of the course where the largest volume of discussion was centred.

5 Conclusion and Further Work

By combining the close monitoring of lab assessment through peer tutoring and feedback and by providing academic support via the discussion forums, a higher pass rate and level of award has been achieved. This system is being modified at the moment to allow access to each individuals performance relative to interaction with the discussion forum. Here we hope to identify when/why a particular student will avail of the discussion board and the change in performance levels achieved in exams post interaction.

References

1. Charlie Daly, Dave Donnellan, Monica Ward and Ray Walshe, The Lab Tutor System of a Large Undergraduate Class: the Lab Tutor's perspective: *Staff & Educational Development Association & All*

BEST COPY AVAILABLE

Student Perceptions Toward Using Instant Messenger to Facilitate *e*Learning Online Interaction in Conventional Versus Virtual Graduate Classrooms

Lih-Ching Chen Wang
Department of Curriculum and Foundations
Cleveland State University
2121 Euclid Ave.
Cleveland, OH 44115, USA
l.c.wang@csuohio.edu

Abstract: This study will investigate student perceptions of two different methods of online interaction in graduate educational technology coursework. All students will use an instant messenger (IM) program to facilitate online interaction between student/instructor and student/student. One group will be required to participate in IM topic-discussion-online in the conventional classroom. The other group will be required to participate in IM topic-discussion-online in the virtual classroom. Both groups will undergo a period of required access to office-hours-online, then be offered the option of continuing to use office-hours-online for the remainder of the semester. Student perceptions toward topic-discussion-online and instructor's office-hours-online between these two groups will be studied, along with their relative perceptions toward online interaction in general.

Introduction

More and more students and faculty are using instant messenger (IM) programs to facilitate quick synchronous online text interaction because IM is faster than other asynchronous electronic interaction media such as email and voice mail messaging. The current most popular, fast, easy, and free IM programs used in academia include AIM (AOL [America Online] Instant Messenger) and MSN (Microsoft Network) Messenger. Both programs provide online interactive functions such as instant online chatting, instant message exchange, instant online calling, buddy group creation, file and image exchange, and so on. The online chat and message exchange functions will be used primarily for this study, along with the ability of IM users to set up and use their own customized discussion groups. Such facilities have great potential in facilitating class synchronous online interaction between the student and instructor and student and student.

Interaction is a powerful force in education. "Online interaction" has recently been used as a factor in assessing a variety of distance education activities by diligent researchers. Wojahn (1994) used it in examining men's and women's online communication behaviors on four electronic bulletin boards and compared them to face-to-face communications. Warschauer (1997) employed it in assessing computer-mediated interaction in a second language based on a sociocultural analysis of the relationship among text, talk, and learning. Hollenbeck (1998) used it in assessing the Internet as a place for fostering democracy in computer conferencing. Essex and Cagiltay (2001) used it in evaluating the feedback of "distressed" students on a Web-based distance education course. Nevertheless, none of these studies have yet used IM to investigate the effectiveness of online interaction.

How can "online interaction" be assessed appropriately in higher education? In 1987, Chickering and Gamson created "Seven Principles for Good Practice in Undergraduate Education." These principles include (1) encouraging contacts between student and faculty, (2) developing reciprocity and cooperation among students, (3) using active learning techniques, (4) giving prompt feedback, (5) emphasizing time on task, (6) communicating high expectations, and (7) respecting diverse talents and ways of learning. Since that time they have been used to assess a variety of arenas in higher education, particularly in the area of instructional technology (for example, see Chickering & Ehrmann, 1996).

The purpose of this study is to investigate whether IM programs can be used to facilitate the online *e*Learning interaction both in conventional and virtual classrooms. Student perceptions toward an IM program applied in class topic discussions will be the focus for the investigation. The first (i.e. encourages contacts between student and faculty), second (i.e. develops reciprocity and cooperation among students), and fourth (i.e. gives prompt feedback) principles among the seven principles of good practice in higher education will be the focus of assessment in the study.

Design and Procedure

Subjects will be graduate students from two sections (conventional versus virtual) of an educational technology class taught at a midwestern urban state university during the Fall 2002 term. The anticipated number of participants is approximately 40. They are mostly Pre K-12 educators.

One section of the class will employ traditional classroom instruction, and will serve as the control group. The other section is Web-based (with the exception of a single initial class meeting in person) and will serve as the experimental group. The course content, instructor, and calendar for both sections are identical.

Both classes will receive direct instruction in the use of an instant messenger (IM) program, and both groups will be required to carry out a planned series of class discussions (centering around major chapter topics) entirely in the IM environment. Both groups will also be required to use the IM-based office-hours-online process for all contacts with the instructor (outside of class) during the first three weeks of the semester, after which all students may choose freely to use either office-hours-online or more traditional means of contacting the instructor.

This is a study of online interaction, and two aspects of online interaction will be involved. The first is that of topic-discussion-online. Both groups will discuss the same topics during the same time frame, with the same preparation and supervision, within the IM environment. The only difference between the two groups will be that one will meet entirely in a traditional classroom setting, and the other will meet (almost) entirely in an online setting. The discussion topics, guidelines and schedule will be provided on the course syllabus for both groups.

The second aspect is that of office-hours-online. Both groups will receive the same direct instruction in the use of IM, and both will be required to use only this method for contacts with the instructor outside of class during the first three weeks of the semester. After the initial three-week period, both groups will be allowed to use either online or other means (e.g. personal contact, telephone, fax, E-mail, etc.) to confer with the instructor. Data will be collected on the issue of which students from which group make which choices in this matter. All students will be told that their participation will be part of their coursework but their grades will not be affected by participation in the experiment.

Research Questions

Within the context of IM-based *e*Learning, four research questions are proposed: (1) Is there a difference in student perceptions toward the IM online interaction methodology during topic-discussion-online in terms of "developing reciprocity and cooperation among students" between conventional and virtual classrooms? (2) Is there a difference in student perceptions toward the IM online interaction methodology during the office-hours-online in terms of "encouraging contacts between student and instructor" between conventional and virtual classrooms? (3) Is there a difference in student perceptions toward the IM interaction methodology during the office-hours-online in terms of "giving prompt feedback" between conventional and virtual classrooms? (4) Which group of student has more "participation frequency" in the office-hours-online between conventional and virtual classrooms?

Data Sources

All students will complete two questionnaires, one a pretest and the other a post-test. The pretest will collect two types of information. One set of questions will address students' prior IM experience and experience with online group discussions; the other will address their perceptions in specific areas dealing with the research questions of this study. The post-test will collect only information on student perceptions, using the same questions used in the perception portion of the pretest.

The first research question deals with student perceptions of topic-discussion-online. The questions in this area will deal with the principle of "developing reciprocity and cooperation among students."

The second, third and fourth research questions all deal with student perceptions of office-hours-online. For the second, questionnaire items will address the principle of "encouraging contacts between student and instructor." For the third, they will address the principle of "giving prompt feedback."

The fourth research question addresses the "participation frequency" between conventional and virtual groups during the instructor's office-hours-online. The data source for this question will not be the pretest or post-test, but will be the instructor's frequency count of office-hours-online participation by class section.

All the experimental material delivery, survey, and data collection will be administered online. An Analysis of Variance (ANOVA) model will be used to test the significance of the differences in students' perceptions in specific areas dealing with the research questions of this study. The three principles (addressed in research questions one to three) and the "participation frequency" (addressed in research question four) are the primary dependent variables while the class formats in using IM program (IM in conventional classroom vs. IM in virtual classroom) are the primary independent variable.

Educational Importance of the Study

The study is educationally significant in a number of ways. It is one of the few studies investigating the differences between the ways in which traditional and online students perceive specific aspects of online interaction. It is also one of the few studies to investigate specific classroom applications of an IM program, both for instruction and for individual contact between students and instructor. Knowledge derived from this study can help us all make better informed decisions about the situations in which it may be pedagogically appropriate to employ online discussions or online office hours, either in an *e*Learning situation or even within the context of a class which is otherwise largely traditional. Should students turn out to regard either (or both) aspects of IM as being at least the equal of more traditional approaches, this information can help us to move toward an optimal balance of traditional and online methodologies for instructional purposes.

References

Chickering, A. W., & Ehrmann, S. C. (1996), Implementing the Seven Principles: Technology as Lever. *AAHE Bulletin*, October, 3-6.

Chickering, A. W., & Gamson, Z. F. (1987). Seven Principles for Good Practice in Undergraduate Education. *AAHE Bulletin*, March, 3-7.

Essex, C., & Cagiltay, K. (2001). Evaluating an Online Course: Feedback from "Distressed" Students. *Quarterly Review of Distance Education, 2*(3), 233-39.

Hollenbeck, J. (1998). Democracy and Computer Conferencing. *Theory into Practice, 37*(1), 38-45.

Warschauer, M. (1997). Computer-Mediated Collaborative Learning: Theory and Practice. *Modern Language Journal, 81*(4), 470-81.

Wojahn, P. G. (1994). Computer-Mediated Communication: The Great Equalizer between Men and Women? *Technical Communication: Journal of the Society for Technical Communication, 41*(4), 747-52.

Electronic Cognitive Apprenticeships: Examining Novice and Advanced Learners' Perceptions of Case-Based Collaborative Learning

Sung Hee Park
Department of Curriculum and Instruction
Purdue University, USA
park32@purdue.edu

Hua Bai
Department of Curriculum and Instruction
Purdue University, USA
baih@purdue.edu

Ling Wang
Department of Curriculum and Instruction
Purdue University, USA
wang23@purdue.edu

Abstract: This study examined novice and advanced learners' perceptions of case-based collaborative learning as they participated in an electronic apprenticeship environment during a semester-long course. Novice and advanced learners analyzed a set of instructional design case studies. Novice learners also developed instructional design projects with feedback from the advanced learners. By engaging in joint case analyses and design reviews both groups of learners developed specific perceptions of case-based discussions and project review apprenticeship experiences. Recommendations for the future format of this course and educational implications of such a course were also addressed.

Theoretical Framework

According to Collins, Brown, and Holum (1991) an apprenticeship environment provides students with opportunities to apply expert problem-solving strategies. In a cognitive apprenticeship environment, the goal is to make visible and explicit complex thinking and problem-solving strategies that experts use in particular domains. By combining six distinct teaching strategies (modeling, coaching, scaffolding, articulation, reflection, and exploration), students can conceptualize their knowledge and use that knowledge in a variety of settings (Collins, Brown, & Newman, 1989).

Supporting these methods of cognitive apprenticeships is the concept of authentic activity—the use of ordinary practices of a given culture as a basis for learning (Brown, Collins, & Duguid, 1989). One promising approach to initiating authentic, contextual learning is case-based instruction.

Case-based instruction has been used in professional preparation programs to make a bridge between classroom and field. Recently case-based instruction was introduced into the instructional design field (Ertmer & Quinn, 1999). The effective use of cases requires students to apply critical thinking to a problem situation to analyze the situation and recommend realistic solutions through better understanding (Ertmer & Russell, 1995; Shulman, 1992; Wright, 1996).

Flynn and Klein (2001) examined the role of group discussion in case-based instruction. Participants working in groups performed better while analyzing cases than those who worked alone. Other researchers (Griffith & Laframboise, 1997; Levin, 1995) found that, for experienced learners, discussion appeared to act as a catalyst for reflection based more on personal experiences than on theory and course content, while for less experienced learners, discussion appeared to allow them to clarify or elaborate their understanding and increase their perspectives on the issues in the cases.

Simply stated, case-based instruction becomes more effective when learners at different levels work collaboratively in an apprenticeship environment. However, previous research focused more on the growth in novice learners' problem-solving expertise and their benefits from this learning experience. Little research has explored how advanced learners perceived the collaborative experience with novice learners. Therefore, it is important to examine how both novice learners and advanced learners perceive the benefits of case-based instruction facilitated in an apprenticeship environment.

Purpose

This study examined novice and advanced learners' perceptions of case-based collaborative learning during one semester in which they participated in an electronic apprenticeship environment. Specifically, the research questions included:

- What are novice and advanced learners' perceptions of case-based collaborative problem-solving activities?
- What are the novice and advanced learners' perceptions of instructional design project reviews in electronic cognitive apprenticeship environment?

Methods

Graduate students (n=19) at one Mid-western university enrolled in an introductory instructional design course (classified as novice learners) and graduate students (n=10) from another Mid-western campus enrolled in an advanced instructional design course (classified as advanced learners) participated in a semester-long study. Three graduate students from the latter group conducted the research.

Qualitative data were gathered from three sources: 1) discussion board postings revolving around case study discussions and instructional design project reviews collected from all participants, 2) open-ended surveys from seven advanced learners and seven novice learners, and 3) follow-up interviews conducted with seven advanced learners and three novice learners.

Throughout the semester, participants analyzed and discussed 10 case studies via an online discussion board and videoconferencing. Online case discussions employed different types of setups including role-play, small group discussions, debate, and so on. A total of 889 messages were posted when participants discussed these cases.

Novice instructional design students created an instructional design project and the advanced learners played the role of mentors to review novice learners' projects. They exchanged their opinions and ideas via online discussion board and synchronous chat rooms. At the end of the course, seven advanced learners and seven novice learners completed an open-ended survey that included 8 questions concerning the activities they participated when taking the course (e.g. Discuss your ideas about our collaboration with HRD 406 students, including the benefits/challenges associated with providing feedback on their design projects). In addition, the researchers conducted follow-up interviews with seven advanced learners and three novice learners. The interviews lasted about 30 to 40 minutes and 10 questions were asked (e.g. What benefits do you perceive of the collaborative discussion of ID cases, especially in terms of how the discussions helped develop your skills and knowledge of ID?). With their permission, the interview data were tape-recorded and then transcribed.

A constant comparison analysis method (Guba & Lincoln, 1989) was used to generate the categories and patterns from qualitative data to determine the advanced and novice learners' perceptions of case-based collaborative learning in the electronic cognitive apprenticeship environment.

Results and Discussion

Case-Based Collaborative Discussion

The advanced and novice learners had similar perceptions of the benefits of the case discussion. They agreed the strongest benefit was that they could share different perspectives and viewpoints with each other and that it deepened their understanding of instructional design. Discussing the cases provided them with the real world ID experiences and they could learn from the mistakes of the case players. Two advanced learners made the following comments on the benefits:

> Be able to get different viewpoint on a problem…I am bound to hear something I wouldn't have thought by myself, I wouldn't have considered then by that I've learned something new.

> The collaborative discussion deepened my understanding to analyze the cases in the real world. First, the benefit is expanding my understanding of the case. Second, it makes me feel more interested in the class and also in the (collaborative) discussion.

One novice learner stated:

> Learning from others' mistakes should help in avoiding the same mistakes, whether the problem was the original mistake or the way it was handled.

For case discussions, a big weakness that the advanced learners reported was the repetition of discussion content via online discussion, videoconferencing and in-class discussion. One advanced learner commented:

> The online discussions were productive but repetitive. I think dedicating so much time online and then in-class was too much time.

Compared to the advanced learners, the novice learners felt confused by the value of the cases. Since they were in the introductory course of instructional design, studying the instructional design model and simultaneously discussing those cases made them feel confused. One novice learner stated: "I thought they [case discussions] did not fit in with the other work we did in this class." The novice learners also addressed the redundancy and quality of online postings: "Students only repeating and agreeing with information already posted."

Project Review Apprenticeship

Compared to benefits of the case discussions, the advanced and novice learners perceived the benefit of the project review quite differently. The advanced learners reported that the project review helped them reinforce and refresh their knowledge of ID. This also gave them an opportunity to think about ID process from the perspective of an evaluator. Furthermore, this process reflected the realistic ID world experience. As one advanced learner noted:

> This is more like realistic ID world… going through without any [subject matter] knowledge. It's very beneficial to see the product from the beginning…and the way we worked in the place where we were presented with problems and did not have SME [all made the experience resemble real world ID].

The novice learners liked the collaborative work with mentors and peers. With the feedback from them, they could improve and revise their ID project. One novice learner described:

> [I was] satisfied with most comments and recommendations. Having never done ID before, I benefited from someone looking at the issue from a different and alternative perspective and offering those types of suggestion.

For the instructional design project review, the advanced learners thought that projects submitted by some novice learners did not meet the requirements of the project assignment made the project review incomplete and unsatisfactory. Moreover, because the advanced learners critiqued only three of the six projects, they were not able to form a whole picture of the novice learners' instructional design projects. They also worried that the novice learners sometimes just took their words as right without arguing and challenging.

The novice learners considered time to be a limitation of the fulfillment and collaboration in project review. One made comments as such: "We don't have enough time to stay in touch. We don't have enough time to collaborate, just a little bit some time online, you know."

Recommendations

The participants suggested that both technical issues and course design issues should be considered when offering such a course in the future.

For the technical issues, the participants suggested that a technical coordinator be used to facilitate the video conferencing in order to make sure the conferencing went on smoothly. Another issue the participants addressed was that, before the video conferencing session, the video and audio quality should be double checked so that quality issue would not be an interruption to the conferencing. The participants also recommended that the learners taking the course should well prepare themselves for a course of such a format by making sure they have access to the Internet either at home or at a place convenient for them.

For the course design issues, the participants specifically addressed issues concerning online discussion, case studies, course syllabus, course participants, and course assignments.

For online discussion, the participants suggested the use of smaller group activities so that the online discussion would be more manageable. They also expressed the need for a facilitator or specific guidelines. As to the cases used for the course, they suggested "the cases used in the course should be made sure updated to the date and explicitly written."

The participants made some suggestion to the arrangement of the course syllabus. They suggested the use of video conferencing at the early stage of the course in order to help participants put faces with names. They also suggested the use of one format of media in each week or the use of different format of media for each case study. In addition, they believed that more cases could be discussed in one week. For example, an advanced learner made such a comment:

> We could have discussed more cases in one week and so hit more topics of ID… we don't have to do one case on-line, then in class, and then on polycom.

Furthermore, they suggested, if possible, more frequent contact or face-to-face communication between participants should be arranged. For example, another advanced learner commented:

> I like it [videoconferencing] very much because it was more personalized. Polycom is a great technology. It allows more freedom in the discussion and does not try to bias the discussion.

Finally, as to who should participate in such a course, they suggested that the two sites for the collaborative learning be of similar size and especially the advanced learners wanted to discuss with learners who had a similar level of ID skills and knowledge.

Educational Significance and Implications

The results of this study suggested both benefits and challenges of case-based discussion and project review apprenticeship for both advanced and novice learners. The recommendations made by both advanced and novice learners from their specific standing points in the apprenticeship environment highlighted the importance of making necessary changes and improvements to the format and design of such an ID course of collaborative learning when it is offered in the future.

References

Brown, J. S., Collins A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher, 18* (1), 32-42.

Collins, A., Brown, J. S., & Holum, A. (1991). Cognitive apprenticeship: Making thinking visible. *American Educator: the Professional Journal of the American Federation of Teachers, 15* (3), 6-11, 38-46.

Collins, A., Brown J. S., & Newman, S. E. (1989). Cognitive Apprenticeship: Teaching the Crafts of Reading Writing and Mathematics, In L. B. Rensnick (Eds.), *Knowing, learning, and instruction: Essays in honor of Robert Glaser*. Hillsdale, NJ: Lawrence Erlbaum Press.

Ertmer, P. A., & Quinn, J. (1999). *The ID casebook: Case studies in instructional design*. Upper Saddle River, NJ: Prentice-Hall, Inc.

Ertmer, P. A., & Russell, J. D. (1995). Using case studies to enhance instructional design. *Educational Technology, 35* (4), 23-31.

Flynn, A. E. & Klein, J. D. (2001). The influence of discussion groups in a case-based learning environment. *Educational Technology Research and Development, 49* (3), 71-86.

Griffith, P. L. & Laframboise, K. (1997). The structures and patterns of case method talk what our students taught us. *Action in Teacher Education, 18* (4), 10-22.

Guba, Y. & Lincoln, L. (1989). *Fourth generation evaluation*. Newbury Park: Sage.

Levin, B. B. (1995). Using the case method in teacher education: The role of discussion and experience in teachers thinking about case. *Teaching and Teacher Education, 11* (1), 63-79.

Shulman. J. (Ed.). (1992). *Case method in teacher education*. New York: Teachers College Press.

Wright, S. (1996). Case-based instruction: Linking theory to practice. *Physical Educator, 53* (4), 190-207.

Impact of Vicarious Learning Experiences and Goal Setting on Preservice Teachers' Self-Efficacy for Technology Integration

Ling Wang
Department of Curriculum and Instruction
Purdue University, USA
Wang23@purdue.edu

Abstract: This pilot study was designed to explore how vicarious learning experiences and goal setting influence preservice teachers' self-efficacy for integrating technology into the classroom. In this pilot study, twenty students from the Teacher Education program at a Mid-western university participated and were assigned into four experimental conditions. Results showed the individual and collective effects of vicarious experiences and goal setting on the participants' judgments of self-efficacy for technology integration. More data were simulated based on the result of this pilot study to detect the effect of vicarious learning experiences and goal setting when the sample size was 80 participants.

Theoretical Framework

Despite the increased availability and support for computers (Zehr, 1997, 1998), relatively few teachers have fully integrated computers into their classroom teaching (Marcinkiewicz, 1996). There is substantial evidence to suggest that teachers' beliefs in their capacity to work effectively with technology, that is, their computer self-efficacy, is a significant factor in determining patterns of classroom computer use (Oliver & Shapiro, 1993). The studies on teachers' self-efficacy beliefs provide sufficient reason to undertake further investigations in this area and to consider approaches to teacher education and professional development that might be effective in increasing self-efficacy for teaching with technology.

Bandura (1986) identified four sources of information used to judge self-efficacy: successful performance attainment; observing the performances of others (vicarious learning); verbal persuasion indicating that one possesses certain capabilities; and physiological states by which one judges capability, strength, and vulnerability. Although performance accomplishments are considered to be the most robust source of self-efficacy information, vicarious learning also provides a powerful source (Bandura, 1986, 1997). That is, viewing others successfully accomplish a particular task can increase one's perceptions of others' efficacy as well as one's own self-efficacy for similar tasks (Bandura, 1997). The effects of vicarious learning merit further examination.

While novice learners can acquire skills and strategies from social modeling, when performing independently they are likely to over- or underestimate their capabilities (Schunk, 2001). However, by making learning goals explicit, students' judgments of progress, as well as their judgments of self-efficacy, increase in accuracy and strength (Schunk, 2001). Goals can motivate behavior and inform people about their capabilities (Bandura, 1997; Schunk, 1996). When students are given or establish a goal, they may experience a sense of efficacy for attaining it.

Based on the literature described above, this study examined the impact of vicarious learning experiences and goal setting on preservice teachers' self-efficacy for technology integration.

Purpose

This study explored how vicarious learning experiences and goal setting influence preservice teachers' self-efficacy for integrating technology into the classroom. Specifically, this study was guided by the following research question:

What are the individual and collective effects of vicarious experiences and goal setting on preservice teachers' judgments of self-efficacy for technology integration?

Based on the self-efficacy literature described above, it was hypothesized that preservice teachers who engaged in vicarious experiences, related to successful technology integration, would experience a significantly greater increase in judgments of computer self-efficacy than those who did not engage in these vicarious experiences. Furthermore, it was hypothesized that preservice teachers who engaged in goal setting, related to increasing their technology integration skills, would experience a significantly greater increase in judgments of computer self-efficacy than those who did not engage in goal setting. Finally, it was hypothesized that preservice teachers who engaged in vicarious experiences and goal setting would demonstrate the greatest increases in judgments of computer self-efficacy compared to students who engaged in either one of these conditions alone.

Methods

Participants were solicited from a four-week three-credit educational technology course at a large Mid-western university. They were sophomores in the Teacher Education program and their age range was from 18 to 25.Thirty-one students signed the informed consent form and agreed to participate, but only twenty of them finally showed up in the study. The thirty-one participants were randomly assigned into four experimental conditions. The numbers of participants who finally showed up for the four experimental conditions were 6, 6, 4, and 4 (Note: The unequal group size was due to the dropouts from the study).

A 2 x 2 (Vicarious Experiences: use of VisionQuest software [Note: VisionQuest is an instructional tool designed to provide opportunities for users to explore models of effective technology integration] vs. no use of VisionQuest software x Presence of Goal Setting: goal setting vs. no goal setting) mixed factorial research design was used to examine how vicarious experiences and learning goals individually, as well as collectively, impacted preservice teachers' judgments of their computer self-efficacy. These independent variables were combined to form four experimental conditions: (a) NVQ / NG: no use of VisionQuest software and no learning goals (also defined as control group), (b) NVQ / G: no use of VisionQuest software but with learning goals, (c) VQ / NG: use of VisionQuest software but without learning goals, and (d) VQ / G: use of VisionQuest software and with learning goals.

Data Collection and Analysis

Demographic data, including information about gender, class, and previous computer experiences were collected from all participating students. A Likert-style survey measuring participants' self-efficacy served as the primary data source and was administered at the end of each experimental condition. The survey was constructed by the researcher after consulting with content area experts. The survey included 21 items regarding participants' confidence for technology use (see the attachment). The participants were asked to rate their level of agreement (from 1-strongly disagree to 5-strongly agree) with statements related to their possession of confidence regarding technology use (e.g., "I feel confident that I understand computer capabilities well enough to maximize them in my classroom." "I feel confident I can regularly incorporate technology into my lessons, when appropriate to student learning."). Cronbach alpha was calculated to determine the reliability of the survey items. The alpha coefficient was 0.9293.

For the groups that engaged in vicarious experiences, participants explored the VisionQuest CD-ROM and observed the exemplar teachers' technology use and classroom management strategies. For the groups that engaged in learning goals, participants were given, at the beginning of the experiment, 3 to 5 specific goals related to learning about technology integration.

Means and standard deviations for each experimental condition were calculated. Two-way ANOVA was used to determine the main effects of IV_1 (vicarious learning experiences through viewing VisionQuest CD-ROM) and IV_2 (learning goals) and the interaction of IV_1 and IV_2. One-way ANOVA was then used to determine which of the four experimental conditions was significantly different from which.

Results and Conclusion

The four experimental conditions had the following means and standard deviations: VQ / G (mean= 4.55, SD=0.33); VQ / NG (mean=4.30, SD=0.41); NVQ / G (mean=4.24, SD=0.52); and NVQ / NG (mean= 3.57, SD=0.14).

The F value (F=5.57, p=0.0082, df=3, 16) from the two-way ANOVA indicated that there was at least one main effect of the two factors was significant. Then when examining the F values for each of the two factors and the interaction of the two factors, the researcher found that the vicarious learning factor had a significant main effect on the self-efficacy (F=9.18, p=0.0080, df=1, 16), the learning goals factor also had a significant main effect on the self-efficacy (F=6.06, p=0.0256, df=1, 16), but the interaction of the two factors was not significant (F=1.48, p=0.2407, df=1, 16).

The F value from the (F=5.57, p=0.0082, df=3, 16) from the one-way ANOVA indicated that the variable—different conditions of the experiment—had a significant effect on the self-efficacy. When examining which conditions were significantly different from which conditions, the researcher found that the following between-condition differences were significant at the 0.05 level: VQ / G – NVQ / NG (the mean difference=0.98), and VQ / NG – NVQ / NG (the mean difference=0.73).

This study was the pilot study for the researcher's dissertation research. From the results of the data analysis, it can be concluded that the preservice teachers who engaged in vicarious experiences, related to successful technology integration, experienced a significantly greater increase in judgments of computer self-efficacy than those who did not engage in these vicarious experiences. Also, the preservice teachers who engaged in learning goals, related to increasing their technology integration skills, experienced a significantly greater increase in judgments of computer self-efficacy than those who did not engage in learning goals. In addition, the preservice teachers who engaged in vicarious experiences (with or without learning goals) demonstrated significant increases in judgments of computer self-efficacy compared to those who engaged in neither of the two conditions. However, the preservice teachers who engaged in learning goals alone did not demonstrate significant increases in judgments of computer self-efficacy compared to those who engaged in neither of the two conditions. Similarly, the preservice teachers who engaged in both vicarious experiences and learning goals did not necessarily demonstrate significant increases in judgments of computer self-efficacy compared to those who engaged in either of the two conditions alone.

Because this was a pilot study with only twenty participants, the small sample size of the study could be a factor affecting the results (or at least part of the results). Therefore, the researcher simulated some data based on the means and standard deviations of the four experimental conditions of the pilot study. After simulation, the sample size was enlarged to 80 participants and 20 participants in each of the four conditions.

The F value (F=27.5, p<0.0001, df=3, 76) from the two-way ANOVA indicated that there was at least one main effect of the two factors was significant. Then when examining the F values for each of the two factors and the interaction of the two factors, the researcher found that the vicarious learning factor had a significant main effect on the self-efficacy (F=40.46, p<0.0001, df=1, 76), the learning goals factor also had a significant main effect on the self-efficacy (F=38.83, p<0.0001, df=1, 76), but the interaction of the two factors was not significant (F=3.21, p=0.0773, df=1, 76).

The F value from the (F=27.5, p<0.0001, df=3, 76) from the one-way ANOVA indicated that the variable—different conditions of the experiment—had a significant effect on the self-efficacy. When examining which conditions were significantly different from which conditions, the researcher found that the following between-condition differences were significant at the 0.05 level: VQ / G – VQ / NG, VQ / G – NVQ / G, VQ / NG – NVQ / NG, NVQ / G – NVQ / NG, and VQ / NG – NVQ / NG.

With the findings from the simulated sample size, the researcher concluded that the preservice teachers who engaged in both vicarious experiences and learning goals did demonstrate significant increases in judgments of computer self-efficacy compared to those who engaged in either of the two conditions alone, in addition to the significant increases detected in preservice teachers' judgments of computer self-efficacy when only one condition was present.

Educational Implication

The results of this study will contribute to the existing body of literature in two significant ways: (1) by describing how preservice teachers benefit from observing teacher models presented via multimedia case examples, such as those featured on VisionQuest, and (2) by describing how preservice teachers benefit from learning goals for technology integration. From an instructor's perspective, the use of electronic models via multimedia and the incorporation of learning goals can positively impact the authentic nature of a course and simultaneously increase the confidence and integration beliefs of students. This type of modeling and goal setting can help preservice teachers develop a vision for what technology integration looks like in real classrooms as well as strategies for implementing those visions.

References:

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory.* Englewood Cliffs, NJ: Prentice-Hall.

Bandura, A. (1997). *Self-efficacy: The exercise of control.* New York: Freeman.

Marcinkiewicz, H. R. (1996). Motivation and teachers' computer use. (Eric Document Reproduction Service No. ED 397 818)

Oliver, T. A., & Shapiro, F. (1993) Self-efficacy and computers. *Journal of Computer-Based Instruction. 20,* 81-85.

Schunk, D. H. (1996). Goal and self-evaluative influences during children's cognitive skill learning. *American Educational Research Journal, 33,* 359-382.

Schunk, D. H. (2001). Social cognitive theory and self-regulated learning. In B. J. Zimmerman & D. H. Schunk (Eds.), *Self-regulated learning and academic achievement: Theoretical perspectives*, 2nd ed. (pp. 125-151). Mahwah, NJ: Lawrence Erlbaum.

Zehr, M. A. (1997). Teaching the teachers. *Education Week: Technology Counts, 17* (11), 26-29.

Zehr. M. A. (1998). The state of the states: Many still haven't dealt with the most difficult policy issues. *Education Week: Technology Counts, 18* (5), 69-71.

Gender, Discourse Style, and Equal Participation in Online Learning

Minjuan Wang, Assistant Professor
Christina Sierra, M.A. candidate
Department of Educational Technology
San Diego State University
mwang@mail.sdsu.edu
cbsierra@yahoo.com
Terre Folger, Assistant Professor
Teacher Education, Westminster College, tfolger@rocketmail.com

Abstract: This paper is a report on the findings of a study conducted on a graduate level online course. We used discourse analysis techniques to examine the chat transcript of texts for evidence of the relationship among gender, discourse style, and equal participation. We also conducted online observations and surveyed participants' perceptions on their online discussions. Findings from all sources do not reveal any significant gender differences in the online discussions. Respondents unanimously felt comfortable with the manners of discussion that this class demonstrated. However, the overall discourse style showed a difference. The participants used some of the interaction styles more often than others, i.e., exchanging information versus negotiation and argumentation. Instructors should intentionally encourage meaning negotiation in online discussions by engaging students in collaborative problem solving.

Introduction

Equal participation, the provision of equal opportunities for participants to contribute and to get feedback in conversations (Flanagin, Tiyaamornwong, O'Connor, & Seibold, 2002), in online learning environments is among the many factors spotlighted in recent research. In order to take advantage of these opportunities, participants must feel comfortable with the medium and the communicative style it allows. In particular, participants in text-based, computer-mediated communication (CMC) rely upon their verbal and linguistic behaviors to reveal information about opinions and attitudes (Adrianson, 2001).

Researchers (e.g., Howland, 2002; Markel, 1999; Moore, 2002) have attempted to determine equal participation in online learning and communication by examining participants' discourse (i.e., interaction) patterns according to gender differences. Although classroom discourse has been studied extensively (e.g., Edwards & Westgate, 1987), new forms of discourse occur in virtual settings (Harasim, 1990; Romiszowski & Mason, 1996). For instance, Markel (1999) found gender differences in discourse styles in an online virtual conference course for in-service teachers. She noted that female students used direct questions and responses to invite discussion; while male students made statements in challenging tones. As a result, males were more successful in receiving responses. The differences in discourse styles therefore contributed to the inequality of this group's online discussion participation. Arbaugh (2000)'s study revealed that men's level of participation in online course maintained stable and moderate levels until the end of the course. Meanwhile, women's participation levels were initially high, dropped to a moderate level, and increased at the end of the course. The results suggested that men placed more emphasis on the competitive aspects of the course as the term progressed, while women viewed the virtual classroom as an opportunity for collaboration and networking and valued the collaborative environment.

Flanagin et al. (2002) stated that "the likelihood, level, and nature of equalization that may occur in a CMC environment are not agreed upon or clear" (p.67). Their study discovered that men exhibited a greater desire to reveal personal information that reveals their social status, while women tended to "recognize and enjoy the social benefits afforded them through reduced social cues" (p.82). They also found that within the CMC environment, women may be more process-oriented than men and less concerned with group composition.

The Study

This review of literature suggests that men and women differ in discourse styles when interacting in the CMC environment. Building on this knowledge base through continued research will promote all learners' active participation in online learning, regardless of their gender. This study will also affect how instructors of the CMC environments conduct the collaborative learning experience. In this presentation, we will report findings from a case study that examines the discourse styles and participation of male and female students in an online graduate-level course. The foci questions of this qualitative case study include:

1. What are the factors (e.g., ethnicity, gender, knowledge base, cultural differences) affecting students' levels of participation in online discussions?
2. How does discourse style affect participation?

This introductory instructional design course focuses on the systematic design of products for education and training. The course engages students in both solo and teamwork tasks in completing several project deliverables. Students' development efforts culminate in a proposal for an instructional product and a report on prototype development and testing efforts. During the course, students interact with a cast of characters from a hypothetical educational design company, a firm that offers a wide range of educational products for corporate training markets and in all levels of public schools. Students work as contractors for this company.

Twenty-one students enrolled in this online course represent many parts of the United States and countries as far away as Hong Kong, Japan, Argentina, and Venezuela. Although the participants' professions are diverse, ranging from life skills teacher to course developer to eBusiness user and support analyst, they are all involved in training and education. Their age ranges from 28 to 45, with a mean of 37. Participants in this course communicated in English via a variety of synchronous or asynchronous tools, including email, class listserv, forum (Instructional Design Café), Live Webcast (an online broadcasting delivered by the instructor via RealProducer), live chat, and occasionally phone conversations. The class had a total of 9 males and 12 females. Their distribution in each of the two sessions is as follows: Session Feb. 7th (seven males and six females); Session Feb. 10 (one male and six females). One male student was absent from that week's discussions.

The researchers collected data primarily through observation of the live chat discussions and forum (an online café) postings. The course instructor provided a random sampling of two Webcast discussion transcripts. In order to accommodate students' schedules, the instructor held redundant Webcast twice a week. Both sessions addressed the same discussion topics and online activities, but involved different participants. The two transcripts represent a variety of discussions as well as interactive presentations and peer reviews.

An end-of-semester questionnaire was distributed to the students in May 2002, surveying their perceptions of the online experiences, self-rated participation levels, learning gains, and satisfaction with the course. The survey also elicited information about whether gender differences do exist in this online class, and whether the students' cultural backgrounds affect their manners of communication with others (e.g., disagreeing, negotiation).

Using Microsoft Word 2000, the researchers first used open coding (Strauss & Corbin, 1998) to individually code the sampled Webcast discussion transcripts. Open coding is a line-by-line analysis of discourse that identifies major concepts and groups them into different categories and subcategories according to their properties and dimensions. The researchers then synthesized the codes to develop a coding scheme, established interrater reliability (>80%), and used the scheme to systematically code all sampled data. Interactions in the transcripts were naturally divided by the individual's name. One discourse unit, an individual's typed input in this case, could be associated with multiple codes.

Synthesizing coding schemes from related research (Adrianson, 2001, Markel, 1999), the researchers generated the following coding categories to represent interaction styles:

1. Information: statements made to make a point or to clarify related issues.
2. Opinion: statements reflecting participant's personal views, an interpretation or inference from the discussion.
3. Suggestion: statements made to solve a specific problem.
4. Summary: recapture or reiteration of discussions.
5. Questioning-answering: questions asked and answers provided.
6. Negotiation: attempts in reaching consensus
7. Argumentation: attempts in imposing one's opinions on others.
8. Agreement and disagreement: upon topics of discussion.
9. Motive: motives implied when supporting a suggestion.
10. Metacommunication: statement referring to the process of communication itself, especially teamwork strategies.
11. Uncoded messages: reference to anything unrelated to the topics of discussion.

Findings

Results of Coding

The frequency (percentage) of substantial messages exchanged was used to assess participants' levels of participation. Greetings such as "hi, hello, howdy" and other courtesy words were excluded from counting. Coding analysis revealed that female participants' frequency of messages (57% of total exchanges) exceeds that of the male participants (43%). However, on-topic messages are closer in number, with messages by males at 48% and females at 52%. Males are more likely to discuss information (60%) while women are more likely to express opinions (85%) and ask/answer questions (79%).

A repeated measures ANOVA (Analysis of Variance) was used to test the statistical difference between gender and discourse style (indicated by the 11 coding categories). The results indicate that there is no statistically significant interaction between gender and discourse style ($F=1.453$, $df=1, 18$; $p=0.1908$, $a=0.05$). However, there is highly significant difference in the overall discourse styles indicated by the 11 categories ($p<0.0001$). That means the participants, regardless of their gender, used some of the interaction styles more often than others. A post-hoc analysis (Fisher's PLSD) reveals that there was a significantly higher amount of information exchange and suggestions provided. There were very few negotiations and no argumentation among the discussants.

Survey Results

The survey responses provided by the 10 respondents had high consensus (80%) and corroborate the researcher's observation and ANOVA test. In general, the respondents agreed that they were active in the online discussions, but could have participated more. They enjoyed the Webcasts, online discussions, and collaboration. The majority of the responses to the survey questions were positive (Agree, Strongly Agree) with no negative responses (Disagree, Strongly Disagree).

In particular, respondents unanimously felt comfortable with the manners of discussion (e.g. netiquette, respectfulness, etc.) that this class demonstrated. In addition, they all enjoyed teamwork, valued networking and collaboration. It seems that there were not any noticeable cultural differences in students' perceptions on ways of working--being collaborative or competitive. A predominant majority of the respondents (90%) did not notice any gender differences in the class discussions. Ninety percent of the respondents also perceived negotiation and debate as acceptable ways of communicating with classmates and the instructor. Only 80% felt comfortable expressing opinions that differed from the instructor's. Ninety percent of the respondents enjoyed teamwork and felt their inputs were valued by classmates.

Conclusions

This mini-case study did not reveal any significant differences in discourse styles according to gender in this graduate-level online class. It seems that the maturation and experiences of the students contributed more to the discourse styles than gender. However, the overall discourse style showed differences in that participants used some of the interaction styles more often than others, i.e., exchanging information versus negotiating. Although participants perceived negotiation as an acceptable way to communicate, they did not negotiate much in the discussions.

It has been noted in previous research that intensive negotiation and argumentation reflect the uninhibited effects of communicating in an Internet-based environment, which, as Walther (1996) argued, could facilitate a higher rate of information exchange and strengthen interpersonal and social relations. Social constructivist researchers (Derry, Gance, Gance, & Schlager, 2000; Mercer, 1995) have corroboratively discovered that negotiation and argumentation can contribute to a higher quality of knowledge construction. Future instructors should intentionally encourage meaning negotiation in online discussions, perhaps through engaging students in collaborative problem solving. In addition, balancing numbers of male and female students in a discussion session will be conductive to the establishment of a stronger social network.

Findings of this study were based on a small sample of data. In order to further identify discourse style and interaction patterns, the researchers will use Sequential Data analysis (Cuomo, 1994; McKean, Allen, and Hoffman, 2000) software (e.g., MacSHAPA) to systematically code more data samples. The software will represent the structure of codes in visual maps that indicates themes and patterns. The software can also count the frequencies of the codes, which can be analyzed through ANOVA tests for differences in the frequencies of certain discourse styles used by males and females. We will also examine the response rate (lengths, wait time, & frequencies of responses) between male and female to corroborate findings on their participations.

References

Adrianson, L. (2001). Gender and computer-mediated communication: Group processes in problem solving. *Computers in Human Behavior, 17,* 71-94.

Arbaugh, J. B. (2000). An exploratory study of the effects of gender on student learning and class participation in an internet-based MBA course. *Management Learning, 31,* 503-519.

Derry, S. J., Gance, S., Gance, L. L., & Schlager, M. (2000). Toward assessment of knowledge building practices in technology-mediated work group interactions. In S. P. Lajoie (Ed.), *No more walls: Theory change, paradigm shifts and their Influence on the use of computers for instructional purposes* (Vol. II). Mahwah, NJ: Erlbaum.

Edwards, A. D., & Westgate, D. P. G. (1987). *Investigating classroom talk* (2nd ed.). Washington, D.C.: Falmer Press.

Flanagin, A.J., Tiyaamornwong, V., O'Connor, J., & Seibold, D. R. (2002). Computer-mediated group work: The interaction of member sex and anonymity. *Communication Research, 29,* 66-93.

Harasim, L. M. (Ed.). (1990). *Online education: Perspectives on a new environment.* New York: Praeger.

Howland, J. (April, 2002). *Gender, Computer-mediated Communication, and the Online Course.* Paper presented at the Annual Conference of American Educational Research Association, New Orleans, Louisiana.

Markel, S. (1999). *Gendered voices: Provocateur in an on-line virtual conference course for in-service teachers.* Paper presented at the 1999 ED-MEDIA Conference. Retrieved February 20, 2002, from http://www.aace.org/conf/site/sample.pdf.

Mercer, N. (1995). *The guided construction of knowledge: Talk amongst teachers and learners.* Philadelphia: Multilingual Matters LTD.

McKean, M., Allen, B. S., & Hoffman, B. (April, 2000). *Sequential Data Analysis: Implications for assessment of usability in virtual museums.* Paper presented at the Annual Conference of the American Educational Research Association, New Orleans, Louisiana.

Moore, T. (April, 2002). *A snapshot of validity and value in education research: Cyber-skills a discourse analysis of technology users in a tertiary educational site or women academics as cyborg figurations.* Paper presented at the Annual Conference of American Educational Research Association, New Orleans, Louisiana.

Romiszowski, A. J., & Mason, R. (1996). Computer-mediated communication. In D. H. Jonassen (Ed.), Handbook of research on educational communications and technology. New York: Macmillan.

Strauss, A., & Corbin, J. (1998). *Basics of qualitative research: Techniques and procedures for developing grounded theory.* Thousand Oaks: Sage Publications.

Webster, J., Hackley, P. (1997). Teaching effectiveness in technology-mediated distance learning. *Academy of Management Journal, 40,* 1282-1309.

Virtual Projects in Distributed Learning Environments

Xuemei Wang and J. Michael Spector
330 Huntington Hall, IDD&E
Syracuse University
Syracuse, NY 13244, USA
xwang09@syr.edu, spector@syr.edu

Abstract: A growing concern among those who implement online learning environments is how to effectively support and facilitate virtual group work. This paper describes four course projects in a distributed learning environment. The purpose of these efforts was to investigate the experience of students with virtual projects as a precursor to planning an online option for the capstone practicum course in the masters curriculum in Instructional Design, Development and Evaluation - a course that requires substantial collaborative project work with actual clients. The particular focus of this exploratory investigation was on how distributed learning environments influence group communication, cooperation and coordination. Benefits, problems and concerns inherent in virtual group work in online course settings will be discussed. Findings include the desire of virtual project team members to meet face-to-face initially and when difficulties were encountered.

Keywords: Distributed learning environment, Online course, Virtual project

Introduction

The growing complexity and dynamics of learning often require teamwork (Spector & Anderson, 2000). It is generally understood how to facilitate teamwork in face-to-face situations. At least there is often clear and immediate evidence when group processes breakdown in face-to-face settings, which allows for adjustments and corrective support. As information and communication technology increasingly is used in facilitating the learning process, virtual teamwork is more and more common. This situation requires additional investigation into how to effectively facilitate virtual projects in distributed learning environments.

The authors have participated in a distributed learning community as facilitators for several online courses. One of these online courses is an introductory survey course offered jointly by the Instructional Design, Development and Evaluation Program and the School of Information Studies at Syracuse University using WebCT as the course management platform. Students in this course study a variety of issues related to educational technology. Emphasis is equally balanced between knowledge about technologies and the use of technologies in educational settings. Technologies introduced include Web-based learning tools, assistive technologies for people with disabilities, multimedia and video-based systems, and so on. In addition to participating in online sessions, students work together in small teams with professional practitioners on a variety of technology-based projects in order to gain practical experience. The project requirement is to spend the equivalent of 45 hours working with clients on an educational technology project approved by the instructors. The capstone course in the IDD&E curriculum is more project-based than this introductory survey course. Before deciding whether there should be an online version of the capstone course, the faculty decided to first see how well virtual project teams would work in the introductory course when it was offered online. The results of four project teams are reported below.

The Projects

In the Spring semester of 2002, the online introductory course was offered online for the first time at Syracuse University. 12 graduate students from different programs and with different backgrounds worked on four projects: the Glossary Project; the Instructional Design Resources Project; the Daring Rural Education to Affect Meaningful Science (DREAMS) Project; and, the International Student Knowledge Management System Project.

The Glossary Project

Students were expected to plan and prototype an interactive, Web-based glossary of educational technology terms to serve as a prominent Web-based resource for professional instructional designers and educational technologists as well as for international students and for students transferring into educational technology from other disciplines. A graduate assistant football coach for SU, a non-matriculated full-time digital reference specialist for AskERIC and an assistant professor of mathematics at Utica College worked on this project. These students were all located in the central New York state area although not all in the same city. They had somewhat different work schedules as well.

The biggest challenge for this project turned out to be the involvement of students from two different courses rather than the fact that it was conducted in a virtual environment. This situation was imposed by the project sponsor and required students to use tools other than those embedded within the WebCT course environment. This requirement also created some dissonance in student roles within the project, since the student project leader was not in the introductory course. The requirements of the two courses were somewhat different in that the students in the more advanced course were not required to spend 45 hours with the client. This difference in course requirements sometimes created differing expectations among project team members. The major communication tool that evolved for this group was private email between each individual group member and the project leader. The project group members in the introductory class also used the email embedded in WebCT as well as a private discussion thread to facilitate their own collaboration. The fact that two course groups were involved made it difficult to assess how technologies available for communication, collaboration and coordination helped or hindered progress.

The difficulties that arose within the group due to the difference courses in which students were registered could have been expected to arise regardless of the virtual nature of the effort, although lack of face-to-face communication may have caused delays in resolving these difficulties. Nevertheless, there was substantial progress on the interactive, Web-based glossary and the project was considered as successful as projects conducted in a face-to-face team environment by the instructors.

The Instructional Design Resources Project

The project team was expected to plan and implement a Web-based repository of instructional design resources. The repository will provide relevant resources for instructional designers and people interested in understanding instructional design and relevant matters. A first year full-time masters student, a corporate trainer for the Hartford Insurance Company and a part-time masters student worked on this project. These students were all located in the central New York state area but had differing schedules.

Teleconferencing was employed as a major synchronous communication technology to facilitate group cooperation. Weekly teleconferencing was set up by one of the group members. During the teleconference, they exchanged information and shared work progress. Regular information was also exchanged using private emails with attachments. This group had more success in making progress more quickly than did other groups, and they did not experience any major difficulties. It is difficult to determine how much of this success is due to the communications technology selected although the group reported general satisfaction with this method.

Overall, the progress made by this group was judged well above average. It is likely that the mixed form of communications (including both Web-based methods as well as teleconferencing) and individual initiative exhibited by all three group members contributed to the success that this group experienced. It is noteworthy that this group devised its own forms of communications that went beyond those suggested by the instructors.

The DREAMS Project

This project team participated in the design and development of an innovative, Web-based, computerized learning environment designed to provide users motivational and enrichment experiences that facilitate the exploration of careers tied to agriculture and environmental sciences. An elementary Library Media Specialist, a high school social studies teacher, a graduate student in science education and a 7th grade English teacher worked on this project. While the team members were all located in the same general central New York vicinity, the client was located more than an hour's drive from the University.

The group met face-to-face at the initial phase and they reached agreement to communicate weekly in one of the chat rooms available in WebCT. The private discussion bulletin board was also actively used by this group. This project also had the most active assistance from the sponsor, which most probably accounts for much of their success. The variety and frequency of communications methods probably contributed to success as well. Overall, this group benefited from having a very involved project assistant who made sure that regular progress was occurring. While the end-user was located some distance from the campus, the sponsor's project assistant was available on campus and through local telephone service and quickly responded to problems as they arose.

The International Students Knowledge Management System Project

Project members engaged in planning and prototyping an interactive Website to support international students in the School of Education. The basic operating premise for this site was that international students can enrich learning and instruction for everyone as well as benefit from having a site dedicated to unique concerns of international students. A doctoral student in Teaching and Curriculum from Ghana and a masters student in the Information Management program from China worked on this project. Both of these students were located near campus and the project sponsor was on campus as well.

Asynchronous technology (e.g., email and discussion threads) was employed as a major communication mechanism. Students also met in person together several times and they also met with the client throughout the semester. The project sponsor for this effort provided only high level guidance and left the team members with an open and creative outlet for their ideas. The project involved the use of a Web-based knowledge management system that made virtual project work and progress potentially quite easy. The team made little use of this technology, however.

This team did manage to implement a prototype in the Web-based knowledge management system but it was not of sufficient quality to include in grant proposals, which was one of the overall goals. Since both team members were international students, they did manage to contribute much substance to the overall effort although the prototype was of marginal quality.

Findings

Collaboration on projects remains a challenge whether conducted face-to-face or via distance or distributed technology. Virtual collaboration can occur asynchronously (for example, through e-mail or postings on bulletin boards) or synchronously (for example, in teleconferences or real-time chat sessions). Many of the barriers to effective online collaboration are the same as for face-to-face collaborations. This became evident in the largest of the project team that had difficulty in settling on meaningful roles for the various project team members. Initial communication is a challenge for all project teams, whether working in virtual or face-to-face settings. Expectations play a key role in establishing effective communication. Those who cannot benefit from face-to-face contact, especially with key project personnel, naturally have more difficulty in developing reasonable expectations and workable project relationships. Some barriers to effective communication common to both environments may be exaggerated when people are collaborating without face-to-face interaction. As suggested by many researchers, an initial face-to-face meeting expedites trust, familiarity, and a willingness to collaborate; consequently, blended environments and a mixture of communications modalities may promote collaborative group work in many settings (Collison et al., 2000; Palloff & Pratt, 1999; Rosenberg, 2001; Simonsen et al., 2000). All but one of these groups managed to find effective ways to communicate early in the project, and all of the groups eventually managed to use a variety of communications modalities. The one group that had problems early on failed to include any provision for a face-to-face group meeting, which may account for the delays they had in getting the effort on track.

Sometimes technology itself causes a unique problem to on-line collaboration. The use of technology can obstruct communication, interaction and collaboration among group members, creating frustration among learners (Ragoonaden & Bordeleau, 2000). Examples of this include the lack of available access to the server during scheduled chat sessions, difficulty in locating the proper chat room, difficulty in uploading artifacts to a shared workspace, and so on. Unless participants are aware of the potential technical problems and how to go about resolving them, working out the problems can become a very frustrating process. As it happened with these four projects, the technical problems were not a real barrier, although the last group could have made better use of the Web-based knowledge management system that was the target for its prototype.

Just as instructors need to develop new skills for facilitating virtual communication, students also need to develop new skills to facilitate learning and working as members of a virtual learning community. Virtual projects require higher levels of interaction than do face-to-face projects, partly because face-to-face communication is both familiar and generally efficient. As a consequence, student participation and information processing in a virtual team environment generally feels more demanding to students than does participation and information processing in face-to-face settings. Based on this initial finding, teaching should help students develop reasonable expectation for virtual project work, making sure that students understand that some cognitive and behavioral adjustments in collaborative work habits are likely to be required. Finally, for many situations, a mixture of online and face-to-face communication and work strategies are likely to effective in many cases.

References

Collison, G., Elbaum, B., Haavind, S., & Tinker, R. (2000). Facilitating online learning: Effectrive strategies for moderators. Madison, WI: Atwood Publishing.

Paloff, R. M., & Pratt, K. (1999). *Building learning communities in cyberspace: Effective strategies for the online classroom*. San Francisco, CA: Jossey-Bass.

Ragoonaden, K., & Bordeleau, P. (2000). Collaborative learning via the internet. *Educational Technology and Society, 3* (3), 1-16.

Rosenberg, M. (2001). *e-Learning: Strategies for delivering knowledge in the digital age*. New York, NY: McGraw Hill.

Spector, J. M., & Anderson, T. M. (Eds.) (2000). *Integrated and holistic perspectives on learning, instruction and technology: Understanding complexity*. Dordrecht: Kluwer Academic.

Simonsen, M., Smaldino, S., Albright, M., & Zvacek, S. (2000). *Teaching and learning at a distance: Foundations of distance education*. Upper Saddle River, NJ: Prentice-Hall.

The Evolving International Role of a research university: An MIT Perspective

Janet Wasserstein
Communications and Development Officer
Center for Advanced Educational Services (CAES)
Massachusetts Institute of Technology
United States
JanetW@mit.edu

Co-author: Professor Richard C. Larson, Director, CAES

Abstract: MIT's Center for Advanced Educational Services is taking major strides in crossing the digital divide through innovative web-course development and strategic e-learning partnerships. This paper will highlight "The Learning International Network Consortium" LINC, a global initiative to empower organizations within developing countries to design, create and operate top quality higher-education e-learning systems. Also highlighted will be the MIT-African Virtual University partnership and the creation of the first two in a series of free interactive web-based courses for healthcare professionals.

Introduction

The role of a research university today, compared to fifty years ago, now needs to be aware of the global picture and interconnectedness. If tertiary education leads to greater understanding internationally and empowers students, what role should a research university play? At MIT, several programs are currently underway that address this question.

MIT offers some distance learning programs but does not offer degrees solely through distance learning.[i] There are other universities that concentrate on that area. MIT is interested in researching new educational technology such as interactive online tutors (e.g. PIVoT[ii]), and initiatives such as the Open Knowledge Initiative and Stellar[iii]. MIT is also looking at new pedagogies that are goal-oriented, non-linear and experimental and new ways of collaborative learning such as the Technology Enabled Active Learning project (TEAL[iv]).

MIT employs many different models for distance learning or technology-enabled education as part of teaching tools that have global dimensions. MIT provides outstanding content by its faculty and innovative research in ways of teaching and learning.

I. MIT models of global learning initiatives

Publishing Model

The latest project that has received much publicity is OpenCourseWare. This is a project to put MIT course materials up on the web free and open to the public. This is not distance learning, however, as no interaction occurs between teacher and learner, but it is an invaluable resource for students and teachers across the globe. "The idea behind MIT OpenCourseWare (MIT OCW) is to make MIT course materials that are used in the teaching of almost all undergraduate and graduate subjects available on the web, free of charge, to any user anywhere in the world. MIT OCW will radically alter technology-enhanced education at MIT, and will serve as a model for university dissemination of knowledge in the Internet age. Such a venture will continue the tradition at MIT and in American higher education of open dissemination of educational materials, philosophy, and modes of thought, and will help lead to fundamental changes in the way colleges and universities engage the web as a vehicle for education. MIT OpenCourseWare will provide the content of, but is not a substitute for, an MIT education. The most fundamental cornerstone of the learning process at MIT is the interaction between faculty and students in the classroom, and amongst students themselves on campus."[v]

MIT Learning Networks

Learning networks are used in many different programs at MIT and are defined as spatially dispersed communities connected together by a variety of communication technologies where everyone is a learner and a teacher, and many opportunities exist for collaborative research[vi]. Examples of these partnerships include the Singapore MIT Alliance (SMA) and the Cambridge MIT Institute (CMI).

Using asynchronous and synchronous technology as well as on-campus immersion, the Singapore MIT alliance is MIT's largest distance learning project and is an innovative engineering education and research collaboration between the National University of Singapore, Nanyang Technological University and MIT (http://web.mit.edu/sma).

This model can best be described as follows: "At MIT, we are using the broader bandwidth Internet2 to deliver five new professional masters degree programs to students on our Cambridge-based campus and to students 12 time zones away in Singapore. But beyond formalized distance learning, SMA involves collaborative faculty research, student exchanges and a wide variety of activities that result in a type of global campus spanning the Pacific".[vii]

II. Current MIT initiatives from CAES to reach global audiences

MIT is a community of over 10,000 graduate and undergraduate students. In 2001-2002, MIT's international student population comprised 8% of undergraduates and 38% of graduate students from 109 different countries. MIT students need to be prepared to enter a global economy and MIT is connected to research institutions all over the world. The MIT International Science and Technology Initiatives (MISTI), for example, have cultural exchange and global programs that have reached thousands of students worldwide. This paper can only touch on a few of the current and planned initiatives from MIT and the focus of this paper will be on the initiatives of CAES – one of MIT's main centers of technology enabled education and distance learning – that collaborates with other MIT schools and departments.

Using some of the models described above, over the last year, CAES has increasingly focused on disseminating its knowledge globally particularly to developing countries through distance learning. The reasons for this outreach are several: the world is transitioning from an economy based on manufacturing and natural resources to one that is more focused on information and knowledge; developing countries have become very active in web based distance learning (e.g. Pakistan, Uzbekistan, Tunisia, Algeria, Jordan, South Africa, Tanzania, Iran); and technology can increase access to larger audiences.

The following three projects are the latest initiatives of CAES (http://www-caes.mit.edu/index.html) :

MIT World

One of the most successful projects of CAES, ***MIT World*** follows a similar model of OpenCourseWare to bring content to global audiences. Although there is no interactivity, intellectual content from MIT can now be seen from Mali to Massachusetts – or indeed by anyone with a computer, Internet access and RealVideo player. ***MIT World*** is a free, open, video streaming web site that currently provides on-demand video of significant public events at MIT (http://web.mit.edu/mitworld). It is the venue for the MIT community, alumni, and the public at large to have access to video taped events at MIT. Content includes: 2001 Nobel Prize in Physics Lecture by Wolfgang Ketterle on "The Coldest Matter in the Universe" and Nobel Laureates David Baltimore, John Hume, Charles Townes, Franco Modigliani, Paul A. Samuelson, and Robert M. Solow. Lectures cover a broad range of subjects including the arts, economics, politics, computer science and management.

African Virtual University

More than 190 students from eight sub-Saharan African countries (Ethiopia, Ghana, Kenya, Mozambique, Rwanda, Tanzania, Uganda and Zimbabwe) participated in an MIT course without leaving their continent, through a partnership between CAES and the African Virtual University. Using asynchronous and synchronous methods, CAES offered a six-week curriculum loosely based on MIT's Introduction to Computers and Engineering Problem

Solving (1.00), which teaches the Java programming language. The resulting course, Java Revolution, was uniformly distributed regardless of equipment and bandwidth. Thirteen learning centers participated, and we expect to enroll more African students in MIT courses in the future. Java Revolution featured videotaped lectures via satellite, a web site for course materials, e-mail moderated by teaching assistants, and two live videoconferences.

Two Interactive Web-based courses

With financial support from Pfizer, CAES and the Harvard MIT Division of Health Sciences and Technology have created the first two in a series of free, interactive web-based courses for healthcare professionals: "Good Practices in Clinical Research" in Spanish and English primarily for physicians in Latin America; and Fungal Infections: Virtual Grand Rounds as a response to a disease that is endemic in many developing countries (http://figrandrounds.org/fi/index.html)

Learning International Network Consortium (LINC)

The Director of CAES, Professor Richard Larson, is the Principal Investigator for a new project that we hope will receive funding in the fall of 2002: the Learning International Network Consortium (LINC). Using the train-the-trainer model, CAES plans to bring world-class educational opportunities through distance learning to those who have not had access to quality education.

LINC is an MIT-managed initiative aimed at the creation of a global community of scholars and practitioners who seek to use modern computer and telecommunications technologies to increase the reach and impact of higher education especially in developing countries. LINC will be a voluntary e-learning network and resource center connecting and building upon individual national and international efforts currently underway. Using e-learning and related technologies, LINC will empower educators working in their own country to bring higher education to a wider population. Students of current 'brick and mortar' university programs will join faculty members and others in collaborative research and development to help create positive change. Educational content will focus primarily in the areas of science, engineering, management, humanities, arts and social sciences.

The key purposes are to empower organizations within countries, especially developing countries, to design, create and operate top quality higher-education e-learning systems; to share educational materials, exercises and courses for the mutual benefit of learners across all participating countries; and to become the top tier community of scholars and practitioners whose focus is technology-leveraged higher education internationally.

The Consortium will be assembled from diverse efforts now operating within many developing countries, utilizing best pedagogical practices whenever possible. LINC will bring world-class educational opportunities to those who do not have access to quality education by partnering with and training teachers in developing countries, who will then work within their own country to increase outreach. At the same time, those in developed countries will have the opportunity to learn about different cultures through the educational networks established by LINC. Members of LINC will be colleges and universities, not-for-profit organizations, foundations, private corporations and selected governmental agencies. Expanding and sustaining e-learning efforts throughout the developing world will be the primary focus of LINC. The reasons behind the initiative include:

- Developing countries are likely to fall further behind the developed world in terms of economic growth and prosperity, without some feasible system for educating their youth. This in turn could lead to larger inequities in the distribution of the wealth of nations and potentially act as a destabilizing factor in world events.
- Establishing a two-way exchange of content between the developing regions and the developed world will enhance mutual understanding and provide a rich source for cultural studies.

Some of the specific goals and services of LINC are as to:

- Host an annual international conference on "e-Learning in the Developing World" that would share "lessons learned", present best practices in e-learning and project plans for future years.
- Design the management and membership protocols and processes of LINC, leading to a sustainable and readily growing organization.
- Create and distribute a variety of educational content both intra-country and across national boundaries.

- Using the train-the-trainer model, design systems and utilize technology to leverage scarce teaching resources within and between countries to reach a maximum number of learners. LINC would provide resources that would focus on training those who in turn would train others in the technology, pedagogy and business of e-learning.
- Create and maintain an easy-to-use web platform for communication among LINC participants and for assisting in the hosting of educational materials.
- Host a complete searchable repository of international e-learning projects and activities that are underway, so participants can identify potential partnerships and other synergies.
- Establish a global network of learners to advance the sharing of skills and raise economic standard of living.
- Raise the educational level of population globally.
- Undertake collaborative research and development, involving faculty and students at existing institutions of higher education, to further this effort.

Conclusion

CAES plans to leverage its educational technology projects and direct much of its attention globally to developing countries.[viii] Distance learning and technology-enabled education will allow increased access to tertiary education – a scarce resource in many countries.

References

---

[i] MIT offers: one degree (Systems Design Management Program) through distance learning that requires one semester on campus; off campus computer and engineering for credit graduate certificate courses through CAES' Advanced Study Program; and short non credit courses through the CAES National Technological University partnership.

[ii] For details about PIVOT see http://www-caes.mit.edu/research/pivot/index.html

[iii] For details see http://web.mit.edu/amps/projects/index.html

[iv] For details about TEAL see http://www-caes.mit.edu/research/teal/index.html

[v] OpenCourseWare Fact Sheet http://web.mit.edu/ocw/ocwfactsheet.html. See also Report of the President 2000-20001 http://web.mit.edu/president/communications/rpt00-01.html.

[vi] Larson, R. C., "MIT Learning Networks: An Example of Technology-Enabled Education." September 1997. http://www-caes.mit.edu/people/larson/learningnetworks.pdf

[vii] Larson R.C. and Strehle G.P. (2002) *Edu-Tech: What's a President to Do?* Lawrence Erlbaum Associates

[viii] A discussion group from a virtual conference on *The Future of Technology in Developing Countries* connecting over 260 participants came up with the following findings: cultural and religious issues must be considered before any new educational strategy is implemented in developing countries; radio is a basic communication tool that serves education especially in areas where there is lack of appropriate bandwidth; and while English is widely used, one must use sensitivity to language issues and that many have difficulty with English as well as accepting new educational technology tools (see www.col.org)

A Development of Multi-lingual Web-Based E-Mail Client Developed by JavaServet Technologies

Kenzi Watanabe
Faculty of Science and Engineering
Saga University
Japan
watanabe@is.saga-u.ac.jp

Akihiko Takeda
Science and Engineering Course of Graduate School
Saga University
Japan
takeda@ai.is.saga-u.ac.jp

Abstract: We have developed a multi-lingual Web-Based E-mail client system by JavaServlet technologies. The system, which is named "Servlet WebMailer", can handle character sets of various languages. When a user browses a mail message using the system, the system recognizes a character set of the message, at first. The system converts the message into Unicode, and displays the message. When a user composes a new message, the user can determine a character set to write the message. The system recognizes the character set, the system converts the message from Unicode to an appropriate character set. We release this system as free software.

Introduction

Web-Based systems are important technologies in recent years. Various systems are implemented in the world. Web-Based E-mail system is one of a typical example of the Web-Based systems. There are many sites operating Web-Based E-Mail services such as "the Hotmail (provided by Microsoft Corporation)"(Microsoft Corporation, 2002). However, every system can handle only one language except English. Because of above reason, users can use his/her native language and English, but can not use other languages. It course problems. For example, Japanese people have to exchange E-mails with Korean people by English, even if the Japanese can read and write Korean.

We have developed a multi-lingual Web-Based Email client named "Servlet WebMailer" using JavaServlet technologies (Sun Microsystems, 2002). The system can handle character sets of various languages at not only browsing messages but also composing messages. In this paper, we describe an outline of the system, how to use the system and implementation of the system.

The Outline

Diagram of the System

The "Servlet WebMailer" is a Web-Based Email client. Fig. 1 shows a diagram of the system. The system works on WWW server. The users use the system via Web browser. Off course, SMTP server and POP or IMA4 server are needed.

Characteristic Features

The system has following features as E-mail client.

(1) Support POP3/IMAP4/SMTP protocols
(2) Support APOP authentication
(3) Address book and signature for users
(4) Text and HTML mail browsing
(5) File attaching/Retrieving files from mail

Further more, the system is multi-lingual. A user can use various languages not only for browsing messages but also for composing messages.

How to use the system

Login and message browsing

The system has similar styles of usage to the other E-mail systems. So that, many people may use the WebMailer without any trouble.

At first, the user starts Web browser and accesses the system. The first window is for login dialog (Fig. 2). The user has to input his/her username and password of the mail server, then click the "login" button to enter the system. The user can select protocols for E-mail message retrieving by which POP3 and IMAP4. After the login procedure, the main window is appeared (Fig. 3). This window has three frames. List of messages are shown in the upper frame. A message is shown in the middle frame. The bottom frame is for the commands to operate the system. The system shows a list of all received messages in the upper frame. A string in the Subject: field works as a link to the message. When the user clicks the link, the message appears in the middle frame (Fig. 3). In this example, the user is browsing a message written by Korean. This figure shows the system is developed as multi-lingual systems.

Composing a new message

When the user composes a new message, he/she should to click the "compose" command. Then the new browser executes and appears the composing window (Fig. 4). The user should fill To:, Cc:, Bcc:, Subject: and message to appropriate fields. After complete message, the user clicks the "send" button. Then the message is sent. The user can attach files into the message up to three files. The user inputs file names into the attachment1, 2 and 3 fields. The files are encoded as MIME multipart messages (N. Freed and N. Borenstein, 1996A, 1996B) automatically. To select the character set from "character set" select-box, the user can determine a character set of the message. The system knows the character set, the system encodes the message into an appropriate character set during message transfer procedure.

Other functions and Logout

The system has other function such as address book, signature, mailbox operation and so on. The user can use these functions via main window shown in Fig .3. When the user has done everything, click "logout" command to logout.

The Implementations

The JavaServlet and the Unicode

The system is implemented by JavaServlet. The JavaServlet is a programming language for server-side Web-Based systems. The JavaServlete can handle "Unicode" as internal character code. Unicode provides a unique number for every character, no matter what the language (Unicode, Inc., 2002). The JavaServlet has character conversion functions between Unicode and other characters. We apply this feature into the system to develop multi-lingual systems. Each E-mail message has own character set. When the system browses the message, the system converts the character set into Unicode. When the system sending a message, the system converts Unicode message into the character set. We will describe following three multi-lingual functions in the following sub-sections.

(1) Characters in the interface
(2) Message browsing
(3) Message composing

Characters in the interface

Mentioned above, the internal character set of the system is Unicode. If the "internationalized interface" button is checked at the login, the system displays every character by the "UTF-8" (X/Open Company Ltd.). The UTF-8 enables mixed-language interface. For example, Japanese and Korean display simultaneously in Fig. 3.

Message browsing

When a user browses a mail message, the system recognizes a character set of the message according to find "charset" parameter in mail header fields, at first. The charset parameter indicates what character set is used in the message. The system knows the character set, then the system converts the message into Unicode message. The charset filed is defined in RFC2045 as internet standards (N. Freed and N. Borenstein, 1996A). The system supports almost charsets.

Message composing

When a user composes a new message (Fig. 4), the user can determine a character set to write the message to select the character set from the character set select-box. The system knows the character set, the system converts the message from the Unicode to the character set during message sending procedure.

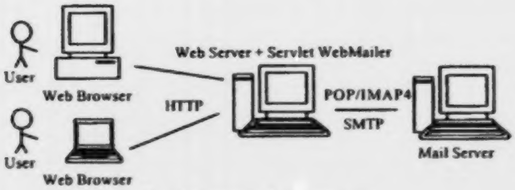
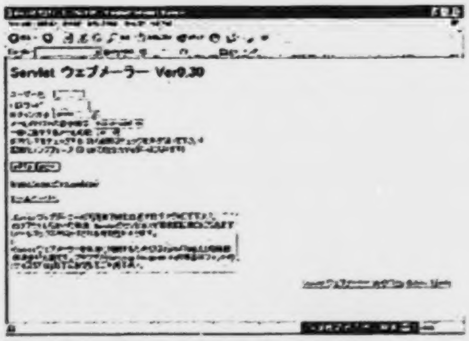


Fig.1: Diagram of the system



Servlet ウェブメーラー Ver0.30

Fig. 2: The login window

BEST COPY AVAILABLE

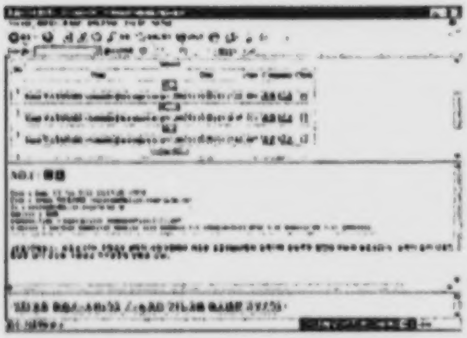


Fig.3: The main window

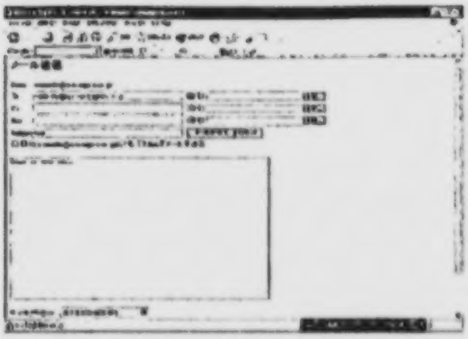


Fig.4: The message composing window

Conclusion

We have developed a multi-lingual Web-Based Email client named "Servlet WebMailer" using JavaServlet technologies. The system can handle character sets of various languages at not only browsing messages but also composing messages. The system is released as free software. If you evaluate the system, you can get it from following URL.

http://www.ai.is.saga-u.ac.jp/~takeda/software.phtml

References

Microsoft Corporation (2002). *msn Hotmail*, http://www.hotmail.com

Sun Microsystems (2002). *Java Servlet technology*, http://java.sun.com/products/servlet/index.html

N. Freed and N. Borenstein (1996A). *Multipurpose Internet Mail Extensions (MIME) Part One: Format of Internet Message Bodies*, RFC2045.

N. Freed and N. Borenstein (1996B). *Multipurpose Internet Mail Extensions (MIME) Part Two: Media Types*, RFC2046.

Unicode, Inc. (2002). *Unicode Home Page*, http://www.unicode.org/

X/Open Company Ltd. *File System Safe UCS Transformation Format (FSS_UTF)*, X/Open Preliminary Specification, Document Number: P316 #4.

BEST COPY AVAILABLE

A Knowledge Handling Model in Educational Activity

Toyohide Watanabe
Department of Information Engineering,
Graduate School of Engineering, Nagoya University
Furo-cho, Chikusa-ku, Nagoya 464-8603, Japan
Phone: +81-52-789-4409, Fax: +81-52-789-3808
E-Mail: *watanabe @ nuie.nagoya-u.ac.jp*

Abstract *Until today, many efforts about the educational support system have been reported, but the effects are not always proven sufficiently. As a powerful educational support system, it is necessary to investigate what functions are required, how to provide the functions, etc. with respect to the fundamental viewpoint for the educational activity of handling knowledge. In this paper, we address a framework of handling knowledge on the basis of educational activity of person. Our objective is to adjust facilities for handling knowledge explicitly so as to look upon our educational activity as a system-supplied mechanism. As a result, we could define a framework for handling knowledge by introducing four operational functions and three knowledge states.*

Introduction

The computer-supported educational systems have been developed as one objective to apply computer powers to various education domains and promote the abilities and activities of learners. However, the traditionally-developed/investigated educational systems are not always designed to supply the knowledge handling process integrated constructively among various education domains for users, but provide only question-answering facilities for exercises and/or explanations or tutoring facilities for individual instructions. When we look upon our educational activities as the knowledge management, it is important to design and implement the cooperative and successive mechanism among individual phases of knowledge management[1].

I.Nonaka, et al. has proposed SECI model which promotes human knowledge management in the organization systematically[2,3]. SECI model encourages four kinds of knowledge-oriented activities under the transition mechanism between two different types of knowledge. Four kinds of knowledge-oriented activities are exclusively classified into the socialization, externalization, combination and internalization SECI model can successfully explain the transition process of knowledge management for individuals in the organization, but is not always adaptable to specify the personal activity for knowledge management or the environment for personal knowledge handling[4-6]. On the other hand, SECI model is not sufficient to specify personal activity without any predefined procedural framework, and is in short of the representative functionality for flexible and intentional activities, which has not been yet prepared in the organization.

In this paper, we discuss first individual functions for handling knowledge and then knowledge representation domains to be manipulated by functional facilities. Additionally, we address the operational relationship between functional facilities and knowledge representation domains. Our idea is to integrate functional facilities with knowledge representation domains correspondingly so as to make the meanings of individual functions clear on the knowledge representation domains. From a viewpoint of this discussion, we divide functional facilities into four different classes, and also partition knowledge domains into three independent sets.

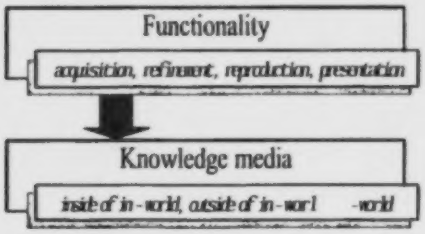

Functionality
acquisition, refinement, reproduction, presentation
Knowledge media
inside of in-world, outside of in-worl -world

Figure 1: Framework of knowledge handling

Framework

Figure 1 shows our framework of handling knowledge conceptually. Our framework is defined by two layers: functionality, and knowledge media. Also, the framework

BEST COPY AVAILABLE

becomes effective when the facilities can be assigned to the knowledge media.

The functionality defines operations for handling knowledge, and is illustrated as knowledge manipulation facilities, such as acquisition, refinement, reproduction and presentation. These facilities may be implemented as role-dependent features and/or be sharable among person roles, associated with different educational environments. At least, seamless transition among these facilities must be powerfully supplied so as to make our educational activity effectual. On the other hand, the knowledge media indicates the information store assigned to subjective person of educational activity, and keeps the consistency in cooperation with knowledge handling facilities. So, the knowledge media accumulates the final/intermediate results. In this case, the knowledge media is not only human brain, but also is regarded as his/her own educational field and its associated tools/means. This modeling viewpoint is very important to construct our educational environment of personal activity as an operationally system-supported mechanism, but not as a mental model.

Functionality and Knowledge Media

We assume that the knowledge is composed of collections of related frames or their networks in order to make the meaningful roles of knowledge handling functions clear. Of course, even if this assumption was incorrect, the incorrect understanding for knowledge structure does not give any heavy drawbacks to us. This is because it is important to investigate different kinds of knowledge handling functions in the educational environment from a viewpoint of personal activity.

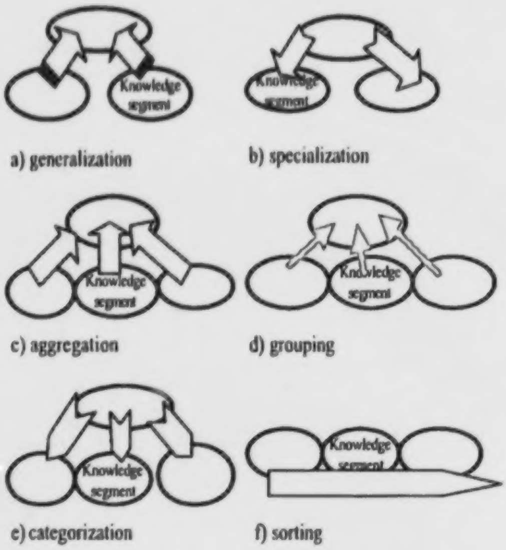
The knowledge handling is categorized into four classes: acquisition, refinement, reproduction and presentation.

1) Acquisition: the knowledge is transferred from *external-world* to *internal-world* in order to generate, add and re-structure newly nodes or edges for existing ones;

2) Refinement: the existing knowledge is modified for attributed values of nodes and/or edges, and can be reorganized in accordance with the relationships among individual nodes and/or edges. When this reorganization can be analytically categorized from a constructive point of view, the typical refinement functions are regarded as the generalization, specialization, aggregation, grouping, categorization, sorting, etc., as illustrated in Figure 2;

3) Reproduction: all these functions such as expansion, creation and discovery generate new knowledge from currently predefined one. Figure 3 illustrates the difference among them conceptually, using the properties and domains of knowledge segments. The domain is loosely defined as the field, related to a main subject. While, the property is roughly corresponded to the attached procedure, fundamental mechanism or etc;

4) Presentation: this function moves the knowledge from *internal-world* to *external-world* with a view to arranging its own content or its relationship among related ones systematically.



a) generalization b) specialization
c) aggregation d) grouping
e) categorization f) sorting

Figure 2: Refinement functions

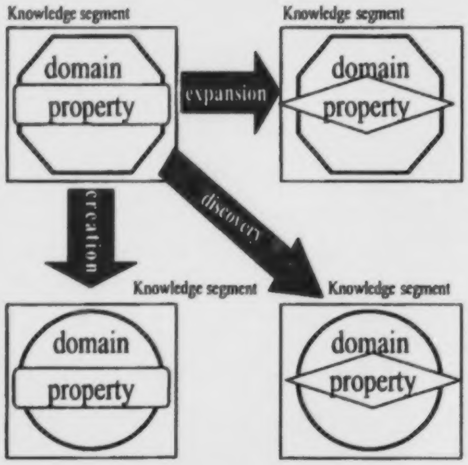


Figure 3: Reproduction functions

BEST COPY AVAILABLE

Figure 4 shows the functionality on three interaction spaces: ***inside of in-world***, ***outside of in-world***, and ***out-world***. ***Inside*** is our brain in itself; and ***outside*** is an interaction activity space for our supplementary or complementary tools/means such as notebooks, textbooks, memos, etc. which can be prepared as extended memories for our own brains by ourselves. Therefore, in Figure 4 computer-supported facilities can explicitly be implemented as the functions related to ***outside***. ***Outside of in-world*** enables to clarify knowledge objects to be directly manipulated. The circles in each space are typical states for individual spaces and the functional indicate the transitions among these states.

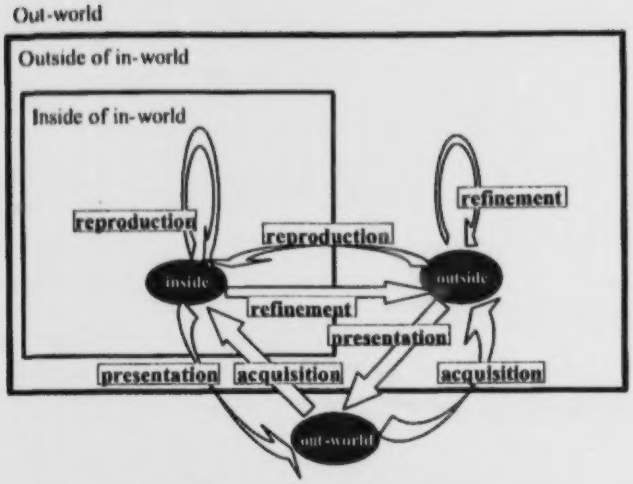
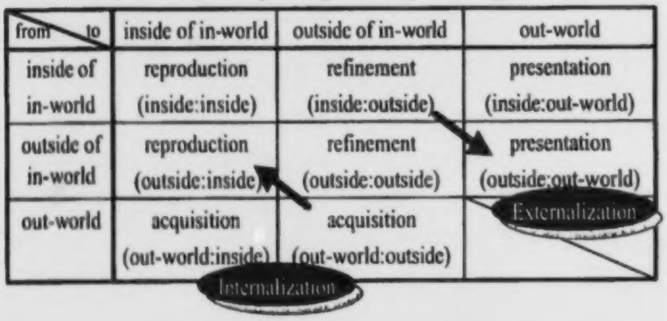

Out-world
Outside of in-world
Inside of in-world
reproduction
reproduction
refinement
inside
outside
refinement
presentation
presentation
acquisition
acquisition
out-world

Figure 4: New mechanism of knowledge handling

Table 1: Relationship among knowledge handling functions



from \ to	inside of in-world	outside of in-world	out-world
inside of in-world	reproduction (inside:inside)	refinement (inside:outside)	presentation (inside:out-world)
outside of in-world	reproduction (outside:inside)	refinement (outside:outside)	presentation (outside:out-world)
out-world	acquisition (out-world:inside)	acquisition (out-world:outside)	

Externalization
Internalization

System Architecture for Knowledge Handling

Table 1 represents the transition relationships among three states with respect to the operations for handling knowledge. Of course, Table 1 is derived directly from Figure 4. In comparison with Figure 4, Table 1 makes the relationship among the mutual operations for handling knowledge clear. From a viewpoint of this knowledge handling between our educational activity and environment, the framework in Table 1 supports the externalization and internalization between *in-world* and *out-world*, associated with education process of our activity. The externalization is an action to make our knowledge structure and content (or representation) explicit for others. In Table 1 ***refinement*** (inside : outside), ***presentation*** (outside : out-world) and ***presentation*** (inside : out-world) are typically regarded as the externalization: ***refinement*** (inside : outside) is the externalization for self-confidence; and two ***presentation***'s are so for other persons. Here, we can define the mutual transition relationship as follows:

[Ex.1] ***presentation*** **(inside:out-world) =** ***refinement*** **(inside:outside) *** ***presentation*** **(outside:out-world)**

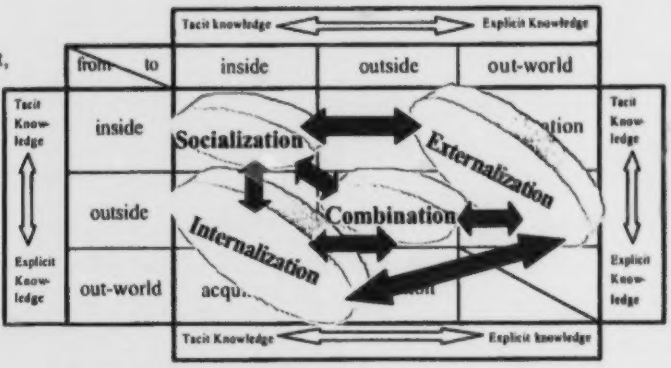

Tacit knowledge
Explicit Knowledge
from
to
inside
outside
out-world
Tacit Know-ledge
Explicit Know-ledge
inside
outside
out-world
Socialization
Externalization
Combination
Internalization
acqu
Tacit Knowledge
Explicit knowledge

Figure 5: Interpretation of our knowledge handling model

Namely, "*presentation* mapped directly from inside to out-world" is effectually replaced by a sequence of "*refinement* from inside to outside" and "*presentation* from outside to out-world". These functions are located to the right-upper side, as denoted by three hatched columns.

While, the internalization is an action to improve or re-structure knowledge definitely. In Table 1, *reproduction* (outside : inside), *acquisition* (out-world : outside) and *acquisition* (out-world : inside) may be looked upon as the internalization. In particular, *reproduction* (outside : inside) is self-improvement, like the knowledge expansion. Two *acquisition*'s are the knowledge transfer with/without layout structures of knowledge forms. The relationship among these functions is specified as follows:

[Ex.2] ***acquisition* (outside:inside) = *acquisition* (out-world:outside) * *reproduction* (outside:inside)**

Namely, "*acquisition* mapped directly from out-world to inside" is successfully replaced by a sequence of "*acquisition* from out-world to outside" and "*reproduction* from outside to inside". These functions are located to the left-lower side, as denoted by three hatched columns.

Next, we consider the meaning of personal activity in Table 1. Our functionality model in Figure 5 and relationship diagram among functions in Table 1 indicate transitions for knowledge handling of personal activity. Here, we introduce the concepts "Socialization" and "Combination" which were proposed by I.Nonaka in SECI model, and adapt them to Table 1 under the assumption that the behavior from *inside* to *inside* is "Socialization" and that from *outside* to *outside* is "Combination". As for "Socialization" this is because the transition from *inside* to *inside* in not explicitly observed for us and also the knowledge reorganizations or improvements are tacit forms/contents. Similarly, concerning to "Combination" the transition from *outside* to *outside* as the refinement is so interpretative to transform or re-arrange knowledge in better representation forms/contents. Of course, the concepts "Externalization" and "Internalization" are already discussed as above. As a result, we can get Figure 5, derived from Table 1. Also, we depict SECI model in Figure 6 in accordance with the similar dimensions. In comparison with Figure 5 and Figure 6, our model includes SECI model and makes the expressive relationship among different activities stronger. Of course, in Figure 5 the relationship for each field is the transition between knowledge handling phases, while in Figure 6 the relationship for each field is the transition between knowledge forms. Thus, these viewpoints are not always consistent: our model should be designed to be adaptable to the personal activity for knowledge handling; and SECI model is intended so as to explain the knowledge management in the organization. In Figure 5, we observe flexible transition among individual activities but not a simply spiral transition.

Conclusion

In this paper, we addressed the functionality and knowledge media for handling knowledge, and also made it clear that the functionality could be defined well on three categorized knowledge media. We defined four different operations for functionality such as acquisition, refinement, reproduction and presentation, and also three different knowledge media, such as inside of internal world, outside of internal world and external world. Under the relationships between four knowledge handling functions and three knowledge media, our knowledge handling is systematically implemented as the computer-assisted mechanism. As for our future work, we must investigate practical procedural functions on the outside with respect to current framework in order to promote the user interaction and activity progressively.

References

[1] P.M.Senge: "The Fifth Disciplines: The Art of Practice of the Learning Organization", *The Spieler Agency*(1990).

[2] I.Nonaka, K.Umemoto and D.Senno: "From Information Processing to Knowledge Creation", *Technology in Society*, Vol.18, No.2, pp.203-218(1996).

[3] I.Nonaka and H.Takeuchi: "The Knowledge-Creating Company", *Oxford University Press*(1995).

[4] T.Watanabe: "Education Support Paradigm as Knowledge Management", *Proc.of ED-MEDIA'01*, pp.2007-2008(2001).

[5] T.Watanabe: "Architecture of Education Support System, Based on Knowledge Management Paradigm", *Proc.of WebNet'01*, pp.1320-1321(2001).

[6] T.Watanabe: "Knowledge Management Architecture of Integrated Education Support", *Proc.of ICCE'01*, pp.1138-1141(2001).

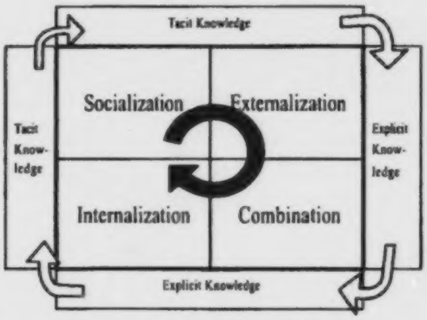


Figure 6: SECI model

Missouri/Taiwan High Tech-High Touch Excursion

John Wedman, Ph.D. and Laura Diggs, Ph.D.

University of Missouri-Columbia

Was John Naisbitt, author of Megatrends, correct two decades ago when he predicted that, the more technology is introduced into society, the more people will aggregate? Since fall 2001, the University of Missouri has facilitated a high-tech partnership involving high school students and teachers in Missouri and Taiwan. In summer 2002, students from Taiwan will visit Missouri to collaborate in lessons and activities facilitated through extended partnerships with Boeing Corporation and the St. Louis Science Center.

This venture will take Missouri and Taiwanese students on high-touch excursions through a flight museum, planetarium exhibits, astronaut wind tunnels, an aircraft assembly line, an avionic electronics lab, and a simulated space station. Throughout the excursions, the students will capture digital artifacts for inclusion in a documentary of the visit. Designed by students during the Missouri event, the documentary will be created and displayed during ThinkQuest. Using various software development applications and large databases (e.g., satellite photographs, maps, etc), Missouri students in Seattle will work directly with students in Taiwan using Internet Video and Shadow netWorkspace (SNS is an open source CSCL environment), the goal being to assemble a multi-media, multi-lingual digital documentary of the recently completed visit. Event observers will have the opportunity to see the "real-time" work of these students and to play an active role in finalizing the documentary. Decide for yourself…was Naisbitt correct?

This paper describes in depth one project that the University of Missouri-Columbia College of Education (MU CoE) has implemented as part of a globalization initiative. There are currently 4 schools in Taipei, Taiwan that are connected with K-12 schools in Missouri as well as MU faculty and pre-service teachers. This year, the MU CoE sent three faculty and staff members to Taipei to develop and implement a literature-based English curriculum for students to share with their American counterparts. The goals of this globalization initiative are a critical 3-part model that is a unique experience that currently does not exist. This experience evolves around information and learning, enabling technology, and global connections. This 3-part model is based on: 1) connecting K12 schools in Taipei, 2) with K12 schools in Missouri, and 3) MU CoE Literacy faculty. The connection is provided through utilizing Internet2 and video conferencing equipment.

The process of this globalization initiative focuses on individual school needs, but all involve utilizing technology to allow students to have email as well as face-to-face conversations to practice online communication, establish friendships with students of other cultures, exchange cultural information, and develop and understanding and tolerance for other cultures. Students from both cultures benefit from the opportunity to improve their English language (written and verbal) skills as well as identifying the benefits and limitations of online communications.

Current projects where partners include schools in Taipei working with Missouri schools include two elementary schools, one K-9 school, and one senior high school. Projects include development of web sites for descriptions and pictures of participating teacher and students, the school and surrounding community, special events and holidays, as well as information on foods and day-to-day life for students their age. Schools have participated in paired reading of English children's literature books and had face-to-face video conversations around the books. Several schools are participating in science projects together where they collect samples of vegetation, water, and wild life to compare and contrast on the web site with their partner school. With the time difference between Taipei and Missouri being a complicating factor, partners are sharing information through threaded discussions and emails as well.

The impact of this globalization initiative has proven to be beneficial to the Taiwanese students having authentic conversations with native speaking English speaking students their own age and improving their English writing and oral skills. The Missouri students have discovered a new cultural appreciation as well as developing friendships. The MU CoE faculty and pre-service teachers have acted as cyber-tutors to help in the writing process as well as professional development for the Taiwanese teachers.

A Mobile Augmented Reality Environment for Collaborative Learning and Training

Reiner Wichert
ZGDV, Computer Graphics Center
Mobile Information Visualization
Darmstadt, Germany
reiner.wichert@zgdv.de

Abstract: The following work focuses on the requirements for a Collaborative Augmented Reality System with the usage of Internet technologies to create new possibilities for collaborative teaching. In most learning environments, learning is imparted through seeing and hearing. In this paper, Collaborative AR Discussion and personal experience are also integrated in order to achieve a quicker transmission of study material and an increase in memory efficiency. We have analyzed the scenarios occur most frequently in service and maintenance and also the literature of Tele-Teaching. The needed requirements were derived and as a result integrated in a test system. This collaborative game simulates a web-based training and teaching environment in Collaborative AR as a new approach for teachers and trainees and describes scenarios and research perspectives for distance education and training at the same location. The game was used as a testbed to clarify the problems associated with AR and Collaborative Learning.

Introduction

Through the integration of Multimedia, study material can be transmitted much faster. In 1965, William Glasser described what influences a student's ability to retain information and ideas in his book Control Therapy in the Classroom. Respective to this thesis, people remember 10% of what they read, 20% of what they hear, 30% of what they see, 50% of what they see and hear, 70% of what they discuss with others, 80% of what they personally experience and 95% of what they teach others (Glasser 65). With Collaborative AR, learners communicate directly with each other in a face-to-face communication, but also interact with remote learners located in other learning rooms. According to Glasser, and as it relates to the interactive aspect in the learning environment of a Collaborative AR, people can remember information in a very efficient way, because users can discuss and have experiences by interacting with the augmented world in the collaborative learning and training environment.

Tele-presence as a multimedia aspect and the access to worldwide distributed information enable a new way of teaching and learning. By combining learning and multimedia, a couple of net-based teaching and training systems have already been realized. By *Tele-Teaching*, we mean the distribution of knowledge in a synchronous Online Scenario or net of computers, in which the teachers and students work simultaneously. By *Tele-Training*, we mean the provision of study materials on network servers. These materials are retrieved by students asynchronously. Tele-Teaching is usually associated with university study, while Tele-Training is more suited for further professional training in a cooperate setting (Effelsberg).

Augmented Reality (AR) has become an important part of computer graphics. "Unlike Virtual Reality where the physical world is completely replaced with synthetic environments, in Augmented Reality environments, 3D computer graphics objects are mixed with physical objects to become part of the real world" Billinghurst says (Billinghurst 00). Computer Supported Cooperative Work (CSCW) has also been expanded as an identifiable interdisciplinary research field. According to Wilson, CSCW is a generic term, which combines the understanding of the way people work in groups with the enabling technologies of computer networking, and associated hardware, software, services and techniques (Rodden 91). By combining CSCW with Augmented Reality, a new collaboration - Collaborative AR - became possible. Collaborative AR is defined by Reitmayr and Schmalstieg, where co-located users can experience a shared space that is filled with real and virtual objects (Reitmayr 01). The use of CSCW technologies in combination with Tele-Teaching and Tele-Training opened a new application area known as Computer Supported Cooperative Learning (CSCL) (McCONNEL 94). But it is a new idea to take CSCL into Collaborative AR. With Collaborative AR, group discussions are possible, where each user can interact and attain personal experience. In reference to Glasser, it is the best way to achieve a quicker transmission of study materials and an increase in memory efficiency.

Findings

Today, the ability to communicate with almost anyone, to exchange knowledge, solve problems, and learn new things via computer networks is widespread. We know that we learn most effectively if we learn together with others in groups. The Internet allows cooperative learning independent of time and place (IPSI).

Almost all of the existing e-learning systems do not support AR. So, one of the advantages of the component-based System will be to support individual users in their simultaneous interaction with augmented objects by using Collaborative AR while exchanging knowledge.

To specify the requirements for a cooperative AR learning environment, the scenarios that occur most frequently in service and maintenance have been analyzed and two standard situations were identified:

1. cooperative interaction in a master / trainee scenario at the same place with e.g. skilled workers and a teacher having different views to the augmented world, standing and discussing in front of a machine;
2. direct interaction with a remote expert using AR Technologies like interactive video and having the same view as the skilled worker. The expert can interact with the skilled worker and offer support.

From these standard situations we have derived the following needed technical and interactive requirements. A collaborative AR system should give support and assistance to a learning group in their common work. Multiple users can be at the same place, at the same time, interacting together directly in the augmented world. Furthermore, group discussions are supported within the field of Augmented Reality. A common central view is established for each participant in order to get a defined understanding of the problem and to meet the requirements for this specific problem. Another aspect of teaching and collaboration is that an AR system has to provide remote support with the help of Augmented Reality over great distances. However, with a mobile aspect, the system would give multiple users access to information and help at any given time. It should clarify technical aspects, such as how to distribute the functionality in a learning collaboration and which methods can be used to get visual or haptic feedback. To meet the requirement of interaction by a collaborative group, a game could be implemented using the Collaborative AR Prototype System with the advantage of 3D group interaction and individual views for multiple users co-operating at the same place or with a connection over the Internet to remote users. As a result, a 3D Tetris clone was implemented as a testbed for different scenarios.

The Tetris game poses a good possibility for realizing the requirements of a collaborative AR learning environment, because it can be played at the same place or from a remote location. It is possible to login dynamically and share the AR Tetris game with other participants. It simulates e.g. the collaboration of skilled production workers and the connection of technicians to a remote expert for support over the Internet. Exploring this research topic within a game presents a significant challenge.

The Tetris game is split in the functionality realized by the Tetris Application and the visualization by the rendering component of the AR system. Both are embedded inside the web page, which displays points, the next piece, and the augmented view of the game (Fig. 1). The Tetris application can be started by any player and other users can login dynamically and share the AR Tetris with these participants. To realize this aspect, the status of the game is transmitted into the collaboration component. The first player who starts the game has the role of the master. The other players do not start another game, but get this status at the beginning of their session and initialize their game with these settings. If a player rotates a piece, the orientation of the actual piece will be set into the system. If a translation is done, the new position of the center of the piece is set in the system. A video server captures the picture of the camera and provides it to the rendering component and to the marker-based tracking system. A component was needed to handle the communication between the main components of the base AR system and to notify other components or other clients co-operating together when values are changing.

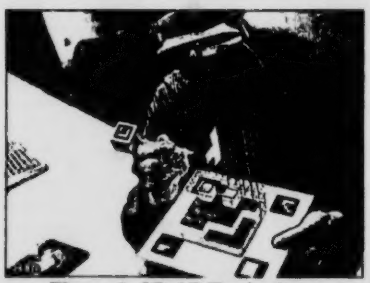


Figure 1: 3D AR Tetris clone

In the case of the collaborative learning environment, the values to transmit are the orientation of the scene, the names of the virtual objects used and also the actions like translations or rotations. The values are present on both the client and server side and are compared by way of a Push Mechanism. The Push Mechanism has been conceived to forward a notification to the clients immediately after an event occurs. Both client- and server-sided components can be informed via notification by the Event Mechanism. Another component is responsible for controlling the collaboration. If two users are changing a value at the same time, this component has to recognize and regulate the collision detection and the common concurrent interaction.

Scenarios

This Collaborative AR System can be used in a wide range of educational, e.g. in the field of commerce, to help users in their homes by way of a furniture company consultant, or in the industrial field, to support skilled workers standing in front of a machine by enlisting an expert. By using Collaborative AR to transmit study materials, a Cooperation at the same place is enabled by transmission of the scene, the actions and the orientation of the virtual objects to all participating users in the group; a remote cooperation over great distances is also enabled, requiring additionally the camera image of one of the cooperating users. Thus, training in a collaborative group interacting together at the same place or via distance education can be portrayed in a lot of scenarios. Both forms of cooperation can also be transmitted to the participants synchronously, as well as asynchronously. With an asynchronous connection, a later alteration of the augmented world is possible through assigning and storing scene, actions and orientation to a specific frame in the videostream. In this way, a later correction can be carried out to better portray an error or problem and to heighten the learning experience. In contrast, with synchronous learning in groups, collision recognition in terms of a simultaneous access of the virtual object is necessary. By implementing a Collaborative Augmented Reality learning environment, applications in the field of Tele-Teaching and Tele-Training become both synchronously and asynchronously realizable. For a remote synchronous learning environments, the remote user can have the same model of the real world, which has to be augmented, and can interact the same way as a collaborative user at the same site. In the case of the Tetris game, both users have the model of a pen or a joystick for interaction and the board of the game. Another synchronous possibility is to transmit the video images of one user to the remote user. The interaction can be done with an interactive graphic and will be sent through the event mechanism, as well. In the case of face-to-face collaboration, a pen with markers is used for 3D interaction. This allows a very natural interaction mechanism with the game. In a later version, speech recognition will be integrated to enable a multi-modal interface and, according to Glasser, we can improve the effectiveness of remembering information with the aspect of speech.

But it is also possible to realize asynchronous teaching and training collaborations. We need to store the camera images of at least one user and also the actions like translations or rotations of the scene, the orientation of the virtual objects and the name of the scene dependent on the frame number of the images. If we store the images of more than one user, we can also switch between the views of the users. In this asynchronous scenario, the images are retrieved from memory, are identified by the corresponding frame number and are superimposed with the formerly valid objects. However, the virtual objects can be altered later as to position or orientation, or other virtual objects can be loaded. In this way, errors can be better explained and understood. This can occur on-site in the real world by projecting the virtual objects time-dependent to the recording in the real world with the help of a head-mounted display (HMD), or in a remote scenario, displayed on the desktop together with the video content. Discussions concerning a particular action could be subsequently initiated and problems better be solved. Explanations could be offered as to the point in time when something was done wrong and how it could be made better could be visualized.

The Tetris game supports multiple users playing one game. This simulates group discussions and the connection to a remote teacher collaborating with a student while assembling a mechanical engine. It also handles the problem of common competing interaction. The actual field of view of other players and their different games can be integrated into the view of a teacher. One special view can be selected and the interaction can be switched to the selected game. This represents the scenario of a master who supervises several trainees learning the AR system or being instructed how to handle a machine. The master can select the view of a trainee and can give him advice and support in his augmented environment. As a result, a master can supervise a few learners.

Another aspect is the view of common and private data by the collaboration participants dependent on the expertise of the users. Thus, each user of the learning collaboration can customize the view to his needs or to see different aspects of the same thing adapted to the circumstance. Converted to the Tetris game, the users play the same game and get a private view of the game and their interactions. The common data is the next piece and the score. The users can add and customize visual aspects to their needs like the deleted levels or the time played.

How to visualize the result of cooperation by a learning group will be a further step in this work. If many people play the same game remotely, a player wants to know why the piece moves to the left even though he/she pushed the piece to the right. Therefore, the representation of the results of the interaction is an important field. The best way to do this will be to use multiple indications like color, arrows and numbers (Fig. 2) or the player can get haptic feedback.

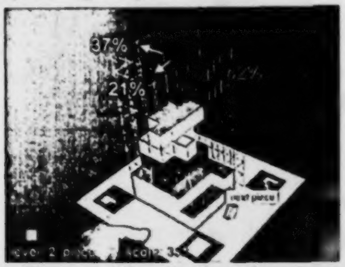


Figure 2: Visualization of results

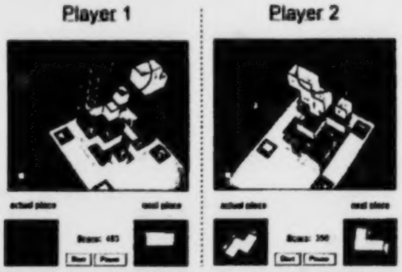


Figure 3: Collision detection and Semaphores

There are a lot of difficulties to solve in sharing virtual learning environments. Mutual exclusions have to be implemented and collision detection is needed. Semaphores have to control the access to interaction mechanisms. This problem can be approached in one game for two players, where two pieces are falling down (Fig. 3). Each person can interact with one piece, gets personalized information and has to coordinate his work with the other player while getting information when collisions are detected.

Conclusions

We have analyzed specific scenarios. The needed technical and interactive requirements for these scenarios have been derived. A collaborative AR environment was suggested and realized prototypically as a test system for a Tetris game. The system can be used in a wide range of educational settings and it allows an asynchronous, as well as a synchronous access e.g. to a learning environment that can be used remotely for distance education or in a collaborative group interacting together at the same place in a master – trainee scenario. It is possible to login dynamically to the same group and share the augmented space with other participants at any given time. It was observed that the fast event mechanism can provide the information to other participants in real time by pushing the information. A further step for the future is to evaluate the outcome of this cooperative game and to transfer these initial results to education applications. But until then, a lot of experiences can be garnered and further research work completed.

References

Glasser, W. (1965). *Control Therapy in the Classroom*, Harper & Row: NY, 1986; *Reality Therapy:A New Approach to Psychiatry*, Harper & Row, NY.

Wolfgang Effelsberg, Lehrstuhl für Praktische Informatik IV, Universität Mannheim, Lehren und Lernen im Internet, *http://www.igd.fhg.de/igd-a6/itti1.html*

Billinghurst, M., Poupyrev, I., Kato, H., May, R. (2000). *Mixing Realities in Shared Space: An Augmented Reality Interface for Collaborative Computing*, ICME2000, New York, USA.

Rodden, T. (1991). A survey of CSCW systems, *Interacting with computers - the interdisciplinary journal of human-computer interaction*, 3(3), pp.319-353.

Reitmayr, G., Schmalstieg, D. (2001). *Mobile Collaborative Augmented Reality*, ISAR2001, New York.

McCONNEL, D. (1994). *Implementing Computer Supported Cooperative Learning*, Kogan Page Publishing.

Fraunhofer IPSI, Integrated Publication and Information Systems, Darmstadt, *http://ipsi.fhg.de/CSCL/*

ARVIKA, Augmented Reality for Development, Production and Servicing, Germany, *http://www.arvika.de/*

The Effect of Hypertext Structure on Recall

Kay Wijekumar, Ph.D.
Assistant Professor
Information Sciences and Technology
The Pennsylvania State University Beaver
kxw190@psu.edu

Abstract: Even though hypertext is the medium of the fastest growing information interchange in the world - the WWW, no research exists on what adults recall from reading information from hypertext. This paper presents preliminary findings from a research study to investigate this.

Introduction

Reading information from printed text or the WWW appears to be the most common method of information retrieval for web-based learning environments or informational web sites. For example, most on-line courses provide notes for students to review and/or web sites for them to visit as activities to collect information about the course. Web sites also serve as the information dissemination methods for many non-profit organizations like the American Cancer Society, American Lung Association, The Sierra Club, and many others.

The research to inform the development of these sites has concentrated on the navigation patterns (McDonald & Stevenson 1998), colors, text size, and layout (Park & Hannafin, 1998). But the organization of web sites but has completely overlooked a large volume of research on prose processing by adults in printed mediums.

Research on prose processing and recall in traditional printed mediums has contributed a lot of information to design and development of printed materials. Text structure has been shown to affect recall of passages by readers with varying backgrounds (Kintsch 1978, Meyer 1975, Meyer et al., 1980). Elements at the higher levels (main ideas) in paragraphs are remembered more than those within. Signaling of main ideas affects the recall (Lorch, 1989; Lorch et al. 1993; Rickards 1997). The readers background knowledge on the topic, verbal ability, educational level, interest, and age have also been shown to affect reading, recall, and use of the information (Meyer et al. 1989, Meyer et al. 1997).

Hypertext is a new format which has taken over a large role in the dissemination of information through its accessibility on the WWW. Hypertext is the medium of web-based learning environments and also the source of information for most web sites. But how is hypertext different from traditional printed text.

Hypertext allows the creation of documents that can contain audio, video, images, and links to other documents (Conklin, 1987). These links to other documents usually appear in different colors and can take the reader to a completely different document. This organization and ability to link documents has the potential to allow the users access to large volumes of interconnected information (Spiro et al., 1992). However, this can also result in some negative side effects (Wenger, 1997). For example, in the traditional text medium highlighting a word or placing the word at the beginning of a passage signals users that it must be important. Would a link which is highlighted by its color serve the same purpose? Reading in traditional text is usually in a linear format and therefore can be organized accordingly within the minds of the reader. Would the links confuse the reader or jumble their organization of the information read?

Objectives of Research

The purpose of this research was to study whether links highlighted by color server as signals to the readers and whether hypertext organization using framed menus affected recall.

Research Design

To study whether hypertext organization affects the recall we used three passages used in many studies conducted by Meyer et al. (1997) and modified them to be presented in a hypertext environment. The first condition presented the entire passage in one screen with no links (This condition was very similar to the standard printed prose). The second condition had links embedded in the text but the participants did not follow the links. The third condition used a frame based presentation with a menu on the left allowing the user to navigate through the information.

Forty two participants over the age of 18 volunteered for the research study. Each participant was given a Quick Word Test (used by Meyer et al. 1997), a pre-experiment questionnaire to identify their prior knowledge on the topics, were randomly assigned to the experimental conditions, after reading the passages they were given a break and were asked to recall as much information as they could from their hypertext reading.

Data analysis was done using a 3 x 2 factorial design to compare the recall score (dependent measure) for each experimental condition (Plain Hypertext, Linked Hypertext, and Frame Hypertext) x (High Verbal Score, Low Verbal Score).

Results

Results showed that 80% of the participants had high verbal scores and there were no significant differences in recall between the experimental conditions. The low verbal score participants had significantly lower ($p < .01$) recall in the linked hypertext conditions than the plain hypertext. There were no significant differences between the linked and frame hypertext conditions for the low verbal score participants.

Conclusion

These preliminary results suggest that high verbal ability adults' recall of information from reading hypertext in plain, linked, or framed options do not differ significantly. However, low verbal ability readers are affected by the different conditions. These findings are similar to those results reported in printed text mediums where high verbal ability adults were not affected as much as the low verbal ability adults in different prose formats and recall.

We continue to collect data to further explore the results on low verbal ability adults and whether the colored links serve as signals and affect their recall. A fourth experimental variable has now been added where the participants follow the links in the documents and read the linked documents before completing the recall test.

References

Conklin, J. 1987. "Hypertext: An introduction and survey." IEEE Computer 20 (9): 17-41.

Lorch, R.F. Jr., Pugzles-Lorch, E., & Inman, W.E. (1993). Effects of signaling topic structure on text recall. *Journal of Educational Psychology*, 85, 281-290.

Lorch, R.F. Jr. (1989). Text -signaling devices and their effects on reading and memory processes. *Educational Psychology Review*, 1, 209-234.

Marchionini, G., and B. Shneiderman. 1988. "Finding facts versus browsing knowledge in hypertext systems." IEEE Computer January, 1988, 70-80.

McDonald, S. & Stevenson, R.J. (1998). Disorientation in hypertext: the effects of three text structures on navigation performance.

Meyer, B. J. F. (1987). "Following the author's top-level organization: An important skill for reading comprehension." In R. T. Tierney, P. L. Anders, and J. N. Mitchell (Eds.), Understanding readers' understanding: Theory and practice. Hillsdale, NJ: Erlbaum, pp. 59-76.

Meyer, B. J. F., & Freedle. R. (1984). "Effects of discourse type on recall." American Educational Research Journal 21 (1): 121-143.

Meyer, B. J. F., D. M. Brandt, and G. J. Bluth. (1980). "Use of top-level structure in text: Key for reading comprehension of ninth-grade students." Reading Research Quarterly 16: 72-101.

Meyer, B. J. F., & Poon, L. W. (1997). Age Differences in Efficiency of Reading Comprehension from Printed Versus Computer-Displayed Text. Educational Gerontology. 23, 789-807.

Park, I. & Hannafin, M.J. (1998). Empirically-Based Guidelines for the Design of Interactive Multimedia. Educational Technology Research and Development, Vol. 41, No.3, pp. 63-85.

Spiro, R.J., Feltovich, P.J., Jacobsen, M.J., & Coulson, R.L. (1992). Cognitive Flexibility, Constructivism, and Hypertext: Random Access Instruction for Advanced Knowledge Acquisition in Ill-Structured Domains. In T.M. Duffy & D.H. Jonassen (Eds.) Constructivism and the Technology of Instruction: A Conversation. Lawrence Erlbaum, Hillsdale, NJ. pp. 57-75.

Wenger, Michael J. (1996). Human information processing correlates of reading hypertext. *Technical Communication*. v43 n1. Feb 1996. p. 51-60.

Information Technology's Role in Biochemical Systematics

Abstract

Bioinformatics is a new discipline that lies at the heart of the recent advances in understanding of genomic and proteomic systems. The NIH defines bioinformatics as "research, development, or application of computational tools and approaches for expanding the use of biological, medical, behavioral or health data, including those to acquire, store, organize, archive, analyze, or visualize such data." Developing course material for learners trained in traditional medical, biological, and information systems disciplines bring new sets of requirements to the e-learning world.

Today practitioners of any discipline in the molecular biosciences find themselves in an exciting and challenging situation. Current research in the biosciences is revealing molecular mechanisms of complex biological processes in an increasing number of areas. Knowledge of the molecular foundations of biological processes is increasing exponentially.

A major recurring theme is the relationship between molecular structure and biological function. Current studies of complex biological processes utilize information from assemblages of linked databases and electronically accessible journals available on the Internet. The use ofInternet based resources gives practitioners information soon after it is made available to the research community. This rapid access to new knowledge is unprecedented, and has changed the way those interested in the molecular Biosciences do their work. Structures and function are increasingly expressed in digital form, and exploring the molecular foundations of complex biological functions requires the application of many techniques from information technology. These techniques have come to be termed bioinformatics, defined by the National Institutes of Health as "Research, development, or application of computational tools and approaches for expanding the use of biological, medical, behavioral or health data, including those to acquire, store, organize, archive, analyze, or visualize such data."

Even the simplest cell, viewed from a molecular perspective, is a highly complex macromolecular assemblage. The assemblage of these systems occurs auto-catalytically, the assemblage is reproduced with fidelity, and these characteristics and capacities are routine attributes of even the simplest of life's forms. Add to this the fact that these are complex adaptive systems, having a capacity to produce progeny that have characteristics and functions different from themselves, and the task of unraveling the molecular events, relationships, ordering and controls that provide this reality begins to appear impossible. We, of course, expect that it is not, and deep studies of these processes are now underway. Techniques are available now, which allow direct activation and deactivation of cell-signaling pathways. It is this level of systems study that brings the field of biochemical systematics to the forefront of current research in molecular bioscience. Most practicing biochemists do not have an extensive background in information technology; similarly most IT professionals do not have extensive backgrounds in biochemistry. The authors of this paper have collaborated since 1998 on the development of a graduate course in biochemical systematics designed for students from both backgrounds. The presentation will use the course structure and features as a vehicle for discussing the deeper issues involved in preparing IT professionals for careers in this new field.

From its inception, this course has included a number of functions from the information technology domain. The course is referenced to two modern textbooks, augmented by a course web site that provides current links and interactive tools to aid in the visualization and manipulation of molecular representations (see http://www.america-tomorrow.com/gmu/biochem). The graduate students in this program are mostly full-time employees at are biotechnology firms, and the course makes use of alternative assessment methodologies including small group class projects that are delivered in the form of Web or PowerPoint presentations. To facilitate the student interaction on these projects, a number of asynchronous and synchronous communication functions have been provided. The course uses a combination of in-class lecture augmented by the class Web material and the discussion forums. This augmented distributed learning environment (Willet and Keefe, 1998) has proven to be particularly effective as the bioinformatics content moved to prominence. Rather than a study of chemistry and chemical reactions, the topic has emerged as a study of life.

From a molecular biology perspective, life is a necessary and obligatory output of the universe. Life forms as a result of the universal laws of physics and chemistry. It should arise when and where conditions are appropriate to the hierarchical molecular assemblages that promote the development of complex, dynamic auto-catalytic self-replicating systems.

Any system that establishes order in the midst of a universe that thrives on maximizing disorder, requires absolutely a ready and continued source of energy for both its initiation and continuance. In a study of life from this perspective, several fundamental concepts become core to both the system's description and any real approach to its understanding. Most Biochemistry texts break out these fundamental areas of knowledge, essential to life processes as we know them, in similar fashion.

Most modern courses on biochemistry begin with an introduction to the fundamental molecular basis of life, either before or after introducing the concept of the "Cell" which forms in all aspects one of the key precepts of molecular bioscience. How one presents and builds upon the "Cell Theory" of life, depends in some measure upon ones own primary subject domain, and area of personal expertise.

Historically, conceptual materials are presented along the lines of developing levels of complexity. Moving from a presentation of the simple molecular entities that serve as the building materials of cellular constituents, to the complex molecular arrays which provide the functional and structural attributes of cells and cellular processes.

Two broad categories of cells exist, those of prokaryotes and those of eukaryotes. Here *the differences lie in the nature* and constitution of the supra-molecular components of their discernable ultra-structure. Those lacking a membranous envelop encapsulating their genetic material, are defined as "Prokaryotes", those having such a membranous structure surrounding and encapsulating their genetic material are "Eukaryotes".

Keep in mind that viruses and other a-cellular parasitic or symbiotic systems, are unable to self-replicate and require, obligatorily, another cellular system, for their replication. Even the simplest cell, viewed from a molecular perspective, is an indescribably (at present) complex macromolecular assemblage. That the assemblage of these systems occurs auto-catalytically, that the assemblage is reproduced with fidelity, and that these characteristics and capacities are routine attributes of even the simplest of life's forms, adds to the overwhelming nature of our task to understand such phenomena at the molecular level. Add to this, the fact that these are complex adaptive systems, having a capacity to produce progeny that have characteristics and functions different from themselves, and the task of unraveling the molecular events, relationships, ordering and controls that provide this reality begins to appear impossible.

Techniques are available now that allow direct activation and deactivation of cell-signaling pathways. It is this level of systems study that brings the field of bioinformatics to the forefront of current research in molecular bioscience. Information gained at this level of investigation of cellular functions requires and demands the application of tools and methods from applied mathematics and the computer sciences. Modeling now, becomes an essential component of research directed toward an understanding of this level of biological function.

Investigations into molecular determinants of cellular function that are now underway illustrate the import and value of Informatics approaches to understanding deeply the mechanisms of cellular signaling processes. Study of cellular signaling processes, like studies of other signaling processes over the past half-century, is facilitated by transducing information about the process and storing the information in digital form for analysis. This enables analysis using the same probabilistic methodologies that form the basis of much current information science. (Zweiger, 2001).

The investigation of complex, multi-component, dynamic functions of cellular systems is now possible. Such studies employ an array of conceptual and technical approaches in their application. Any review of the current literature highlights this aspect of research in the molecular biosciences. The application of molecular techniques, within biosciences is now universal.

References:

Willett, J. and Keefe, D. (1998). A pilot project in augmentative distance learning: George Mason University graduate course in biochemistry. In proceedings of *10th World Conference on Educational Multimedia and Hypermedia*. Freiburg,

Germany; June 20-25. AACE
see http://www.america-tomorrow.com/gmu/biochem/aace698.pdf

Zweiger, G. (2001). Transducing the genome: Information, anarchy, and revolution in the biomedical sciences. New York: McGraw-Hill

2444

Web-Assisted Projects: Collaborative Learning in an Electronic Environment

Vicki S. Williams
Training & Development Program
Penn State Harrisburg
United States
vqw@psu.edu

Barry O. Williams
Training & Development Program
Penn State Harrisburg
United St ates
bow100@psu.edu

Abstract: Two graduate classes, from different academic programs, were brought together to work collaboratively on the design and development of a Web-Based Training project. The projects were problem-based and derived from students' workplace situations. The classes were supported by a course management system that provided supplemental instruction, communication and file-sharing capabilities, as well as access to common resources and instructor guidance and feedback. Students met with their instructors weekly, and met for an hour of each class with their teams. They continued the team discourse via message boards, chats, and electronically shared documents, all within the course management system. This paper describes this experience and the impact the computer-supported learning environment had on the quality of student projects and recounts some of the stumbling blocks and successes.

Background

Currently, there are two courses being taught that deal with creating documents for the World Wide Web (WWW). One course is taught in the Information Systems (INFSY) curriculum and deals with the technical side of the Webpage in programming and markup languages including JavaScript and XML. The other course is taught in the Training & Development (T&D) program and deals with the effective design of Web-Based Training (WBT) and its application in the workplace. Each courses' requirements included a team project consisting of detailed planning documents and an operational WBT site. The INFSY course required programming documents, while the T&D course required instructional analyses, objectives, and storyboards.

At the end of each semester, Student Evaluations of Teaching Effectiveness (SRTE) forms were completed by each student and the results reviewed. Responses to the written, open-ended questions indicated that students in the T&D design class, while satisfied with the design skill practice, would like to have more skill in the technical aspects of WBT and familiarity with the capabilities of Java, JavaScript, and XML to carry out their designs. Their designs were well-done, but their lack of technical skills prohibited them from fully developing the instructional website project they had designed. Projects in the INFYS course sometimes lacked the structure and organization necessary to be effective, although they utilized the programming languages skillfully.

The INFYS students lacked the instructional design background and the T&D students lacked the technical skills to create functional, professional quality websites. The student projects required by both courses were being evaluated on either technical skill or design, but not both, due to the scope of each course's objectives. Since both design and development is critical to professional WBT, and there is currently no single course that would provide student competency in both, the students become proficient on only one level. Would this be a good application of collaborative learning?

In searching for related research specifically focused on higher education, one study were identified dealing with the effects of collaborative activities on a group of undergraduate students' tolerance toward diversity (Terenzini, 2001). Another study investigated cooperative groups of college physics students working on solving problems in groups (Heller, 1992), but no research was identified that investigated cross-discipline teams in computer-related courses, working on a collaborative project. This study is intended to evaluate the factors affecting the success of that cross-discipline collaborative project activity among graduate students.

If the INFSY students were exposed to good design practices and the T&D students learn some of the capabilities of Web programming, the student experience would be more complete and result in better WBT sites. The collaborative nature of participation on a design and development team allows for peer tutoring opportunities across disciplines and the synergy should result in a better product. It was hypothesized that students would benefit from working collaboratively on a Web-based Training (WBT) project, but some students like team projects and others prefer working alone. Would required participation on a collaborative project put any students at risk?

The Study

The instructors of the two courses worked out a mutually acceptable semester schedule which included separate instructional times along with joint sessions for the collaborative teams to work. Since the students initially lacked the skills to produce the project, the first half of the semester was spent primarily in instruction. The 36 students participating in the study (24 INFSY and 12 T&D students) were introduced to the course management system and to their team members early on. There were five teams with 5 to 9 members on each team. There were at least two T&D students on each team and the teams were mixed in gender. They were instructed to discuss with their team members possible training problems for which they might design and develop the WBT. As the semester progressed and their skills increased, students met with their teams more frequently and for a larger portion of the class session to design and develop these WBT solutions.

The course management system was utilized to create a learning environment where students could communicate through message boards and chats, as well as e-mail to teams, individuals, or groups of individuals. The system allowed the instructor to assign teams and set up the team communications. Students utilized the team file manager most. There, they could upload design and web documents to a common team area accessible only to instructors and members of that team. They were constantly receiving feedback from team members, peers, and instructors through one of these communication conduits.

Results

At the end of the course, the students were asked to complete an online satisfaction survey in addition to the usual SRTEs. The survey was a Likert scale assessment tool of 21 statements where students were asked to rate their own contributions or those of their project partners on issues such as attitude, amount of work completed, correction of errors, level of participation, degree of knowledge, organizational skills, and willingness to participate in another collaborative WBT project with those team members. Of the 14 females and 22 males participating, 50% reported having a Very Strong relationship with their project team members and the same number responded that the work done by their partners on the project was done fairly accurately. In general, they were pleased with the amount of work (61% Very Strong) and attitude toward the work of project partners (55% Very Strong, 25% Strong).

There were mixed responses regarding issues such as technical competency of their project partners (47% responded Very Strong, 42 % Strong, 6% Neutral, 3% Weak) and the reliability of project partners (44% very good, 36% good, 14% neutral, 6%poor). Communication with the team was a problem with only 36% reporting the communication as Very Strong, and 31% reported Strong communications (14% Neutral, 17% Weak, 3% Very Weak).

In addition to the survey, the students made a presentation to the combined classes, demonstrating their final projects. Each project was graded once by each instructor, using the same criteria used for the projects completed when the courses did not collaborate. The INFSY instructor evaluated the programming and technical aspects, while the T&D instructor evaluated the instructional design aspects and the use of principles of screen design. The quality of the projects was very good They followed a more intuitive course and demonstrated a logical application of Web conventions to facilitate learning. Students felt that they had a better grasp of the whole process and that, although exasperating at times, the cross-discipline team experience was valuable in learning a broader approach to instructional Website design and development.

Conclusions

The survey results and comments reflected that students felt that the final project was better for the teamwork, but that working with a team could be very frustrating. Many cited problems with scheduling time together, communications, poor turn-around time of partners, poor corrections of errors by partners, and poor flexibility. In spite of this, they felt that their project partners were fairly technically competent, fairly accurate in their work, completed the work assigned them, had good attitudes and did their share of the work.

The students also felt that they could not have accomplished as much as they did without the supporting elements of the course management system. The instructors were able to track students' logins and course management system usage. Most of the students used all the communications conduits at one point or another and liked the ability to share documents the best. They would post a design or programming document and get feedback or modification suggestions from their team members, make the changes, and post again within a short amount of time. The course management system allowed them to work together at a distance and continue the dialog begun in class, getting peer as well as instructor guidance.

While the collaborative project activity was successful, student support provided by the course management system facilitated the process and allowed student to learn from one another. It encouraged an on-going dialog among the team members and sustained the creative endeavor.

References

Heller, P., Keith, R., & Anderson, S. (1992). Teaching problem solving through cooperative grouping. Part: Group versus individual problem solving. *American Journal of Physics, 60*(7), 627-636.

Terenzini, P., Cabrera, A., Colbeck, C., Parente, J., & Bjorklund, S. (2001). Collaborative learning vs. lecture/discussion: Students' reported learning gains. *Journal of Engineering Education, 90*(1), 123-130.

Adult Learners, Juvenile Behaviors:
Constructive and disruptive *ad hoc* communities in higher distance education.
An analysis of synchronous and asynchronous settings

Dee Anna Willis, EdD
College of Education
willisd@nsula.edu

Frank Fuller, PhD
College of Education
fullerf@nsula.edu

Paula Furr, EdD
College of Liberal Arts
furrp@nsula.edu

Karen McFerrin, EdD
College of Education
nmcferrin@nsula.edu

Northwestern State University
Natchitoches LA 71497

Abstract: Distance education fosters new kinds of collaboration among students and between students and instructors: some unintended. This presentation summarizes parallel studies of distance education community building in asynchronous and synchronous, desktop-video environments. Using observation, focus group response, and reflective journals, the researchers analyzed the interaction among class members and the perceived outcome of that interaction as part of student learning. Results indicate that disengagement or dissatisfaction in synchronous classes caused individual student disengagement with learning process; similar reaction in synchronous classes caused disruptive communities to form among learners that exhibited both internal mores and persistence over several class meetings. Discussion of results includes recommendations for identification and remedy.

Introduction

Distance education is collaborative education. At the least, the predominant design among recent prescriptions for designing or administering distance education post-secondary classes and training programs recommends collaborative strategies for learner activity and for the virtual classroom. Distance education, of course, means education facilitated by recent technology. It is important to change, but equally important that no one be left behind, or be made to feel left behind, in the course of changing (VanDusen, 1997).

Among those areas examined in recent studies of distance education is the intriguing nature of community or interaction among students. Russell's *No significant difference* study, now in its fifth edition (2001), summarizing more than 350 studies dating back more than a half century, demonstrates that design, rather than proximity, has always been the key to successful instruction. Measuring outcomes remains a normative business, however, with the WICHE (Western Interstate Commission for Higher Education) standard of "outcome significantly equivalent to traditional instruction" as the goal of distance programs.

Nonetheless, concern about the image of the learner, deprived of companionship or access because of the medium, strikes at core of traditional views of college classes.

This report presents research conducted in parallel studies examining incidental learning in two kinds of university distance education: asynchronous Internet and desktop video classes, and what happened to community in them.

The Studies

A dichotomy may exist between teaching and learning in online distance education courses and desktop video conferencing courses, for, incidental learning outcomes not identified as part of the formal curriculum are clearly evident (Furr 2000, McFerrin 1998). Learning to use technology and individual and group attitudes and behavioral patterns are two important outcomes. And they aren't always desirable. Technology problems and lack of sufficient class interaction and participation cause students to become distracted from focusing on course content. While frustration levels in students in the DVC courses are higher than those in the online courses, elements of frustration exist in both (Furr 2000, Hara & Kling 2000, Johnston 2000, Robertson 2000, Collins 1999, McFerrin 1998).

Asynchronous Online

McFerrin (1998) examined the incidental learning activity in an asynchronous online course. Two types of incidental learning outcomes occurred. The first developed from the students' learning to use the technology itself. The second type of incidental learning centered on certain areas of the students' personal development. An increase in time management ability, self-directive behavior, self-confidence, and self-discipline occurred. Students in the online course exhibited an increase in self-knowledge and a belief that more new goals can be set and successfully accomplished.

The results of the study illustrated the importance of incidental learning in an asynchronous online course. Both students and instructors must see the value of incidental learning to the student and must foster its development.

Desktop Video Conferencing

The second study (Furr 2000), addressed learning in desktop video conferencing (DVC) courses, a relatively new delivery medium for college courses. Because DVC is a new technology, even less literature targets its effects on teaching and learning environments (Cifuentes et al. 1999, Merisotis & Phipps 1999, Thorpe 1998, Mize 1996). The DVC study was structured to replicate the 1998 study in asynchronous, online college instruction. The researcher examined the experiences and perceptions of participants--faculty, students, and staff--in five desktop video conferencing courses

Consistent with McFerrin's findings, the researcher discovered two types of incidental learning outcomes not identified as part of the formal curriculum: learning to use technology and individual and group attitudes and behavioral patterns. Factors that afforded positive experiences and perceptions were convenience and reduced driving time, informal class atmosphere, small classes, prior computer skills, access to a computer and the Internet, internal student traits, and instructor facility with technology and distance education pedagogy. Factors that diminished a positive experience were technical problems, insufficient administrative support, inadequate training, weak proctor system, and negative student behaviors.

Unlike McFerrin's study, Furr (2000) found a higher level of frustration among participants in the DVC courses. Of the 52 students polled at the semester's end, 48% said they would take another DVC course, 17% said "no," and 21% said the type of course offered would determine their decision. The remaining percentage of students either did not answer the question or said they were graduating. Of those willing to take another DVC course, convenience was the top-cited reason. They were also willing to forgive technical problems, believing "bugs would be fixed." Nonetheless, a sizable number of students reported either a negative or neutral stance regarding DVC. "It became ongoing and public and diminished a professor's authority and respect," one proctor said. One instructor noted that the array of technology available to students during class and the added focus and concentration needed for instructors to deliver a course and for students to process the content prompted students to go "mentally off-line."

If a positive outcome is to occur, then DVC requires substantial technical training and support, administrative support for faculty, and a strong proctor system. Importantly, educators must continue to refine the pedagogy of effective teaching and learning with DVC.

As with any program, monitoring participants' experiences and perceptions is critical to success. Fulk (1993) proposed that an organization's members could be expected to develop coordinated patterns of behavior based on observations of each other's behaviors, the consequences of behaviors, and emotional reactions. Detecting those patterns, whether faculty, student, or staff, is crucial to avoid falling into the trap of the "rapture of technology" and failing to assess how different learners use technology differently with different and sometimes unexpected results (Ehrmann 1998).

Similarities and Differences

The two studies highlighted similarities that existed between these particular asynchronous online and synchronous DVC courses, including the need for students to be self-disciplined, self-motivated, and patient; variance in computer skills and technology accessibility that existed among the students; use of email for communication between student and instructor; compulsiveness of students; unrealistic expectations of students; lingering technology frustration; vulnerability of at risk students; lack of driving time and expense devoted to travel; newness and niftiness of the technology; expense to operate courses successfully; smaller size of the classes; and lack of university-wide system for student evaluation.

The studies illustrate several key differences between the two media. In a text-based online course, students tend to be more careful in their comments about other students, the course, and the instructor. In a DVC course students at remote sites can informally converse among themselves, with negative behaviors and comments often going unchecked. A strong proctor system, particularly with younger or more immature students, is key for DVC. In a DVC course, negative individual attitudes and behaviors can affect an entire group, with an instructor unable to monitor individual and group behaviors simultaneously. Classroom management issues and strategies become accentuated in DVC courses. In an asynchronous course, students understand the "transactional distance" between themselves and the instructor and do not expect immediate, real-time feedback. A DVC course gives students the illusion of one-to-one contact with the instructor and active participation. When a student's electronic raised hand or comment in the chat box goes unnoticed or unacknowledged for even a brief time, students tend more easily to disengage from class. Students in online classes are accustomed to and expect a primarily text-based system, whereas the camera and monitor in a DVC class prompt in students a "TV" attitude. However, current DVC technology with its small video window and jerky transmission often relegates faculty and other students to tiny, out-of-focus talking heads.

Boredom and disengagement again can result if students are not themselves focused, motivated, and disciplined. A DVC system requires more technical support during class for both the instructor and students at remote sites. While an online class can weather downtime, a DVC course cannot. A DVC course requires more faculty technical training and preparation for technical contingencies. In an online course, students can choose the time, pace, and duration of their course interaction. In a DVC course, the hours are set just as in a traditional course. Being tethered to a computer for two to three hours and staring at a computer screen can be physically tiring and boring, conditions ripe for frustration and disengagement. For DVC courses, changing activities and frequent breaks are key.

Conclusion

College education has always been, to a certain extent, a process of forming communities of learners. Isolation is a frequently-cited disadvantage of distance education (Olgren, 2000) and a common cause of students' non-completion (Holt, 1998). Ironically, these two studies, taken together, demonstrate a reciprocal relationship between engagement and isolation: students in asynchronous classes, engaged with distant colleagues or mentors, were not deflected by the virtual enticements of the Internet; however, synchronous students, in the company of dissatisfied companions, became themselves distracted, regardless of the potential of their class to engage their interest.

The two studies highlighted the differences and similarities in learning and teaching environments fostered by the two different delivery systems, especially in the area of behaviors. The intriguing nature of community or interaction among students is underscored. Although "good teaching" has many universal tenets, the notion that faculty or students can seamlessly transfer from the traditional classroom to varied electronic formats should be dispelled. These findings underscore the importance of specific faculty development, curriculum planning, and administrative support for distinct electronic venues.

References

Cifuentes, L., Beller, C., & Portela, J. (1999). Integrating desktop videoconferencing into middle school classrooms and teacher education. *International Journal of Educational Telecommunications, 5* (1), 79- 91.

Collins, M. (1999). I know my instructional technologies: It's these learners that perplex me! *American Journal of Distance Education,* 13 (1), 8-23.

Ehrmann, S. (1998). *What outcomes assessment misses.* Speech delivered at the 1998 AAHE Assessment Conference. Retrieved September 8, 2001 from http://www.tltgroup.org/programs/outcomes.html

Fulk, J. (1993). Social construction of communication technology. *Academy of Management Journal,* 36 (5), 921- 950.

Furr, P. (2000). *The occurrence of incidental learning in higher education desktop video conferencing classes: An ethnographic study.* Unpublished doctoral dissertation, Northwestern State University, Natchitoches, LA.

Hara, N., & Kling, R. (2000). Students' distress with a web-based distance education course. Article accepted for publication in *Information, Communication & Society.* Retrieved April 8, 2002, from http://www.slis.indiana.edu/CSI/Wp/wp00-01B.html

Holt, M. E. (1998). Ethical considerations in Internet-based adult education" *New Directions for Adult and Continuing Education, 78,* 63-69. SF: Jossey-Bass.

Johnston, C. (2000). *Fostering deeper learning.* The University of Melbourne. Retrieved March 12, 2001, from http://www.ecom.unimelb.edu.au/ecowww.fost.html

McFerrin, K. (1998). *Incidental learning in a higher education asynchronous online distance education course.* Unpublished doctoral dissertation, Northwestern State University, Natchitoches, LA.

Merisotis, J.P., & Phipps, R.A. (1999). What's the difference? *Change,* 31 (3), 12-18.

Mize, C.D. (1996). Desktop video communication: A primer. *TechTrends,* 41 (6), 44-47.

Olgren, C. H. (2000). "Learning Strategies for Learning Technologies." *New Directions for Adult and Continuing Education, 88,* 7-16.

Robertson, D.A. (2000). *Teaching and learning in the computer-mediated conferencing context.* Unpublished doctoral dissertation, University of Toronto, Canada.

Russell, T. L. 2001. *The no significant difference phenomenon. Fifth edition.* Montgomery AL: IDECC.

Thorpe. R. (1998). The use of personal video conferencing with special needs pupils from three schools serving rural areas: A case of successful adoption of new technology. *Journal of Information Technology,* 7 (3), 395-411.

VanDusen, E. (1997). The virtual campus: Technology and reform in higher education. *AAHE ERIC Higher Education Report, 25,* 5. Washington, D.C.: ERIC Clearinghouse on Higher Education. (ED 412 816)

Cheating an Online Test: Methods and Reduction Strategies

DR. JOSEPH WINSLOW
Coastal Carolina University
College of Education
P.O. Box 261954
Conway, SC 29528
jwinslow@coastal.edu

This paper reports findings from an empirical study investigating the degree to which an online test created using a popular web-based testing development tool—*Coursebuilder for Dreamweaver MX*—is susceptible to student cheating. Results indicate that students at all computing ability levels are capable of discovering viable cheating methods, even when specific anti-cheating measures have been implemented. However, these measures can significantly reduce the quantity of online cheating occurrences. The paper concludes with a discussion of additional derived strategies for further reducing the probability of cheating online. Designers, developers or trainers utilizing web-based testing systems should take interest.

Context

For more than two decades, computer-based testing (CBT) systems have been used to administer interactive objective assessments to students at all education levels. Supporters of CBT have noted many logistical advantages over traditional test administration—including flexibility of setting and format (Bonham et al., 2000), reduction in testing time (Bunderson et al., 1989), automatic grading and performance tracking (Greenberg, 1998), adaptive remediation (Meijer, 1999), psychometrics (Whalen, 1998), and comparability to paper testing (Bocij, 1999; Bugbee, 1996). Despite these advantages, the use among faculty has often been limited to either the purchase of proprietary question data-sets from textbook publishers, or the development of custom assessments using expensive and complex authoring systems (Byers, 1999).

Fortunately, the origin of the Internet as an open-source medium has recently undermined the dependence of educators on proprietary systems. Standardized technologies like HTML, XML and Javascript have been integrated into inexpensive, intuitive authoring tools easily mastered by non-programmers (Byers, 1999). As a result, web-based testing (WBT) systems are increasingly common components of Internet-delivered courseware (Cooper, 1999). However, these same standards that facilitate innovative faculty development efforts also provide tech-savvy students with new ways to cheat. The need to identify these online cheating methods and the specific technical vulnerabilities they exploit thus becomes critical to the sound instructional design of WBT systems.

Although cheating within the context of WBT is not a well-studied domain, existing research on conventional cheating provides a useful schema through which it may be examined. Cheating at the undergraduate level is a very prevalent and very documented phenomenon. Newstead et al. (1996) reported survey data from 943 college students that indicated cheating was "widespread," especially among men and less able students. In a study of 480 undergraduates from two colleges, Graham (1994) found that eighty-nine percent had cheated at least once. Hollinger (1996) found that over two-thirds of undergraduate students had participated in some form of "academic dishonesty" during a sample semester. Lord (1995) reported that over seventy-five percent of students enrolled in college science classes admitted to cheating on large exams and major projects, whereas Kerkvliet (1994) noted that almost half the students (n=443) in undergraduate economics classes from two major universities have cheated on at least one major examination.

The psychology of cheating is also well investigated, with researchers consistently noting that factors most positively associated with cheating are extrinsic. For example, in a recent meta-analysis of 107 studies on cheating, Whitley (1998) found that the strongest correlates of cheating include an expectation of success and anticipation of reward, as well as a perception that social norms support cheating. Nowell (1997) reported that cheating is unrelated to gender, religion or grade point average, but is positively associated with poor performance in class. Similarly, Graham et al. (1994) found that attitudinal variables were better at predicting cheating behavior than were background variables.

Prevention strategies recommended by researchers have generally advocated developing student compliance with value systems. Instituting honor codes, for example, has been noted as an effective countermeasure (Schneider, 1999; Paldy, 1996). Other researchers have delineated less formal but equally values-driven methodologies, including academic integrity codes (Alschuler, 1995), professional integrity development (Odom, 1997), and the implementation of ethics courses (Warman, 1994) or ethical decision-making frameworks (Booth, 1992).

One domain of technology-centric cheating that has received attention in the literature is online plagiarism. Researchers have noted that the Internet facilitates an increased ability to commit plagiarism and academic fraud (Van Hartesveldt, 1998), either by copying and pasting text directly from web documents (Drogemuller, 1997), or downloading previously written and scored compositions from online paper mills (McCollum, 1997). Recommended online plagiarism prevention strategies are varied, and include teaching students about copyright or intellectual property issues and scholarship (Walker, 1998), selecting relevant paper topics and insisting upon full referencing (Drogemuller, 1997), using digital portfolios for combined assessments (Sherry, 1997), and using the Internet to "preview" possible plagiarism (Carnevale, 1999).

What this presentation will include

The purpose of this paper is to report findings from an empirical study investigating the degree to which students were able to cheat an online objective quiz developed using a popular standardized courseware development tool, Coursebuilder for Dreamweaver MX. Three questions of primary interest to the researcher included:

(1) are there any differences in the quantity of cheating methods used between two versions of the same quiz (secure and not secure),
(2) which cheating methods are most common, and
(3) does prior computing experience relate to quantity of cheating methods?

As web courseware development tools continue to evolve, and as individual faculty take greater responsibility in the development of their own custom assessments for online delivery, answers to these questions are critical to the derivation of specific strategies to reduce online cheating.

This presentation will detail the major methods, findings and implications of this unique study. The methodology utilized to invoke student cheating will be described. Both versions of the quiz (secure and not secure) will be presented, and more importantly, all major cheating methods employed by students will be demonstrated.

From these cheating methodologies, strategies for preventing online cheating will be derived and discussed. These strategies will include both technical and non-technical methods to reduce the probability of online cheating. For example, issues to be examined include interface design, user authentication, file security, content management, as well as online testing policy and administration.

Like much of the previous research on compter-based-testing (CBT), recent studies in WBT have focused on electronic testing as an intervention effecting typical outcome variables like achievement and attitude. Gretes and Green (2000), for example, found that when students use WBT modules for "practice" testing, achievement on "real" testing improves. The focus of this study is on the use of WBT for "real" classroom-based testing, and as the data abundantly indicate, the test environments investigated are hardly cheatproof.

To faculty, cheating has always been the "problem that won't go away" (Paldy 1996), and to expect technology -based testing systems to be completely impervious is unrealistic. Given Shaughnessy's (1988) conclusion that "very few students deliberately plan ahead to cheat [but] will take advantage of a situation if given the opportunity," as well as McCabe's (1996) observation that technology -related forms of cheating are on the rise, the findings of this study are relevant to any designer, developer or trainer utilizing web-based testing systems.

Sources

Alschuler, A. and Blimling, G. (1995). Curbing epidemic cheating through systemic change. *College Teaching*, 43(4), 123-126.

Bocij, P. and Greasley, A. (1999). Can computer-based testing achieve quality and efficiency in assessment? *International Journal of Educational Technology*, 1(1).

Bonham, S. et al. (2000). Education research using web-based assessment systems. *Journal of Research on Computers in Education*, 33(1), 28-44.

Booth, D. and Hoyer, P. (1992). Cheating: Faculty responsibilities when integrity fails. *Nursing Outlook*, 40(2), 86-93.

Bugbee, A. (1996). The equivalence of paper-and-pencil and computer-based testing. *Journal of Research on Computing in Education*, 28, 282-299.

Bunderson, C., Inouye, D., & Olsen, J. (1989). The four generations of computerized educational measurement. In R. Linn (Ed.), *Educational measurement* (3rd ed., pp. 367-407). New York: American Council on Education and Macmillan.

Byers, J. (1999). Interactive learning using expert system quizzes on the internet. *Educational Media International*, 36(3), 191-194.

Carnevale, D. (1999). How to proctor from a distance. *Chronicle of Higher Education*, 46(12), A47-A48.

Cooper, L. (1999). Anatomy of an online course. *Technological Horizons in Education Journal*, 26(7), 49-51.

Dickhoff, G. et al. (1996). College cheating: ten years later. *Research in Higher Education*, 37(4), 487-502.

Drogemuller, R. (1997). Designing cyber-assignments. *Australian Science Teachers Journal*, 43(4), 42-44.

Graham, M. et al. (1994). Cheating at small colleges: an examination of student and faculty attitudes and behaviors. *Journal of College Student Development*, 35(4), 255-260.

Greenberg, R. (1998). Online testing. Techniques: *Making Education and Career Connections*, 73(3), 26-28.

Hollinger, R. and Lanza-Kaduce, L. (1996). Academic dishonesty and the perceived effectiveness of contermeasures: an empirical survey of cheating at a major public university. *NASPA Journal* 33(4), 292-306.

Kerkvliet, J. (1994). Cheating by Economics students: acomparison of survey results. *Journal of Economic Education*, 25(2), 121-133.

Lord, T. et al. (1995). A look at student cheating in college science classes. Journal of Science Education and Technology, 4(4), 317-324.

McCollum, K. (1997). One way to get into college: buy an essay that worked for someone else. Chronicle of Higher Educaiton, 43(25), A25-A26.

Meijer, R. and Nerning, M. (1999). Computerized adaptive testing: overview and introduction. Applied Psycholgical Measurement, 23(3), 187-194.

Newstead, S. et al. (1996). Individual differences in student cheating. Journal of Educational Psychology, 88(2), 229-241.

Nowell, C. and Laufer, D. (1997). Undergraduate cheating in the fields of business and economics. Journal of Economic Education, 28(1), 3-12.

Odom, J. (1997). Academic and clinical ramifications of integrity and cheating. Journal of Dental Education, 61(8), 681-685.

Paldy, L. (1996). The problem that won't go away: addressing the causes of cheating. Journal of College Science Teaching, 26(1), 4-6.

Schneider, A. (1999). Why professors don't do more to stop students who cheat. Chronicle of Higher Education, 45(20), A8-A10.

Sherry, L. (1997). Linking technology with promising practices to improve teaching and learning. Paper presented at ...

Van Hartesveldt (1998). The undergraduate research paper and electronic resources: a cautionary tale. Teaching History: A Journal of Methods, 23(2), 51-59.

Walker, J. (1998). Copyrights and conversations: intellectual property in the classroom. Computers and Composition, 15(2), 243-251.

Warman, E et al. (1994). Dental students' attitudes toward cheating. Journal of Dental Education, 58(6), 402-405.

Whalen, S. and Bejar, I. (1998) Relational databases in assessment: an application to online scoring. Journal of Educational Computing Research, 18 (1), pp.1-13.

Whitley, B. (1998) Factors associated with cheating among college students: a review. Research in Higher Education, 39 (3) pp.235-274.

HARBOROUGH COMMUNITY LEARNING NETWORK A MODEL FOR COMMUNITY E-LEARNING

David Wortley, Mass Mitec, United Kingdom, dwortley@massmitec.co.uk

Abstract: The Information Age is creating many challenges and opportunities for our global society. Paradoxically, the same technologies which offer unrivalled opportunities for mankind to communicate, collaborate and build a rich, equitable and sustainable future, are also creating a divided world in which individual self-interest could lead to the destruction of the human race.

Virtual learning/conferencing technologies offer great hope for the development of social and economic wealth within communities, helping to address some of the less desirable aspects of globalisation by creating an environment in which people can work together to mutual benefit, and strengthening the bonds of stable and fruitful relationships.

The Harborough Community Learning Network project in the UK is a pioneering scheme to explore how HP's Virtual Classroom technology might be used to create a virtual community centre in which all sectors of the Harborough community can learn, work and socialise.

INTRODUCTION

Information Communications Technologies are transforming global society to an extent and at a pace never before experienced in the history of man. It is this level and pace of change which is posing a threat to the very survival of the human species.

Throughout the history of mankind, it is the development of new communication technology which has caused all the major quantum changes in civilisation. The development of language, cave paintings, ancient scriptures, roman roads, the printing press, railways, telegraph, telephony, aviation, radio and television have all played a significant role in the creation of wealth and power. Today, the internet is arguably the most profound development of them all, not simply because it has achieved a faster penetration into society in the developed world than any previous technologies, but primarily because it places the power to communicate and therefore influence into the hands of the ordinary citizen in a way never previously experienced.

Society has always been based on hierarchies and chains of command and control in all aspects of human life, but we are now moving into a networked society in which the power to communicate and influence is suddenly dispersed. Such a massive dislocation of an existing and ingrained social and economic order places a great strain on governance and stability. Mankind has never before had to evolve in a situation so dynamic and rapidly changing.

The now widely accepted dimension of finite environmental resources is a complication which adds to the challenge and makes it imperative that society responds at a global level to protect our species from the danger of self-destruction. It is a situation not dissimilar to a nuclear reaction in which the human atomic elements are impacting on each other with increasing power and unpredictability. Unless we can harness this process into a positive force, there is every danger that it will get out of control with dire consequences.

The solution to this problem situation has to be a massive cultural change towards a recognition of our mutual inter-dependence and a commitment to societal collaboration in the interest of a sustainable future.

E-learning technologies may have a fundamental role to play in facilitating this cultural shift in the dwindling time available to make the necessary changes.

COMMUNITY KNOWLEDGE NETWORKS

One of the paradoxical side effects of the Information Age has been the fact that information has never been more accessible, yet never more difficult to find. We have a far greater knowledge of people and cultures across the globe than ever before, yet we know less than ever about our neighbours. This is a major problem for society because it encourages unnecessary and illogical consumption of valuable resources.

If society was able to easily identify and harness local resources to common social and economic purpose, mankind would be more able to create sustainable communities capable of development without the level of resource consumption we are currently witnessing.

The concept of a community knowledge network based around a physical community perhaps holds the key to our future. The Harborough Community Commerce and Knowledge Network (www.comknet.org.uk) project developed between 1998 and 2000 was a pioneering attempt to explore the viability of using ICT to support the social and economic development of a community.

Many different applications were explored including e-commerce, web portals, discussion forums, mailing lists and web conferencing. It was the potential of web conferencing as an engine of social and economic change which seemed to offer the most potential as a basis for the next initiative.

HARBOROUGH COMMUNITY LEARNING NETWORK

The Harborough District is situated in the East Midlands Region of the UK and comprises two market towns and a total of 90 parishes, most of which are rural villages. The ICT revolution has resulted in a massive loss of services in these villages – Post Offices, banks, schools, stores and public transport have all been victims of the Information Age.

Dramatic action is required to prevent the death of these small communities and further damage as a result of increasing urbanisation.

The Harborough Community Learning Network is a cross sector partnership initiative to establish a community learning and media centre as a hub to a network of rural public access points delivering local knowledge and services and stimulating innovation and enterprise within village communities.

The HCLN project (www.hcln.net) is still in its early stages, but there have already been some exciting initiative holding great promise for the future. Amongst these initiatives is a concept known as "THE Radio with Pictures Show" which is a hybrid community learning environment formed by combining community radio broadcasting with web conferencing to create a highly interactive learning experience.

In the pilot series of 15 broadcasts on the theme of the Information Society, local people joined national and international special guests on a breakfast radio chat show supported by a virtual classroom in which participants could interact with each other and view slide presentations and web pages relevant to the topic.

This was not only a valuable learning experience for the community, but it also began to sow the seeds of an understanding of the situations and problems faced both within the community and in the world at large.

The community learning and media hub has just started its operation and is already attracting significant numbers of people across all age groups and backgrounds into this lifelong learning environment.

As the project develops, we will be exploring in more depth the potential of interactive broadcasting as a community learning tool capable of building capacity and helping this community shape its own social and economic future.

Web-Based Learning from the Student's Perspective

Linda Wright-Smith
Department of Multimedia Design
Cameron University
United States
lindas@cameron.edu

Abstract: The motive for this ongoing research is to create the best possible web-based learning environment for our university's online students. Professors strive to design an engaging virtual environment with enough scaffolding to facilitate learning and the development of critical thinking skills. On the other hand, some students will never flourish with web-based classes; however, because of time and space constraints, many more students will take university online classes. These students can provide us with feedback that will enable us to make timely changes in how we present tacit and theoretical knowledge. Additionally, the feedback can promote changes in how we motivate students to participate, interact, and communicate in our virtual classroom. A combination Likert-scale and open-ended questionnaire with follow-up interviews is being used to see online classes from the students' perspective.

Introduction

Our undergraduate and graduate students can take classes on campus and some classes online. During the school year, they have a choice among approximately 40 different online classes for which they pay forty dollars more per semester hour. The Cameron online listing of web classes advises students that: "Students should be aware that online courses generally require more time and self-discipline than traditional lecture classes." However, at this time a few classes such as "Advanced Web Communications" can only be taken online. Boehle, (2002) wrote about her experiences as an online learner and provided a unique "student" viewpoint even if it was actually an undercover reporting endeavor. Very few articles provide this perspective; consequently, I began collecting data from my multimedia design students as they experienced taking online classes. These students quickly learn how to work with a computer in order to develop 2D/3D graphics, 3D animation, video production, web pages, and instructional packages with different graphics and authoring software. However, effective learning online requires more than a comfort level with computer technology. Goldenberg (1999) states that a quality learning environment "involves teachers being sensitive to different learning styles and adapting teaching techniques, showing a concern for the student and generally developing a feeling of awareness and sensitivity between the teacher and all students involved." (p.16). The feedback I was getting from my students indicted that they believed that being an accepted member of the online community helped to facilitate their learning process. Along with the students' sense of community, there should be learning "activities" and choreographed "sets of tasks for students that encourage learning" (Fisher, 2000, p. 108). Hence, the research question evolved into: What is the view of online learning from the students' perspective?

The Study

Goldenberg (1999) notes that there is a sparsity of articles correlating "the connectedness a student feels with a teacher, their peers, and how if it affects their learning of the subject matter" (p.19). One of the features of Blackboard is a discussion board where students can respond to different topics, add new threads, and ask questions of fellow students. Additionally it has a virtual classroom where students and the professor can meet for real time discussions. Feedback from students indicated that the virtual classroom archives were being used as source of intelligence gathering by online students who were unable to make it to the virtual classroom. I make use of the technology to query my student's about their perceptions and observations along with their gut reaction to class. They were offered a 5 point bonus for responding to my inquires concerning their feelings and finishing the survey during the last week of the course.

The student frames of references that I am looking at included:

Interaction – Lack of Interaction
Empowerment – Dis-empowerment
Support – Lack of Support
Advantage – Disadvantage
Compatibility – Incompatibility

In addition to the queries, I provided an online survey for my online class to start developing a picture of online learning from the students perspective. The pilot survey consisted of a Likert scale questionnaire and the following open-ended questions:

17. Compare the exchange of ideas online to the exchange of ideas in your typical classroom.
18. What drives you "nuts" about your online class? (One online student suggested this question.)
19. When Blackboard is inaccessible how does it affect you?
20. What problems are you encountering in your online class?
21. List the advantages of taking an online class.
22. List the disadvantages of taking online class.
23. How do you develop rapport with your online professor?
24. If you were the professor, what changes would you make in your online class.

After one semester, I decided to extend this survey to include all online students at the university. Two of my undergraduate students, Wendy Baggett and Patricia Davis, helped to develop the survey for all the web-based student population. Then, Wendy Baggett used Web Surveyor to make the survey available to all online students. The students had room to make comments and answer open-ended questions. When the survey was posted, we asked the online professors to point out the site to their students.

The following pilot questionnaire was used.

Online Course Questionnaire

The information in this section is to ensure that we have sufficient diversity in respondents.

Class Taken:

Age: 15-19 20-24 25-29 30-34 35-39 Other

Sex: Male Female

1. What do you feel is the best thing about taking an online class?
2. What made you decide to take an online class?
3. Other than your online course, have you ever gone online to access instructional material on how to do something? If yes, please explain.
4. Please describe what your comfort level was while participating in the online course, as opposed to how you felt while participating in a traditional classroom setting?
5. What are your feelings towards the use of computer technology? Please explain.
6. What were the factors that helped to promote peer interaction in your online course?
7. While in your online course environment how easy or hard did you find it to follow the navigation of the course? Why or why not?
8. Did you ever feel overwhelmed while participating in your online course? Please explain.
9. If you had the choice to take the same course again, but you had the option of choosing between a traditional classroom and the online course, which one would you choose? Please explain why?
10. Compare the exchange of ideas in your online course as opposed to participating in a traditional classroom?

11. What was the one thing that drove you "nuts" about your online class?
12. Did you encounter any problems during your online course? Please explain.
13. Please list what you feel are the advantages of taking an online course.
14. Please list what you feel are the disadvantages of taking an online course.
15. Do you feel you were able to develop a rapport with your online course professor? Why or why not?
16. If you were the professor of your online course, what changes would you make to the course?
17. If you were conducting this interview, what question(s) would you ask that I have not?

Results

Online Class Results

The return rate in my online class of 22 students was a 100%. They demonstrated the gamut in adjusting to the online class. They did provide useful data for changes in the present online class. For example, we used a digital camera to take everyone's picture and I am making an online class portrait. Below are some of their comments.

"In the future I will probably not take too many online courses because I prefer to have an instructor. I do however like the flexibility of when I use the computer for class."

"I really don't like online classes, I guess because I'm so lost."

"You remember that I referred to the class as nebulous. It's nebulous in that it's this big thing that isn't solid and is floating in a void. You know it's there, but you're not exactly sure what to do with it or why."

"It is just difficult not having you in the lab with us for immediate person to person contact when we have problems that we cannot describe on line. Some things we just have to show you what we mean as we ask the question."

"I got into the test and only got to the second question when my ISP booted me out. I hadn't answered anything and I didn't even get to read the third question. The website wouldn't let me access it again."

"I have always been able to absorb and retain what's been given me in lectures combined with my note taking, so without those learning tools I feeling kind of out of place."

"I must say that in the beginning, I was confused and frustrated about some of the things that were required or being required, but as the year went along things became so much easier that I couldn't believe it. I really think that most of that was due to my attitude adjustment."

"This is a wonderful class. However, it is difficult when there is not an instructor right there to see what difficulties we may have on the spot."

"Well I must admit that I am not as panicky as I was in week one...but that in it self makes me panicky. I still feel somewhat stranded, the tools are there but I am still unsure of what is expected. The discussion board is very helpful. I enjoy the interaction with other students."

"I also like how our graded exam is on the screen right after we take it."

"I don't like this set up at all. I personal think the department should've offered at least one section of this course in a regular classroom setting, instead of all of them online. ...I'm totally lost. I just now realized that I'm a week behind."

Web Surveyor Questionnaire Results

The Web Surveyor questionnaire did not get a response across the different academic disciplines. Our return rate of the actual online student population was low. Most online professors did not send their students to the web survey site. On respondent noted that the best thing about his online class was that "I am in Korea so it is helpful not having to be in Oklahoma." Statistically, 37 percent of the respondents had taken online classes before. Flexibility and convenience were often sited as the best part of taking an online class. However, one person stated that it "gives me the responsibility of having to learn pretty much on my own, which I have found works better for me."

The comfort level of learning online was good to very good for 60% of the class but 29% had a very poor comfort level. Yet over 50 percent experienced feelings of being overwhelmed while participating in online classes. The things that drove them nuts included the amount of reading required, trying to find the homework sheets, stress from other students getting off target topic, not having the internet in their homes, having to contribute to the discussion board, and problems with enrollment.

Conclusions

For the most part, Cameron University online students also attend regular university classes during any given semester. These students have an opportunity to mitigate any frustrations they feel about an online class by visiting with their professor at the university. This closer physical proximity also provides us with the opportunity to examine their perspective with one-on-one interviews. At this point in the research, it appears that we need to assure online professors that we are not evaluating their teaching skills or knowledge base. Without the cooperation of these online professors, we will not be able to build on the survey and get meaningful results. While researching how student's learn in a computerized learning environment, Burge (1994) identified key categories of learning strategies: "choice, expression, peer interaction, and organization of information" (p.19). As professors we all need to look at the flip side of learning strategies which involves the seven principles of effective teaching by Chickering and Reisser as cited by DeBard and Guidera (2000):

1. Encourages Student-Faculty Contact
2. Encourages Coooperation Among Students
3. Encourages Active Learning
4. Gives Prompt Feedback
5. Emphasizes Time on Task
6. Communicates High Expectations
7. Respects Diverse Talents and Ways of Knowing (p. 22)

The students' perspective at Cameron reinforce the need to develop these learning strategies along with good instructional design to facilitate the use of these strategies. There is also a strong need for a sense of community. One student e-mailed me about his efforts to learn online and end with: "have been having a bit of trouble understanding some of the readings, but some of the other people in class are going to start meeting at the lab for group sessions. It will all fall into place as long as we stick together."

References

Boehle, S. (2000). My exasperating life as an online learner: Training reporter goes undercover and finds frustration at Online U. Training June 64-68

Burge, E.J. (1994). Learning in computer conferenced contexts: The learners' perspective. Journal of Distance Education Vol. IX(1) 19-43

Debard, R. & Guidera, S. (2000). Adapting Asynchronous communication to meet the seven principles of effective teaching. Journal of Educational Technology Systems 28(3) pp.219-230

Fisher, M. (2000) Design guidelines for optimum teaching and learning on the web. Journal of Educational Technology Systems Vol 29(2) 107-118

Goldenberg, J. (1999). Virtual Learning Communities: A students perspective. Journal of instruction delivery systems Vo l. 13(2) pp.16-20

http://www.cameron.edu/info/schedules/online-fall.html

Teaching Resources for Fetal Echocardiography

Krzysztof P. Wroblewski
Department of Radiology, University of Pennsylvania School of Medicine, Philadelphia, PA 19104, U.S.A. and
Wroblewski Consulting, Drexel Hill, PA 19026, U.S.A., krzyszto@mail.med.upenn.edu

Zhi Yun Tian
Children's Hospital of Philadelphia, Philadelphia, PA 19104, U.S.A. tian@email.chop.edu

Piotr M. Wroblewski
Wroblewski Consulting, Drexel Hill, PA 19026, U.S.A. pwrob@chek.com

Abstract: We have developed and tested an Artificial Intelligence (AI) program combining textbook of fetal echocardiography, an atlas of ultrasound images, and an expert system to form a single resource for reference and education. It was designed to teach physicians and medical students to analyze a typical ultrasound scan obtained around the 20th week of pregnancy in order to detect congenital heart diseases in fetus. The expert system guides the user through the process of making diagnosis, asks relevant questions, and supports the process of detection of congenital abnormalities. For over two years the expert system was available for free download from the Fetal Echocardiography Homepage (http://www.med.upenn.edu/fetus). We registered over 900 downloads, and we obtained comments and criticism from over 200 medical offices from all over the world.

Introduction

Until recently, little could be done for unborn babies suffering from anatomical abnormalities. Now, improved fetal sonographic and sampling techniques and a better understanding of fetal pathophysiology make therapy for the fetus an option. Many prenatally diagnosed malformations can be managed by traditional means, but some anatomical abnormalities with have predictable, life-threatening prenatal pathophysiological consequences require correction before or immediately following the birth. It is still a common opinion between doctors that routine ultrasound evaluation of a fetal heart during the pregnancy does not decrease mortality caused by congenital heart diseases. Unfortunately this is partially true. The main reason for such situation is a paradox: the detection of congenital heart diseases depends on non-cardiologists. It is the responsibility of obstetricians and primary care physicians who simply lack proper training. It is a serious problem because only in the United States every day about 100 babies born alive have congenital heart disease, and in many, perhaps even in most cases, existence of the abnormality surprises the mother as well as the doctor taking care of her during the pregnancy. Today's modern ultrasound machines provide enough power and capabilities to obtain good images of the heart, but keen observation and understanding of fetal cardiac abnormalities are crucial [Huhta et al 1991]. Today's computer technologies can be utilized to support a process of making diagnoses and improve the rate of detection of congenital heart diseases. The goal of this project is not to convert obstetricians and primary care physicians into cardiologists, but to use computers to teach them how to detect congenital heart abnormalities before baby is born.

Methods

Fetal Echo Expert system is a rule-based expert system [Giaratano et al 1994]. It links together knowledge of several human experts in the area of fetal cardiology and ultrasonography, and contains knowledge from presently available textbooks and publications. The program includes a step-by-step tutorial, a library of congenital heart diseases, graphic images, digitized echocardiograms and an expert system, which can support the process of detection of congenital heart diseases. The block diagram of this program is shown in figure 1.

Expert systems are software technology that has been successfully applied to development of systems that model information processing tasks. The design of a rule-based expert system involves a process of interaction between a domain expert and a knowledge engineer who formalizes the expert's knowledge in the form of inference rules and encodes them in the computer. Since human experts vary in skills and experience, and they often do not know what knowledge they actually used in solving their problems, the process of building of an expert system requires enormous amount of effort and is rather time consuming. Despite of difficulties in creating of such system they have several advantages [Giaratano et al 1994]:

- The expertise is permanent. Unlike human experts who may retire, quit or die, the expert system will last indefinitely.
- The knowledge of multiple experts can be made to work simultaneously.
- The expert system can explain in detail the reasoning that led to the conclusion.
- Steady unemotional, and complete response at all times. This is very important in real-time and emergency situations when human expert may not operate at peak efficiency because of stress or fatigue.
- The expert system may act as an intelligent tutor by letting the student run sample programs and explaining the system's reasoning.

Knowledge that is attributed to intelligent entities more often has the form of uncertain beliefs rather than crisp, indisputable facts. A consideration in the development of an expert system is the ability to deal with uncertainties as they occur when conclusions are only partially confirmed by a piece of evidence. One way of logically manipulating uncertain propositions is to use one of the models of uncertainty.

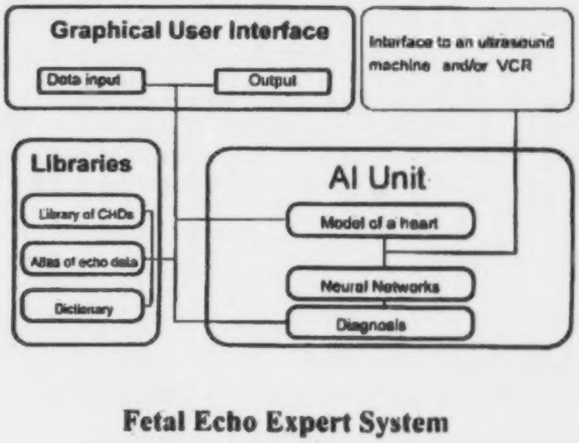


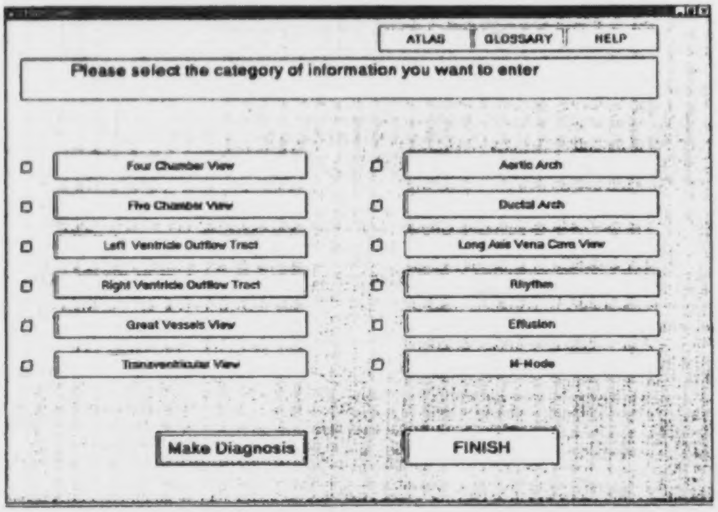
Fig.1 Block Diagram of the Fetal Echo Expert system

Traditionally subjective estimates of probability and Bayesian processing have been used to specify and propagate uncertainty through an inference network. One disadvantage of this approach is that it requires the assessment of a large number of conditional possibilities and is subject to combinatorial problems in the inference procedure. Another means of logically manipulating uncertain propositions is to use the Dempster-Shafer [Dempster 1968] [Shafer 1976] theory of evidence implemented as support logical programming by Baldwin [Baldwin et all 1986] and successfully implemented in building of expert systems. This algorithm has also been implemented in the Fetal Echo Expert System.

Results and Discussion

BEST COPY AVAILABLE

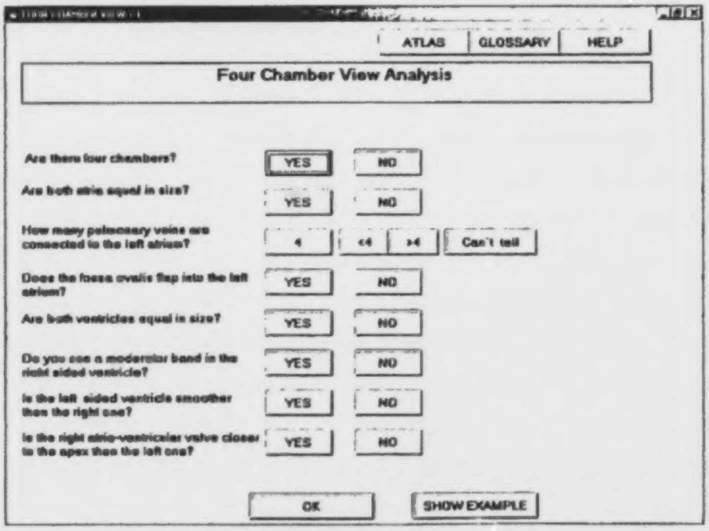
Fetal Echo Expert System is designed to guide a physician or student through data obtained from an ultrasound examination. It is assumed that user can view the study that is stored on magnetic tape or in the PACS system at the same time he/she is using the program. The questions asked by the program are divided into twelve groups that correspond to the different views of a heart and different techniques used as shown in the figure 2. Every time one set of questions is answered, the user may click on the "Make Diagnosis" button and obtain a suggested diagnosis based on the data entered. The program will also search the library of images and display images and video clips corresponding to the data entered in order to compare them with the ones from the patient. It is possible to change the information supplied to the program and observe how it affects diagnoses.



Please select the category of information you want to enter

- ☐ Four Chamber View
- ☐ Five Chamber View
- ☐ Left Ventricle Outflow Tract
- ☐ Right Ventricle Outflow Tract
- ☐ Great Vessels View
- ☐ Transventricular View
- ☐ Aortic Arch
- ☐ Ductal Arch
- ☐ Long Axis Vena Cava View
- ☐ Rhythm
- ☐ Effusion
- ☐ M-Mode

Fig. 2 Choice of views and techniques that can be analyzed before the diagnosis is provided.



Four Chamber View Analysis

Are there four chambers?	YES	NO		
Are both atria equal in size?	YES	NO		
How many pulmonary veins are connected to the left atrium?	4	<4	>4	Can't tell
Does the fossa ovalis flap into the left atrium?	YES	NO		
Are both ventricles equal in size?	YES	NO		
Do you see a moderator band in the right sided ventricle?	YES	NO		
Is the left sided ventricle smoother than the right one?	YES	NO		
Is the right atrio-ventricular valve closer to the apex than the left one?	YES	NO		

Fig. 3 Four Chamber View Analysis

BEST COPY AVAILABLE

The system includes also a "fetal calculator" which helps to determine actual gestational age of the fetus based on the measurements of head circumference, biparietal diameter, abdominal circumference, and femoral length. A large discrepancy between values calculated from these four measurements may suggest other congenital abnormalities such as the Down Syndrome.

The expert system was written in MS Fortran and is linked to the graphics user interface written in MS Visual Basic. The program runs under Windows 95 or higher including Windows 2000 and Windows XP. The program requires a CD-ROM drive, and at least 30 MB of free disk space.

For over two years a simplified version of the expert system (equipped only with a basic library of images) was available to download for free from the Fetal Echocardiography Homepage (http://www.med.upenn.edu/fetus). We have registered over 900 downloads, and obtained comments and constructive criticisms from over 200 medical offices from all over the world. The final version of the program is being prepared now, and it should be available in the first quarter of 2003. At this stage, before regular clinical trials, it is difficult to estimate the contribution of false positive and false negative diagnoses, particularly if the quality of ultrasonograms is not very high. However, preliminary data obtained during the process of testing indicate that regular use of the Fetal Echo Expert System results in a significant increase in the rate of detection of congenital heart diseases in fetus.

References

[Baldwin et all 1986] Baldwin J. Support logic programming. In Jones A., Kaufman A., Zimmerman D.J. (eds), Fuzzy Sets: Theory and Applications, Reidel, Dodrecht-1986 pp 133-170.

[Cios et al 1990] Cios K.J, Freasier R.E., Goodenday L.S., Andrews L.T. An expert system for diagnosis of coronary artery stenosis based on 201Tl scintigrams using the Dempster-Shafer theory of evidence. CABIOS 6, 333-342 (1990).

[Dempster 1968] Dempster A.P. A generalization of Bayesian Inference. R.Statist.Soc.J. B-30, 205-247 (1968).
[Giaratano et al 1994] GiaratanoJ. Riley G., "Expert Systems Principles and Programing". PWS Publishing Company, Boston 1994.

[Huhta et al 1991] Huhta J.C., Rotondo K.M., Fetal Echocardiography. Seminars in Roentgenology, vol XXVI, pp 5 -11 (1991).

[Shafer 1976] Shafer G. A Mathematical Theory of Evidence Princeton University Press, Princeton-1976.
[Wróblewski et al 1996] Wróblewski K.P., Tian Z.Y, Wroblewski P.M. Multimedia System for Fetal Echo Analysis. J.Am.Coll.Cardiology 1996, 9A (1996).

[Wróblewski et al 1996a] Wróblewski K.P., Tian Z.Y, Wroblewski P.M. Fetal Echo Expert System, Radiology 201(P), 519 (1996).

Acknowledgments

We wish to thank Prof. James Huhta from the University of South Florida in Tampa Florida, Prof. Bogdan Kaluzewski from the Medical Academy of Lodz, Poland, and Prof. Maria Respondek-Liberska from the Polish Mother's Memorial Hospital in Lodz, Poland for sharing their knowledge, and fruitful discussions about the program. W want also thank to all physicians who tested the program and sent us their comments, suggestions, and criticism.

Implementing SCORM real issues and resolutions

The idea of the Sharable Content Object (SCO) means that we can create content once and use it where applicable in many different courses. What makes this even better is that someone else can use your content or you can use content that was created by someone else. You can do so because all learning objects' SCOs use the same Application Programming Interface (API) for communication with your Learning Management System (LMS) and use the same metadata for description and searching.

The reality is that current browser security limits the ability for users to create courses with learning objects that reside outside of their domain. We have implemented a technique that will solve this problem, allowing course designers to link to content that resides outside of their domain and thereby eliminating the need to copy content and import it into their LMS.

With this being a reality, we are faced with other major implementation issues such as: How does this affect the end-user experience? How does the content sequencing work? How do you create a seamless learning environment with content that looks and navigates differently from each other? And how do you manage who can access your content? These are the questions and issues we had to resolve as we developed an LMS to manage and deliver SCORM compatible content from multiple vendors for three different organizations.

A Trust Model for Distributed E-Learning Service Control

Yuefei Xu and Larry Korba
Institute for Information Technology [1]
National Research Council of Canada
[yuefei.xu@nrc.ca | larry.korba@nrc.ca]

Abstract: As with traditional face-to-face education, "trust" is an important factor for the interactive e-learning. To deal with security and privacy concerns, this paper proposes a trust model for distributed interactive e-learning applications. The working mechanisms are based on policy-negotiation and public key cryptography. By using this model and proposed approach, fine-grained trust control of common e-learning services can be maintained. The logical model, core concepts, and typical e-learning trust interaction processes are described. An example is also provided to illustrate how the introduced model would be deployed.

Introduction

Similar to the situation in traditional face-to-face education, "trust" is an important factor in interactive e-learning. On the one hand, the e-learning provider requires some basis upon which to make trust decisions of the learner. For example, the provider must ensure that the user accessing the system, from somewhere on the Internet, is someone eligible for the service. On the other hand, the learner needs to trust that the provider and the services will protect personal information, and will release information regarding performance for instance, only to those authorized by the user.

Trust levels may also indicate the learner's levels of motivation or aspiration for learning. It is easy to imagine that students and teachers, whether young or adult, who thrive in an Internet-based e-learning environment that provides mutual trust, respect, and freedom will become a happy, safe harbor for their learning and teaching activities. Trust then will be the most crucial factor for the success of distance learning process with the maturation of e-learning.

In this work, we focus on security- and privacy-related concerns for distributed e-learning systems, where trusted interaction form the underlying requirement between clients and service providers. The concerns can be divided into two main areas. (1) Security: the concerns may include authentication, confidentiality, authorization, non-repudiation, etc. For example, users can access only those resources and services that they are entitled to access, and qualified users are not denied access to services that they legitimately expect to receive. (2) Privacy: mostly, this refers to the privacy of individuals. This includes all the individual's concerns regarding collection and use of personal information.

Trust is also an important topic in information security research. It has received a good deal of attention in recent years [Mass, Y. 2001]. However, very few focus on e-learning related issues. This is remarkable considering the boom of e-learning applications. Based on our study of proposed or applied trust-related protocols and mechanisms like X.509/PKIX (2002), PGP (2001), and KeyNote [Blaze, M. 1999], we propose a policy-based trust model for e-learning. The model supports policy negotiation between parties. The rest of this paper describes the logical model, core concepts and typical interaction processes. We then provide a sample to show how these concepts and models are used to deal with e-learning security and privacy concerns. We end with discussion and conclusions.

Proposed Trust Model

As most e-learning systems are distributed applications, and the typical application mode in e-learning is demand/supply, we consider the Client/Server (C/S) model as the basic communication model. The browser/web-server model can also be thought as a particular type of C/S model. Peer-to-peer (P2P) e-learning systems have some similarities in that in this instance, each peer has both a client process and a server process. Therefore the C/S analysis is still applicable for these applications.

---

[1] Bldg. M-50, Montreal Rd., Ottawa, ON, K1A0R6, Canada. NRC Paper #44950

We propose a policy-based trust model for e-learning systems. This trust model provides fine-grained policy-based security and privacy control for e-learning services as well as provisions for policy negotiation. The logical model is shown as Figure 1.

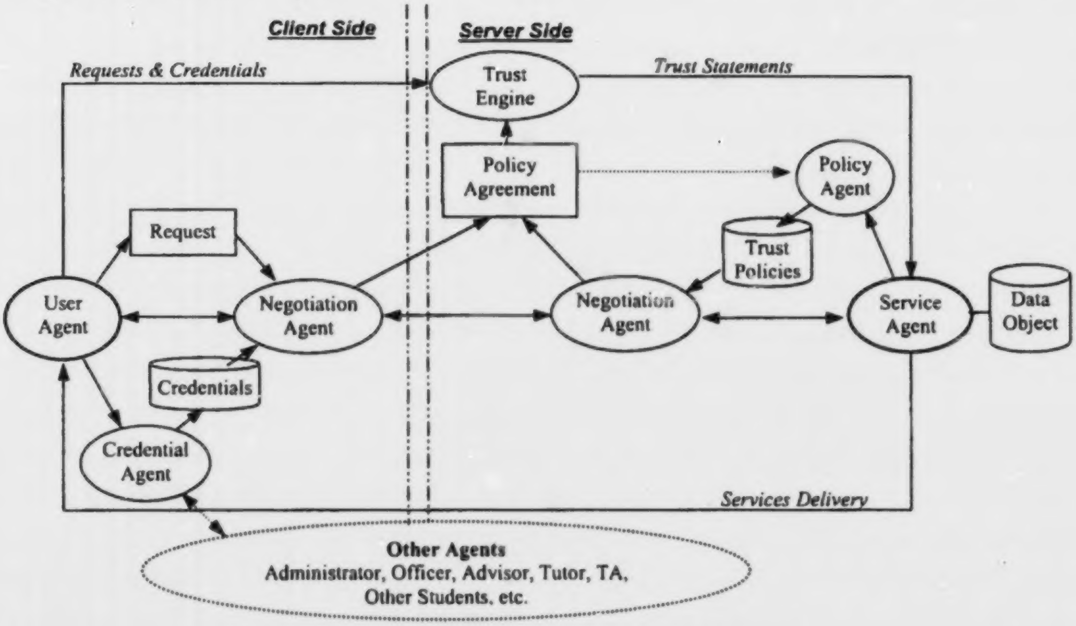

Client Side
Server Side
Requests & Credentials
Trust Engine
Trust Statements
Policy Agreement
Policy Agent
Request
Trust Policies
User Agent
Negotiation Agent
Negotiation Agent
Service Agent
Data Object
Credentials
Credential Agent
Services Delivery
Other Agents
Administrator, Officer, Advisor, Tutor, TA,
Other Students, etc.

Figure 1. Policy based Trust Model for E-Learning Service Control

There are two logical sides for the model: a client side, which request services and a server side, which provides services. The active agent on the server side is the "service agent, while there is a "user agent" on the client side. In most cases, the clients and servers are geographically distributed and connected by a network (Local Area Network (LAN) or a Wide Area Network (WAN)). The network, including the Internet, may be open and unsecured.

On the server side, there are a series of provided services, such as web contents, multimedia, file management, discussion groups, course registration, and so on. Logically, these services can be seen as many computer processes and a series of data objects. For example, an HTTP server process and many html files provide static web content, and course registration service consists of a register process and some database tables or records. When a learning service receives a request from a user, a new service agent is created corresponding to this request. The service agent and related data objects then responds to the request. Each service agent also maintains a series of policies, which specify the security and privacy concerns on the data objects and services. Only requests compatible with these policies can be served.

On the client side, the user also holds one or more credentials, which certify he has some granted rights to receive some services perhaps under limited conditions. For example, before a student wants to register for a course, the student must provide proof of an approval letter (credential) signed by an advisor or supervisor.

In order to initiate a service, the two sides must first form a service agreement. The service agreement states what service is provided to the user and the conditions for that service. Then according to the request contents, the service agent may deliver some data objects to the user or execute some actions on the data objects.

Core Concepts

Role: The Role describes the operational function of an individual or group in the learning system. Examples of roles include: "tutor", and "registrar officer". This concept is used to simplify system management.

Public Key, Signature: Each individual and each role has a unified key pair: a public key and a private key. Both of these are provided by a designated authority. The public key is used as the identification of the key holder. The private is used to form a signature on the credential and request. This key is a key secret to the individual.

Request: The Request describes who wants to do what, stating the "requestor", "objects", "actions" and "signature". For example, the request of "Bob wants to edit the course score " is described as:

Requestor: Bob's public key
Object: course score
Action: edit
Signature: Bob's signature

Credential: The Credential describes what right the holder has been delegated under some conditions, as well as whether or not the rights can be delegated to third parties and the conditions of such a delegation. Credentials are issued by other agents and normally stored on the user side. For example, the follow credential describes "Scott is delegated by Bob to evaluate the student presentation of course CS302 and during school term of 2002-Fall".

Licensee: Scott's Public Key
Object: Presentation
Action: Evaluate
Condition: if (course = CS302 && term = 2002-Fall) then (approve)
Delegation: No
Signature: Bob's signature.

Trust Policy: The Trust Policy specifies who and what operations are authorized on the data objects and the conditions for those operations. The policies are bound with the service on the server side. For mobile services, the policy is mobile with the service. Service administrators initially define policy. An administrator may authorize other individuals to take on the role of defining policy. The policy has the same format as a credential. The difference is that policy is stored with the service. During the life of an e-learning process, some credentials may be accepted and stored with the service if the policy agent accepts them. In this manner, the user doesn't need to provide this credential again when he request some service. This is implied that multiple credentials may be or may not be required when user requests services depending on what policies the service has had. For example, if Scott has the credential granted by Bob to do something, but the system has no policy allowing Bob to do that, a credential on Bob's priority must be provided at the same time if Scott wants to get the service.

E-learning Trust Interaction Scenario

A typical e-learning trust interaction process is described briefly as follows:

- A user browses the service categories, which describe what services are available and simple statements on requirements for receiving the services.
- The user makes a selection requesting a service. A service provider agent is subsequently generated to deal with the request.
- Requests with the available credential types are collected and checked against the trust requirements of the service policy by the two negotiation agents.
- If the request and credential types are not compatible with the service policy, the two negotiation agents will try to solve the conflicts by coordinating actions on both sides via the following actions:
    (a) Let the provider adjust his policy; and/or
    (b) Let the user change his request; and/or
    (c) Let the user seek more compatible credentials from other agents.

- After negotiation, both sides arrive at a joint agreement. The joint agreement reflects the final service policy corresponding to this request and service. The trust engine then checks the validity of user's credentials, and calculates the final compliance value of the request against provided credentials and the joint agreement.
- The result of this compliance is sent to the provider agent as the "trust statement", which indicates the trust decision as well as additional operational requirements.
- The provider agent provides the corresponding services to the user depending on the trust statement. Some additional actions, such as logging, altering, or encryption, are also executed.

Example

In this section, we briefly illustrate how the introduced model and concepts could be deployed using the following example. In particular, the example involves protection of student personal information. Student personal information stored on the server like address, email, telephone, may be changed at any time by the owner. But some critical data, like name, birthday, or nationality may only be changed with the mutual agreement of both the register officer and the owner. The two policies bound with the service are:

Policy a

Licensee: Registrar officer
Object: Name, Birthday, Nationality of personal record
Action: Edit
Condition: if (approved by Owner) then (approve)
Delegation: Yes
Signature: Administrator's Signature

Policy b

Licensee: Owner of personal data record
Object: Name, Birthday, Nationality of the owner's record
Action: Edit
Condition: if (approved by Registrar Officer) then (approve)
Delegation: Yes
Signature: Administrator's Signature

Then a student "Alice" can delegate her rights to Registrar Officer by issue the following Credential *c*.

Credential c

Licensee: Registrar Officer
Object: Name, Birthday, Nationality of Alice's record
Action: Edit
Condition: if (notify Alice@abc.ca) then (approve)
Delegation: No
Signature: Alice's Signature

Request d

Requestor: Registrar Officer's public key
Object: Name, Birthday, Nationality of Alice's record
Action: Edit
Signature: Registrar Office's signature

If a registrar officer holds the credential c, she/he can edit Alice's record by sending the above Request *d* to the personal record management service. The final trust statement will be *(approve and notify Alice@abc.ca)*,

Discussion and Conclusions

People working or learning in cyberspace need mechanisms to develop trusted relationships. Building trust is recognized as a key factor for using and developing the new interaction paradigms, particularly vital for e-learning applications. The approaches and technologies we discussed above could provide a trust decision and enforcement mechanism for interactive distance learning. This work is still at a preliminary stage. There are other important issues to be investigated. In particular, key management, credential version control, and mechanisms for adaptive negotiation among others. Approaches for dealing with these issues are currently being developed within our group. They will be reported in later publications.

Reference

Mass, Y. (2001), Distributed Trust in Open Multi-agent Systems, LNAI 2246, Springer-Verlag, 2001

X509/PKIX (2002), Public-Key Infrastructure, Jan. 2002, *http://www.ietf.org/html.charters/pkix-charter.html*

PGP (2001), An Open Specification for Pretty Good Privacy, July2001, *http://www.ietf.org/html.charters/openpgp-charter.html*

Blaze, M. (1999), The KeyNote Trust-Management System V2, IETF RFC 2704, Sept. 1999

A "Thinking Journey" to Mars using Scientific Visualization Technologies : a New Approach to Teaching Astronomy

Yoav Yair
The Open University of Israel, Tel-Aviv, Israel

Yaron Schur

The Weizman Institute of Science, Rehovot, Israel

Rachel Mintz
The Center for Educational Technology, Tel-Aviv, Israel

ABSTARCT

We present a novel approach to teaching astronomy and planetary sciences, centered on visual images and simulations of planetary objects. The "Thinking Journey" concept takes the students to the other planets as travellers, and teaches science through the observation of various natural phenomena. The use of 3D animations and VR-like features greatly enhances the visualization capabilities the teacher can use, allowing simulated flights over the terrain of Mars, studying it as if observing from a spaceship in orbit. The program focuses on the study of the planet Mars, by means of observation, interpretation and comparison to the planet Earth. Students learn to use updated, web-posted images from orbiting spacecrafts, and to recognize similar geological and atmospheric processes on both planets. They discuss astronomic phenomena and discover that the same basic physical laws govern all objects in the solar system.

DIFFICULTIES IN ASTRONOMY EDUCATION

Astronomy and Space Science have a strong appeal to children in K-12 classes. It is a dynamic and exciting science, which is deeply rooted in their everyday life and in the surrounding culture. Teaching astronomy at the primary and secondary school levels is usually a challenge for science teachers, because it contains complex subjects in physics, requires an understanding of three-dimensional geometry and dynamics and demands (from the students) advanced cognitive capabilities. To understand the basic astronomical phenomena such as day and night, the occurrence of seasons, eclipses, phases of the moon and the motion of the planets - they must have the capability of visualizing events and objects as they may appear from different perspectives simultaneously. Astronomy teaching is considered difficult also because of the large amount of facts and details it contains and because some of the concepts seem abstract. Teachers are often faced with the dilemma of what topics from the large curriculum to cover in the limited time frame that is usually allocated.

Children have initial conceptions of celestial objects and phenomena, which are often reminiscent of ancient philosophical ideas, notably Aristotelian geocentric views of the sun and planets (Nussbaum, 1985). Piaget noted many such conceptions in his early studies of child development, and showed that children evoke their own cosmological explanations even at very young ages. As they grow up, their early ideas are probably influenced by erroneous information presented in everyday culture and mass media (Lanciano, 1999) such as science fiction films and TV series. The private cosmological ideas become deeply rooted beliefs, which are often inconsistent with the accepted scientific view. Some of these alternative frameworks continue well into adulthood and are even found in university students. DeLaughter et al. (1998) present a variety of misconceptions found among students in an introductory Earth Science course and cite the famous Shapiro et al. (1988) video that showed Harvard graduates failing in explaining the cause of seasons on Earth. The common misconceptions students have in astronomy may come from factual misinformation, mythical concepts and language imprecision, misinterpreting sensory information and incomplete understanding of scientific processes (Commins, 1993). Without a contextual framework within which to compare astronomical objects (that is, specific tasks or everyday experiencese) , students have difficulty in mentally filing the facts associated with them. They also have difficulties in creating the "big picture" from its various components (Bennet, 1999).

SCIENTIFIC VISUALISATION AND VR SIMULATIONS

In its modern, digital version, scientific visualization links science, technology, computer science, and applied visual arts in the designing of systems that can translate huge amounts of quantitative data into digital graphic images. However, even a rather simple and unique form of scientific visualization in planetary sciences, such as the one introduced by Miller and Hartman (1993), can be a powerful tool for teaching. They drew pictures, views and landscapes of planets, moons and asteroids, based on the scientific data transmitted by the Voyager and Pioneer spacecraft and that obtained by Earth-based telescopes. They provided vivid and spectacular renderings of the clouds of Jupiter and the rings of Saturn, as well as of the volcanoes of Io and the craters of Miranda (moon of Uranus). These images enabled one to tour and study the surfaces and atmospheres of different planetary objects in the solar system, with no other means but a still picture.

Modern ultra-fast computers enable scientists to use ever-subtler variations in color and shading to represent numerical data, that describes different aspects of natural phenomena and processes. Such representations can portray complex phenomena in their entirety and can also consist of a series of images depicting changes over time. In relation to astronomy teaching, scientific visualization can easily become a powerful strategy to overcome the described hurdles. Images from satellites and spacecraft, as well as from the Hubble Space Telescope, become a source to new scientific information. Classroom materials, lesson plans and complete courses have already been developed by NASA (see for example: http://www.thursdaysclassroom.com/) and are widely popular.

The introduction of virtual reality (VR) technologies to desktop computers have greatly increased the ability to simulate and present complex three-dimensional objects and phenomena to the average PC user (Mohler, 2000). This trend coincides well with the notion promoted by Bliss and Ogborn (1989), who stated that computerized simulations act as an exploratory tool and promote the user's understanding of complex dynamic processes. Barab et al. (2000) have presented a virtual solar system as a tool for teaching astronomy.

Lately, Yair et al. (2001) described the application of scientific visualization technologies to astronomy teaching. They developed a 3-dimensional model of the solar system, which includes the sun, planets, moons, asteroids and comets. IN this model, all these objects revolve and rotate in their orbits against the constant background of the Milky Way, the stars and constellations. High resolution NASA images were used and the planetary orbital data were calibrated with great accuracy (Figure 1). The user enters a virtual model of the physical world, where the computer mouse functions as a spaceship of sorts. This permits a journey in the virtual representation of outer space, enabling students to zoom in or out as they wish, easily changing their viewpoint and perspective. Such a learning environment offers an exciting learning experience and facilitates the construction of a scientific concept of the solar system (heliocentric vs. geocentric). Nevertheless, an on-going study at Tel-Aviv University (Gazit et al., 2000) shows that students require guidance and assistance in their interaction with the astronomy VR program, and that they have difficulty in constructing their knowledge without mentoring and mediation by an instructor or a teacher.

THE "THINKING JOURNEY" CONCEPT

A thought experiment ("Gedankenexperiment") is a strong mental tool, used by many scientists to investigate basic natural phenomena. Galileo and Einstein are the most famous examples for the use of this intellectual exercise, discussing questions of gravity and of relativity theory, accordingly. Thought experiments can be used in educational settings as well, providing a powerful stimulus for children studying science (Gilbert and Reiner, 2000).

In a newly developed program, Schur (1998) have introduced the "Thinking Journey" concept to astronomy education. Using images

BEST COPY AVAILABLE

of Earth and the Moon, as well as of spaceships and astronauts, students are directed and coached in a gradual, structured manner, to investigate and discover various subjects in basic astronomy. The approach is based on the works of Feuerstein, Rand and Rynders (1988) and Feuerstein (1998), that focused on the relations between the way children observe natural phenomena and their abilities to understand them. These works describe the connections between thinking processes and the ability to observe a phenomenon and its changes. For Feuerstein, learning science includes observing the organization and regularity of natural phenomena, which is a necessary prerequisite for understanding the relevant scientific facts and content. After learning these scientific concepts, the way is paved for the child to observe the phenomenon in a new manner and to understand it.

In his book, Schur (1998) devised a cyclic learning process that is composed of six stages. The guiding principle of this process assumes that for learning to take place children must undergo a conceptual change, and that they must be performing tasks involving the subject matter, under the supervision and mediation of their teacher. For studying astronomy, children are initially asked to observe a phenomenon (either directly in the sky, or in an image from space). They are then guided (by targeted questions referring to the image) to define and collect the results of their observations. Then, they analyze the data, explain it and look for interconnections between different items. At this stage, the teacher (tutor, instructor) supplies additional information, as well as guidance and counseling. The children then draw conclusions, generalize the observation and look for rules (or natural laws). The last stage is an introspection of the previous stages, to create awareness and as a preparation for a repetition of the process to the next assignment (=observation). This is a dynamic learning process where students are active participants in the acquisition of knowledge, rather than passive recipients of information. The place of the learner is important and explicit throughout the learning process. The learner is not the outside observer who watches the phenomenon. The learner is a part of context.

Since many students have difficulties with mathematical and verbal skills, ways must be found to enable them to interact with the physical environment, while circumventing the mathematical and verbal obstacles. Using pictures of the Earth, the moon and outer space enables students to interact with a congenial modality. Students find the pictorial modality familiar: they are accustomed to it in their everyday interaction with television, movies and computers. Perrig and Kintsch (1985) observe that the pictorial modality is easier for students to remember and to understand than the verbal modality.

COMBINING SCIENTIFIC VISUALISATION WITH THE "THINKING JOURNEY"

An exploratory effort to combine the Thinking Journey method with a multimedia based astronomy program has been carried out at the Center for Educational Technology in Tel-Aviv. The authors have used the "Touch the Sky, Touch the Universe" astronomy CD-ROM (Yair et al., 1997), that is widely used in schools throughout Israel, to develop a special training program for K-12 science teachers. This program utilized the mutual strengths of both components and implemented the cyclic learning process to dynamic animations, MPEG movies and still images embedded in the various items within the software. The positive outcome of these teachers' courses paved the way to applying the new concept to an astronomy program for high-school students who do not major in science.

Taking advantage of the fact that the power of visualization technologies has increased significantly in the last couple of years, we created an advanced program that focuses on a Thinking Journey to virtual landscapes of the planets and moons, as presented in the 3D-VR solar system model described above. The new "Thinking Journey to Mars" program is to be studied by non-science high-school students in Israel and will be a part of the matriculation requirement in science. We chose to focus on the planet Mars because it is one of the most exciting scientific targets of research and the object of dedicated space missions such as the Mars Global Surveyor and the Mars Pathfinder. The up-to-date images received from these space probes were used to create the virtual surface of Mars, and a novel, special "Fly-over" capability enables students to experience a virtual flight above the Martian landscapes. Using a "flight remote control" the user has the ability to fly over the terrain at extremely low altitudes, to zoom-in and out, pan, rotate and tilt the image according to his chosen viewpoint. Figure 2 shows a close-up on the famous Valles Marineris, an immense geological feature in the equatorial region of Mars. This image reflects the new and unique visualization capability of the software, and many important details can be deduced by simply observing the emerging planetary landscapes. Navigation tools and a menu of pre-selected targets (volcanoes, ice caps, mountain ranges and craters, see Figure 3) allows the learner to study in detail the Martian and lunar surfaces in a dynamic, interactive manner. In addition, the user can visit landing sites of spacecraft such as Viking (on Mars) or the Apollo and Luna missions (on the moon, Figure 4), and investigate the characteristics of the landscape and main geological features in these places. This facilitates creating the important sense of "ownership" of the constructed knowledge by the learner, who feels he has control of the learning experience (Goforth, 1994).

The Thinking Journey to Mars builds a narrative that takes the learners to the Red Planet in a scenario that resembles the planning of a real-life mission. They are asked to decide on landing places and to discuss surface properties, as well as to predict weather conditions and astronomical phenomena such as day-and-night and the changing of seasons. By observing Mars from close-by with high-resolution images, and by answering a series of well-guided questions, they can construct a story of a planetary landscape that can be compared with the one they know from Earth. They gradually construct their knowledge of Mars from images, animations and simulations that visualize landscapes that otherwise would have been abstract or alien. Coming "back" to Earth after "staying" some time on Mars can make the learners observe the Earth from a different perspective.

The textbook that is the center of this program (Schur, Brandt and Yair, 2002) uses numerous images of Earth and Mars from space, as well as images of different landscapes both planets. Through questions and activities, as well as by active teacher mentoring, it lets students observe both planets from a new perspective. They can compare the Earth and Mars in numerous aspects, with an approach that is very much like the one used by practicing researchers in planetary sciences. (Planetary geologists often compare the landscapes formed by erosion and ice processes on Earth to those that are observed on Mars, mainly for trying to decipher the important questions of Martian water). This inquiry-based approach drives students to discover by themselves the uniqueness of planet Earth, the characteristics of its dynamic environment and the special conditions that had enabled it become a haven for life. A reflection on the learning process they have experienced through their virtual journeys is considered vital by many researchers (Scardamalia et al., 1989). This is achieved by a set of targeted questions and activities that summarize the Thinking Journey, where students are asked to summarize and deduce the significant changes in their own ideas and concepts of Earth and Mars.

An experimental implementation of the "Journey to Mars" program had started in 2001 in three schools in Israel and will be further expanded in 2002/3. Although the program was originally developed to enhance the scientific literacy of non-science majors in high schools (that is, students who do not matriculate in any of the sciences), it can be easily adapted to any science education program from the 10th grade onwards.

Future research will focus on the ability of students to navigate complex three-dimensional virtual worlds and the whether if they interpret correctly the visualized astronomical phenomena they observe. An extensive teacher-training program had already been initiated and will be evaluated and repeated to increasing numbers of science teachers. We also plan to expand the Thinking Journey concept to the central object in the solar system, that is, our Sun.

SUMMARY

Astronomy and Space science are a natural arena for the use of visualization technologies. Nevertheless, the information a young student may gleam and interpret from watching models, animations and simulations of planetary objects does not necessarily reflect the correct scientific view. Harper et al. (2000) discussed the simulation paradigm and pointed out that experiential simulations such as the described VR tour to the planets have a weakness in that too much complexity can make learners insecure and they lose track of learning objectives. Providing mentoring and carefully constructed activities within the virtual journey can alleviate this weakness, and let the complexity of the learning environment manifest itself and support active, exploratory learning (Goforth, 1994). The use of images, films, computer programs and other means that make use of visual information is bound to increase in the future educational programs (Barab et al., 2000). Using the visual mode of communication requires a different way of teaching, with an emphasis on the process of observation. The combination of a well-guided Thinking Journey with the new 3D-VR models may greatly increase the effectiveness of the learning experience and can guarantee that the student constructs his view of the world in a scientifically correct and enjoyable manner.

Bibliography

S. A. Barab, K. E. Hay, K. Squire, M. Barnett, R. Schmidt, K. Karrigan, L. Yamagata-Lynch, and C. Johnson, (2001): Virtual solar system project: Learning through a technology-rich, inquiry-based, participatory learning environment. J. Sci. Ed. and Techn. 9(1), 7-25.

Bennet, J. O. (1999), Strategies for teaching astronomy. Mercury, vol. 28, 6, 24-31.

Bliss, J. and J. Ogborn, (1989), Tools for exploratory learning. Journal of Computer assisted Learning, 5(1), 37-50.

Comins, N. F. (1993), Misconceptions about astronomy: their origins. In Proc. of the 3rd Inter. Sem. on Misconceptions in Sci. and Math., edited by Novak, J. D., Cornell University.

DeLaughter, J. E., S. Stein, C. A. Stein and K. R. Bain, (1998), Preconceptions abound among students in an introductory earth science course. EOS, vol. 79, 36, 429-431.

Feuerstein, R., Rand, Y. and Rynders, J.E. (1988), Don't accept me as I am - Helping "Retarded" People to Excel, New York: Plenum.

Feuerstein, R. (1998), The human being as a changing entity. Tel-Aviv Broadcasted University (in Hebrew).

Gazit, E., and Chen, D.(2000). "A Virtual Journey through the Solar Systen" Learning Basic Astronomical Phenomena by Using Virtual Reality Technology: A Case Study, preliminary results. Proceedings of the 12th Scientific Conference of the Israeli Association for Research on Education, Tel-Aviv, Israel, 303-308.(in Hebrew).

Goforth, D. (1994). Learner control = decision making + information: a model and meta-analysis. Journal of Educational Computing Research, 11(1), 1-26.

Harper, B., D. Squires an A. McDougall, (2000), Constructivist simulations: a new design paradigm. Jour. Edu Multimedia and Hypermedia, 9 (2), 115-130.

Lanciano, N.(1999). Teaching and Learning Astronomy at the Elementary School Level. In: New Trends in Astronomy Teaching, edited by Gouguenheim, McNally and Percy, (pp. 133-138). Cambridge University Press.

Miller, R. and W. K. Hartman (1993), The Grand Tour – a traveler's guide to the solar system. 208 pp, Workman publishing, New-York.

Mohler, J. L., (2000), Desktop virtual reality for the enhancement of visualization skills. Jour. Edu. Multimedia and Hypermedia 9 (2), 151-165.

Nussbaum, J. (1985), "The Earth as a cosmic body," in R. Driver, E. Guesne and A. Tiberghien (Eds.), (Chapter 9) Children's Ideas in Science, Open University Press, Milton Keynes.

Perrig, W. and Kintsch, W. (1985). "Prepositional and situational representations of text". Journal of Memory and Language, 24, 503 – 518.

Gilbert J. K. and M. Reiner, (2000). Thought experiments in science education: Potential and current realization, Int. J. Sci. Educ. 22(3), 265-283.

Scardamalia, M., Bereuter, C., McLean, R. Swallow, J. and Woodruff, E. (1989), Computer supported intentional learning environments. Journal of Educational Computing Research, 5, 51-68.

Schur, Y. (1998), A Thinking Journey to the Moon, (in Hebrew), 216 pp, Ma'alot Press, Jerusalem .

Schur, Y., R. Brandt and Y. Yair (2002), A thinking Journey to Mars, 155 pp, Center for Educational Technology, Tel-Aviv.

Shapiro, C. WHITNEY P.Sadler, M. Schneps,, and I (1988). A private Universe (videotape), Harvard-Smithsonian Center for Astrophysics, Science Education Dept., Science Media Group.

Yair, Y., R. Mintz and S. Litvak, (1997), Touch the Sky, Touch the Universe. A multimedia-based astronomy encyclopedia, CD-ROM, Center for Educational Technology, Tel-Aviv.

Yair, Y., R. Mintz and S. Litvak, (2001), 3D Virtual Reality in Science Education: An Implication for Astronomy Teaching. Jour. Edu. Multimedia and Hypermedia, 20 (3), 293-305.

List of Figures

Figure 1

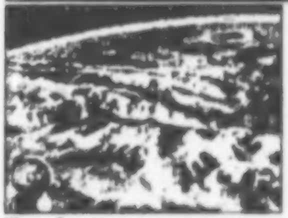


Figure 2

BEST COPY AVAILABLE

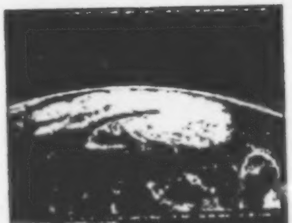


Figure 3

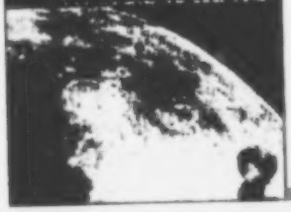


Figure 4

Figure Captions

Figure 1 – The planet Mars and its moons with the constellations and the Milky Way in the background. The virtual solar system displays orbital lines and numerical information, as well as navigational tools (bottom left).

Figure 2 – An oblique view of the great Valles Marineris on Mars. The extreme close-up and fly-over capabilities allow the student to observe planetary surfaces in great detail.

Figure 3 – The Martian northern polar cap. By observing similar features on Mars and earth, students can relate the two planets and discuss common aspects, such as the availability of water and the existence of life forms.

Figure 4 – The lunar craters as observed from an altitude of 500 km. The user can alter his point-of-view at will, and study the morphology of geological features.

Evaluation and Implementation of a Networked Multiple-Choice Question-Posing and Peer Assessment Learning System

Fu-Yun Yu
Graduate Institute of Education
National Cheng-Kung University
Republic of China, Taiwan
fuyun@mail.ncku.edu.tw

Abstract: A web-based question-posing and peer assessment learning system was developed to facilitate multiple-choice item developing peer-assessing, item-viewing and drill-and-practice learning activities. The rationale for the development of the system was described, followed by a preliminary study evaluating student motivation and factors influencing student use of the system. Questionnaires and students' written responses to open-ended questions revealed that via embedding different sources of motivation the system helps cultivatinga motivational learning environment for participants Based on the obtained data guidelines pertaining to instructional implementation were offered.

Introduction

Currently, as computer and telecommunication technologies converge, web-based learning systems are getting popularity and presenting themselves as a promising learning environment for the 21st century. In addition to many of the distinct features that are frequently associated with computers, for instance, immense storage space, high processing speed, multimedia appealingness, learner control, instant and personalized feedback, and multiple-branching capabilities, etc. (Alessi & Trollip, 2001; Heinich, Molenda, Russell & Smaldino, 2002), there are several extra-advantages to have learning activities implemented via Internet. First and foremost, being web-based means that the system is not tied to particular computer architectures or bound to a specific operation system. In other words, web-based learning system is less device-independent (Kahn, 1997). Secondly, the fact that information and resources can be accessed by anyone from anywhere at anytime as long as he or she has a computer with an Internet connection permits global accessibility. Without time and place restriction web-based environments help promote worldwide connectivity and collaboration. Via such interactions multiple perspectives and expertise can be shared and attained more conveniently (Kearsley, 2001). Thirdly, updating, maintenance and management of databases are easy as materials and users' database are stored at the server site (Zhang, Cooley & Ni, 2001).

In view of web's inviting features and its potentials for active learning, a networked domain-independent learning system, named Question-Posing and Peer Assessment (hereinafter named QPPA) was developed in 2001. In general, QPPA allows multiple-choice item constructing, peer-assessing, item-viewing and drill-and-practice for participants for all educational levels for various subject matters in a more instantaneous, anonymous, convenient and environmentally friendlier way. Specifically, with the support of Web technology all items generated by students can be assessed and viewed at individuals' discretion at the very moment the item is submitted. It reduces delay and paper expenditure, and avoids the hassles of collecting, shoveling and re-disseminating items among students as if done traditionally. Besides, without revealing who the question constructors and assessors are, web-based question-posing is less inhibitive and objective assessment among peers would be more easily ensured

In the following section, an overview of the various functions in QPPA is introduced first. As researchers suggested that engaging in the process of questioning is conducive to student motivation (Balajthy, 1984; English, 1998), a study set out to evaluate the motivational value of the system was described next. Moreover, factors influencing student use of the system were examined to help instructors implement such system in classrooms. Finally, instructional suggestions for classroom implementation are presented.

Overview of the QPPA Learning Environment

Mainly, QPPA is comprised of four functions. "*Question-posing*" allows students to contribute to multiple-choice item construction by providing a stem, the correct answer, and three distractors. All items constructed by students are kept in a temporary item bank database.

"*Peer-assessment*" intends to further learning via, from assessors' point of view, critically evaluating others' works, and, from question constructors' point of view, adapting and synthesizing comments given by their peers. Once deciding which item to assess from the "listing of questions" window, students can give their feedback in the "assessment form" window. Some frequently made mistakes in multiple-choice test construction, such as, the stem is not presently clearly, the stem is not in its simplest form, include unnecessary repetition of material in the options, more than one correct answer, distractors are not plausible enough, etc., along with suggestion for revising are provided through a pull down menu in the assessment form window. This intends to, on one hand, act as a set of criteria for objective peer assessment, and, on the other hand, a scaffolding device for writing better multiple-choice items. Students can also type in their suggestions to the item being assessed, and then by the assessor's discretion be sent directly to the original question-poser for reference for further revisions. To control the quality of each and every item constructed by students, a peer assessment process by at least five assessors and with at least half of the assessors rated the question as acceptable was set as the criterion for transferring questions from the temporary item bank database to the formal item bank database

"*Item -viewing*" provides an observational learning opportunity for students to learn from each other by observing items constructed by others as well as the comments/suggestions given by assessors.

"*Drill-and-practice*" allow students to choose the exact number of questions for drill-and-practice exercises. After answering, feedback as to how many questions answered correctly and a review button, which permits further reviewing and learning, was provided.

Beside these four main functions, some additional features were included in QPPA to increase its intrinsic motivational appealingness to users. For instance, Edu-dollars, which, in essence, is a virtual currency, and is accumulated by engaging in different functions in the system; six different ranking lists, that is, players who accumulated the most Edu-dollars, players who contributed the most questions, players who assessed the most questions, players who answered the most questions correctly in drill-and-practice, players whose questions were viewed by most participants, players who spent most time on-line; and statistics summaries on individual and class average performance in the system. Overall, by engaging students in the actual process of writing multiple-choice items and embedding various motivational enhancement features, the system intends to provide students with a motivating learning experience. A preliminary study examining the system's motivational value and factors influencing student use of the system is described in the following section.

Preliminary Study

Participants & the Learning Environment

Two classes of six-grade students (N=52) from one primary school in the southern part of Taiwan participated in the study. Students participated in the study for six instructional sessions. In these sessions, students used the system as an extra-curricular learning activity for mathematics, natural science and social science. Prior to interacting with the system an orientation session on the features and operating procedures of QPPA was arranged for all participating students.

Measurement Instruments

A post-session self-report questionnaire was disseminated to students to be completed individually. The questionnaire consisted two parts. The first part measures student "Motivation toward the Learning Experience." Hung's "Learning Experience Scale" were adopted and adapted to make the items better fit the learning situation and target population involved (Hung, 2001). In total nine Likert scale items were included and rated on a five-part discrete scale, with corresponding verbal descriptions ranging from "strongly disagree" through "disagree," "no-opinion," "agree," to "strongly agree." To counteract possible response-set tendencies, both positive and negative statements were included. Sample questions included, "*After initial contact, I frequently thought of using the system again; the system grabbed my attention at first, but did not sustain my attention for long.*" The internal consistency reliability (coefficient alpha) for the scale was 0.70.

The second part of the questionnaire solicits student opinions on system's usability under different conditions. Three questions were included—(1) Constructing questions for which of the following subject matters (i.e., mathematics, natural science, social studies, etc.) is most difficult (mark only one), and in what way; (2) Constructing questions for which of the following subject matters is the easiest (mark only one), and in what way; (3) Your overall reaction and suggestions to the system.

Results on Student Motivation Toward the Learning Experience

After tallies on the negative statements on the scales were reversed, it was found that at an average 66.62% participants felt "agree" or "strongly agree" to statements on the motivation scale. Overall, students rated favorably on the system's motivational value. Student written responses to the open-ended question (i.e., your overall reaction and suggestions to the system) gives clues as to the system's motivational value to the users—"*Constructing questions gives me a sense of achievement; engaging in this kind of learning activity is fun and helps me learn along the way; I hope more subjects can adopt the system to support learning; I like the system because it helps me think more critically; by constructing and assessing questions, I can help others learn better; quizzing each other via the system is fun, exciting and less threatening; I can challenge other's thinking and reasoning; ranking lists make learning more rewarding and satisfying; a larger chance of winning is provided via the various kinds of ranking lists available,* etc."

Analysis of the aforementioned statements suggested that the sources of motivation might be from a sense of achievement, pure entertainment, altruism, sense of security, challenging other's existing knowledge, feeling of satisfaction, and sense of confidence, etc. Via embedding an array of sources of motivation within the system to satisfy people various motivation, it seems that QPPA provides a motivational learning environment and experience for participants.

Results on the Use of the System For Different Content Areas

Data from student opinions on the system's usability under different conditions indicated that among mathematics, natural science, and social science, 55.8% students felt that constructing questions for mathematics was the most difficult one whereas 40.4% students thought constructing questions for natural science was the easiest one (See Table 1 for details). A one-group chi-squared test was followed to test statistical significance. Though it did not yield a statistically significant level of .05 for the easiest (chi-square = 1.529, df = 2, $p > .05$), a one-group chi-squared test showed a statistically significant difference for the most difficulty one (chi-square = 268.67, df = 2. $p < .0005$).

Different Subjects	The Easiest	Most Difficult
	N (%)	N (%)
Mathematics	14 (26.9%)	29 (55.8%)
Natural Science	21 (40.4%)	6 (11.5%)
Social Science	16 (30.8%)	15 (28.8%)
Total	51 (98.1%)	50 (96.2%)

Table 1: Student Opinion Toward Usability of QPPA for Different Subjects

Constant comparative method was used on the 82 entries from student written responses to the two open-ended questions to provide explanations for the observed phenomenon (i.e., using QPPA for which of the following subject matters is most difficult and in what way; using QPPA for which of the following subject matters is the easiest and in what way). Based on the data analysis, it indicated that several factors influencing the learning activity, especially multiple-choice items development. These include: typing skills and speed, availability of instructional materials and supplementary learning resources, availability of sample test items, individual capability in the subject matter, the complexity and difficulty of the subject matter, computer literacy, and Chinese phonics. For instance, students mentioned that *"Constructing questions for natural science is easiest because many references with sample test items available," "Constructing questions for math is most difficult partly because there are a lot of numbers and symbols involved, and mainly due to the fact that you need to completely understand the principle in the instructional materials," "Math is difficult and harder to apprehend, comparing to other subjects," "Posing arithmetic story problems is hard," "I am good at natural science," "It is hard to come up with plausible options for social science content, and usually there are a lot of typing involved,"* etc.

Conclusions

With the advent of networking and multimedia technologies, the emphasis on technology-based education of all kinds for the support of student learning has been the focus of contemporary education. In the present study a networked system enabling students to contribute to multiplo-choice item development, which, in turns, are evaluated, viewed and practiced, was launched in 2001. Via containing different sources of motivation as suggested by motivational theorists the system tended to cultivate a motivating learning environment for participants. Moreover, several factors influence the learning activity, especially item development. Based on the obtained data guidelines pertaining to instructional implementation were offered.

To support question-posing learning task, instructors might want to provide additional instructional scaffolding mechanism for different subject matters during the activity. Specifically, in additional to references and sample questions, orientation training sessions on question-posing strategies, such as, sentence analysis, use of exam clue words, model higher-level questions, base exercises on a hierarchy of comprehension levels, etc., as suggested by Balajthy (1984), may help question construction exercise more manageable and meaningful. Besides, tutorial sessions for special symbols key-in, for instance, operators for addition, subtraction, multiplication, division, equation, power, and fraction, etc. for mathematics, would be indispensable particularly for younger learners whose typing skills, computer skills and phonics for Chinese spelling capability is limited.

References

Alessi, S. M., & Trollip, S. R. (2001). *Multimedia for learning: methods and development.* 3rd ed. Boston, MA: Allyn and Bacon

Balajthy, E. (1984). Using student-constructed questions to encourage active reading. *Journal of Reading,* 27 (5), 408-411.

English, L. D. (1998). Children's problem posing within formal and in formal context. *Journal for Research in Mathematics Education,* 29 (1), 83-106.

Heinich, R., Molenda, M., Russell, J. D. & Smaldino, S. E. (2002). *Instructional media and technologies for learning.* 7th. ed. Prentice Hall Merrill Education.

Hung, M. H. (2001). *The Effects of sub-titles and Captions on Foreign Language Learning.* Unpublished Master's thesis. Graduate Institute of Education, National Cheng Kung University.

Khan, B. H. (1997). Web-based instruction (WBI): What is it and why is it? In B. H. Khan (Ed). *Web-based instruction.* Englewood Cliffs, NJ: Educational Technology Publications. p. 5-18.

Kearsley, G.. (2001). *Online education: learning and teaching in cyberspace.* Wadsworth.

Zhang, J. Cooley, D. H., Ni, Y. (2001). NetTest: An integrated web-based test tool. *International Journal of Educational Telecommunications,* 7 (1), 33-35.

Acknowledgements

This project is funded by the Ministry of Education of the Republic of China: Learning Technology, Active Social Learning and its Applications from Taiwan to the World," sub-project: "A Synchronous Competitive Educational Game" (Project No. 89-H-FA07-1-4). Thanks are extended to Chia-Chung Yeh for his assistance in revising the system and Chung-Chi Hung for implementing the study.

Impacts of the Anonymity Feature of Networked Synchronized Competition on Motivation and Interpersonal Relationships

Fu-Yun Yu
Graduate Institute of Education
National Cheng-Kung University
Republic of China, Taiwan
fuyun@mail.ncku.edu.tw

Yu-Hsin Liu
Department of Civil Engineering
National Chi-Nan University
Republic of China, Taiwan
yuhsin@ncnu.edu.tw

Chialing Han
Graduate Institute of Education
National Cheng-Kung University
Republic of China, Taiwan
hc122382@ms39.hinet.net

Tak-Wai Chan
Department of Computer Science and Information Engineering
National Central University
chan@src.ncu.edu.tw

Abstract: The present study investigated the impacts of the anonymity feature of networked synchronized competition on students' continuing motivation and interpersonal relationship. Two classes of fourth-graders (N=68) participated in the study for three instructional sessions. A synchronous competitive gaming system was devised to have each pair of students compete answering multiple-choice questions with another randomly assigned pair of students. Data analyzed using independent samples t-test for each of the dependent variables yielded that there is a significant difference between different treatment conditions in motivation ($p = .047$); however, no significant differences were found in student perceptions toward their opponents. In view of the preliminary nature of this study, future research in related areas to extend the scope and extent of the generalizability of the present study are proposed.

Introduction

Competition has been suggested as a means of enhancing the motivational appealness of educational activities, and as a way to foster learner involvement and excitement in the activity (Butler & Kedar, 1990; Malone & Lepper, 1987). Adding an element of competition between individuals or groups is widely believed to be a motivational-enrichment strategy in play, work, and education (Deci, Betley, Kahle, Abrams & Porac, 1981; Malone & Lepper, 1987). Despite the fact that competition is often considered as an effective technique to motivate people to learn and excel, the adversary effects that competition may have on learning have provoked discussion and concerns. While empirical bases suggest that competition may have detrimental effects on learning (Nicholls, 1983; Pepitone, 1980; Stipek, 1988), past studies were primarily conducted in traditional classrooms involving face-to-face situations. Anonymous real-time group competition and their associated effects were out of academic research arena till the advent of networking technologies. Gleaned from social-psychological research that anonymity leads to deindividuation; that is, individuals may act as if they are submerged in the group (Diener, Fraser, Beaman & Kelem, 1976; Gergen, Gergen & Barton, 1973). Though this line of research suggests that anonymity contributes to deindividuation, the effects of loss of identification within synchronized competitive learning environment have yet to be explored. Thus, the present study set out to examine the effects of the anonymity feature of computerized synchronized team competition on some of the educational outcomes that have caused concerns among educators and researchers in the past, that is, competition's effects on students' continuing motivation and interpersonal relationship among competing groups.

A number of questions can be examined within this context. First, will the added feature of anonymity enhance students' continuing motivation toward the computerized competitive educational activities? Malone and Lepper (1987) suggested that there are four primary sources of intrinsic motivation that an activity may provide an individual. The one that is most relevant to anonymity of opponents in competitive learning environments is the construct of challenge. Malone and Lepper (1987) suggested that the optimal challenging activity is one whose attainment is uncertain. As participants in the anonymity condition don't know whom they are competing with within the learning system, it introduces additional source of intrinsic motivation—challenge, due to uncertainty of success. Whether this added feature of anonymity in networked synchronized competition would enhance its motivational appealingness to participants via increasing uncertainty of success is examined in the study.

Second, nonverbal cues, such as gestures and facial expressions, are easily emitted in face-to-face situations. Will such emotions and/or reactions, which are more commonly aroused and detected in face-to-face team competition, for instance, uneasiness, impatience, aversion, resentfulness, and feeling of agitated, etc., contribute to more negative perceptions toward opponents, as compared to anonymity team competition? Or, conversely, anonymity has been shown in social psychological research to lead to deviant, harmful, and socially undesirable behaviors due to losses of sense of self-awareness and individual accountability (Festinger, Pepitone & Newcomb, 1952; Gergen, Gergen & Barton, 1973). Will such anti-social behaviors manifest themselves within anonymity competitive learning situations to an extent that lead to less favorable perceptions toward their opponents as compared to face-to-face team competition?

In sum, two research hypotheses are proposed.

1. There will be significant differences in student continuing motivation of the learning task between students assigned to the anonymity team competition condition and those assigned to the face-to-face team competition situation.

2. There will be significant differences in student interpersonal relationship between students assigned totwo different treatment conditions.

Methods

A total of 68 fourth-graders (ages 10-11) from one primary school in the southern part of Taiwan participated in the study. All students in the participating school had been taking computer literacy classes for almost two years, and possessed a fundamental krowledge of computer hardware and software operations.

A synchronous computerized competitive gaming system, calledJoyce, was devised for the purpose of the study. Joyce withits origin dated back from 1972, in essence, adopts a board-game format that allows learners practice answering multiple-choice questions with competing opponents simultaneously via network or in a face-to-face situation (Yu, Chang, Wang, Han, Chan & Liu, 2001).

To compare the differential effects of face-to-face and anonymous real-time team competition on student motivation and interpersonal relationships, two competition modes were derived in the study. In Treatment A (the face-to-face team competition condition), pairs of students competed with their randomly assigned opponents, who were sitting next to them for the duration of the activity. In Treatment B (the anonymity team competition condition), pairs of students also competed with their randomly assigned opponents. However, in Treatment B, competing teams did not know against whom in the class they are competing because pseudonyms instead of real names were used during the interaction. In Treatment B, pseudonyms were randomly selected from a list by each dyad and used to log in the system for the duration of the activity.

In the present study, students participated in three instructional sessions for three consecutive weeks. In the first session, ground rules for participating in the activity, including "Be on time," "Stay in your seats," and "Raise hands before posting questions," and the purpose of the learning activity were announced and explained. Various features and the operating procedures of the learning environment were introduced and demonstrated before having students compete answering social science questions with their randomly assigned opponents. At the beginning of the second session, the ground rules and procedures for running Joycewere reviewed before having students compete answering natural science questions on the system with their randomly re-assigned opponents on computers. At the beginning the third session, before having pairs of students compete with their randomly re-assigned opponents on social science and natural science questions, the teacher quickly reviewed the basic procedures involved in operating Joyce. Students were given a questionnaire to be completed individually afterwards

A post-session self-report questionnaire was disseminated to students to be completed individually. The questionnaire consisted of two 5-point Likert scales. They are "Student Continuing Motivation Scale" and "Student Perceptions of Opponents Scale." Ten statements were included to test students' continuing motivation toward the learning task. Sample items included, "*I frequently think of playing the game after the first instructional session; I wish I can participate in this kind of activity again in the future, etc.*" 16 items with high evaluative content were included to test the hypothesis relevant to student perceptions of their opponents. Sample items included, "*My opponents are slow responders; My opponents make me nervous; Interacting with my opponents is an unpleasant learning experience for me, etc.*"

Results & Discussion

The means and standard deviation (SD) values for each of the dependent variables are listed in Table 1. The results showed that students in the anonymity condition tended to have higher mean scores than those in the face-to-face team competition condition on both of the sub-scales.

	Face-to-Face Team Competition (N=34) M, SD	Anonymous Team Competition (N=34) M, SD
Motivation	40.2647, 8.6701	43.9706, 6.2401
Perceptual Impressions of Opponents	54.2647, 11.0736	57.5000, 9.6836

Table 1: Descriptive Statistics of Face-to-Face vs. Anonymous Team Competition on Interpersonal Relationship and Motivation

Collected data were analyzed using independent samples t-test on each of the dependent variables. Results from t-test showed that there is a statistically significant difference between the two treatment conditions in student motivation, t (1, 66) =2.023, p = .047. However, data analysis did not show statistically significant differences between the two treatment conditions in student perceptual impressions of their opponents, t (1, 66) = 1.282, p = .204. The obtained results of the two treatment conditions on each of the dependent variables are discussed separately in the following sections.

Motivation

Based on Malone & Lepper's theory on intrinsic motivation, the present study conjectured that adding the feature of anonymity might increase the intrinsic motivational value of the competitive learning activity via increasing its challenge level originating from uncertainty of success. The results of the present study provided empirical evidence supporting our hypothesis that suppressing opponent's identify during synchronized computerized team competition promotes students' continuing motivation of the learning task. Students in the anonymity condition tended to be more willingly to engage in similar kinds of learning activities in the future as compared to the face-to-face condition. Anonymity condition in the study seemed to be more facilitative of continuing motivation due to the added ingredient of uncertainty of success and the fun and suspense of not knowing who the opponent is while participating in the activity.

Interpersonal Relationship

Though students in the face-to-face team competition rated their opponents less favorable than those in the anonymity condition in the present study, the obtained data, however, did not yield statistically significant differential effects in subject perceptions toward their competitors. Observations during the experiment indicated that by engaging actively in the gaming system, which is filled with numerous intrinsic motivating features, students in neither face-to-face nor anonymous competitive learning situations displayed the kind of defensive or aggressive behaviors toward their opponents as warned by social psychological or mass communications researchers. As no aversive behaviors directed at opponents were exhibited during the interaction, it did not have a negative effect on interpersonal relationship.

Conclusions

The present study set out to examine the feature of anonymity within a computerized competitive learning environment on students' motivation and interpersonal relationship. The obtained datafrom the present study tended to lean toward the position that to enhance students' continuing motivation of the learning task networked team competition where opponents were not identified (i.e., anonymous) might be a more preferable instructional strategy to adopt, rather than a face-to-face team competition approach. In view of the preliminary nature of the present study, it is tentative at best to recommend that designers of competitive game-based learning systems include the feature of anonymity in their system to support student learning.

It is clear that much more research in this area is needed to extend the scope and extent of the generalizability of present study. As the present study employed fourth-graders who were engaging in multiple-choice questions answering activity for three instructional sessions, future studies with longer duration of experimental time, different age groups, and interaction tasks should be research priority. Moreover, the present study involved pairs of dyads competing in objective-type question-answering practice. As group process in larger group sizes are more complex than dyadic ones while engaged in problem-solving questions, further studies involving team competition of various group size and different question types might make finer distinction so as to make practical recommendations regarding the particular situations in which anonymity could be used for the enhancement of learning outcomes.

References

Butler, R., & Kedar, A. (1990). Effects of intergroup competition and school philosophy on student perceptions, group processes, and performance. *Contemporary Educational Psychology, 15*(4), 301-318.

Deci, E.L., Betley, G. , Kahle, J., Abrams, L., & Porac, J. (1981). When trying to win: competition and intrinsic motivation. *Personality and Social Psychology Bulletin, 7*, 79-83.

Diener, E. Fraser, S.C. Beaman, A.L., & Kelem, R.T. (1976). Effects of deindividuation variables on stealing among Halloween trick-or-treaters. *Journal of Personality and Social Psychology, 33*, 178-183.

Festinger, L., Pepitone, A., & Newcomb, T. (1952). Some consequences of deindividuation in a group. *Journal of Abnormal and Social Psychology, 47*, 382-389.

Gergen, K.J., Gergen, M.M., & Barton, W.N. (1973). Deviance in the dark. *Psychology Today, 7* (5), 129-130.

Malone, T.W., & Lepper, M.R. (1987). Making learning fun: a taxonomy of intrinsic motivations for learning. In R.E. Snow, & M.J. Farr, (Eds.), *Aptitude, learning, and instruction: Cognitive and Affective Process Analyses (Vol. 3)*. Hillsdale, NJ: Erlbaum.

Nicholls, J. (1983). Conceptions of ability and achievement motivation: a theory and its implications for education. In S.G.. Paris, G..M. Olson, & H.W. Stevenson (Eds.), *Learning and motivation in the classroom* (pp. 211-237). Hillsdale, NJ: Erlbaum.

Pepitone, E.A.(1980). *Children in cooperation and competition*. Lexington, Mass.: Lexingtonbooks, 118-119.

Stipek, D. (1988). *Motivation to learn: from theory to practice*. Englewood Cliffs: NJ: Prentice-Hall.

Williams, E. (1977). Experimental comparisons of face-to-face and mediated communication: A review. *Psychological bulletin, 84*(5), 963-976.

Yu, F.Y., Chang L.J., Wang C.T., Han, C., Chan T.W., & Liu, Y.H. (2001). Student Preference and Satisfaction Toward Network and Face-to-Face Computerized Competitive Learning Environments. *Proceeding of the International Conference on Computers in Education*, 53-60.

Acknowledgements

This project is funded by the Ministry of Education: Learning Technology, Active Social Learning and its Applications, from Taiwan to the World, sub-project: "A Synchronous Competitive Educational Game." (Project No. 89-H-FA07-1-4) Thanks are extended to Chung-Chi Hung, Chia-Wen Chen, and Hsin-Fu Wang for their assistance while conducting the experiment. Finally, special thanks are extended to Chin-Tau Wang and Li-Jie Chang at the department of Computer Science and Information Engineering in National Central University for their efforts in revising the system to better fit the needs of the study.

Developing Adaptive Hypermedia using an Extended Hierarchical Mixtures of Experts Approach

Jeong-Su Yu*
*Department of Computer Education
Jeonju National University of Education
E-mail Address: jsyu@jnue.ac.kr
Tel: 82-63-2817157

Abstract

To cope with the increasing demand on educational opportunities in web-based educational environment, various intelligent tutoring systems are developed. These tutoring systems engage the students in learning by doing. To make the systems even more beneficial and adaptive to the student needs. This paper presents the neural network model for Web-based adaptive learning. The developing model is based on hierarchical mixtures of experts for regression and classification. Courses are adapted to students by taking into account their own features(such as background knowledge of the learner) along with the actions performed by them during the learning process. The proposed approach allows generating the content of a hypermedia page from pieces of educational material based on a goal-oriented way of teaching. We show a possible solution, which we have used for course of the primary school about computer education. We then discuss this solution as well as advantages and problems, and identify several research issues, which have still to be solved for adapting course materials

Keywords

Adaptive hypermedia, Parallel Mean Field Annealing, Hierarchical Mixtures of Experts, Electronic-Textbook, Intelligent Tutoring System

1. Introduction

Recently, hypermedia systems have become more and more popular as tools for user driven access to information. Hypermedia systems used for learning generally offer no constraint on the user. Proponents of hypermedia argue that a student should able to learning using methods that suit them. Adaptive hypermedia systems engage a larger number of interactions without the help of an adapter to change their state or behaviors. An important characteristic of an adaptive hypermedia system in order to succeed to its educational potential is the opportunities it offers for individualized learning.

The introduction of adaptivity into the hypermedia systems aims at providing the system with the ability to change dynamically according to the changing learner's needs and learning level[3,4]. It would be very helpful to have different contents for different types of learners, for students with different interests and

---

This study was granted by the research project the Jeonju National University of Education

different initial knowledge on the topic. To make a step in this direction, we propose a neural network approach to implement different contents and contents sequencing. Also, we propose realization of an adaptation component for an open, adaptive hypermedia system, which, on the other hand, enables integration, and adaptation of learning material found in the WWW. The proposed model is useful in dealing with the problem of extracting information about the students.

2. Approache to implement adaptivity in educational hypermedia

Our aims are to facilitate hypermedia systems with ability to adapt to their students' needs as they progress through the systems. To this end we have developed a prototype hypermedia shell, which provides a combination of knowledge-based representations and an extended hierarchical mixtures of experts(eHME) approach. Figure 1 demonstrates the architecture of the proposed approach.

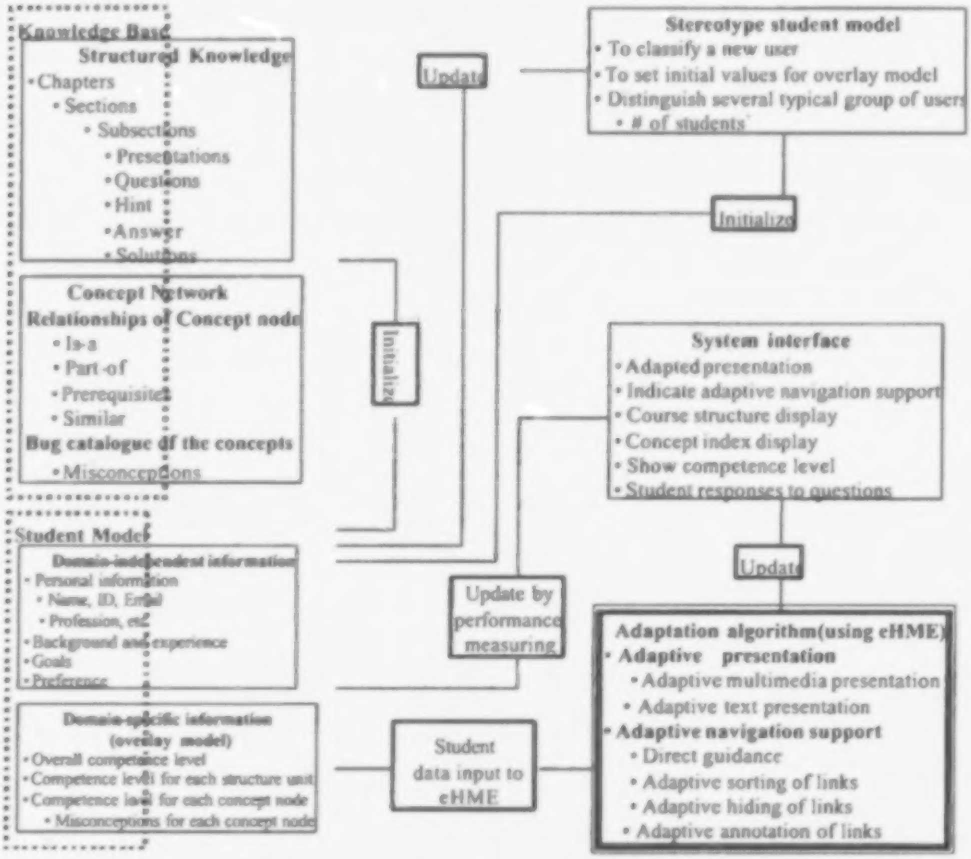

Knowledge Base
Structured Knowledge
• Chapters
• Sections
• Subsections
• Presentations
• Questions
• Hint
• Answer
• Solutions
Concept Network
Relationships of Concept node
• Is-a
• Part-of
• Prerequisites
• Similar
Bug catalogue of the concepts
• Misconceptions
Student Model
Domain-independent information
• Personal information
• Name, ID, Email
• Profession, etc
• Background and experience
• Goals
• Preference
Domain-specific information (overlay model)
• Overall competence level
• Competence level for each structure unit
• Competence level for each concept node
• Misconceptions for each concept node
Updat
Initializ
Stereotype student model
• To classify a new user
• To set initial values for overlay model
• Distinguish several typical group of user
• # of students
Initializ
System interface
• Adapted presentation
• Indicate adaptive navigation support
• Course structure display
• Concept index display
• Show competence level
• Student responses to questions
Updat
Update by performance measuring
Student data input to eHME
Adaptation algorithm(using eHME)
• Adaptive presentation
• Adaptive multimedia presentation
• Adaptive text presentation
• Adaptive navigation support
• Direct guidance
• Adaptive sorting of links
• Adaptive hiding of links
• Adaptive annotation of links

Figure 1. Approach of the adaptive educational hypermedia

The structure of the knowledge domain is represented as a bayesian network of domain concepts. In this paper, we focused on the adaptive learning presentation approach, which is usually realized using eHME. We construct dependency graph for the knowledge items that describe the computer literacy education in the Primary school. The dependency graph is the neighboring graph of the partial ordering < of the set of knowledge items. The proposed network is as figure 2. The domain knowledge structure is based on a concept level hierarchy where all the concepts are identical and are the connected with prerequisite relations. Each concept takes values from 0 to 1.0. It consists of a series of expert networks, which are trained on different parts of the educational materials (text, multimedia data, etc). The first layer is organized in classes, such as text, multimedia date, examples, simulations, exercises and so on. Weights connecting the internal layer and the final layer are connected to several classes of educational material. The educational material is then joined under a predefined form of presentation to generate a course. The output of the experts are combined by a gating network which is trained to stochastically select the expert which is performing best at solving a particular part of the problem.

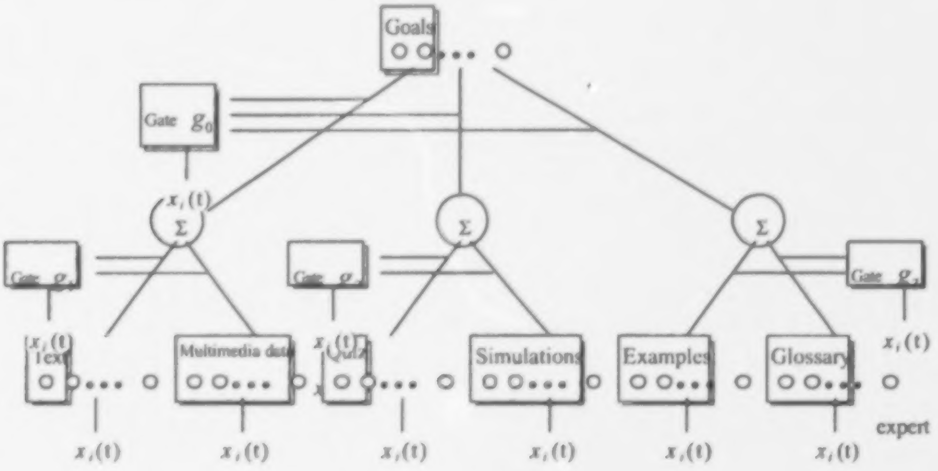


Figure 2: The structure of an eHME of the domain

Expert network(i,j) produces an output $\mu_{ij} = f(\theta_{ij}x)$, where θ_{ij} is a weight matrix and f is a softmax activation function. The gating networks also have a softmax output activation function. The top level gating network is the softmax function. The architecture operated synchronously: (a) it updated the stated of nodes simultaneously, and (b) all the nodes have the same input patterns during each iteration cycle. Patterns of relationships among internal layers implement different strategies of generating the content of the selected knowledge goal. The values of concepts are changed through the learning process as follows. The proposed network is trained using the modified EM algorithm. This algorithm consists of two steps: a propagation of posterior credits to each node in the model (the E step) and a maximization of a likelihood function weighted by the posterior credit of each node (the M step). Details of the EM algorithm can be founded in [1,2,8]. In this section, we describe the extended EM algorithm with annealing forthe proposed network. The proposed annealing algorithm is called parallel mean field annealing(PMFA). This annealing algorithm is modified mean field annealing. Mean Field Annealing(MFA) algorithm deals with binary discrete spaces.

The SA(simulated annealing) and PMFA algorithm are present to solve the M-step of the EM algorithm. One of the two algorithms, PMFA algorithm has not yet used by others for the prediction problems. The conventional mean field annealing algorithm deals with the binary, multiple state problems, and so that algorithm is not appropriate to apply to continuous state problems. The proposed PMFA algorithm can be applied to continuous state problems. It was successfully applied to solving the difficult optimization problem [5,6]. The proposed algorithm can be founded in [7]

3. Conclusion

The use of eHME approach to facilitate adaptation to the students in the learning process in an adaptive hypermedia system is a novel approach. The project is currently in its early stages. The results of experiment can be improved on learner's learning process by matching the lesson to their level of understanding and educational needs. We currently investigate techniques to enhance the generalization performance of our approach.

References

[1] M. I. Jordan and R. A. Jacobs, "Hierarchical mixture of experts and the EM algorithm," Neural Computation, 6:181-214, 1994.

[2] Tham, C. K., "On-line learning using hierarchical mixtures of experts," IEEE Conference on Artificial Neural Networks," pp347-351, 1995.

[3] Papanikolau, K.A., Magoulas, G.D., Grigoriadou M., A Connectionist Approach for Adaptive Lesson Presentation in a Distance Learning Course", Proc. of Int. Joint Conf. on Neural Networks, Washington, paper #679, 1999.

[4] Stathacopoulou, R., Mogoulas G.D., and Grigoriadou M., Neural Network-based fuzzy modeling of the learner in intelligent tutoring systems, Proc. of the Int'l Joint Conf. On Neural Networks, Washington, July 1999.

[5] Jeong Su Yu and Won Don Lee, "Parallel Mean Field Annealing Neural Network for Solving Traveling Salesman Problem," IJCNN, Vol. 4, pp532-536, 1992.

[6] Jeong Su Yu and Won Don Lee, "Application of Hierarchical Mixtures of Experts to Prediction of Precipitation Using a Continuous Mean Field Annealing EM Algorithm", Lecture Notes in Artificial Intelligence, 1585, Springer, 1999.

[7] Jeong Su Yu, "The Application of Neural Network Approach to Hypermedia ", Proc., of International Conference on Computers in Education, pp238-241, 2001.

[8] S. R. Waterhouse and A. J. Robinson, "Non-linear Prediction of Acoustic Vectors Using Hierarchical Mixtures of Experts," NIPS 7, pp835-842, 1995.

MULTIMEDIA APPLICATION
In Higher Education: Political Science

Online course http://www.yusisters.com/luc.htm

Keywords: eLearning, offline and online course, multimedia, higher education, political science, CDNet

YING YU

YU SISTERS MULTIMEDIA STUDIO
MONTREAL, CANADA
yingyu@yusisters.com

LUC DUHAMEL

DÉPARTMENT DE SCIENCE POLITIQUE
UNIVERSITÉ DE MONTRÉAL, CANADA
luc.duhamel@umontreal.ca

ABSTRACT

The paper is to open Prof. Luc Duhamel's eTEXTBOOK in big multimedia classroom;
It is to show the multimedia application in teaching of UNIVERSITÉ DE MONTRÉAL;
It is to explore a future to educational multimedia…

INTRODUCTION

YU SISTERS MULTIMEDIA STUDIO started to design and produce the interactive multimedia teaching coursewares for Prof. Luc Duhamel from December, 2001 to April, 2002 so that professor can submit his textbook to huge screen for 280 students in the 350 seats classroom by computer and multimedia projector, meantime, created the online course for professor and his students to interactive eLearning website and to explore a new way to success by Multimedia Assisted Instruction - CDNet = CDROM + WEBSITE. (CDNet is a combination of educational software CDROM and eLearning website)

RESEARCH & DEVELOPMENT

Prof. Luc Duhamel proposed to practise the interactive multimedia coursewares in order to improve classroom teaching, YU SISTERS MULTIMEDIA STUDIO assisted Prof. Luc Duhamel to co-research and develop the offline and online course project.

POL1008 - FORCES ET COMPORTEMENTS POLITIQUES is one general theory course of political science and the students come from different departments and programs that have been spread during the last decade and the number of students is increased significantly at least in social sciences. Furthermore, the students of the course have more and more different backgrounds. With such disparate group of students it has become harder for the professor to teach. How to overcome all these problems related to the first year course? Multimedia is improving the big classroom teaching. Another advantage to use multimedia is that we can produce CDROM for the students (instead of books). CDROM give the opportunity to make update every year. How to make the 280 freshmen understand basic and abstract concepts very well and refresh their memories? It is one great challenge to Today's teaching and learning.

YU SISTERS MULTIMEDIA STUDIO designed the interactive multimedia presentation for teacher's teaching and the online course website for student's learning. The coursewares are compiled by text, image, audio & video, animation, when we designed the topic "Medias & Political Science", we decided to link the CNN's webcast program"911-Attack at USA" to show the power of media, and unforgettable moment on the Internet, however, even though we tried many times, but when we clicked the video clip for the 280 students in class, we found the download speed by LAN cable web was still very slow, because of the tech limitation, "the world shock" lost its impact. The problem let us to consider how to guarantee quality and real-time effects in class? How to effectively use and develop the external website and internal website (WebCT)for teaching and learning? At first, we put the offline PowerPoint coursewares to external website http://www.yusisters.com/luc.htm so that students could review the course and get the useful info out of class. WebCT is the world's leading elearning system, it is an internal website, only the course instructor and his students could use it with passwords.

Some promoted info needs to be searched by search engine, some detailed coursewares need to be locked by WebCT, but how to take advance of the external website and internal website for learning? How to design offline and online coursewares for teaching? How to get the solutions? We are studying and practising. But the educational multimedia application in the university has helped Prof. Luc Duhamel's one blind girl-student, the handicapped student got the good points in the exam through multimedia courseware assisted instruction.

In the 2002 winter term we finished the title"FORCES ET COMPORTEMENTS POLITIQUES"(9 coursewares) and practised every courseware in multimedia classroom, 280 students from different departments evaluated the experiment and Prof. Luc Duhamel got the excited feedback and inspiration. Now let us focus on one courseware "MEDIAS & POLITICAL SCIENCE", because it is a new exploration in educational multimedia.

How to clearly show the relationship of Medias and Political Science to students?

YU SISTERS MULTIMEDIA STUDIO designed and produced the new radio program in French to broadcast "RADIO ADDRESS OF THE PRESIDENT", this is the most famous radio program in the broadcasting history.

The 32nd American President (1933 - 1945) Franklin Delano Roosevelt hosted the radio program "Fireside Chat" delivered from the White House, he made the White House as a warm home and he sounded like a FATHER sat near fireside to gently chat with his family members to submit his political strategies to his beloved motherland and people. On World War II, when the Japan attacked on Pearl Harbour in December 1941, Roosevelt secured a declaration of war against Japan with a stirring speech. In April of 1945, the president collapsed and died of a cerebral haemorrhage, just weeks before the German surrender...

The above is the best example that one president took advantage of mass media to broadcast his political ideas and policies from 1933 to 1944 by the radio program "Fireside Chat".

On Sept. 11, 2001 when terrorists suddenly attacked at USA, it was a world shock! The American President Bush hosted his television program in the CNN evening news

Good evening.

The pictures of airplanes flying into buildings, fires burning, huge structures collapsing, have filled us with disbelief, terrible sadness and a quiet, unyielding anger.

These acts of mass murder were intended to frighten our nation into chaos and retreat. But they have failed. Our country is strong. A great people have been moved to defend a great nation...

President Bush's television speech won the supports all over the country and around the world; America started its new war against terror.

Because UNIVERSITÉ DE MONTRÉAL is a French-speaking university, the produced radio and TV programs from USA need to be translated into French and to be re-produced according to the instructor's course content. Because CANADA is a bilingual country, the website's design is required to have the 2 v ersions: French & English so that YU SISTERS MULTIMEDIA STUDIO has to think of more works and problems in the future.

FUTURE

Etraffic Solutions Inc. & SIDES Online reported:

The Educational Multimedia:
- **2002: All teachers to be equipped and skilled in the use of the Internet & multimedia**
- **2003: All students to be digitally literate by the time they leave school**

The Education Market:
- **2025: 180 million learners globally**
- **2025: 30 – 80 million will be online**

The Issues & the Opportunities
- **Lack of quality educational content to date has deterred teachers and students (OECD)**
- **Inadequate professional development for teachers and administrators (Kerrey Report 2000)**
- **Lack of good content in online resources (OECD)**
- **Lack of interactive multimedia in online resources (OECD)**

The eLearning Market Services and Products
- **equipment, local networking, install, set-up, servicing**
- **Internet access**
- **operational software**
- **content: multimedia software, Internet applications, web applications**
- **technical support and training**

CONCLUSION

Prof. Luc Duhamel from UNIVERSITÉ DE MONTRÉAL collaborated with YU SISTERS MULTIMEDIA STUDIIO for multimedia courseware research and development, it is a start and trial.

UNIVERSITÉ DE MONTRÉAL has developed eLibrary (http://www.bib.umontreal.ca/) and open the world's leading elearning system - WebCT(http://www.coursenligne.umontreal.ca/) to all the teachers and students, over 500 courses have been created on WebCT since 1999. The web-based learning resource "eLibrary" and the web-based coursesupport system "WebCT" as well as the equipped multimedia classrooms in the UNIVERSITÉ DE MONTRÉAL are ready, but how to use them by all the teachers and students? The technical training will be a must. How to create the interactive multimedia courseware, design user interface and software for teaching?

YU SISTERS MULTIMEDIA STUDIO is exploring the offline teaching and online learning to higher education: to create CDROM for intelligent computer-assisted instruction in multimedia classrooms and to build the virtual universities websites for interactive distance education..

Welcome to Montreal - the international multimedia capital

Welcome to Multimedia city in downt own Montreal, Canada

Handheld Computing in Education

Steve Chi-Yin Yuen, Ph.D.
Department of Technology Education
The University of Southern Mississippi
United States
steve.yuen@usm.edu

Patrivan K. Yuen
I. E. Rouse Library
William Carey College
United States
pyuen@wmcarey.edu

Abstract: Handhelds or Personal Digital Assistants (PDAs) may just become the mobile computing technology that revolutionizes the face of learning. The intuitive interface, portability, and wealth of third-party software applications make the handheld an ideal educational tool to enhance instruction and learning in and out of the classroom. Educators are exploring ways in which the handheld computer can improve active learning in the classroom, and also provide students with valuable insights into real-world applications of handheld technology.

Introduction

Computers can be great learning tools when used effectively, but high costs have long hindered educators from providing each student with a desktop computer or laptop of their own. Some educators indicated that computers have not have a positive impact on teaching and learning because students and teachers have limited access to them and thus are not using them (Soloway et. al, 2001). Many educators have been exploring the less-expensive handheld option. Already common in the business world, handhelds or Personal Digital Assistants (PDAs) are just now being introduced into schools, with iPAQs by Compaq Computer Corporation, Jornadas by Hewlett-Packard Company, Palms by Palm Inc., and Visors by Handspring Inc. competing for the education turf. Today, handheld devices such as Palms and Pocket PCs are making technology accessible, affordable, and fun for teachers and students alike. More and more school officials believe that handheld computers, which are relatively inexpensive compared with laptops or desktop computers, are the best way to put a computer in the hands of each student. This is an important equity issue because handheld computing brings together the power of technology with the ease, convenience, and low cost of small portable devices, thereby offering a solution to access and equity issues.

Using Handhelds in Education

Handheld technologies are changing the way people access and work with information. These devices are becoming smaller, cheaper, better, and more connected. Educators are exploring ways to take advantage of these emerging technologies to encourage exploration, stimulate learning, and enhance lifelong learning. Handhelds give students full-time access to computation and wireless connectivity, while expanding where educational computing can take place to the home, field, and any places. Handhelds also could be used to assist students with special needs such as dyslexic and physically handicapped students.

Handheld devices function not only as a computer, but also as a textbook, media, calculator, calendar, notepad, and pencil. Students can use the devices to edit and revise their work. Handhelds also hold advantages over traditional computers with their ability to beam data from one device to another (Branigan, 2001). The infrared beaming capability offers opportunities for real-time student collaboration and allows users to "beam" word processing documents, spreadsheets, drawings, data, and even applications to each other without having to download and print out or send via e-mail. Students can beam questions and assignments to teachers or send parts of a project from their own handheld to other classmates.

Handhelds offer portability while at the same time packing enough computing power for writing, calculation, graphing data, data gathering and manipulation. They also can send and receive e-mail, access the Web, through a desktop, their own modem or wireless device. Some can even record your voice, play videos, display digital photos, drawings, or hold maps, city guides, or an electronic book.

Students can use handheld devices to gather, store, and retrieve important information. They can use handhelds to monitor their grades and keep track of their assignments and due dates. Students armed with a handheld can also take advantage of the plethora of software options including dictionaries, e-books, graphing calculators and more.

Handhelds offer simple, quick, inexpensive ways to communicate, teach and learn wherever you go. With a handheld, a teacher, student or administrator can take notes, calculate, sketch ideas, access the Internet wirelessly, collect data, access resources, manage school activities and courses and instantly beam information to others. Teachers and administrators can give PowerPoint presentations right from a handheld with the Presenter-to-Go module connected directly to a digital projector. Teachers can use handheld computers for personal management tasks and for teaming with others. They can share information and collaborate with administrators, other teachers, and students. In addition to the general applications for personal management, there are many educational applications for using handhelds in teaching and learning: course management, content delivery, assessment, communications, calculation, and research.

Advantages

Handhelds provide a feeling of true ownership. Although students can use computer lab or classroom desktop computers, they must share them with others. A handheld computer, on the other hand, can be a true "personal computer." Like desktop computers, handhelds can be transformed by adding different software or hardware. They can be used as scientific graphing calculators, digital cameras, notepads, cell phones, digital voice recorders, or scientific sensing devices. Their small size makes them easy to carry from class to class and from school to home, giving handhelds a major advantage over the desktop computers and laptops. This portability, combined with powerful data processing and versatility, makes handheld computers a significant educational tool. Many educators believe handheld computers will transform educational technology in schools. For as low as $100 each, students can have more computational power in the palms of their hands than ever. Handhelds offer more versatility than desktop computers and are much more portable than the laptop. In addition, many of the newest handheld models can be wirelessly networked, students can send and receive e-mail and surf the Web without having to "sync up" to a personal computer.

Problems

Despite the potentials of handhelds in education, some school districts see the problems of using handhelds in the classrooms. The handhelds are not universally enamored by educators. Among the major concerns are the theft risk, high cost, and the distraction resulting from the misuse by students. Handhelds can be a threat to classroom order and student integrity. Some schools have banned their use because some students use the handhelds to cheat on tests, play noneducational games, or e-mail friends inside or outside the school (Shields & Poftak, 2002). In addition, current handheld devices have many limitations: the computational power tends to be low, multimedia is problematic, writing extended documents via stylus-input is inefficient, and the screen is too small.

Conclusions

Today, handhelds such as Palms and Pocket PCs are making technology accessible, affordable, and fun for teachers and students alike. Handheld computers may just become the mobile computing technology that revolutionizes the face of learning. The intuitive interface, portability, and wealth of third-party software applications make the handhelds an ideal educational tool to enhance instruction and learning in and out of the classroom. Educators are exploring ways in which the handheld can improve active learning in the classroom, and also provide students with valuable insights into real-world applications of handheld technology. Handhelds give students full-time access to computation and wireless connectivity, while expanding where educational computing can take place to the home, field, and any places.

References

Branigan, C. (2001). Research team develops free ed software for handhelds. Retrieved July 26, 2002, from http://www.eschoolnews.com/news/showStory.cfm?ArticleID=2516

Shields, J. & Poftak, A. (2002). A report card on handheld computing. *Technology & Learning*, 22 (7), 24-36.

Soloway, E.,, Norris, C., Blumenfeld, P., Fishman, B., Krajcik, J., & Marx, R. (2001). Log on education: Handheld devices are ready-at-hand. *Communications of the ACM*, 44 (6), 15-20.

Museum Satellites: Web Spaces for Learning

Laura B. Zadoff
Communications, Computing and Technology
Teachers College, Columbia University
United States
lbz13@columbia.edu

Danielle E. Kaplan
Communications, Computing and Technology
Teachers College, Columbia University
United States
danielle.kaplan@columbia.edu

Stacey Hagreen
Communications, Computing and Technology
Teachers College, Columbia University
United States
sdh2002@columbia.edu

Abstract: This paper describes the pilot *Museum Satellites* project, involving development of a web-based learning activity, linked to a museum. The objective of the project is to improve the learning experience that takes place in museums by providing pre and post visit continuity for museum visits and opportunities for a more personal and meaningful learning experience. *Museum Satellites* are activities for multimedia exploration, visual organization of multimedia information, and presentation. The project explores the possibilities of spatial organization of information for inquiry, reflection, presentation, and collaboration. The satellite becomes available on the web for asynchronous collaboration of multiple participants, making it an ongoing exhibit. As part of the museum's educational outreach, the satellites belong to the museum, which makes its resources available by providing images of their artifacts, information sources, and guidance of its educators and experts.

Introduction

Together with museums' missions of object preservation and research, museums aim to teach their cultural patrimonies. This historical mission has been changing over time and in accordance with education theories and the technologies that are available. This project involves software for enhancing the learning experiences of museum visits and improving the general teaching possibilities inherent in museums and their educational outreach.

A Museum Satellite is a web-based program that allows for a participant or group of participants to create a multimedia visual organization of the exploration of a topic, question, or object related to the Museum's themes and collections. This visual presentation of their inquiry will work as a tool for thinking and organizing the search, as well as for sharing their ideas with others. These multimedia maps will allow experts and educators from the museum to make suggestions and relations to ideas and objects, helping the participants to create more domain expert-like associations.

Rationale

Experience in different museums has shown a need for a means of making school and individual visits to museums a less isolated experience. Museum visitors who take full advantage of the visit experience are those who bring authentic questions with them to the visit. These questions can have their origin in school activities and projects or they can emerge from students' own curiosity and inquiries (*Foundations*, 2000). These questions are the basis of scientific research and artistic development that are sometimes ignored by the educational system. Helping the visitors' place this experience within the larger and more meaningful context of their personal questionings and providing means for exploring those questions after the visit is over can enhance the educational experiences that the museum provides to its visitors. The activities of inquiring and building representations help learners develop their understanding and therefore enhance the possibilities for attention and memory that foster understanding and interest during the visit. The Museum Satellite project involves learners in the development of spatial visualization and organization of information as a powerful tool for thought (Tufte, 1991). The process of organizing, demonstrating, and displaying ideas and conceptions is an understanding performance (Perkins, 1992) that allows learners to have agency in the construction of these knowledge representations and involves them in demonstrating their work.

As a pre and post visit activity, the Satellite provides a structure for using the visit to the museum as a resource and also as an avenue for further exploration of what was learned. The experience of working on constructing a Satellite will provide training for the learners in inquiry, helping them to define their interests and, possibly, even help them to figure out career paths.

Existing web-based activities offered by museums focus on giving access to digital images of the collections, lesson plans, and game-like activities. But they do not take advantage of new media and museum resources for learners to construct their own thematic research and exhibiting project. Different from what museums generally offer, this project provides the participants with a way to set up questions, ideas, resources, relations, and assumptions. The ability to visually display questions and ideas will help the learners start to explore the topic and develop critical thinking skills before the visit --as knowledge owned, during the visit, and, with the improvements of multiple modifications, developments, and collaboration of others, after the visit. Possibilities will open also for those students who cannot actually attend the museum but can collaborate with their classmates who do go to the museum.

This project is innovative in offering tools for helping students to organize their ideas and intellectual inquiries, visualize relationships, and link their work as an in-progress satellite to the museum website. By being part of the museum instead of the school, students can go on working on their projects beyond the school year. The Museums Satellites can work as an entry for using and exploring the museum as a resource for studying that can be accessed anytime, instead of a once a life school outing.

Project Description

Museum Satellites are multimedia web-based spaces which function as part of the museums educational outreach program for students or other interested visitors. They are spatially organized/displayed in-progress research maps with embedded annotation and discussion tools. Guidelines and tools are provided for the students to build their work areas and options include using images of museum artifacts as starting points, or using questions to start the inquiry. The satellites are supervised by museum educators who may intervene when they consider it appropriate, providing suggestions, questions, links, information for contacting experts, and so on. Museum resources for information and direct contact with experts of the specific topic of the satellite are integral to the success of the projects.

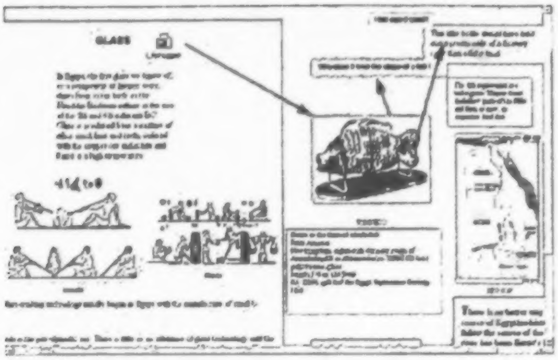


Figure 1: Example of a Museum Satellite work that has an artifact (a glass fish-shaped bottle) from Ancient Egypt as its starting point

Even though the satellites have starter authors, at some point they become open to the general public to participate in the discussions. In this sense, Museum Satellites are dynamic and will go on developing with time and increased interventions. As complementary to museum visits, they work as a pre-visit inquiry project that will elicit interesting questions and purposes to be brought into the visit and where to go on developing the knowledge and ideas gained from the museum visit. The satellites provide a way to keep in touch with the museum and become part of it as a contributor.

This pilot project will be developed for an art museum and will be started by high school students.

Future Directions

There are numerous possibilities for Museum Satellites as a multimedia technology that fosters and promotes the educational outreach of museums. In the near future we hope to establish a museum partnership, build the technology and space on a museum website from which the satellites will be linked, develop the human resources (probably interns) for its functioning, and advertise the project, in its pilot stage, with the teachers and schools that already have a relationship with that museum. This project can be exported and expanded by developing in multiple museums and by allowing the satellites to link more than one museum according to learning goals, academic research, and personal/institutional interest.

References

Directorate for Education and Human Resources National Science Foundation (2000) *Foundations: A monograph for professionals in science, mathematics, and technology education Inquiry.* http://www.nsf.gov/pubs/2000/nsf99148/front.htm

Perkins, David. *Technology Meets Constructivism: Do They Make a Marriage?* In Thomas Duffy and David Jonassen (Eds.) (1992) *Constructivism and the Technology of Instruction: A Conversation.* Hillsdale, New Jersey: Lawrence Erlbaum.

Tufte, Edward R. (1991) *Envisioning Information*, Graphics Press, Cheshire, CT.

BEST COPY AVAILABLE

NON-LINEAR WEB BASED (NLWB) FOR TEACHING 3D COMPUTER MODELLING

Mohd Izani, FCM,MMU ,Cyberjaya,
Selangor, 63100, Malaysia
izani@mmu.edu.my
Aishah Abd. Razak, FIT,MMU ,Cyberjaya,
Selangor, 63100, Malaysia
aishah.razak@mmu.edu.my

ABSTRACT

Nowadays wherever we go most of the people keep talking about information technology. One of the field that grows rapidly is E-Learning, which is another alternatives to enhance and deliver the contents. It is undeniable that the use of the latest technology today can help and simplify certain process. This paper will explain and elaborate about the method that applied in teaching 3d animation subject. This subject has been introduced since 1997 by Faculty of Creative Multimedia. The application of non-linear teaching does not mean to totally replace the current conventional way (actual class lecture). By having this method students can use their computer as vistual teacher and this method is just another enhancement for what already done. Finally we will expose and observe how effective is this approach in assisting virtual class.

KEYWORDS
Non-Linear, E-Learning, Interactivity, Three dimensional (3D) computer modelling,

1. INTRODUCTION

3D Computer modelling is apart of the process in creating 3D animation. At Faculty of Creative Multimedia this subject has been taught as an introductory course for 3D digital contents creation. This subject will allow student to cover various methods and techniques ranging from modelling, texturing, lighting and rendering. Back in 1997 this subject has been taught in a very conventional way with teaching aids like audio visual projection and power point presentation. The course assesment are based on quizzes, projects basis and exam. This subject is mainly a pre-requisite subject which the students need to accomplish before they can proceed to the major course like BSc. in Film Animation. Generally this course is delivered through theory, graphics and practical, hence we believe the old conventional is not enough to make it more interesting and understandable. Figures below explain about two methods used to deliever the contents.

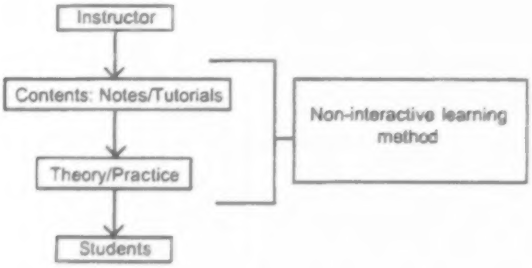


Figure 1: A conventional method for teaching 3D computer modelling

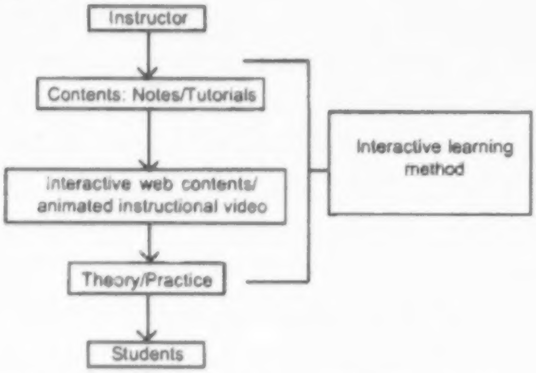

Instructor
Contents: Notes/Tutorials
interactive web contents/ animated instructional video
Theory/Practice
Students
Interactive learning method

Figure 2: Non-Linear Web Based (NLWB) method for teaching 3D computer modelling

Basically both methods use a specific network backbone as its pipeline to transfer data from server. The students can access the notes from anywhere as long as they are connected to the internet. Furthermore, web based learning can give more unique opportunities to assist students in learning. Naps et al. [1]. discuss several particular advantages to using the web as a medium for delivering interactive material. These include remote accessibility to materials, support for disntance learning, the development of system independent applications and the use of hypermedia.As for NLWB method it has been enhanced with interactive video as their instructor, means students can repeatedly replay the contents for how many times they like which is impossible for the conventional method because it relies on physical instructor. We believe that presenting material in an interactive manner is an effective

BEST COPY AVAILABLE

technique for making learning more memorable. The major difference between these two methods is an additional of virtual instructor in form of animation has been added for the second method. Wetzel et al. [2] explain, "a variety of characteristics that make animations uniquely effective for instruction."After its implementation we found that this method is more efficient. Hiltz and Turoff[3]described, "*the uses of networked computer communications as a way of widening educational access and supporting life-long learning*". In the next page we will describe some basic introductions to the terms of interactivity and how NLWB system works as contents provider.

2. INTERACTIVITY

Interactivity can be divided into many levels which is ranging from click interaction, click, drag and drop and application of information in new and authentic contexts. In delivering the contents we will describe about five teaching architectures.Teaching architectures is a model that have been developed by Schank and Cleary [4], this is particularly related to computer implementation.

2.1 Simulation-based Learning by Doing

Humans learn by doing. Learning a new skill, then, would ideally include practice with the actual skill, accompanied by coaching, advice, and correction by an expert. The very nature of simulations requires active participation y the learner, who may sometimes 'enter in' to the simulated world as an actual participant.

2.2 Incidental Learning

Much information to be learned is not inherently interesting (think of the multiplication tables). Lists and facts are learned naturally, however, by engaging in fun tasks whose outcomes are interesting. In this design the base facts are imparted almost covertly.

2.3 Learning by Reflection

This strategy is appropriate when learners need to ask questions about their learning or need someone off whom to 'bounce' their ideas. In this case, the instructor (who could be virtual) helps the learner analyze the problem and find ways to continue in their progress.

2.4 Case-based Teaching

Imparting information at the precise moment of need has been recently dubbed just-in-time learning. In this architecture, learners may consult an expert when experiencing difficulties or out of curiosity. Experts, by virtue of their expertise in a field, have a large repository of stories to tell, or cases, which illustrate key learning elements relevant to the task at hand.

2.5 Learning by Exploring

When learners become involved in their new tasks, they naturally generate questions. These questions are optimally answered at the time they are generated. The key to this architecture is conversation, either virtually or in face-to face interaction. To elaborate interactivity in details, seven different forms of interactivity were derived from the taxonomies of interactivity [5] as illustrated in table below. (Table 1).

Interactivity	Description
Exploratory	Where the participant is exploring the "information landscape" for details of application structure and operation.
Navigational	Where the participant chooses to move from one location to another or selects a menu option
Presentational	Where the participant is watching the dynamic presentation of material
Involved	Where the participant is purposefully involved in following a set of actions to achieve a goal or assessing the static content being displayed
Manipulative	Where the participant is actively manipulating content objects to achieve a goal
Reflective	Where the participant is discussing aspects of their overall experience with the observer
Accidental	Where the participant initiates an interaction for which there is no program response

Table 1: Interaction Types

3. NLWB FOR 3D COMPUTER MODELLING

Due to the proliferation of the World Wide Web (Web) in recent years, many educators seek to improve the effectiveness of their instruction by providing web based course contents to the students. Motivated by this goal, we developed NLWB method to improve the current method. The next figure is a schematic that indicates the functionality of NLWB systems. The main contents are delivered through a website as a delivery engine and it is categorised into few sections: Course outline,file upload-submission, projects, quizzes, grading and interactive video based instructions (Figure 3).To make it more interesting we developed a virtual host to describe a basic introduction about this online course. (Figure 4). In general most of the project submission of this subject will be in image file format like JPG and TGA. (Figure 5 & 6).

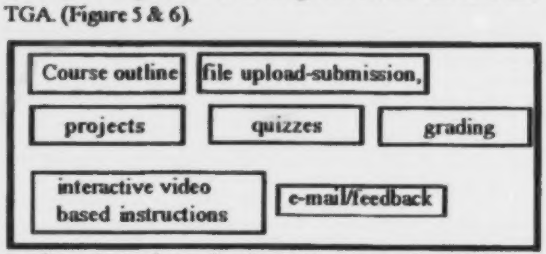


Figure 3: A schematic of NLWB contents for website

BEST COPY AVAILABLE

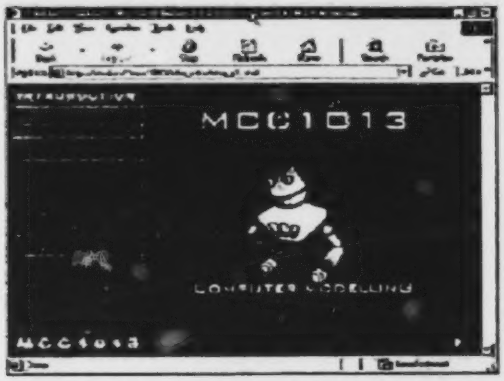


Figure 4: Main page of the website for 3D computer modelling subject.

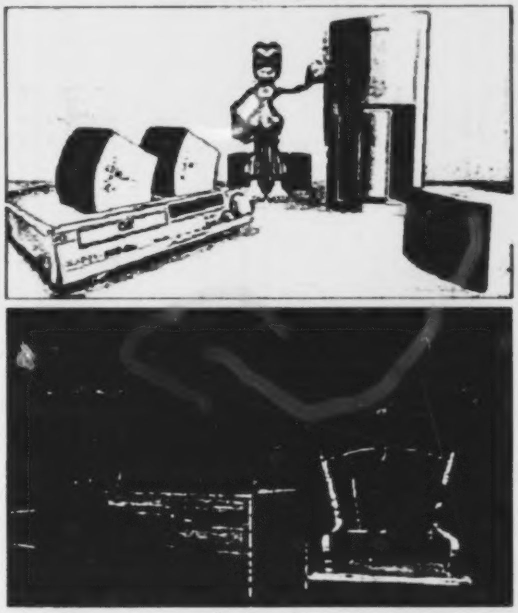


Figure 5: Examples from the project output (Image courtesy of FCM, MMU).

The next page we will discuss about the basic components/ elements in NLWB system for this subject. We will begin with the process for 3D computer modelling and followed by the infrastructure of the system.

3.1 3D Computer Modelling

For this subject the basic process will consist of modelling, texturing, lighting and rendering. Below we describe the process graphically. Firstly students may start their project by having some idea and from the idea, it will be transferred to the paper. Then it will be modelled in computer by using any 3D softwares. In our research we will concentrate on 3D StudioMax as a modelling platform. Modelling is a process of creating geometry in 3d software. It may involve with tweaking, sculpting and reshaping.(Figure 6).The following stage is mapping. This can be done by applying any mapping elements (texture/image) to the surface of the object. Balint [6], describes" *Image mapping is where an actual photograph or other raster image is applied to the surface of an object in order to give it a more realistic appearance. Texture mapping still affects what the surface of an object looks like, but deals mostly with mathematically generated shapes, colors and texture simulations.*"

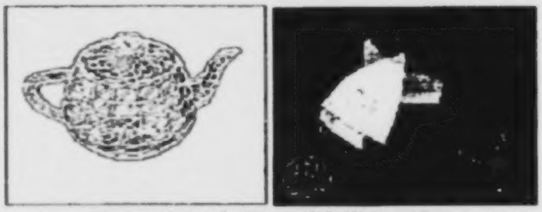


Figure 6: Basic 3D models that can be created by using any 3D softwares.

By adding texture mapping, we will basically get the look of the models as shown below. (Figure 7).

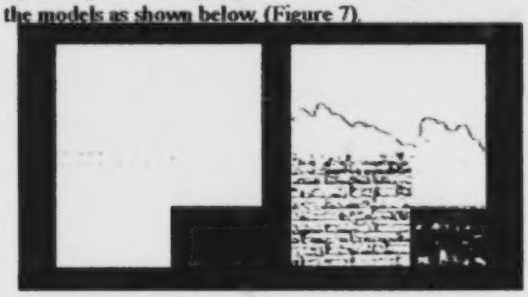


Figure 7: Applying texture to the 3d models.

Another important stage in 3D computer modelling is lighting. This method will make objects look more 3D effect. Lighting can be used to create more of a 3D effect by separating the foreground from the background, or it can merge the two to create a flat 2D effect. It can be used to set an emotional mood and to influence the viewer . Lights are one of the most essential parts to either having a great looking animation, or a terrible animation. They can be used to not only light up a scene, but to add depth,mood and visual effects. In almost any 3D scene, there should be a bare minimum of 3 lights. Finally we will discuss about the most crucial part which is rendering. Rendering is defined as when 3D software applies a skin to 3D geometry, which may involve coloring or even texturing the objects, but there are multiple types of rendering methods for different purposes. The next figure shows the rendering output in image format (Figure 8). For animation the output can be in sequence images or movie files.

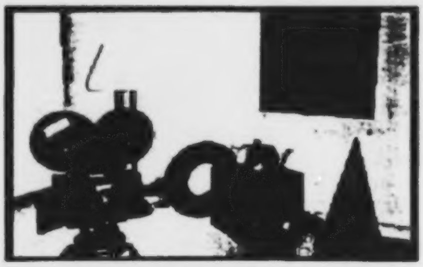


Figure 8: Fully rendered image.

The proper use of lights in computer graphics is one of the things that differentiates the talented artist from the

BEST COPY AVAILABLE

untalented. This is not a new topic as a large amount of work has been done on lighting issues in photography, film, and video.

3.2 Preparing Materials For NLWB

The contents for NLWB are driven by two aproaches; Video based (animated video) and Java Applet (Viewlet builder). Contents for both methods need to be prepared and provided by instructors. Once it is ready they will be transformed into these two types.(Figure 9)

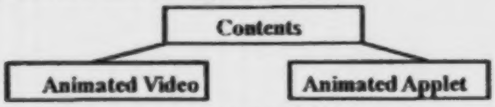


Figure 9: Contents divisions.

Animated video can be created by using video camera and transfer into any video format (mov,avi,mpeg). To optimise this, it must go for certain compression method, this is to ensure its practicality to be online. For second method (animated applet) it works as first method but as a series of sequence images, this means it is more economical and practical. For this purpose we use Viewlet Builder as its tool to create.(Figure 10).

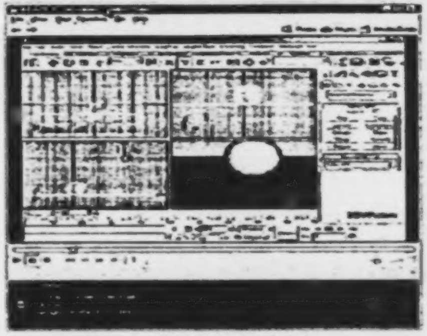


Figure 10: Animated video.

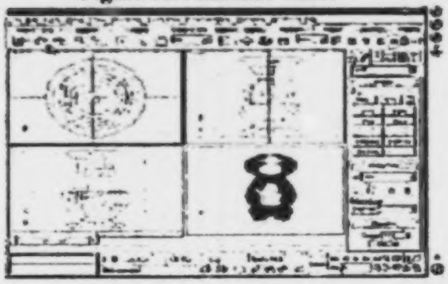


Figure 11: Animated applet.

All of these files will be uploaded to the server and it will be online for intranet use. In MMU the students can access their tutorials, demos and contents from internal server. It is illustrated as figure below. (Figure 12).

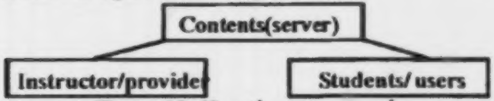


Figure 12: How the system works.

4. Research Findings

From the completed research, the authors concluded research findings into few points.

i-Animations allow an instructor to emphasize the important parts of a subject by removing unnecessary and distracting details. With the networked structure and support, this geographically help the student wherever they live.

ii-These methods have the ability to visually present subjects and ideas that would be difficult to illustrate in the real world. Students can save and re-use the contents outside of the campus.

iii-From the methods applied it can aid in discrimination by presenting cues that direct the viewer's attention to salient points of the presentation. Throughout the various animations presented herein, we have attempted to make use of these characteristics in order to make learning more effective.

iv-The contents only need to be prepared once, this means it will be stored as a set of database in the server and the instructor only need to update if necessary. Because of the large amount of time needed to develop quality materials, reusing existing materials as much as possible was a crucial objective.

5. Conclusions

The environment of online teaching/ virtual class is rapidly changing and contents development initiatives must respond appropriately. Currently the methods introduced in this paper are well implemented and may be for futher development a few things can be improved such as:

i-Network performance- due to more students rely on this method, the possible problem that may arise is net congestion. Thus, good network backbone is important.

ii-Developing a comprehensive understanding and contents of the interactive learning will not only lead to more effective usability and learning online environments, but also to those applications working better for the learner.

By presenting this paper, we hope this it goes some way to influencing and encouraging more institutions to do the same.

4. REFERENCES

[1] Naps, T., J. Bergin, R. Jiménez-Peris, M. McNally, M. Patiño-Martínez, V. Proulx and J. Tarhio (1997), "*Using the WWW as the delivery mechanism for interactive, visualization-based instructional modules*," (ITiCSE-WGRSP '97), ACM, New York, NY, pp. 13-26.

[2] Wetzel, C., P. Radtke and H. Stern (1994), *Instructional Effectiveness of Video Media*, Lawrence Erlbaum Associates, Hillsdale, NJ.

[3] Hiltz and Turoff (1978), *The Network Nation*, pp. 191-197.

[4] Schank, R.C., & Cleary, C. (1995). *Engines for education*. Hillsdale, NJ: Lawrence Eelbaum Associates.

[5] (Schwier & Misanchuk, 1993; Aldrich, et al, 1998) - Schwier, R. & Misanchuk, E. (1993). *Interactive Multimedia Instruction.*, NJ: Educational Technology Publications.

[6] Imre Zsolt Balint Jr. (2001), *3D Fundementals 101*, Windows Microsoft, pp. 31.

BEST COPY AVAILABLE

The Interactivity Issues in Using Blackboard

Chenfeng Zhang Ph.D.
Assistant Professor of Instructional Technology
Department of Curriculum and Instruction, Graduate College of Education
University of Massachusetts Boston
chenfengzhang@hotmail.com

The most difficult part in using Blackboard is the utilization of its interactivity functions to ensure a good interaction between the professor and students and among the students themselves. A surveyed of 10 faculty members from different departments in a Pennsylvania university was conducted to gather data on how they used the interactivity functions when they were teaching an online course. The survey revealed that most of the faculty members used asynchronous mode of interaction and seldom used synchronous modes of interaction. Suggestions are made to improve the interaction, especially synchronous mode of interaction.

Introduction

More and more university faculty members are using Blackboard for teaching an online course or as a supplement for their regular classes. From my own online teaching experience, I found that the most difficult part in using Blackboard is the utilization of its interactivity functions to ensure a good interaction between the professor and students and among the students themselves. There has been little research in this area. I surveyed 10 faculty members from different departments in a Pennsylvania university to gather data on how they used the interactivity functions when they were teaching an online course.

There are two kinds of interactivity abilities Blackboard offers. One is asynchronous, such as Email, Discussion Board and Digital Drop Box. The other is synchronous, such as the Virtual Classroom. From the survey we could see that the faculty members were using more asynchronous modes of interaction than synchronous modes.

Results of the Survey

The ten faculty members surveyed were from the Education Department, Math Department, Computer Department and Music Department. All of them were teaching one or more online courses at the end of the Spring semester 2002 when the survey was conducted. They had first-hand experience of using the interactivity functions of Blackboard.

The first set of questions was on the asynchronous mode of interaction, namely, the Email, Discussion Board and the Digital Drop Box. Eight faculty members used both the email capability in Blackboard and their own email account. Two faculty members only used their own email accounts. The reason for this was that personal email accounts were normally easier to use than having to log on the Blackboard server to access the email. Most of the faculty (80%) used email to respond to a quick individual question, to announce cancellation of a field trip and to send compliments to students after a test or exam. They used Announcement in Blackboard as a means for regular announcements. Only two faculty members used their own email accounts for regular announcements.

All the faculty members used Discussion Board. In a typical semester, they would post 8 to 20 discussion questions that students can discuss. Students were encouraged to express different opinion on another students post. 5 faculty members allocated 10% of the total grade for actively participating in the discussions. All the faculty members created a thread in the Discussion Board entitled "Help Each Other Section". They were doing so because another faculty members sent an email to his fellow colleagues to suggest that the "Help Each Other Section" was a very good idea to enhance interaction among the students. In this section, students could post whatever questions they had and sought answers from fellow students. Eighty percent of the faculty members would go to this section to monitor the progress, but did not participate in the answering of questions. Only two faculty members did answer students' questions in this section.

Most of the faculty members found using the Digital Drop Box a headache. Nine out ten of the faculty members used Digital Drop Box. Five of them only used it as a means to receive students' work or projects. The other four faculty members used Digital Drop Box to receive students' work and made comments on their work and sent it back to them. But almost all the faculty members using Digital Drop Box complained that it was troublesome to use. First, the server is slow. Second, they had to open up students' work in another software, made comments and saved the file before sending it out to the students. The Digital Drop Box was designed in a way that all the files were on the same page and it was difficult to tell if the file was sent by the student or sent by the professor.

The second set of questions was on the synchronous mode of interaction, namely the Virtual Classroom. The synchronous interactivity tools were not commonly used by the faculty members. Only two of them used the chat function for a couple of times. They found that when they used the chat function, students had to be present before the computer at a predetermined time and not all students could do it. Also, when several students were talking at the same time, it was difficult to follow up what each student tried to say. Easily, the chat would go uncontrolled. No faculty member had ever tried to use the White Board or the voice function in the Virtual Classroom. The main reason was that the faculty members themselves were threaten by the technology and had a hard time when they experimented with these functions. They were afraid that they would not use these functions properly in actual online teaching.

Most of the faculty members indicated that their major ways of interaction with the students were Discussion Board and Emails. As for ways to ensure interaction among students, most faculty members assigned group rather than individualized projects to encourage the interaction. One faculty member assigned heavy loads of work in order to force students to cooperate with one another to finish them.

From the survey we could see that most of the faculty members used asynchronous mode of interaction and seldom used synchronous modes of interaction. They expressed their fear of using synchronous mode beyond the technical difficulties of slow servers and lack of proper computer accessories.

Implications

The first implication we could draw from this survey is that faculty members still need training support even though they are pioneers in the adoption of online teaching. They need to understand the full functions of Digital Drop Box and the use of the Virtual Classroom in particular.

To ensure a quality interaction between professor and students and among students themselves, faculty members should try to explore all the possible functions of interactivity provided by Blackboard.

The Blackboard software should be modified so as to serve the needs of better interaction. For example, the faculty should be able to create folders in the Digital Drop Box to place work files of students and comment files from professors. The White Board function should be improved so that when students draw a picture on the white board, the faculty should be able tell who is drawing and be able to monitor the process. It would also be ideal that professor could play video clips or sound clips in the Virtual Classroom.

With better training support and the advancement of technology, e.g. faster servers and more computer accessories, I believe there would be better interaction between professor and students and among students themselves.

Axes to classify Learning Content Units

Annett M. Zobel, Matthias Hupfer, Ulf Schubert, Charles A. Wüthrich
Bauhaus University Weimar, CogVis/MMC
annett.zobel | matthias.hupfer | ulf.schubert|caw@medien.uni-weimar.de

Abstract: In this paper we propose a theoretical framework for structuring pools of learning material cooperatively maintained by students and teaching staff in higher education. In many learning technologies documents are modularised in units we here call *Content Units*. Authors create Content Units and need to sort them into a structured pool. Authors of learning or course documents need to find the Content Units in the pool to integrate them into documents. Our Content Units in documents are exchangeable so that for a specific learner the best version can be picked up from the pool dynamically during the rendering process. For structuring the content pool we use 6 main axes to classify a Content Unit.

Introduction

Teaching Media study courses involves teaching components of the humanities, design, economics and of high-tech disciplines. Given the broad band of material necessary, some institutions have introduced project-based learning to train flexibility and creativity instead of stuffing students with material which will anyway be outdated in short time. Students get project themes, develop and deliver project results each semester. Since project oriented teaching can be most different (e.g. technical oriented or arts oriented) the available tools were not adapted for developing multimedia web based teaching material.

When learning in a project oriented way, teaching staff and students build up information pools cooperatively. When faced with this problem we decided to develop our own famework that meets our special needs of cooperative developing and maintaining pools of information and learning content in the project m^2 [mediasquare]. In the project, computer scientists, interface designers and Media Culture scientists develop an experimental eLearning platform as well as multimedia courseware representing 1000 hours lesson. This courseware will be the basis for a new study course in Media. By the experiences of these developments, production and the planned evaluation studies a university concept for implementing web based learning as well as cooperative production and management of learning material will be developed by the end of the year 2003.

Definition of axes

There are two main requirements for a shared information pool. It should be possible to develop content and integrate it into the pool so easily that it can be managed by students and to render individualized learning and course documents. Individualized means to adapt the content, didactics and (medial) representation to the needs of the learner and his/her boundary conditions. A learner usually has a prior knowledge and a learning objective which specify the learning content to be presented. Learners have different learning styles and prefer different didactical and medial representation. Some learners like to get an overview first and then go into detail and some like to learn with practical examples and other like to start on a higher abstraction level.

To adapt learning documents for instance by exchanging practical samples with abstract samples within an essay it is necessary to modularize documents into here called *Content Units* and to classify these units in a way to be able to pic more user-fitted versions from the pool. Compared to other frameworks [2, 5, 8, 13] it is not just possible to change the layout but also to change the kind of content and didactics dynamicly within the rendering process too.

This *Content Unit* we define (according to "conceptual units" of the Knowledge Management System [12] at the university of Passau) as the smallest textual cohesiv content which can not be splitted in a reasonable way. These Content Units can be integrated flexibly to *Learning Documents*, and by adding course specific content and metadata the course author develops *Course Documents*.

To manage exchangeable Content Units for one unique content we need axes where a Content Unit is defined by choosing one value on each axe. The parameters of the user profile and boundary conditions have to be mapped to a tuple of these axes to find the most fitting Content Unit.

To define these axes we selected suitable elements from metadata standards [1, 3, 7, 9], a didactical ontology from Meder [10] and analysed the structure and classification used by experienced authors. Depending on the subject area, the so called domain, the values on the axes will differ. So authors / experts have to define these values to work cooperatively with a shared content pool.

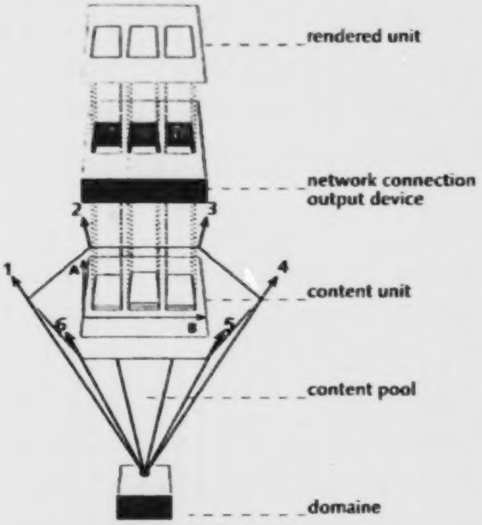


figure 1: axes model of the Content Unit pool

Usually authors differentiate between didactical representation like essay, lecture with slides, sample, exercise type. So the axe *didactical type* (axe 1 in fig. 1) represents the used didactical way to present a content. In the LOM element 5.2 these didactical types are mixed up with media or structural elements like table, diagram and figuret. To represent content more practice oriented or more abstract we use the axe of *abstraction level* (axe 2 in fig. 1). The most obvious axe is the *language* (axe 3 in fig. 1) (English, German, French, ...) also meaning cultural language differences (business English in Egypt). *Content profundity* (axe 4 in fig. 1) describes how deeply a content is presented and can be adapted to the degree of expertise of the user. *Density* (axe 5 in fig. 1) represents with how much text and media a content is explained (referring to LOM 5.4). For instance whether it is an abstract/summary for repetition use or a broad explanation. To get the best learning success the content has to be based on the grade of user experience represented by the *prior knowledge / user level* for instance: freshmen, basic studies, main study period, post graduate (axe 6 in fig. 1). In contrast to the two LOM elements: 5.6 Context and 5.7 typical age we represent these aspects on one axe.

Versions of Content Units

One content can be represented by many Content Units which differ in the values on the described six axes. A Content Unit can be represented by a single XML document with a grammar (DTD) according to the didactical type and a set of metadata.

In these XML documents versions of Structure Elements, Block Elements and Inline Elements can be created. Users have different preferences to use media for learning (e.g. visualizer /verbalizer). To support this the additional axe *Media types* (axe A in fig. 1) provide alternatively use of media like picture, audio, video, text. On the axe *functional complexity* (axe B in fig. 1) the author can define functionalities that can be provided to the user accordingly to his/her cognitive abilities, for instance how many and which links to further information are shown.

These XML documents can be reused in other domains. Because the scales of the axes might be different for domains a new set of metadata has to be created. Which means that the same XML document is another Content Unit in the other domain. To increase the usability of a Content Unit the learner can give feedback if the Unit has not fit to his/her needs in a specific context. The feedback function can create feedback metadata which can be proposed to the author.

Technical conditions

For learning and course documents the *ability of the output device* (for instance screen size or ability to show pictures or VRMLs) and *bandwith of the network connection* define which Media and navigation structures are chosen to render.

Suitable scales for the axes will be experimentally investigated for the Media domains. User and course profiles have to be developed in a way that a mapping of their parameters to these axes is possible within the rendering process. Accordingly to these results the developed rendering process has to be adapted. To represent Content Units and Documents we use XML technology. To realise the rendering process we use an Apache/Cocoon 2-framework [4]. Export functionality will allow to render metadata eLearning standards for the learning and course documents and the courses.

Acknowledgements

The project m^2 [mediasquare] receives funding from the German Ministry of Education and Research within the programme "New Media in Higher Education". Much of this work could not have been done without the help and support from Simona Empoli, Tobias Hofmann [11], Marko Meister and many other participants of the project.

References:

[1] Advanced Distributed Learning, Sharable Courseware Object Reference Model (SCORM). http://www.adlnet.org

[2] CHAMELEON project homepage (2001). http://www-mmt.inf.tu-dresden.de/projekte/chameleon/

[3] Dublin Core Metadata Initiative. http://www.dublincore.org/

[4] Apache cocoon homepage http://xml.apache.org/cocoon/

[5] The Edutella Project. http://edutella.jxta.org/.

[6] Henning Lobin. Information-Modelling in XML and SGML (Original title: Informationsmodellierung in XML und SGML). Heidelberg 2000

[7] IMS Global Learning Consortium Inc. IMS Learning Resource Metadata Specification v1.2.1. http://www.imsproject.org/metadata/

[8] LMML, Learning Material Markup Language Framework, University Passau, www.lmml.de, March 2002

[9] IEEE Learning Technology Standards Committee. IEEE LOM Working Draft 6.1. http://ltsc.ieee.org/wg12/index.html April 2001

[10] Norbert Meder. Didaktische Ontologien. In: H. Peter Ohly, Gerhard Rahmstorf, Alexander Siegel. Globalisierung und Wissensorganisation: Neue Aspekte für Wissen, Wissenschaft und Informationssysteme. Würzburg 2000

[11] Tobias Hofmann, Thore Schmidt -Tjarksen. MAMBO - Experiences from developing, implementing, and evaluating a multimedia-enhanced distant education learning system. In Proceedings of ED-MEDIA 2001: Norfolk, VA 23514-3728 USA: Association for the Advancement of Computing in Education (AACE). 2001

[12] Christian Süß, Burkhard Freitag. Development and Usage of Teachware (original title: Entwicklung und Nutzung von Teacheware). The Passauer Knowledge Management System. In: Rudolf Kammerl (Ed.) Computer Supported Learning (original title: Computerunterstütztes Lernen), München, Oldenburg 2000

[13] TARGETTEAM project homepage – The TeachML Language (2001) http://www11.in.tum.de/forschung/projekte/targetteam/index.html.de

Evaluation of a Homegrown LCMS: All Work and No Play?

Terry Taylor, Nanette Zorn
General Libraries - Instruction
DePaul University
United States
ttaylor@depaul.edu, nzorn@depaul.edu

Abstract: DePaul University Library's answer to the changing demands of the technological revolution was the creation of a homegrown LCMS, the Instruction Builder. When we took instruction online, our ultimate goal was to develop a system that would maximize the efficiency of our teaching and make it easier for students to learn. As we phased in the use of Instruction Builder, it became part of a two-tiered approach to instruction. The online workshop is typically followed by an in-person research session, which teaches more abstract skills such as evaluation of information. The Instruction Builder has solved many of the library's unique instructional issues, but has our two-tiered implementation changed the learning outcomes of the students? This paper reports on a study -- conducted over the course of two consecutive quarters -- that attempted to evaluate the effectiveness of our implementation of the Instruction Builder as an e-learning solution.

Faced with reduced human resources, evolution of learning styles, more students at a distance, and more databases available online, libraries are forced to start taking a critical look at the traditional method of delivering library instruction. DePaul University's solution was to change not only the method of delivery but also the structure and form of the content.

We began to design online instruction in the winter of 1998 using WebCT as the framework for development. There were inherent problems in using WebCT software for this particular purpose. The library is unique in that we have just one classroom opportunity to reach the students. We do not teach quarter-long courses, issue grades, or give tests. We found that, as a tool for library instruction, WebCT lacked the flexibility to adapt to different teaching objectives, and the individualized feedback we wanted to provide to each student about specific research needs was not possible. So in the fall of 2000 we decided to develop a homegrown Learning Content Management System (LCMS), the Instruction Builder.

Developed within the library, the database-driven system provides the following features:

- Content can be broken into discrete sections (modules), and is therefore deployable in parts or as a whole.
- Content can be delivered in more interesting ways by integrating Flash, HTML, and assessment tools in various formats.
- Students are able to complete the exercises on their own time and at their own pace, as well as receive and respond to individualized feedback from a librarian.
- Librarians communicate with each student, increasing and reinforcing learning and fostering a positive discourse about the process and the content.

We designed a modular workshop that teaches the research process using online resources. Each module teaches a single aspect of the research process, and each element of the module teaches a single skill. (An instruction element might consist of one to three screens of information.) The workshop is an integrated component of the information literacy instruction provided in a required freshman composition course (English 104). Each section of the course typically has 23 students, and the course is taught every quarter, often to more than 40 different sections. The students complete the online workshop early in the quarter, and the assignment (built into the workshop) is sent to the librarian designated as the grader for the particular section. The librarian goes into the grading interface of the LCMS and responds to each student's submission by giving individualized research advice and assigning a rating of "complete" or "incomplete."

The results, including both the student's original answers and the librarian's detailed response, are then sent to the student via e-mail with copies sent to the English 104 instructor and the grading librarian. The students then can log back into the system to correct their mistakes and resubmit the workshop assignment for additional evaluation by a librarian.

In phasing the workshop into courses, we decided to continue to have a librarian present a follow-up instruction session in-person and in the library. This session provides an opportunity to review the skills taught in the workshop and to teach the additional, more abstract skill of evaluation of information. As a department, we also felt the in-person session had inherent value for freshman students because it gave the students an opportunity to become acquainted with the physical library and the organization of resources within the library building. In addition, a face-to-face session introduces students to a library staff member in a supportive environment from which they can begin to build a relationship with the library and research. As soon as we began using the Instruction Builder in the winter of 2000, it was immediately apparent to the library instructors that students who had taken the workshop got more out of the in-person session than in years past. In addition to asking better questions and participating more, we found that the in-person session also allowed for peer-to-peer communication and group work, a facet of online learning that our LCMS did not facilitate. Furthermore, since the students submitted the online workshop and received individualized responses from the librarian regarding their research interests, the librarian had already built a relationship with the student before they met face to face. More importantly, each librarian was aware of the parts of the workshop that had been difficult for each student or for the class as a whole. The session could then be customized to the individualized needs of the class.

It is true that this two-tiered approach to teaching library skills did not reduce the time commitment of human resources that were already strained. Instead of just preparing and teaching a session, we now had to grade workshops by issuing individualized responses, which could involve multiple attempts by each user, as well as prepare and teach the session. However, we knew the time was well spent because we could tell from the level of participation in the classes that there were distinct merits to having a combination of online and in-person instruction. We wondered if either one could stand as well on its own since the sum of the components seemed to generate something greater by virtue of the variety of teaching methods catering to diverse learning styles.

In the winter of 2002 we conducted a study in which we selected two English 104 classes with the same instructor. We constructed a pre-test and a post-test to assess student learning of the concepts taught in the online workshop.

- Class A was given a pre-test, took the online workshop, followed that with in-person instruction, and then completed a post-test 2 days after the class session.
- Class B was given the same pre-test, given in-person instruction only, and the same post-test two days after the session.

In analyzing the data, we discovered that the students who had both in-person instruction and online instruction scored an average of 1.25 points better on the 12-question post-test. The students who had only in-person instruction scored, on average, only .1 (one-tenth of a point) better on the post-test. These results indicate that the students who took the online workshop did benefit. Through their marked improvement on the post-tests, these students demonstrated an increased proficiency in the understanding of concepts introduced in the workshop and reinforced through the successful completion of the workshop. The in-person session alone did not have as great an effect in improving the students' scores. There are many external variables that we were not able to control – previous library experience, previous education experience, academic achievement, etc. Further studies need to be done in these areas. Even with those qualifications, we feel that these preliminary results revealed what we suspected all along – the two types of instruction are more effective in combination than either is by itself.

In phase two of the study we attempted to verify the conclusions of the previous study and expand the experiment. The second phase, concluded in May of 2002, included three sections of English 104 with the same course instructor and library instructor as in phase one. In using the same instructor and librarian, we hoped to reduce the impact of different teaching styles as a variable that could affect results. The inclusion of three classes allowed us to isolate and individually assess each discrete component of the instruction. Evaluating pre- and post-test assessments with the third class would help us isolate which part of the library experience was most useful, the online workshop, the in-person session or a combination of both. The instruction for the three sections broke down as follows:

- Class A took the pre-test, took the online library workshop, had in-person library instruction and then took the post-test.
- Class B took the pre-test, did *not* take the online library workshop but did have in-person instruction and then took the post-test.
- Class C took the pre-test, did the online workshop, took the post-test and then had in-person instruction.

We found that the results from the follow-up study did support the previous conclusion. There was a marked improvement in the scores from the post-test for the students that completed the library workshop and had in-person instruction. Students who took the online workshop and had in-person instruction improved their score by 2.3 points. Students who had only classroom instruction improved their score by only .75 of a point. This 1.55 point difference between populations is actually a greater difference than in phase one of the study where the point difference between the two populations was just 1.15.

Even more important, perhaps, is that in examining the results of class C we could tell that the online workshop alone improved the performance of the students on the pre- and post-tests. Students in this population scored only one-tenth of a point lower than the students who had BOTH online instruction and in-person instruction with a librarian. Based on the initial study in the fall, we had concluded that it was the *combination* of in-person and online instruction that was successful in reaching freshman students. What the preliminary results from the first study did NOT show was the value of online instruction alone because we did not have a third class on which to test just the online component while still keeping the variables of instructor and librarian the same.

On the one hand, this result validates the many hours that went into creating the LCMS and the labor-intensive process of continuously developing, animating and refining new online content. What we are doing online *is* working. Students are able to learn the online content and seem to benefit significantly from the way the LCMS facilitates communication with a librarian. On the other hand, it still does not give us definitive information on the effect of the in-person instruction because the pre- and post-tests did not cover the additional content provided in that session. While we recognize that the face-to-face contact has an important effect on students' ability to understand research concepts and provides other benefits mentioned earlier, this result was unexpected. We had assumed that the reinforcement of the workshop concepts in class was a necessary supplement to online instruction. The results indicate that we could probably use the in-class time to cover different material and let the online instruction content stand as a self-contained unit. However, the methodology of this study was not formulated to capture the more qualitative benchmarks of students' research habits. The pre- and post-tests did not in any way quantify how much better a student *feels* personally, knowing a librarian by face and name nor does it show how much time is saved in the long run by becoming acquainted with the physical location and organization of the library.

It is clear that if we were to determine that the qualitative aspects of in-person instruction should be a lower priority considering other demands on our staff time, we could let go of the two-tiered approach and accept an entirely online approach to teaching introductory research skills. We could even do this with some confidence that the students would complete the online workshop with a demonstrable grasp of complex research skills. However, as educators, concerned personally about students and professionally about attrition rates, we find ourselves unable to do that. In addition to the obvious drawbacks for students, this approach could damage a currently strong relationship we have with our faculty. Eliminating in-person instruction for a population that struggles with research could send puzzling and troubling signals to the faculty and cause faculty to question what the library's role is in delivering more advanced levels of instruction. In short, in the eyes of our faculty, it could send a very dangerous message that we don't value classroom instruction and ultimately it could affect how involved faculty become with the library and its staff.

In conclusion, while the design of our LCMS facilitates communication between the librarian and the student, there are still some areas that need to be further developed to facilitate peer-to-peer communication and a more active engagement of all the senses through interactivity, immediate feedback and sound functionality. In other words, if we are going to seriously entertain the prospect of eliminating face-to-face instruction, our system needs to evolve to the level of simulating the effects of one-on-one contact more accurately than it does now. There are very few librarians who would deny the merits of classroom participation and engagement. As we grapple with time constraints and staff reductions we might be forced to accept that it is impossible to supplement online work with an in-person session as we do now, but if we do, we have to be prepared for fall-out from faculty and students. If this is a step we must take, we need to realize that the energy we currently use to grade workshops, develop online materials and teach in the classroom will have to be redirected into taking a much more active role in marketing to faculty and approaching online content development more creatively. Furthermore, we must realize that our homegrown LCMS is an evolving creation, and it must continue to grow and adapt to keep up with the changing needs of students and faculty.

A Web-Accessible Lab Equipment for Training Courses on Chip Design

Peter Rössler
Institute of Computer Technology
Vienna University of Technology
Gusshausstrasse 27-29, 1040 Wien/Austria
roessler@ict.tuwien.ac.at

Abstract: Since terms like e-learning and distant education become more and more popular, today many academic institutions are using state-of-the-art internet technology to provide general information on lectures, lectures notes, on-line courses, educational tools etc. to their students or even handle the whole lecture over the internet. However, this does not work well for practical courses where e.g. students have do some practical examples in a lab using a dedicated test and measurement equipment. This paper presents the project *asix4web* which aims to connect all the input and output user interfaces of a physical lab equipment, used for a training course on chip design at the Vienna University of Technology, to the internet. Hence, students are now able to doing the practical lab exercises for the course from home. As shown with the asix4web project, distant education is also possible for practical oriented lectures and training courses.

Motivation and Related Works

The Institute of Computer Technology (*ICT*) at the Vienna University of Technology is working in the area of chip design since a long time in research, education as well as in projects co-operating with the industry. Several lectures cover a lot of topics starting from the beginners level up to advanced courses. Some considerations were taken into account in order to satisfy the needs of the students and hence to present the lectures in a modern and attractive way by using today's internet technology as transport and communication media in terms of e-learning and distant education.

Nowadays, there exist a lot of internet sites from both academic institutions as well as from companies providing information on chip design, integrated circuits, hardware description languages, tools and some other related topics. For example, (Smith 1997) is a HTML (*HyperText Markup Language*) version of the very popular book *Application Specific Integrated Circuits* from Michael John Sebastian Smith, University of Hawaii at Manoa. However, these web pages are more or less an electronic copy of the paper version without using the special features of the internet, e.g. extensive use of hyperlinks. Another example is the course *Design of VLSI Systems*, an internet tutorial on chip design by Daniel Mlynek from Swiss Federal Institute of Technology, Lausanne Switzerland, and Yusuf Leblebici from Worcester Polytechnic Institute, which makes more use of internet features like hyperlinks or enlargeable images, see (Mlynek, Leblebici 1998). Yet another approach is presented by the U.S. company Aldec. After having registered on their website, see (Aldec 1998), a tutorial on VHDL (*Very High-Speed Integrated Circuits Description Language*), one of the two state-of-the-art hardware description languages used for chip designs, can be downloaded for free and executed on a local PC. A lot of animated figures and images illustrate the content very clear and much more diverting than any ordinary book.

In general, however, for education in the area of natural science or engineering, practical exercises are often a must in order to prove theoretical theses or to e.g. learn the handling of a dedicated test and measurement equipment. Students are not able to do these exercises from home because they do not have the required lab equipment. As it seems at first sight, distant education is not possible for practical courses. Anyway, if it would be possible to give students a kind of remote access to a distant lab equipment, some practical exercises could of course be done from the student's home. That was exactly the goal of the *asix4web* project, started some time ago at the ICT in Vienna: The input and output user interfaces of a physical lab equipment, used for a training course on chip design, should be connected to the internet to allow students to do practical lab exercises from home.

The ASIC Design Course at the Institute of Computer Technology

The *ASIC Design* course from the ICT gives an introduction to the basics of digital integrated circuits design. It consists of a theoretical part and a lab. In the lab, students are implementing a microcontroller which runs a simple application program like a pocket calculator or a chronometer. Due to the tremendous effort and hence costs, the microchip is of course not manufactured in a semiconductor factory but the chip design is implemented in a so called PLD (*Programmable Logic Device*), see (Salcic 1997), which is already physical available and much cheaper. Similar to a PC which has to load an operating system and an application program after power-up, a PLD is initially unconfigured and must be "loaded" with the application prior to the use of it. However, the basic design steps are the same for both designing a chip for manufacturing in a semiconductor fab and designing an integrated circuit which will be "loaded" into a PLD.

All chip design work for the ICTs ASIC design lab is done by using *MAX+plus II* from the company Altera, a suite of EDA (*Electronic Design Automation*) tools which is specially tailored to PLDs from this major provider of programmable semiconductor devices, see (Altera 1997). The last step in the design flow is a test of the chip design in the "real world". For that purpose, a *UP1 Education Board* from Altera is used which is a printed circuit board containing a PLD device as well as some light emitting displays, two push buttons and several switches as general purpose peripheral elements, see right side of (Fig. 1). The PLD on the board is connected via a cable to the printer port of an ordinary PC which runs MAX+plus II. After having programmed the PLD device by using MAX+plus II, the PLD contains the student's chip design. Finally, the design is tested by controlling and observing the peripheral elements contained on the UP1 Education Board. In the case of the pocket calculator example, the buttons and switches on the board are mimicking the calculators keyboard while the light emitting displays work as the calculators display.

The concept of the ASIC design course, described in the last chapter, is well accepted by both the students and the instructors of the course. Some improvements were introduced in order to advance in the context of distant education, see (ICT 2002a):

- Installation of a website containing general information on the ASIC design course and related lectures, time schedules, results of the exams, contact information to course instructors, etc.
- Implementation of an on-line registration system which allows students to select group, time and date for the lab hours over the internet, e.g. from home.
- Providing a free student edition of the MAX+plus II tools for download.
- Providing lecture notes in PDF (*Portable Document Format*) format as well as templates and MAX+plus II design examples for download.

The asix4web Project

Although students are able to prepare their lab example from home by downloading MAX+plus II, lecture notes, templates and design examples, as described in the last chapter, testing on the real hardware (UP1 Education Board) is only possible at the university lab. To overcome this drawback the project *asix4web*, an acronym for *Application Specific Integrated Circuits for the Web*, was started, see (Fig. 1).

A shown in this figure, a UP1 Education Boards is physically connected to a server which is located at the ICT, Vienna. A web server and several dedicated application programs make it possible to upload a chip design from the student's home to the PLD and, further on, to control and observe the status of the input and output peripherals (switches, push buttons and displays) contained on the ICTs UP1 Education Board over the internet, see (ICT 2002b). Hence, by using a standard web browser students have access to the education board for 24 hours a day, 365 days per year and are able to test their lab examples whenever they want to do this. It should be mentioned, that access to the UP1 Education Board is of course not restricted to the students of the University of Technology, Vienna. In general, asix4web provides a PLD-based prototype board to everyone all around the world by using today's internet technology.

More information on asix4web can be found in the asix4web tutorial as well as in the asix4web FAQ section, see (ICT 2002b).

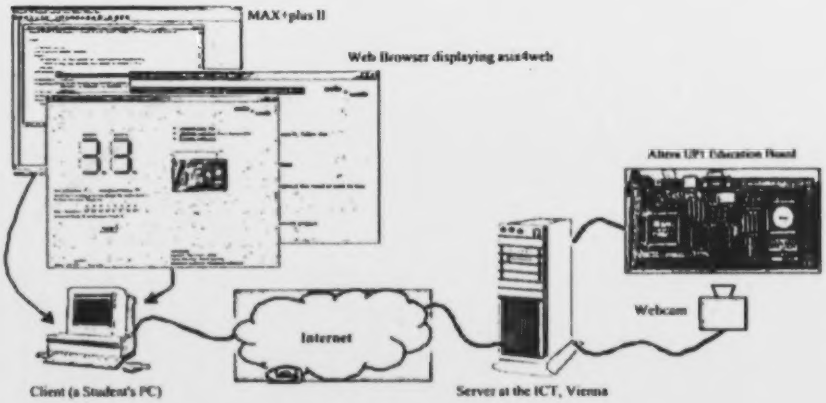

MAX+plus II
Web Browser displaying asix4web
Altera UP1 Education Board
Webcam
Internet
Client (a Student's PC)
Server at the ICT, Vienna

Figure 1: Basic Concept of the asix4web Project

Conclusion and Future Prospects

The first running version of asix4web was finished in May 2002 and is currently on the web, see (ICT 2002b). It was tested using a number of common used web browsers like Internet Explorer 6.0, Netscape 6.0 and Opera 6.0. Moreover, asix4web was also tested on slower internet connections, like e.g. a 56K modem connection, without any problems or even limited performance. However, asix4web will have to pass it's first "real" challenge in winter 2002/2003, when about 60-70 students will attend the new ASIC design course at the ICT.

As shown in this paper, distant education is also possible for practical oriented lectures and training courses. However, it is obvious that the effort on connecting a complex physical equipment with a large number of user interfaces to the internet can be tremendous. Anyway, it is of course possible for an equipment with a small number of user interfaces, like the UP1 Education Board used for the ASIC design course of the ICT.

References

Aldec Inc. (1998). *EVITA (Enhanced VHDL Tutorial with Application)*, Revision 2.1, USA, http://www.aldec.com/

Altera (1997). *MAX+PLUS II Getting Started*, Version 8.1, USA, http://www.altera.com/

ICT (2002a). *ASIC Design Website of the Institute of Computer Technology*, Vienna University of Technology, Austria, Version 7/2002, http://www.ict.tuwien.ac.at/asicdesign/

ICT (2002b). Project website *asix4web*, Institute of Computer Technology, Vienna University of Technology, Austria, Version 7/2002, http://www.ict.tuwien.ac.at/asicdesign/asix4web/

Mlynek, D. & Leblebici, Y. (1998). Web-based course *Design of VLSI Systems*, Swiss Federal Institute of Technology, Lausanne Switzerland, Worcester Polytechnic Institute, Version 11/10/1998, http://vlsi.wpi.edu/webcourse/

Salcic, Z. & Smailagic, A, (1997). *Digital Systems Design and Prototyping Using Field Programmable Logic*, Kluwer Academic Publishers, USA.

Smith, M.J.S. (1997). HTML-Version of the book *Application Specific Integrated Circuits*, Addison-Wesley, USA, http://www-ee.eng.hawaii.edu/~msmith/ASICs/HTML/ASICs.htm

BEST COPY AVAILABLE

Interactive Sessions

Technologies To Support Communities Of Practice Interactive Sessions

John Smith & Bronwyn Stuckey
CpSquare
USA & Australia
John.Smith@LearningAlliances.net
b.stuckey@qut.edu.au

Thomas McKegney
Public Sector Communities of Practice Platform
Canada
McKegney.Thomas@tbs-sct.gc.ca

Noshir Contractor & Andy Swarbrick
University of Illinois
USA
contractor@uiuc.edu
swarby@yahoo.com

Shady Kanfi
Bellanet
Canada
skanfi@bellanet.org

Maj. Peter Kilner,
United States Military Academy
West Point, NY 10996
Peter.Kilner@usma.edu

Session Abstract: On-line communities of practice use a variety of software tools and applications. These four interactive sessions will explore the commercial, customizable and open source tools currently furthering the development of community. Each tool meets a different community and organisational need. Each of the presenters is the organizer, developer, champion and researcher of the community building and communication strategy they present. This is chance to see available tools put to work and to meet the people who have experience in effectively adapting these resources in the workplace.

The Interactive Sessions for this hour are:

- John Smith & Bronwyn Stuckey - CpSquare Communities of Practice Workshop in WebCT
- Thomas McKegney - Canadian government in Tomoye / Simplify
- Noshir Contractor & Andy Swarbrick Network Analysis in I-know
- Shady Kanfi Bellanet - D- groups for international community building
- Maj. Peter Kilner, CompanyCommand.com and PlatoonLeader.org

These interactive presentations have been teamed into one session to allow attendees to explore a range of technologies available for the support of communities of practice. The products to be showcased ranged from customized implementations of commercial products to purpose built open-source resources for communication across low bandwidth environments. Each of these implementations represents a successful marriage of technology and the values at the heart of community development.

Web Crossing for CpSquare Communities of Practice Workshop: a flexible environment for learning in community

John D. Smith*
Learning Alliance & CpSquare
John.Smith@LearningAlliances.net

Bronwyn Stuckey⊕
Queensland University of Technology
b.stuckey@qut.edu.au

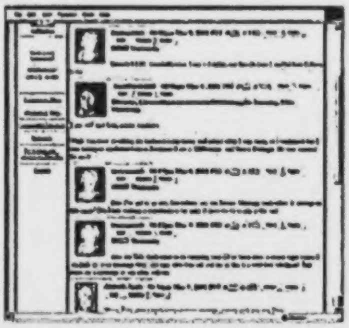
Abstract: Web Crossing, a highly configurable web conferencing platform is described and demonstrated as a useful tool for learning communities. Many of its underlying capabilities are described and several typical extensions are illustrated. Some of the product's advantages and disadvantages are discussed.

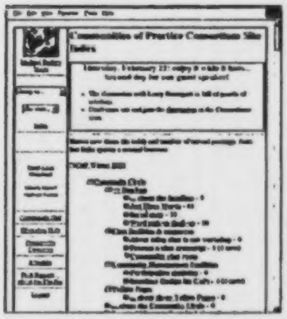
Context

We discuss Web Crossing from our experience, which is largely with smaller, focused learning communities, as opposed to the very large, primarily social "online communities" that were so much discussed during the dot-com bubble. The examples that are offered come mainly from an online workshop that's offered regularly on a Web Crossing platform, from a community of community scholars and practitioners, and from exponents of knowledge management best practices.

Basic features.

At the simplest level, Web Crossing is a web-based conversational engine that runs on UNIX, Macintosh, and Windows platforms. It can organize postings in either threaded or conversational (chronological) modes. A Web Crossing discussion feature that seems to promote sociability is that each posting is accompanied a thumbnail photo of the posting's author. The discussions that contain postings can be gathered together in folders, which can also contain many other discussions or folders. Folders can also contain chat rooms and web link objects. The Web Crossing server supports two programming languages: a rich macro language and Java Script. Together these two languages make Web Crossing highly configurable and extensible.





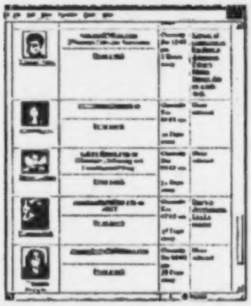
Applications. Although the basic features of Web Crossing provide a good working environment, we have found that there are several additions to the basic facilities that are important for learning communities. Many of these are available for free at WebXHarbor, a community that uses Web Crossing to discuss and learn about Web Crossing. Probably the most important resource is a Web Crossing instant messenger that provides an indicator when other people are "present" on Web Crossing. Knowing who else is currently logged on is a great aid to the sociability that moves a learning community forward, especially when people make a practice of greeting each other and acknowledging each others' presence.

---

* CPsquare – John.Smith@CPsquare.com
⊕ Queensland University of Technology – b.stuckey@qut.edu.au

BEST COPY AVAILABLE

Web Crossing's extensibility serves to make navigation of complex spaces somewhat simpler either through simple devices such as providing a navigation bar or through more complex programs such as the one that produces a dynamic index of an entire directory structure.



We have found that a program that produces a "community directory" is very helpful in suggesting "presence" and involvement because it shows a photo and contact information along with a name and the amount of time since each individual has logged on to Web Crossing.

We have found that collecting data from a learning community (quick surveys that feed information back to the group as a whole or is to be used by community leaders) are an important programmed add-on to Web Crossing. The fact that Web Crossing's Java Script facilities can read and write records from a number of SQL databases is attractive, although we do not have experience in its use.

Readily available examples of Web Crossing discussion spaces include:

- Community Return on Investment conference which was held in June 2001 and brought together many people from the "online community industry": http://roi.webcrossing.com/
- An ongoing online community of programmers, designers, and facilitators who use Web Crossing is at http://webx.webxharbor.com/.

Advantages and disadvantages of Web Crossing.

The following table summarizes several Web Crossing characteristics, each of which can be seen as an advantage or a disadvantage, depending on your point of view or the kind of learning community involved.

	Advantage	**Disadvantage**
Programmability	Complete flexibility as to appearance of additional resources.	Expectations or complexity can increase beyond available programming resources.
Cost: low but not free	A supported product that evolves over time.	Not free.
Security	SYSOP has fine-grained control over user access.	Delegation of security access control to ordinary users demands user expertise.

BEST COPY AVAILABLE

A Community Information and Knowledge Exchange Tool to Support Organizational Readiness in the Public Sector

Thomas McKegney
Chief Editor
Public Sector Communities of Practice Platform
McKegney.Thomas@tbs-sct.gc.ca
www.compra.ca

Abstract: The Organizational Readiness Office (ORO) in the Chief Information Officer Branch of the Treasury Board of Canada Secretariat decided in February, 2002, to acquire a Web-based tool to encourage and support learning and knowledge sharing initiatives within the IT, IM and Service Delivery Communities.

The Business Case:

The ORO is supporting development of capacity within communities to provide leadership to human resource development issues that align with government's Service Transformation agenda. The argument for acquiring a tool capable of supporting exchanges within communities was that literature on "proven practices" for support of CoPs suggests that one of the most important supports that an organization can provide is an effective mechanism for sharing relevant, validated information and knowledge among members. The ORO recognizes that communities exist because of the interests of individuals, and technology is only relevant if community members feel it furthers those interests. The ORO will be exploring ways that technology designed specifically to support CoP activities affects the development of the IT, IM and Service Delivery Communities, as well as a variety of other public sector CoPs that are being given access to the tool. One government organization also plans an independent formal evaluation of how access to this Web-based knowledge-sharing tool affects several of its communities that have not previously had access to on-line information sharing tools of this type.

By offering access to the tools, the ORO hopes to identify informal communities that exist in workplaces throughout the public service, provide opportunities for participants to be recognized for their expertise, and provide opportunities for community members to develop and demonstrate their leadership skills. As well, the ORO hopes to identify the most effective ways that on-line tools could be best used to achieve the objectives set out in the ORO Business Strategy. These are:

1. Awareness and Engagement
   Given the large number of federal public servants in the IT, IM and Service Delivery communities, and their distribution from coast to coast to coast in Canada, electronic information-sharing mechanisms are the only realistic option.

2. Human Resource Capacity Building
   The ORO is primarily interested in developing capacity of the overall IT, IM and Service Delivery Communities to participate in managing HR issues related to Service Transformation and other organizational changes as the role of government continues to evolve. Because of the nature and magnitude of the cultural change involved, leadership will be required at all levels. Informal workplace communities of practice provide a forum in which leadership skills can be recognized, providing an incentive for further personal development and community involvement

3. Sharing of Management and Work Practices
   Government organizations have many mechanisms for distributing information about formal policies and procedures. However, little if any support has traditionally been provided for informal knowledge sharing among public servants. As individual knowledge and expertise

becomes more important to knowledge organizations such as governments, CoPs are attracting organizational attention. Their informal nature and their focus on work practices encourages sharing of knowledge across departments and other traditional organizational boundaries. This knowledge sharing goes on because of individual interests, regardless of whether the organization recognizes or values it. Providing a Web-based tool can encourage sharing of knowledge on a broader scale to support organizational objectives, but – as noted above – only if it also reflects individual interests.

Selecting a tool

A review of "off the shelf" collaboration tools on the market found only one that met all the key requirements for this project. The basic requirements identified were that the tool must not require any special hardware, software, technical knowledge or sophistication of community members; that any customization needed could be done by community members with no technical support; that no technical support to the communities would be needed; and that community members be able to navigate and post in their choice of French or English. As required by government purchasing policies, a notice of intent to purchase this product was published inviting vendors to propose other suitable products. No other vendor challenged the conclusion that Simplify was the only available product to meet the needs identified.

The ORO requirements were based on its plans to make the tool available to members of the IT, IM and Service Delivery communities. However, there was immediate interest in the tool from a number of "communities of practice," some of which had been in operation for a period of years. However, as informal communities, most had limited organizational support and could not on their own acquire or maintain Web-based tools.

ORO strategically decided that allowing other communities to share the platform would meet its objectives of helping increase awareness of workplace communities, and encourage a co-ordinated approach across government to support for CoPs. This made the tools accessible to communities that could otherwise not have afforded any tools of the sophistication of Simplify. It also encouraged sharing of experiences and ideas among various communities, helping to avoid costly and unnecessary duplication of software evaluations, license fees, server maintenance, training, etc. The vendor has taken a very enlightened approach to this sharing of the tools, and has shown no hesitation to help the ORO develop innovative ways to test the limits of the product design

ORO involvement in the platform has given increased legitimacy to CoPs, and has provided an opportunity to bring leaders of many CoPs together on a monthly basis to discuss issues related to CoP activities in a federal government setting. Often the interest in the ORO platform comes from individuals who are looking for "the tool" that will create or support a community for their organization. It is useful for these individuals to meet with other community leaders who know from experience that technology does not create community.

This platform is also giving the ORO an opportunity to evaluate modern management theories that suggest individuals who are passionate about their work will share their enthusiasm and knowledge with others if they see this as a value to themselves and/or their community. ORO's decision to provide this tool for community use is seen as evidence that government recognizes that CoPs can play a role in change management, if they are given the opportunity and tools needed to participate effectively. It also reflects a degree of respect and trust for communities, recognizing that they are informal structures that are neither directly accountable to nor formally part of decision-making structures. However, the risk of misuse is considered low given that community members are public servants who occupy positions of public trust.

The Product

Simplify is provided by Tomoye Inc of Gatineau, Quebec. The original product was developed for the Food and Agriculture Organization in Geneva to support knowledge exchange among researchers and experts within the global fishing industry. While the technology is based on email and a Web repository just as many other discussion-support solutions, Simplify is specifically designed to support development and activities of communities of practice.

The ORO made a conscious decision to have the Government Informatics and Telecommunications Service (GTIS) configure and maintain the server needed to support this platform. This decision was taken to encourage GTIS initiatives to develop capacity to support innovative, cross-jurisdiction services. GTIS offered service at a cost comparable with a private sector supplier, and is able to allow access by public servants both via the Internet and the government Intranet.

Dgroups Overview

Shady Kanfi, Bellanet
Canada
skanfi@bellanet.org

Abstract: Dgroups is a partnership whose aim is to nurture and support many kinds of groups and communities related to international development. Whether supporting a team, a group, a network, a partnership or a community, the partnership hopes to provide an environment that is simple, non-commercial, respectful of privacy, and targeted at low bandwidth users in the South. Dgroups is also the name of the platform that exists at www.dgroups.org and of the software application that was developed.

Who is Dgroups ?

Current partners include Bellanet, IICD, OneWorld, UNAIDS and DFID. The platform was developed and hosted by Bellanet and is supported by all partners with more joining all the time. Current participation is limited to Dgroups partners and their respective networks of projects and stakeholders.

Why Dgroups?

As part of the overall rise in Internet use among international development organisations, recent years have seen an ever-increasing number of organisations that want or need to host online groups, events, dialogues or communities. Instead of continuing to develop separate or one-off solutions, with unconnected spaces and non-transferable skills and information, the Dgroups partners decided to come together and support a common and re-usable platform not just for each other, but ultimately for the entire development community.

The partners see support for Dgroups as a way to develop such a public platform, to provide valuable services to their respective stakeholders and networks, and to create an easy way for people to find out about groups and communities of interest to them from the central Dgroups site.

Why create something new? Because until today, the partners know of no comparable service which is as simple, non-commercial (no end user cost/advertising), respectful of the privacy of personal and group information, and targeted at low bandwidth users in the South.

Fostering strong communities is an art that involves a subtle understanding of group dynamics, the use of good facilitation techniques, and the use of appropriate tools. The successful combination of these factors will help foster an environment where individuals identify with, and easily interact with, their group. The Dgroups platform focuses on the development of appropriate tools, while Dgroups partners together try to develop the facilitation and community management skills that are necessary.

Background

A major focus for Dgroups is to service users from developing countries with low bandwidth connections to the Internet. Making sure that participants from the South can be "first-class citizens" in our online spaces has resulted in the adoption of email-based discussion at the core of all group spaces. Email offers the flattest learning curve, the lowest bandwidth requirements, and benefits in terms of push vs. pull technology for both Southern and Northern participants. Mailing lists, the ultimate expression of email based "groupware," have thus become the core Dgroups technology.

But email-only interaction is not sufficient for many. With good intentions, many push the technological envelope by innovating with web-based repositories and databases allowing the sharing of various resources (news, events, project information, documents, links, contact information,

organizational information, etc.). Yet Dgroups partners have realized that not rooting a knowledge or information sharing effort in the context of a specific and well understood group of people severely undermines that effort's chances at success and sustainability.
Groupware is not a new concept, and "Communityware" is a popular evolution of this idea. Unfortunately few, if any, retain a low-bandwidth orientation (i.e. a focus on email-only participation) without compromising on web-based functionality and without commercial disadvantages (i.e. high costs, advertising, unacceptable privacy policies, or unacceptable use of personal or group information).

Thus evolved the Dgroups "workspace." Half mailing list, half 'group home page,' a workspace is a hybrid tool that starts with the ease of participation that a mailing list provides and allows a group to expand into the arena of web-based information sharing in a simple fashion and at its own pace.

Design Vision of the Dgroups Workspace

There are three core elements to the standard Dgroups workspace. In order of priority they are: the discussion, the people, and the related resources.

First and foremost every workspace is oriented around a single mailing list based discussion. The website acts as a public or private 'home base' for this discussion by providing access to browse discussion archives, and is usually augmented by highlighting recent postings on the home page, or by offering a full text search capability. The discussion is considered the fundamental glue that holds each community together regardless of whether or not it serves objectives from a larger context (such as organisational mandates, or upcoming events).

Second, workspaces highlight user profiles and individual participation in the group. A strong sense of who people are in a community allows one to establish the crucial context in which messages are sent, information is shared, and knowledge is learned. A better understanding of a user's pattern of activity, their individual background, or their organisational affiliation helps other members of the group judge the value of the information they glean.

Finally, workspaces offer groups the capacity to collect, manage and disseminate related resources and material. Often this functionality is used by and for the groups themselves, but sometimes it is used to disseminate information publicly when a Dgroups workspace is open to the public. Resource types include links, Word files, PowerPoint presentations, spreadsheets, news items, bibliographic references, audio files, video files, etc. The system automatically converts some of these resources to web pages for ease of viewing. Even though management and editing of these resources may be the principle objective of a given group (such as a team developing a joint project proposal) the emphasis in the workspace is not on the resources themselves, but on the discussion and the people involved in the management or editing process.

Other features such as calendars, voting tools, multiple mailing lists, databases, photo albums, etc. are all possible and some are currently being used, but they are not central to the design and use of the platform. An important goal of Dgroups is to remain focused on nurturing a single group identity through dialogue and through a better understanding of one's fellow group members.

US Army: CompanyCommand.com and PlatoonLeader.org.

Maj. Peter Kilner,
CompanyCommand.com and PlatoonLeader.org
Peter.Kilner@usma.edu

Abstract: CompanyCommand.com and PlatoonLeader.org connect platoon leaders and company commanders in the Army allowing them to share what they are learning real-time, laterally across the entire organization. In addition to better preparation and learning while in the job, participating in these communities ensures that key experience is not lost. These communities also facilitate a culture change that encourages collaboration and the sharing of knowledge and experiences. Considering that all Army officers-literally thousands each year-command a platoon or company, the impact of this concept is phenomenal.

Pete Kilner provides both a scholarly and practitioner oriented approach to organizational learning and knowledge management with a focus on the development and organizational impact of distributed communities of practice. Pete is a founding member of two robust distributed communities of practice in the Army: CompanyCommand.com and PlatoonLeader.org. He is part of a leadership team that facilitates the efforts of over 20 volunteers who act as project managers, online discussion facilitators, and subject matter experts with the primary focus of creating and delivering value to these communities of practice.

The team is beginning to see the fruit of their work. Leaders throughout the Army are accessing knowledge, sharing ideas, and tapping into the experiences of others. The Web sites log over 55,000 unique visitors, making over 1.5 million hits a month who download the data equivalent of over three Microsoft Encarta Encyclopedias.

These sites capture not only the Intellectual Capital but also the spirit of the organization.
The websites are running off of php and perl scripts. PlatoonLeader.org represents our push toward a more automated community that requires very little technical expertise to run/operate. PlatoonLeader.org is running a variant of the widely popular PHP-Nuke Portal script. The branch that we are using is MyPHPNuke. This is a complete "portal" solution that is available for free (http://www.myphpnuke.com). While the creators call this a portal it is easily turned into a community of practice. Once installed on a server this free software has an Article Section, Threaded Discussions, Live Chat, Links Database and much more. Some setup and tweaking is required but the software comes with a robust administrative area that is controlled through a simple web page interface. Many of the commercially available "portal" and/or community solutions offer the same sort of function but at a much greater cost. No matter what solution is chosen it must always be tailored to fit the needs of the enterprise. Starting with a free, open source product allows for greater customization and innovation for the company that is using it.

Recently the team was recognized by Fast Company's Fast50 (March 2002 issue) for the model they have created. Additionally, the companycommand.com and platoonleader.org communities of practice were recognized by the Army as the Army's Most Innovative Knowledge Management Initiative this year. As a result of the impact these communities are having on the way the Army learns and shares knowledge, Army senior leaders have asked the team to work full time in the development of a Center that provides strategic planning and development of online communities of practice throughout the Army.

Network Analysis with I-know

Noshir Contractor
University of Illinois
contractor@uiuc.edu

Andy Swarbrick
University of Illinois
swarbrick@uiuc.edu

Abstract: Because information transacted over electronic media such as the Web can be stored in digital form, a new generation of software called "collaborative filters" or "communityware" (Contractor, O'Keefe, & Jones, 1997; Kautz, Selman, & Shah, 1997) can be used to make visible the work communities' virtual social structure. One such tool, IKNOW (Inquiring Knowledge Networks On the Web; `http://iknow.spcomm.uiuc.edu/`), has been designed by a team of UIUC researchers to assist individuals to search the organization's databases to automatically answer questions about the organization's knowledge network, that is, "Who knows what?" as well as questions about the organization's cognitive knowledge networks, that is, "Who knows who knows what?" within the organization.

Unlike traditional web search engines that help an individual search for content on the web, tools such as IKNOW search for content and contacts (direct and indirect). In addition to being instantly beneficial to users, they also provide researcher and e-moderators with an opportunity to unobtrusively and reliably study the influence of Communityware on the co-evolution of knowledge networks.

Noshir Contractor (http://www.uiuc.edu/ph/www/nosh) is a Professor of speech communication and psychology at the University of Illinois at Urbana-Champaign where he teaches courses and doctoral seminars on organizational communication processes, communication network analysis, dynamic systems analysis, collaboration technologies, and quantitative research methods. His research interests include applications of systems theory to communication, the role of emergent communication and knowledge networks in organizations, and collaboration technologies in the work place. His current research focuses on collaboration, including the role of computer- based tools to augment collaboration and group decision-making processes in team and organizational settings.

Online Media Juke-Box

Luca Botturi
Istituto Comunicazione e Formazione
Università della Svizzera italiana
via Giuseppe Buffi 13
CH-6900 Lugano
luca.botturi@lu.unisi.ch

Abstract

This interactive session presents *Online Media Jukebox*, a web interface for delivering online one or more selections of digital resources (texts in any web-compatible format, streaming video and audio, links) with a minimum of technical competencies. The software is a easy-to-use tool which has proved useful and of simple usage in its application for a course at the Università della Svizzera italiana.

Intended audience

The interactive session is intended for teachers of all levels and education practitioners who would like to try out a simple tool for collecting online resources. No particular prerequisite is necessary.

Software description

The presented software is a simple runtime database in JavaScript designed to contain online resources of different formats and intended to gather e.g. a case study. Supported media types are:

- texts (any Web-cpmatible format)
- Streaming video and audio (on the same or on a different server)
- URLs

Documents are catalogued according to the media type, but can as well be ordered with other criteria.

The construction of a collection of resources is done simply by editing a text file with the description of the digital resources. It has been used for implementing online case studies on more than 20 institutions in the course *The Institution in the Context of Society* at the Faculty of Communication Sciences at the Università della Svizzera italiana in Lugano, and is available for reuse.

Further developments are foreseen in year 2003 with the development of an online repository of digital resources and an application for selecting them and producing automatically an *Online Media Juke-Box*.

Software presentation

The software will be presented according to the following perspectives:

1. Student interface
2. Web and software architecture
3. Implementation: how to use it
4. Demo: Case study on Institutions - a possible scenario
5. Discussion

Collecting digital documents will also be the chance for discussing related issues such as

- Copyright management issues
- Reuse and re-contextualization of learning resources
- Quality of Internet information

Proposed length

1 hour.

Presenter's qualifications

After his graduation at the University of Lugano with a thesis on educational adaptive hypermedia systems and educational design (ALSTOM Power 2000 prize for the best graduation), Luca Botturi is currently Ph.D. student at the same university with the topic *Designing Technology-dependent Educational Environments for Higher Education*.
He is fellow student of the doctoral school *NewMinE – New Media in Education*, funded by the Swiss National Science Foundation (www.newmine.org).
For the Istituto Comunicazione e Formazione he is involved in several e-learning projects as media designer, among which SWISSLING (www.swissling.ch). In the same institute he is coordinator of the seminar *Cognitive models and technologies*.
He was local co-chair of the ICNEE 02 International Conference on New Educational Environments (Lugano, May 8th-11th 2002).

Professional Development + Instruction + Minerals = A DVD that Rocks!

Renee M. Eggers, Ph.D.
Department of Teacher Education
Youngstown State University
United States
rmeggers@ysu.edu

Salvatore A. Sanders, M.S.
Media and Academic Computing
Youngstown State University
United States
sasanders@ysu.edu

Donna J. McNierney, Ed.D.
Department of Teacher Education
Youngstown State University
United States
mcnier@zoominternet.net

Raymond E. Beiersdorfer, Ph.D.
Department of Geological & Environmental Sciences
Youngstown State University
United States
rebeiersdorfer@ysu.edu

Abstract: This paper details the creation of a multi-purpose DVD. First, the DVD can be used for professional development to teach P-12 teachers how to integrate a DVD into an instructional setting; a lesson plan is included that helps to illustrate the use of a DVD in the teaching of a topic. Second, the DVD, which contains instruction about rocks and minerals, can be given to students to use on either a computer with a DVD drive or on a DVD player connected to a television. Third, the DVD serves as a promotional tool; in this case, the DVD helps to promote both the mineral museum that is on the campus of Youngstown State University and Youngstown State University itself.

Introduction

This paper focuses on the creation of a DVD-based multimedia program that spotlights the subject of geology. DVD authoring allows for inclusion and integration of a variety of digital resources such as digital video, still images, audio and Web links. Ability to include subtitles and interactive menus adds to the instructional appeal of DVD. This DVD is a multi-purpose tool that can be used for professional development, instruction, and as a promotional tool.

Design and Development of the DVD

The authors are fortunate to have an excellent mineral museum located on their campus. Access to the museum facilitated the collection and/or creation of digital images, virtual reality movies, and digital lectures, along with handouts, for inclusion onto the DVD. Instructional components were collected and incorporated into an instructional DVD, which also contains a model lesson plan plus instructional techniques that can be used by teachers in their classrooms to integrate the DVD into an instructional setting. Design and development of the DVD was accomplished using a Power Mac® G4 computer and Apple DVD Studio Pro™ software.

Instructional

As with all multimedia projects, the authors had to address various instructional design issues. Four instructional design areas required the most attention. The first area was deciding what information to include for a multimedia presentation. A second issue was deciding the delivery method for the multimedia presentation; after examining the advantages and disadvantages of various delivery modes, a decision was made to create a DVD. Use of the DVD created another instructional design issue: what to do in a situation where the learner is accessing the information, especially handouts, via a DVD player connected to a television. The final instructional design issue was the layout of contents and navigational design of the DVD to make the DVD user-friendly for diverse range (age, knowledge of subject matter, and technological abilities) of end-users.

To include various types of content (video and other files) and to take full advantage of the storage capacity (4.7 GB) of the DVD disc, the authors choose to create a hybrid DVD, which contains files that comply with the DVD video and audio standards and files that do not (Apple Computer 2001). In this particular project much of the video complies with the DVD standard and, therefore, can be viewed and navigated using most DVD players. Some of the content such as QuickTime VR (virtual reality) movies, and supplemental instructional materials require a computer system with a DVD-ROM drive to access and utilize them. By using a hybrid format, a single DVD disc can contain the high quality video, characteristic of DVD, and the supporting instructional materials and files necessary for multiple uses.

Professional Development

Effective, efficient, and appropriate use of technology in today's classrooms is critical. However, technology cannot be the major focus, but rather it needs to be integrated seamlessly with instruction so that the subject content is the emphasis, and not the technology. To accomplish a seamless integration for instructional use in the classroom, professional development that concentrates on technology integration must be given to teachers. Modeling the instructional strategies for teachers about how and why to integrate media and technology in their classrooms can be beneficial in transforming a traditional teaching approach to one that is more progressive. The instruction brought about in the classroom can change the way students learn about the content and certainly makes it more motivating and personally more interesting. When making instructional decisions about web-based and/or multimedia learning activities, teachers need support and motivation for the development of the project. An instructional lesson plan was designed that included learning outcomes, concepts to learn, purpose of lesson, strategies, and assessment. This plan may be adapted for different concepts and grade levels.

Additionally, information is contained in the professional development section that describes how the teacher can utilize the DVD for different instructional settings. This component covers ways that the DVD can be incorporated into a whole class lesson; in addition, there are suggestions as to how a teacher can use the DVD as a learning tool on an independent basis at school or at home.

Instruction

The DVD is also designed to be used by students of various ages. Because of that, the geological information included on the DVD was selected to be visually appealing and to allow the students to have an interactive learning experience. Much of the video in this project provides access to subtitles, a feature that should prove useful to hearing impaired users. To maintain a student's interest, the DVD contains information in different forms. Some information is present in text form. Other information is presented by using images with accompanying audio. There are also virtual reality movies of some of the minerals housed in the museum. To add a touch of humor and a "fun" feeling to the learning experience, video of Dr. Beiersdorfer, co-author of this article and professor in the Department of Geology and Environmental Sciences, singing about rocks was incorporated into the DVD.

Promotion

Besides using the DVD for professional development and instructional purposes, the DVD can be used as a promotional tool. The DVD can be given to individuals (adults and/or children) so that they can see images of the minerals housed in the museum and learn, on an independent basis, about those minerals. In this section, the viewer is encouraged to visit the onsite and online mineral museum to see the minerals on display. Promotion of the museum is done via a video tour of the museum. A link to the museum's website is part of this aspect of the DVD.

The mineral museum is not the only promoted location. Youngstown State University is also a featured component. This part of the DVD permits the student to enjoy a virtual tour of the University. Additionally, for individuals who access the DVD via a computer that is connected to a printer, undergraduate and/or graduate applications can be viewed and printed.

Conclusion

DVDs are no longer just for movies! Access to DVD burners permits the creation of instructional materials that can be used in a variety of ways. With careful thought and good design, use of a hybrid DVD format allows inclusion of video, audio, and other media and data files onto a single DVD disc. The increased storage space provided by DVD allows for the inclusion of various types of content making the creation of a disc that has content suitable for multiple purposes a possibility.

The DVD is an innovative teaching tool that certainly will capture the interest for students in a discipline area, such as geology. Opportunities and access for students to view and analyze minerals in a science class can prove to be expensive, and often the school district lacks the laboratory materials to provide an enriched learning experience for its students. Using the capabilities of a DVD can overcome such obstacles.

Reference

Apple Computer. (2001). *DVD studio pro user's manual*. Cupertino, CA: Apple Computer.

Developing Online Courses using Robohelp

Introduction

With the dramatic development of the Internet, universities and colleges are zealously developing online courses and programs. A lot more care needs to be taken in the development of an online course than a traditional course, specifically in overall design, look and feel, navigational convenience, and interactive content. Robohelp from Ehelp Corporation provides a powerful (and familiar to Windows users) environment for developing and publishing course content within course management software or on the World Wide Web. This Interactive Session will demonstrate how to create comprehensive content for Online courses and Programs.

Software to be Demonstrated

Robohelp, from Ehelp Corporation Navigation is the perfect tool for developing online content with point-and-click ease. When used with course management software such as Blackboard or WebCt, it is possible to create professionally developed courses rapidly and with lower cost. Anyone familiar with Microsoft Office Help has used the Robohelp paradigm in which topics are created in books and can be individually read and sequentially navigated, searched by keywords, or navigated by index topics. If you are viewing this document in Microsoft Word, click on *Help -> Contents and Index* to see how content created with RoboHelp is presented.

Significantly, output of Robohelp is a folder that can either be loaded as content into course management software or published directly as a website on a web server. On the development side, users can use RoboHelp's built in HTML editor, or substitute one they are familiar with. The environment supports editing at either the tag level or WYSIWIG (what you see is what you get).

Interactive Session

The presenters will show how to create content for a multi-book educational topic. This will demonstrate how to create a new project, new books, new topics and how to edit and ultimately generate the website.

If there is a connection to the Internet (wireless or wired), the presenters can demonstrate both how to publish the project on a website and incorporate it directly into Blackboard.

Audience

This interactive session is for educators who are interested in learning effective ways to develop powerful professional courseware easily and quickly for online courses and programs. There are no prerequisites, but participants with a course in mind to develop content for will benefit most from the presentation.

Proposal for AACE E-Learn 2002

The Integrated Electronic Course Portfolio (IECP)

Yitna Firdyiwek
ybf2u@virginia.edu

As is well known by now, the World Wide Web has afforded teachers broad access to information and and the possibility of well integrated work environments for collaborative activities. However, while surfing, chatting online, and building personal web pages are fairly easy activities, developing even moderate scale interactive content sites that organize and maintain student work remains too difficult for many. There are numerous programming and infrastructure issues that need to be resolved, and carefully selected appropriate tools that need to be in place before the power of Web-based connectivity can be tapped directly and constructively by teachers and students with average technological skills. Thus, the viability of web technology for supporting teachers on a wide scale has been late being realized.

Part of the problem stems from the limitations of the Web itself. Though it's a powerful tool for delivering information, when it comes to organizing what it delivers, the Web by itself is rough and chaotic. Because of this weakness, the Web cannot be taken advantage of fully without additional tools such as databases for structuring the information it delivers. Integrating the web with databases allows for the functions of "delivery" and "organization" of documents to be accomplished via tools that are appropriate for each function. With the advent of systems that make building web-based interfaces for databases easier, the possibility of collecting, storing, and disseminating large amounts of documents in a manner that simulates paper-based classroom interactions is within the grasp of teachers.

Another part of the problem that hampers teachers in the use of the Web for collaborative classroom activities is the design of such tools. Even when web-database integration is leveraged, the design of the user interface for such tools can pose severe limitations stemming from the fact that most of the tools are either not designed with teaching and classroom environments in mind, or designed at great cost and for specific teaching environments only. Another related problem involves the dynamic nature of any rich teaching environment. To allow teachers and students to be creative in their use of the tool without diminishing the dynamism of their exchanges a tools needs to be extremely flexibile, easily customizable, and either transparent to, or part of, the content and pedagogy at hand.

The interactive session being proposed for this AACE conference involves the demonstration of the Integrated Electronic Course Portfolio (IECP also known as E-folio). Developed for use in the management of portfolio-based writing instruction, the tool was initially designed to respond to two specific problems posed by that method of teaching: handling a large number of documents produced by students, and fostering interaction and collaboration by teachers and students over the work they produce. Using Electronic Performance Support as a method of software design, the tool was developed in collaboration with writing instructors who had used portfolio-based writing instruction and who had identified the two most severe problems that kept them from successfully implementing the portfolio method. While still a tool designed primarily for handling writing-intensive courses, the IECP has been effectively used in a variety of teaching environments from high-school to graduate level courses. Through an interactive demonstration of the IECP participants will be able to see how the tool has addressed the problems of harnessing web-interactivity and producing an effective user interface design.

Developing and Authoring Multimedia Presentations Using Trivantis "Lectora"

Dr. Ted Folwer
College of Education
University of Cincinnati
United States
ted.fowler@uc.edu

Abstract: Trivantis *Lectora* is a software package allowing easy creation of interactive multimedia courses, tutorials, portfolios, and presentations for Internet websites or self-contained CD-ROMs. Four applications are demonstrated: professional teacher portfolio, tutorial presentation on electrical safety, interactive instructional protocol for classroom management, multimedia kit for use by students. All contain text, images, audio, and video demonstrating the power of the software. The code that was written to create the applications is shown and explained along with the variety of tools included with *Lectora*. The authoring of a simple multimedia presentation is interactively demonstrated using the "book" metaphor basis of *Lectora*. Emphasis is placed on identifying the instructional principles upon which the applications and illustrations have been built, including Borich's five key teaching behaviors, constructivist learning, and social interaction during the teaching/learning process.

Introduction

Trivantis *Lectora* is a software package that allows easy creation of interactive multimedia courses, tutorials, portfolios, and presentations that can be published as Internet websites or as self-contained CD-ROM applications. Four of these applications were demonstrated during the interactive presentation:

- professional teacher portfolio
- tutorial presentation on electrical safety
- interactive instructional protocol for classroom management
- multimedia kit for use by students

These applications contain text, photographic images, audio, and video. *Lectora* also supports Shockwave, Flash, HTML, Java, and JavaScript.

Objectives

- Participants observed several practical applications of the *Lectora* multimedia software package.
- Participants came to understand the manner in which the applications were developed and programmed.
- Participants came to understand the fundamental capabilities and operation of *Lectora*.
- Participants understood the educational and instructional principles that were used as a basis for construction of the various applications demonstrated.

The presentation was appropriate for anyone with a general understanding of multimedia applications and was intended for all grade levels preK-12, higher education, and industrial/agency training.

Interactive Presentation

Each of these applications was be presented in a way that demonstrated the power of the software. The simple code that was written to create the applications was shown and explained. The variety of tools included with *Lectora* was exhibited within the context of the applications in which they were used. Finally the authoring of a simple multimedia presentation was demonstrated using the "book" metaphor that is the basis of *Lectora*.

The professional teacher portfolio was produced by a graduating English major and makes use of many of the features of *Lectora*, including video, exhibits of student and teacher work, Flash animation, and complex indexing. The electrical safety materials were developed by the presented in conjunction with the Centers for Disease control, National Institute for Occupational Safety and Health (CDC, NIOSH). A variety of techniques have been used to optimize the knowledge and attitudinal impact of the course materials, including photography, linked text, video, branching, and multiple entry points. The teacher protocol material makes use of branching contextual video to demonstrate a variety of teacher instructional skills with reflective statements by the teacher in order to drive home the critical instructional acts. The multimedia kit demonstrates a technique that provides appropriate scaffolding for project-based learning. A variety of resources are provided students to build a multimedia presentation based on audio recordings of Thane Maynard, *The Ninety Second Naturalist*, from the Cincinnati Zoo. Students, using *Lectora* or other multimedia packages, are able to work in small groups to assemble accurate and entertaining information for class presentation using a "jigsaw" cooperative learning approach. Appropriate scaffolding is supplied in the kit to allow students to focus their learning during a class project, aiming to develop valuable intellectual and group process skills.

Emphasis was placed on identifying the instructional principles upon which the applications and illustrations have been built, including Borich's five key teaching behaviors, constructivist learning, and social interaction during the teaching/learning process. *Lectora* supports these principles well and is also able to be integrated with *Blackboard* to further support defensible instruction and training.

Participants were able to work through some initial development examples using interactive small-group worksheets designed for the session: here is the task, think about it, order the steps, tell me what to do. This allowed for maximal participation of a wide range of experience levels and assured interaction among the participants. The later part of the session was be driven by participant questions and reactions.

References

Borich, G. [1998]. *Effective teaching methods*. New York: MacMillian Publishing Co.

Loos G, Fowler T. [1999]. *A Model for Research on Training Effectiveness (TIER)*. Cincinnati, OH: U.S. Department of Health and Human Services, U.S. Public Health Service, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health, Publication No. 99-142.

The Challenge of Turning Professional Development into Professional Practice

by
Sharon Friesen and Pat Clifford
Galileo Educational Network

Introducing new technologies should never be about pouring old wine into new bottles. Students must be given the opportunity to think in compelling ways each time they pick up a digital tool. In a general sense, technology should allow students to do things at a level of complexity and sophistication impossible without a computer. It should allow them to create, not simply consume and reproduce knowledge. And technology use in school should have more in common with students' out-of-school experiences with digital environments than with digital textbooks and worksheets.

Teaching to accomplish these goals requires a commitment to inquiry-based learning, and teachers who think differently about curriculum, teaching and learning. The Galileo Educational Network is a professional development and research initiative focused on the kinds of fundamental changes to teaching, learning and staff development that information and communications technology both requires and enables. Providing professional development both onsite and online through an innovative professional development service called IO (Intelligence On-Line), we are assisting teachers make necessary changes to their professional practice.

The Galileo Educational Network was formed in 1999 to provide this kind of professional development in a face-to-face environment in order to assist teachers to integrate information and communication technologies (ICT) into teaching and learning in core academic areas. In September 2002, we will complement the proven success of our on-site approaches to professional development with an on-line environment that supports teachers as they learn to plan and think in new ways. Drawing on three years of intensive on-site work, this new initiative carries our commitment to school reform into an e-learning environment.

It is clear that in order to infuse information and communication technology into the world of the classroom in genuinely effective and innovative ways, fundamental changes to our understanding of teaching and learning are required. We need to produce and develop teachers who can move with confidence and skill away from old teacher-centered structures and ideas about their work. Such teachers must learn how to create compelling project-based inquiries for teaching and learning if educational investments in technology are to bear fruit. This shift requires a fundamental cultural change:

- Curriculum must become increasingly learner focused, and learner driven

- Learners must become far more deeply engaged in meaningful tasks that are of value to self and to others.
- Learners' experience with technology in school must become much more like the experiences they currently have outside school

The on-site work of the Galileo Educational network has begun to provide compelling answers to the following questions:

- What are the impacts on student learning when teachers learn new things in new ways?
- What is the nature of inquiry-based learning for teachers and students?

Our on-line initiative addresses a further question:

- How can on-line professional development for technology integration result in changed professional practice?

Intelligence On-Line (IO)

Technology is leading the way with conversations that need to be held at every level of formal education. How do we create personalized learning environments rather than the generic, teacher-centered ones that continue to characterize so much of children's experience at school?

Effective, highly personalized on-line environments must begin to discard the assumptions of distance learning, where courses, lectures and materials are still delivered, essentially in one direction, from instructors to learners. They must even go beyond the interactive supports for such courses now provided by bulletin boards and chat environments. Personalized environments push these edges to require learners (in our case, teachers-learners) to create something new. It is a move away from a central metaphor of course delivery. The root metaphor, itself, changes. Knowledge is not delivered; it **grows** in unpredictable ways because learners move through an e-learning space according to their own needs, intentionally connected to others. Participation in this space makes it grow for you, over time and through your use and interaction. For each learner, the space becomes what it is **because** each learner uses it in the ways that make most sense to them.

In February 2001, the Galileo Educational Network Association formed a partnership with Axia Netmedia. Together, we created an online Intelligence Online (IO). Our goal is to help teachers develop and refine environments where their students learn **with** technology as opposed to learn **about** technology.

Galileo and Axia share a strong fundamental belief that successful teacher professional development:

- Is ultimately about students and improving student learning
- Must be viewed as an ongoing and integral part of teachers' professional lives
- Must be focused on specific outcomes that are desirable to both teachers and stakeholders

Through IO, teachers can learn to create highly engaging inquiry-based projects "in which the desired learning outcomes…[are] the construction of new knowledge and understandings rather than merely summarizing what…[is] already known about a topic" (Jacobsen, 2001b p.20). There is classic content available in this place, but it goes much further than that. They will have access to tutorials just in time, not just in case they might need the information six months down the line. Teachers will be able to collaborate with others, consult with world-class experts, and see powerful examples of what learning with technology truly ought to mean: what can students do with technology that they have never been able to do before, or what can they do more deeply, more powerfully, with more passionate engagement than paper and pencil have ever allowed. And, most significantly, teachers will learn about effective technology integration by being immersed in a culture of use in which they will "experience first hand the learning opportunities they…[will then be able] to provide for children" (Jacobsen, 2001, p.19).

Currently, much of what is available to teachers on line takes a landfill approach: provide hundreds and hundreds and hundreds of examples of teacher-generated units and hope that some of it is useful. More recently, enthusiasm for on-line repositories objects has added to the heft of available learning objects without addressing fundamental issues of how teachers might use such objects in robust inquiries. In such environments, "good" generally means "lots". IO is far more sharply focused than this. It is an innovative move to on-line environment that becomes more particular to teacher needs, questions and interests the more they use it.

Conclusion

It is our belief that effective e-learning environments for professional development must learn important lessons from what works in face-to-face environments while utilizing the particular character of communications and information technology in new and exciting ways if we are to make wide-spread progress in changing the face of teaching and learning in schools. This presentation

- demonstrates both the ways in which new approaches to professional development in face-to-face environments address gaps in current practice identified in the research literature;
- suggests ways in which what we have learned can be translated into e-learning environments
- suggests directions for the fruitful marriage of face-to-face and e-learning professional development for maximum effectiveness.

References

Jacobsen, D. M. (2001). Building Different Bridges: Technology Integration, Engaged Student Learning, and New Approaches to Professional Development. *Paper presented at AERA 2001: What We Know and How We Know It, the 82nd Annual Meeting of the American Educational Research Association*, Seattle, WA: April 10 - 14, 2001.

In-service Development for Educational Assistants

Abstract

The Special Needs Opportunity Windows (SNOW) Project is an online provider of professional development opportunities and resources for educators and supporters of students with special needs. Using Web-based courseware tools, SNOW offers training and curriculum materials along with interactive discussion forums to assist Ontario educators in applying experience and strategies to benefit all learners. The Inservice Development for Educational Assistants (IDEA) workshop series provides educational assistants with the opportunity to receive Web-based training to support learners who have special needs.

With budget pressures and crowded classrooms, demands on educators today have never been greater. Classroom management becomes more complex as Ministry guidelines to handle students with special needs become more comprehensive. Educational Assistants provide support to teachers by working individually with students to assist with their responsibilities. For such a paramount role within the Ontario education system, an EA is inclined to tread through uncertain waters in an effort to help, though more often than not they are unqualified to do so. In some cases, an EA has little to no experience in dealing with students who have special needs.

One solution is the Special Needs Opportunity Windows or SNOW Project, an initiative funded through the Ontario Ministry of Education that is hosted and administered through the Adaptive Technology Resource Centre at the University of Toronto. The SNOW Project is an online provider of professional development opportunities and resources for educators and supporters of students with special needs. Using Web-based courseware tools, SNOW offers training and curriculum materials along with interactive discussion forums to assist Ontario educators in applying experience and strategies to benefit all learners.

Recognizing the need to support educational assistants, SNOW launched its In-service Development for Educational Assistants or IDEA workshop series in January 2001. The goal of the program was to provide educational assistants with the opportunity to receive training to support learners who have special needs. Covering a wide range of exceptionalities, the IDEA workshops are designed by experts in special education and feature moderators experienced in delivering distance education and are adept at creating an engaging and interactive learning environment.

Web-based training has inherent advantages compared to standard classroom training. For instance, SNOW workshops:

- Have anytime, anywhere access providing convenience for those who require a flexible schedule,

- Are developed using multiple file formats (text, images, audio and video) to support learning objectives across multiple platforms,
- Offer opportunities to perform investigative research and lateral learning in addition to the authored course content,
- Are offered in asynchronous formats so participants can choose when is most convenient for them to schedule their study time, and
- Afford participants the ability to communicate both with the instructor as well as peers to receive a broader base of knowledge and experiences.

IDEA workshops cover topics surrounding support for learners with autism, cerebral palsy, acquired brain injury, spina bifida, epilepsy, behaviour disorders and learning disabilities. The workshops are not restricted to educational assistants; anyone who works with learners who have special needs will benefit from these workshops.

The SNOW Project is funded by the Ontario Ministry of Education through the Provincial Schools Branch. For information on the SNOW Project and the IDEA workshop series, please visit http://snow.utoronto.ca/

Written by Craig Hegins
Curriculum Coordinator for the SNOW Project

PRESENTATION TITLE

Motivate Others to Change: How to Accelerate Personal CHANGE-ability and Master Resistance!

LEARNING OBJECTIVES

As a result of attending this workshop, participants will be able to:

1. greatly enhance their personal ability to manage change;
2. more effectively influence others, including small and large groups, to change;
3. understand and manage the roots of resistance;
4. apply the practical tools needed to effect large-scale group change.

DESCRIPTION

This session will provide a provocative, cutting-edge approach to change that combines psychotherapeutic methods and in-depth experience helping employees through significant change. Provides a solid foundation and practical tools to enhance individual CHANGE-ability and successfully affect change in organizations.

The session explains the deep roots of resistance and provides practical tools to overcome it. Provides participative exercise to explore how the nature of change is significantly different than in the past, and why we must get much better at handling complexity and change. Participants learn the typical reactions to change and use a self-assessment to understand their **own** reactions. The session defines the secret formula for large group change and shows how the formula can be applied. There are hands-on group exercises that enable participants to employ tactics and strategies to help others through change.

BIOGRAPHICAL SKETCH

Peter Hess is the President of ***CHANGE Partners***, a Human Resource management consulting firm. With 20 years' business experience and a proven ability to achieve business goals through people, Peter has enabled clients to achieve bottom-line impact by better managing change, aligning corporate culture and strategy, and improving team effectiveness.

CHANGE Partners' clients include Pfizer, Bristol-Myers Squibb, Bayer Corp., Sterling Winthrop, Merck KGaA, Pharmacia Biotech, JP Morgan Chase, MetLife, Prudential, AT&T and Nabisco.

Peter has a BS in Psychology from Swarthmore College and a MS in Human Resource Management from Rutgers, and has taught classes for Rutgers, Columbia, NYU and the AMA.

OUTLINE

- ***The New Context for Change***
  - What can we learn about change from the great thinkers and doers, and how does this apply to our everyday lives?
  - Participative exercise to explore how our world in the '00's is significantly different, and implications for the need to get much better at handling complexity and change.
- **Awww, Do I Have To?**
  - Explains and illustrates the deep roots of resistance, and provides practical tools to overcome resistance.
  - Shows the three typical personal reactions to change and complexity, and provides a self-assessment participants can use to understand their own reactions.
- **Invigorating CHANGE-Ability**
  - Provides research and practical, real-world examples to help participants under the five paths to Change Mastery.
  - Participants work together to understand and apply the five paths to Change Mastery.
- **What Great Change Agents Do**
  - Defines the secret formula for large group (organization or community) change, and shows how the formula can be applied.
  - Hands-on small group exercise that enables participants to employ tactics and strategies to help others through change.
- **Energizing an Organization or Community**
  - Practical application of the seven stages of large group change.
  - Participants craft a customized Change Mastery Plan for their organization or community.

Best Practices in Blended eLearning

Presenters: Jennifer Hofmann, President, InSync Training Synergy, LLC
Gregory Dunkling, faculty, The University of Vermont

The efficacy of eLearning that has been demonstrated over the past few years through corporate training and higher education initiatives gives distance learning professionals great hope for the future of this educational and training medium. Yet there are significant obstacles to overcome before online education achieves the level of acceptance that many predicted it would just a few years ago. In this presentation we explore the use of blended eLearning, defined here as the use of asynchronous and synchronous Web delivery, focusing on research that we conducted over the summer of 2002 as we examined emerging best practices. We also explore whether these obstacles that are impeding the growth of online education can be addressed through the use of an appropriate mix of asynchronous and synchronous delivery.

Let us first examine the history of distance education. This brief timeline illustrates the changes that distance learning has undergone over the past two centuries:

- 1840 - 1st Correspondence study
- 1900's - Audio Recordings
- 1920's - Radio Stations
- 1930's -Television
- 1960's - Satellite
- 1980's - Fiber Optic/ Audio visual Tech/CD ROM
- 1990's to Present - World Wide Web

The introduction of each of these technologies brought with it the promise of a revolution in education. Some visionaries were even so bold as to declare that new distance learning technologies would supersede the traditional classroom. Indeed, after the invention of motion pictures in 1913, Thomas Edison asserted that:

"Books will soon be obsolete in the public schools. Scholars will be instructed through the eye. It is possible to teach every branch of human knowledge with the motion picture. Our school system will be completely changed inside of ten years."

While there have been some very enduring distance education enterprises, traditional classroom education is still by and far the norm. The failure of Edison's vision raises the question, "why hasn't distance education become more accepted?" The answer may lie in the way distance learning professionals approach content design. Instead of creating content that utilizes the most appropriate techniques for the instructional goals and is adapted to the latest technology, distance learning course developers (i.e. faculty and trainers) have historically taken the traditional classroom format, dropped it into the new technology, and waited for the technology to do the work.

At the Open Learning Conference in Brisbane, Australia in December 1998, Professor Peter Swannell, Vice-Chancellor of the University of Southern Queensland, commented on the infeasibility of this approach, emphatically asserting that, "Without a new pedagogy, the technology will fail."

With this realization, it is necessary to return to the current developments in eLearning. While most agree that eLearning holds much promise, there are still significant obstacles that must be overcome before this medium makes a profound impact on education and training.

Three of the most important challenges hindering the progress of eLearning development are: 1) how to develop quality educational content in cost-effective ways; 2) how to reduce the development time of quality eLearning content, and 3) how to maximize the learning experience of participants in online education by recognizing different learning styles and using an optimum balance of asynchronous and synchronous delivery.

Recent changes in both the online and traditional classroom paradigms point the way to the future. Dr. Roy Lundin of Queensland University of Technology in Australia, discussed the changing technologies and uses of synchronous and asynchronous delivery in education at the seventh annual Sloan Foundation Conference this past year. He finds that:

"With the introduction of various technologies, more particularly online technology, the face-to-face paradigm is giving way to an increase in asynchronous work being done through email, discussion groups/forums, and Web based activities. In contrast, the off-campus educational paradigm traditionally involved only asynchronous contact, firstly via correspondence lessons using print interactions, then some basic audiovisual components, including broadcast radio and television. This then gave way to the introduction of synchronous technologies. With these two major delivery paradigms now coming together the question arises whether there is an optimum balance between the need for synchronous and asynchronous interaction among teachers and learners."

Distance learning professionals working to develop eLearning programs, it seems, are drawing on changes that online technology now make possible.

The combination of work in higher education and the corporate training community offer interesting opportunities to learn from our collective experiences. For example, in the early-stage efforts to put training and education on the Web, colleges and universities focused on instructor-led asynchronous delivery while corporate training initiatives emphasized self-paced eLearning and some use of synchronous delivery. Yet both have been challenged by the need to keep learners engaged in their learning and ways to best accomplish this. Often, the worst of first wave eLearning was little more than eReading and Powerpoint with audio, while best uses incorporated a blending of asynchronous and synchronous delivery with strong instructional design. The disparity between the "worst" and "best" of eLearning was significant. Nevertheless, a convergence of best practices is beginning to emerge. This growing knowledge-base and cross-fertilization between formerly disparate eLearning efforts in higher education and corporate training will help provide answers to how to best design fast, affordable and high quality online educational content.

In July, 2002, we launched a survey entitled "Best Practices in Blended eLearning," to look at how organizations are implementing distance learning, with special focus on instructional approaches that have contributed to quality programs. Certain survey respondents are being selected for follow up interviews based on the success stories and problems they described in their responses. Our goal is to establish examples of best practices in blended eLearning solutions. We asked respondents to comment on issues and trends in several categories, including:

1. **Technology blends.** Taking a look at what technology is being used in the Best Practices scenarios is critical. While there are many excellent examples of eLearning programs that only utilize one technology, the appropriate blending of technologies seems to lend itself to better participant retention and appeals to more learning styles. Cracking the code to discover some of the best technology mixes was a critical goal of our research.

2. **Change management techniques**. As the Internet and its related technologies mature, educational tools become easier to use for content development and delivery. In fact, implementation of eLearning in an organization is often more of a change management initiative than a technology implementation. We wanted to know what change management techniques were being employed in these initiatives to get the buy-in from the organization, prepare teachers to teach, and help students learn. We also investigated the successes and failures of new eLearning initiatives that did not have change management components.

3. **Design strategies and development techniques.** The success of eLearning programs is often determined by the quality of the instructional design. We identified the key questions that must be addressed to ensure that design matches content: What types of performance objectives are being delivered successfully through the different technologies? What is the most appropriate media? How much interaction is required? How do you keep your audience engaged? How do you know if they are learning?

As with any new trend, the possibilities and pitfalls of eLearning technologies are not yet fully realized – and probably will not be for some time to come. Training and education professionals are creating their own best practices as they go along – best practices that may have a very short shelf-life, as it will not be long before we can improve on them. During this early stage of synchronous development, effective implementation will only be realized through prudent and conscientious development to create the right settings and learning environments. Content must also be well designed, blending the most appropriate delivery methods. eLearning seems to be here to stay; but its impact on education remains to be seen. Through thoughtful planning to ensure that the quality of instruction meets or exceeds the classroom experience, however, it may be a welcome alternative to traditional pedagogical formats.

In this interactive presentation, we will report our findings on the recent survey of American colleges and corporations exploring the effective use of blended learning solutions. Participants will be encouraged to contribute by bringing their own research or experiences to our discussion of best practices in blended eLearning.

Interactive Session Description

Title – ***Best Practices in Blended eLearning***

Based on the results of the "Best Practices in Blended eLearning," this interactive session is designed to allow eLearning practitioners to learn about best practices in blended eLearning and provide a forum to exchange ideas and share their own experiences. Participant input will be documented and made available after the session. A paper describing our findings from this research will also be made available for attendees.

Session Objectives

In this session we will:

- Review the structure of our survey
- Report on research findings
- Facilitate a discuss around the reaction to the research findings
- Exchange best practices and encountered problems.

Intended Audience

This presentation is intended for experienced practitioners in the eLearning field. Attendees should have been involved in the design, development, delivery, or implementation of several eLearning programs. Participants should be familiar with examples of asynchronous and synchronous delivery software.

Online Professional Development in Instructional Technology: Star-Online

Patty LeBlanc, Ph.D.
Department of Education, Stetson University USA
pleblanc@stetson.edu

Ms. Angelique Lewis Nasah, M.A.
Bethune-Cookman College
nasaha@cookman.edu

Abstract: This interactive session will demonstrate an online package used at Stetson University and Bethune-Cookman College with faculty, students, and K-12 partnership teachers for professional development and growth. In addition to demonstrating Star-Online, the presenters will describe how it is used for professional development at the two institutions and the results of their use at the college/university and K-12 levels. Participants will be encouraged to "test-drive" a module to determine whether they might be useful in their work environments.

E-Learning

E-learning has been described as "the use of technology to design, deliver, select, administer, support, and extend learning" (American Society for Training & Development, 2000). The power of the Internet as an e-learning delivery system is in its ability to increase personalized, individualized learning to meet the learner's interests, skills, and needs at that particular time. In e-learning, the learner is allowed to actively construct his/her learning in a way that meets his/her needs and learning styles.

A number of commercial and government providers have developed and marketed outstanding training/learning materials to be delivered online to business, government, and private sector employees in an effort to provide "anytime, anywhere learning" available, for a fee, to anyone who has access to a computer and the Internet. Key elements of this type of learning and delivery method include:

- An extensive library of coursework for user selection;
- Focus on adult learners and adult learning theory;
- Authentic, practical learning that is engaging to the user;
- Assessment of skill development and progress, including pre-tests that allow the user to personalize his/her learning path;
- Outstanding instructional design;
- Mentoring and collaboration capabilities as needed;
- Supplemental resources for the user to extend learning.

Stetson University and Bethune-Cookman College are part of a consortium funded by the U.S. Department of Education's PT3 initiative to prepare prospective teachers and university faculty to use technology effectively to achieve instructional goals. One of the capacity building efforts of the third and final year of the PT3 project was to find web-based solutions for technology skill and integration training which could be accessed anytime, anywhere. A comprehensive examination of a number of *just-in-time* technology training systems revealed that there are many outstanding web-based products on the market today. Many of the products demonstrated exemplary instructional design and included each of the key elements mentioned above. However, we felt that Star-Online best met the training needs of the PT3 project goals and was the most cost effective product reviewed.

This interactive session will demonstrate Star-Online and how it is used at Stetson University and Bethune-Cookman College with faculty, students, and K-12 partnership teachers for professional development and growth. The presenters will describe its utility for professional development and the results of its use at the college/university and K-12 levels. Participants will be encouraged to "test-drive" a module to determine whether Star-Online might be useful in their work environments.

Star-Online

Star-Online was produced by the United Star Distance Learning Consortium (USDLC) as part of its *Anytime, Anywhere* grant funded by the U.S. Department of Education. Star-Online in an inexpensive, but sophisticated resource for pre-service, new, and veteran teachers that provides training, support, and communication links to facilitate the effective use of instructional technology to enhance teaching and learning. Teachers can access mentors, colleagues, and resources via its web-based Virtual Teaching and Learning Community (VTLC). STAR-Online (Supporting Teachers with Anytime/Anyplace Resources) recently received top ratings recently in eSchool News' online Readers' Choice Awards for best training solution (Edmin, 2001). It placed third in the category of Professional Development Management Tools and fifth in Curriculum Integration Tools in a comprehensive review of training and delivery models for educators.

The components of the Star-Online program include:

- 32 online modules on use of technology in the classroom, emphasizing both skill-based training and application of newly learned skills to educational settings;
- Assessment systems that include a pre-survey for individual self-assessment of needs, which results in an individualized staff development plan;
- Differentiated instruction based on the operating systems used by participants;
- Individualized, online portfolios for teachers to access module status, technology survey results, competencies, activities, lessons, and results from modules;
- Feedback from expert reviewers at Star-Online regarding individual progress;
- Reports for schools/districts to assess need, use, and effectiveness of the online training;
- Online support to teachers, as well as to mentors and technology/staff development planners;
- Online resources with links to relevant sites;
- Online communication tools (chat room, listserv, and bulletin board) for networking.

Each of the 32 staff development modules is self-paced, includes the same components, and has the same common user interface:

- competencies that correlate to ISTE's technology standards for teachers,
- interactive lessons,
- application activities,
- integration ideas,
- sharing,
- evaluation.

Using PT3 grant funds, a site license for Star-Online was purchased for use at Stetson, Bethune-Cookman, and Bonner Elementary in Daytona Beach area in central Florida. The modules and support systems in Star-Online were used during the summer by K-12 teachers as a pilot to determine their effectiveness, and will be used during the 2002-03 academic year as part of the grant's capacity building efforts. Pilot data revealed that every teacher (n=30) who used the modules rated them as excellent learning tools and very useful for developing both skills and ideas on how to integrate technology effectively in their specific work environments.

This fall, Star-Online will be used in a variety of settings: 1) faculty members in Teacher Education and the College of Arts and Sciences will use the modules for their own professional growth in the area of technology integration, 2) pre-service teacher education majors will be using the modules as part of their coursework assignments, and 3) teachers at the partnership school, Bonner Elementary, will use the modules in true anytime, anywhere fashion as part of their efforts to increase their proficiency and comfort with technology. Star-Online's performance-based assessment portfolio and the products created make it easy to quantify the level of use and whether or not the student or teacher has achieved mastery of the module topic. Those who use the modules have been asked to evaluate each one and provide feedback to the project director, who will analyze the results of use at the end of the each term in the 2002-2003 academic year.

Time will be given during this interactive session for participants to review the Star-Online modules and ask questions.

References

American Society for Training and Development, (2000). A Vision of E-Learning for America's Workforce: Report of the Commision on Technology and Adult Learning. http://www.masie.com/masie/researchreports/ELEARNINGREPORT.pdf

Edmin, (2001). Virtual Education Scores at eSchool News Reader's Choice Awards, http://www.edmin.com/news/e_school_readers.cfm.

Acknowledgements

The T3 project is funded by the U.S. Department of Education as part of Preparing Tomorrow's Teachers to Use Technology Initiative (PT3). The project will receive $967,263 over three years, which is 42% of the total cost of the project. The T3 consortium will contribute $1,343,060 (58%) of the total project costs over three years.

Teaching the Rule of Thirds for Photography Interactively through Macromedia Flash

Patrick Colabucci
Higher Diploma English Program
Dubai Men's College, Higher Colleges of Technology
United Arab Emirates
patrick.colabucci@hct.ac.ae

Richard Laprade
Higher Diploma English Program
Dubai Men's College, Higher Colleges of Technology
United Arab Emirates
richard.laprade@hct.ac.ae

Susan Lister
Communication Technology Program
Dubai Men's College, Higher Colleges of Technology
United Arab Emirates
sl_info@yahoo.com

Abstract: The "Rule of Thirds in Photography" is a Macromedia flash-based program which aids learners in becoming visual literate through the introduction of design principles and compositional techniques emphasizing the Rule of Thirds. The product uses multimedia activities addressing the special needs of English as a Second Language learners in the realm of photograph composition. Produced for Communication Technology students at the Higher Colleges of Technology in the United Arab Emirates, this product uses highly graphic culturally and geographically reflective course materials and exploits Flash's interactive environment. This paper presents a plan to evaluate the "Rule of Thirds" multimedia software which was developed by the authors.

Introduction

The students in the Communication Technology program at the Higher Colleges of Technology (HCT) in United Arab Emirates graduate with a Diploma after three years in the College Program. Teachers recognize that although the students are highly technology savvy and have grown up in a world where visuals are a prominent part of their life, the students have done very little interpretation, analysis, critical review of the visuals invading their lives. The instructors know that for the students to be successful in the program, they need to become visually literate. There are many courses through their three years that work at improving the students' visual analysis skills and there are several instructional methods used. This proposal looks at using multimedia as one method of teaching pertinent visual skills.

In the first year of study in the Communication Technology program, not only do the students learn about Graphic Design, Journalism and Video Production (the three fields they can later specialize in) but the foundation is also set for them to become better visual communicators. One first year course, Visual Communication I, is paramount to the students achieving good results in their future specialization. The course has a large hands-on component where the students complete over 12 projects during the 14 week semester. Through these projects the students develop a more critical view of their work, their peers' and professional work. Recognized by both teachers and students as one of the key courses in year one, the course promotes reflective thinking concerning graphic design, photography, video and other visual content.

BEST COPY AVAILABLE

One part of the Visual Communication course teaches the students the Rule of Thirds. It is found specifically in Goal #2, Objective #2 which states:

> ***GOAL #2** - The student will demonstrate good compositional techniques in the production of a variety of images.*
>
> ***Objective #2** - Identify and apply the elements of composition (Point of View, Rule of Thirds , Framing, and Perspective) in the production of images*

The Rule of Thirds is a well known photographic compositional technique but surprisingly, it can be traced back to Greek times where it is known in its original form as the Golden Mean. Basically, the idea presented in the Rule of Thirds is that you should not put a subject in the middle of a photo but rather, it is most pleasing to our eye to have it along an imaginary line that divides the photo in thirds either horizontally or vertically.

Rule of Thirds Software Background

The "Rule of Thirds in Photography" software was developed by the authors as part of the "Quality in Teaching and Learning" professional development program at HCT. Although not expected to replace the instructor, the software has been developed for students to use on their own in a self-learning mode. As a follow up, it is expected that the students would complete a 'real world' photography shooting assignment where they would apply the rule of thirds to their own photography.

At the completion of the thirty to forty-five minute computer-based training program, the software suggests that the student will be able to:

1. Choose the main focal point of a photo or identify photos that do not have a focal point.
2. Explain the terms focal point and composition.
3. Explain what the Rule of Thirds means and why a good photographer might use it.
4. Show how the Rule of Thirds can be used when composing photos.
5. Identify photos which use the Rule of Thirds from those that don't

The software is organized in this way:

1. Learn about focal points
2. Create a focal point
3. Focal points vs. Centre of Photos
4. Introduction of the Rule Of Thirds
5. Rule Of Thirds Activity
6. Summary
7. Quiz

The Study

This study will look at the use of multimedia to teach the Rule of Thirds, as well as other compositional techniques. Currently, the Rule of Thirds is introduced in a classroom setting where the students review photos (professionals and their own) and apply the rule, while discussing its implications; next the students would complete a hands-on assignment where they shoot photographs that reflect the Rule of Thirds. This study will alter the lesson somewhat, in that the in-class session will be replaced with 'technology' – the multimedia software to be tested. The discussion about the Rule of Thirds and the assignment will still occur, with both happening when the students hand in their photo assignment.

In particular, the study will investigate (1) WHAT students are learning about the Rule of Thirds and photography in general; and (2) HOW students learn about the Rule of Thirds using technology. Some of the outcomes we are particularly interested in include:

1. We want to know if the students ....

  - Will learn the "Rule of Thirds" – as in, can they recite it and demonstrate how a photo follows the rule.
  - Will begin to use a new way to talk about photos, essentially incorporating some of the, terms, style and content introduced on the Test Software.
  - Will talk about the Rule of Thirds and/or other compositional techniques as expressed in the Test Software, when describing their own photos or their peer's photos.

2. Does the software hinder their learning in any way? Are there features that they found annoying or frustrating or ones they didn't understand?
3. What features did the students feel helped them the most to learn the Rule of Thirds or other compositional techniques?
4. Do the students afford themselves of the various learning opportunities the software developers believe they have included in the Software?
5. We will ask the students what they feel they learned from the Test Software.
6. When going through the software to learn the rule of Thirds, (usually an individual process) will the students change the learning environment into a more social one, where they will share with each other what they find as they go through the product?

Evaluation Plan

In order to discover *(1) WHAT students are learning about the Rule of Thirds and photography in general; and (2) HOW students learn about the Rule of Thirds using technology*, we have devised a plan that includes such items as video captures of the screen while students use the software, classroom videos of the students using the software, focus group feedback sessions by the students as well as individual interviews. A web-based feedback form will be in operation throughout the evaluation period for other classes throughout the HCT system to use and assess the software.

At the same time that the students' feedback is sought, there will also be a strong attempt to acquire responses about the software from a variety of significant sources. In particular we will also be compiling observations from all the teachers who use the concerning administering the software, software content, usability and what features of the software they believe that their students learned best from. As well, software evaluation, photography and multimedia experts will be asked for feedback on both the evaluation process and the software product itself. We are planning to attend several international conferences throughout the year to present the software and get feedback from our peers in our industry. One such conference is the Association for the Advancement of Computing in Education E-learn Conference in Montreal, Canada, 2002 where we are presenting an Interactive Session.

Anticipated Outcomes

It is expected that with the amount of feedback and assessments we have planned for the product there will be ongoing development work of the software throughout the year. We expect to receive many good suggestions about how to improve the product and we intend to follow through to ensure we have a top-quality product.

This study will investigate two main questions: (1) WHAT are students learning about the Rule of Thirds and photography in general; and (2) HOW are students learning about the Rule of Thirds using technology. It is anticipated that the students will definitely learn the Rule of Thirds from the software. It is an easy concept to grasp as reflected in the many simple websites that present the idea. So the greater interest is - how much of the 'other' compositional techniques included within the software will be added to the students' 'visual tool bag'. It is anticipated that what else the students learn from the software will be a function of what they bring to the software. Students who have shown a keen interest in the visual arts will pick up and adopt more of the "other" information included in the software. Although this finding won't be a surprise, it will emphasize the importance of nesting more advanced terms/ideas (compositional techniques) within a simplerone (the Rule of Thirds).

Outline for Interactive Session

A standards based math program developed by classroom teachers has resulted in 30 student modules that are customized, Internet based, and video enhanced.

1. Overview - Objectives

Participants will:

- view and interact with a Professional Development module and experience one student module with its interactive, video, gaming components

- receive information on a proven process that has been successful for districts receiving millions in technology awards; used by a consortium of 6 school districts to build a technology rich middle school mathematics curriculum that is standards based; process has been replicated for other technology initiatives among school districts

- articulate the process of consortium building and developmental stages of "break-through thinking" in designing a customized multi-media, Internet delivered curriculum for diverse student populations for middle school mathematics

- have information as how to access the eMath Project with 30 math modules as funded by a $1.8 million TIE Grant from the Texas Education Agency; how to participate in on-going research of the impact of emerging technology in mathematics education

- experience one teacher's journey in break-through thinking on developing the mathematics modules for grades 6-8

2. Outline of Presentation

- Review 3 years of planning, goal setting, defining needs by 6 school districts
- Discussion of teacher input, curriculum design, break-through thinking in process of designing the curriculum;
- Outline of the design of the web-based content to support the original video clips used in the modules with a thematic and problems based approach

Audience will experience photos of teachers in the development process, see examples of modules that teachers have developed, view a video clip of administrators discussing the support given to the project; experience a module (as though they are students) to solve the posed problem and work toward solutions with web-based and a gaming activity.

3. Research Based — Because this project is cutting edge of emerging technology curriculum development, an Expert Panel of nationally known math professors was engaged through TEXAS A&M University to write a 'White Paper" on best practices in middle school technology initiatives in mathematics. The research is embedded in a staff development module.

4. Presenter Qualifications—In past 9 years the presenter has received funds for nearly $22 million for technology initiatives for consortiums of Texas schools, all the while serving as assistant superintendent for curriculum or acting as project director. Served on the 1999-01 Texas Education Agency Educational Technology Advisory Committee. The eMath Project is a first in the area of convergent media that uses both video and interactive web-content and delivery. This pilot for six school districts with 85 middle school math teachers and 6,000 students is being carefully followed in Texas for its impact of delivery of mathematics in the future.

5. Co-presenter—is a Research Scientist in the College of Education, Texas A&M University, College Station, Texas. Dr. Jolly is known nationally for being involved in the development as well as research of technology rich projects from Kindergarten to the post-secondary levels. The eMath Project is being evaluated from a "legacy issue" basis to determine the process that teachers must engage in as part of restructuring the delivery of curriculum that is integrated and cross-disciplinary.

   - Workshop appropriate because it represents a major effort to integrate emerging technologies into the middle school math program; uses teacher expertise in designing the content and delivery system
   - The hand-on presentation will provide participants an opportunity to experience cutting-edge mathematics that teachers and students will have access to in the near future throughout the State of Texas
   - Major Presenter has given presentations to local, state, national, international audiences on technology, school reform, staff development for past 15 years; Co-presenter is known nationally for research and evaluation of cutting-edge projects
   - The eMath Program of 30 modules will be presented and how other districts can access the federally funded (TIE) initiative

Community Capacity Building with an E-Learning Strategy

Connect New Brunswick focuses on "engaging' entry level computer users in individual or small group setting. Connect New Brunswick Community Computer Access Network staff deliver grassroots programs to attract people to the onramp for the information highway. It is critical that citizens that have worked in our more traditional jobs have "access" to computers, skills training and confidence building opportunities, in their communities, so they to can participate in the economy with the required skills training as they did when they supported and drove the old economy!!

This session will include an overview of this community - based network and profile its E-Learning strategy and resources for supporting these entry-level learners.

Communities can't exist without jobs and employers can't exist without an employable workforce. Community Capacity building is sustainable with a "Hand up" rather than a "Hand out" therefore, consideration of an entry-level program should be the first step in any E-Learning strategy!!!

E-Learning initiatives of Connect NB Branché:

The following programs have been developed/utilized by CNBB for delivery in Community Access Centres. Their dual mandate is to meet the training needs identified throughout rural New Brunswick as well as generate a revenue stream to support the sustainability goals of the Centre.

Each program is supported with resources online to standardize program implementation and delivery. In addition, a network of Regional Liaisons that work directly with centre employees is mandated to monitor these training protocols with new and current staff as each new program is developed.

Programs include:

GED-Training Online- Connect NB Branché provides "Virtual Mentor' supported online training for GED clients throughout New Brunswick at access centres in communities where the clients live! Connect New Brunswick is the first in North America to provide this service to our citizens with an outstanding success rate to date.

Policy 701 Online- Connect New Brunswick developed this bilingual program to support the standardized delivery and validation of the compulsory Dept. of Education Policy 701 training for Access Centre Staff and volunteers. In addition, the Dept. of Education officials for support to Administrators validated the resource in the public school system. The website is maintained by CNBB staff and materials have been distributed throughout the province.

IntroNet Online - This bilingual online training program was developed by Connect NB Branché and Industry Canada as an introduction to the Internet and is utilized by Access Centres throughout New Brunswick to support the training and sustainability goals of the centres. Trainer Resource Materials and course access are available at all centres via password.

QuicClics- This bilingual online training program has been developed to utilize the concept of *Train the Trainer* to prepare 1-½ hour courses for all 250-centre staff to offer in their centres for revenue generation. Each course is supported by all the necessary presentation material from power point presentations to certificates of completion, and with lesson plans, handouts and evaluation forms to name a few. Each employee can be trained online ready for program implementation in a 2 week period on any program we design!!
Programs include:
Basic "10 slide" PowerPoint
Managing your Internet History File
Drag and drop File Management
Basic Scanning
Digital Camera Basics
BoaterExam.Com Supervision protocols
Abuse Prevention Protocol
CyberSafety

Microsoft Office Computer Based Training Program- Connect NB Branché purchased this CD ROM based training tool from EduPerformance Ltd. (French version) and Mentor Networks (English version) to support the advanced training needs of citizens in rural communities where other options may not be available. The service also supported the sustainability goals of the Centre.

BEST COPY AVAILABLE

Reader Rabbit Series- Each Centre has been provided this CD Rom training series for children at the Toddler, Pre School, and Kindergarten levels to support learning strategies and content for children at these age levels. The service is free.

Brunnet Training Courses- Each centre has access to password controlled introductory and advances, unfacilitated courses online from any Centre in our province. The intent of this partnership is to extend online training opportunities utilizing over 300 online courses while revenue splitting with the partner to support the sustainability of access centres. Securing a partnership with a similar Francophone course provider is in the works.

Cybersafty – A 2 ½ hour online "information" program designed for parents and teachers to understand the not so common knowledge about monitoring children on the Internet. This informative program was developed in partnership with Telephone Pioneers International and the RCMP.

Abuse Prevention Protocol – A two-hour personal look at abuse and its recognition and prevention for parents and professionals. Topics are sensitive in nature and require a mature perspective. Content was recently released and piloted with Sport Coaches and Youth Camp Counselors. Full delivery is in its formative stage.

Regional Liaison Program- Connect NB Branché has developed a bilingual training model to support the skill development of Centre workers and volunteers. The intent is to standardize the skills of workers in centres and familiarize them with the delivery standards required for programs offered by the centres for citizens in the community. Individual instruction plans are developed by one of our 10 Regional Training Assistants utilizing several assessment tools. A complete training guide has been developed to guide this model.

CNBB Resume'

In 1995-96, the Province of New Brunswick, in partnership with Industry Canada, NBTel and the Department of Education, successfully piloted the first six electronic Community Access Centres in Canada providing rural citizens with public access to the information highway. From this pilot evolved a national initiative by Industry Canada called the Community Access Program (CAP).

In 1996, recognizing the future potential of providing New Brunswick citizens with affordable access to the information highway, Connect NB Branché was formed as an operating agency of the Information Highway Secretariat and Economic Development, Tourism and Culture. The Community Access Program (CAP) is supported by and maintained through a partnership with the Industry Canada, the Province of New Brunswick, NB Tel and a network of over 200 volunteer community steering committees representing over 400 communities. Connect NB Branché's role was to assist these communities in developing their own locally managed and operated public Access Centres to meet the following objectives:

- To provide New Brunswick with more affordable access to computer technology and the Internet and to raise awareness about its potential for learning, jobs and growth;
- To stimulate the use of new electronic learning tools to further develop services by and for all New Brunswick communities;
- To provide Internet and World Wide Web training facilities for local entrepreneurs, employees, educators, students and others interested in improving their information management and networking skills;
- To stimulate access to the electronic delivery of government and other services and obtain feedback from citizens about how they would like these presented.

In order for Connect NB Branché and the Community Access Centre Network to realize these objectives. it had to embrace the following direction:

- VISION – To establish partnerships with and for communities to further their economic, cultural, and social development regionally and nationally.
- MISSION – To provide citizens of New Brunswick with lifelong learning opportunities utilizing current information technologies in an accessible community environment.
- MANDATE – To establish and provide sustainable support to Community Access Centres in all locations throughout New Brunswick.

Today, Connect NB Branché and the province of New Brunswick are recognized as a world leader in providing its citizens with access to information technologies and on-line opportunities in a community environment.

A. 1999-2002 Statistical Brief

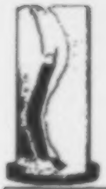
230 Community Access Centres in New Brunswick
    132 English 98 French
    153 in schools 77 in other locations
300,000+ visitations to Community Access Centres
221,000 hours of public access provided
250,000 hours of volunteer assistance contributed annually
1,928 courses offered
20,760 people took training
426 persons hired to work in Centres facilitated by CNBB
63% of Social Assistance Recipients found work after 6 month work practicum in Centres
826 individuals found jobs or economic benefits through Centres
200+ "good news" stories published in NB newspapers
16 International delegations visited
3 Countries contracted with CNBB for support

B. Major Accomplishments, Human Resource Assets, Contractual Agreements

I. ***Accomplishments***

1998 National Information Technology Awards winner of the Distinction Award for ***"Cross Jurisdictional Cooperation"*** *(Federal – Provincial) in the management of information and technologies in the public sector*

1998 GTEC Silver Meda



2000 National Award winner of the Conference Board of Canada Award for **"Broad Community Collaboration"**

Conference Board 2000

3. 2001 CANARIE National "IWAY" Award Winners in the category "Application of Technology"

BEST COPY AVAILABLE

E-learning in Spanish: a Language and Culture Course and a Placement Test

Jessica Payeras and Evelyne Diabaté
École de langues
Université du Québec à Montréal
Canada
payeras.jessica@uqam.ca

Abstract This paper presents two projects that make full use of WebCT in the Spanish language department of the University of Quebec at Montreal. These projects are: a Spanish language & culture course and a Spanish language placement test. With respect to the culture and civilization course, we shall focus in three specific aspects: the communication and collaboration tools, assessment tools and varied content release. The communication component includes the possibility of using Discussions, Chat, Whiteboard, and Mail. The evaluation tools include self-tests, surveys, and quizzes with a variety of question types, giving instructors unlimited flexibility in how they choose to incorporate assessments into their courses. The selective content release allows instructors to create content modules or assessments and selectively release them to individuals or to groups, based on a variety of parameters, such as time or student performance.

Introduction

The literature on computer-assisted language learning indicates that language learners have generally positive attitudes towards using computers in language testing. This view is expressed in a large bibliography, including the following studies: Alderson, Clapham and Wall (1995) and Bachman (1990). From a manually corrected placement test, we decided to switch to a computer-based placement test using the WebCT platform. WebCT is a global market-leading course management system. With a complete set of easy-to-use teaching and learning tools for course development, course delivery and course administration, WebCT was the best choice available in the market for our specific needs. WebCT empowers institutions with the ability to serve broader student populations and offer flexible learning opportunities to meet diverse student and administrator needs as we shall see in this interactive session. WebCT also provides a comprehensive set of options for accessing, managing, and migrating course content. Instructors have the unique ability to direct and pace the learning experience based on time or student performance parameters. We present in this presentation the two projects in our department: the language and culture course and the placement test.

The language culture course

The language course stems out from a joint effort between the History department and our department in order to produce a Web site that could be used in conjunction with the culture course. An electronic version of the Culture course was created with the HTML format. Special care went into the design of the sections and the links (see Figure 1). In addition, grammar exercises were incorporated in the PDF format to allow students to print out pages and do these assignments at home on a voluntary basis. Even though the appearance of the course was very appealing to the eye, we were sure that we could make it much more efficient including links to help them with their research topics, a virtual dictionary and all the communications components such as the e-mail and chat services. The course design comprises the following elements: the course description, an interactive calendar that allows students to customize information according to their needs, the complete text book in html

BEST COPY AVAILABLE

format, the multimedia workshops, a power point presentation of the grammar content, grammar notes, links to web pages related to the contents of the course, an on-line dictionary, an individual and private link to each student's grades, a communications component (e-mail, forum and chat limited to the class students and the teacher), a basic grammar quiz to verify the entry level and a separate links that allows students to download the latest version of programs that might be needed such as WinZip, Acrobat Reader, etc. The main window of the virtual culture textbook can be observed in the Figure 1, below.

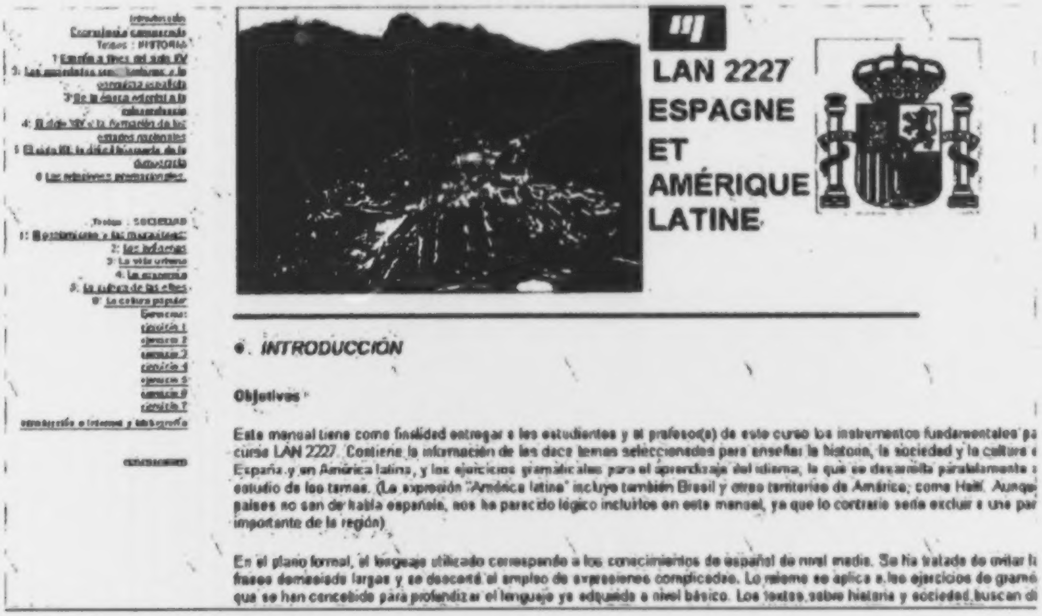


Figure 1: The language and culture course

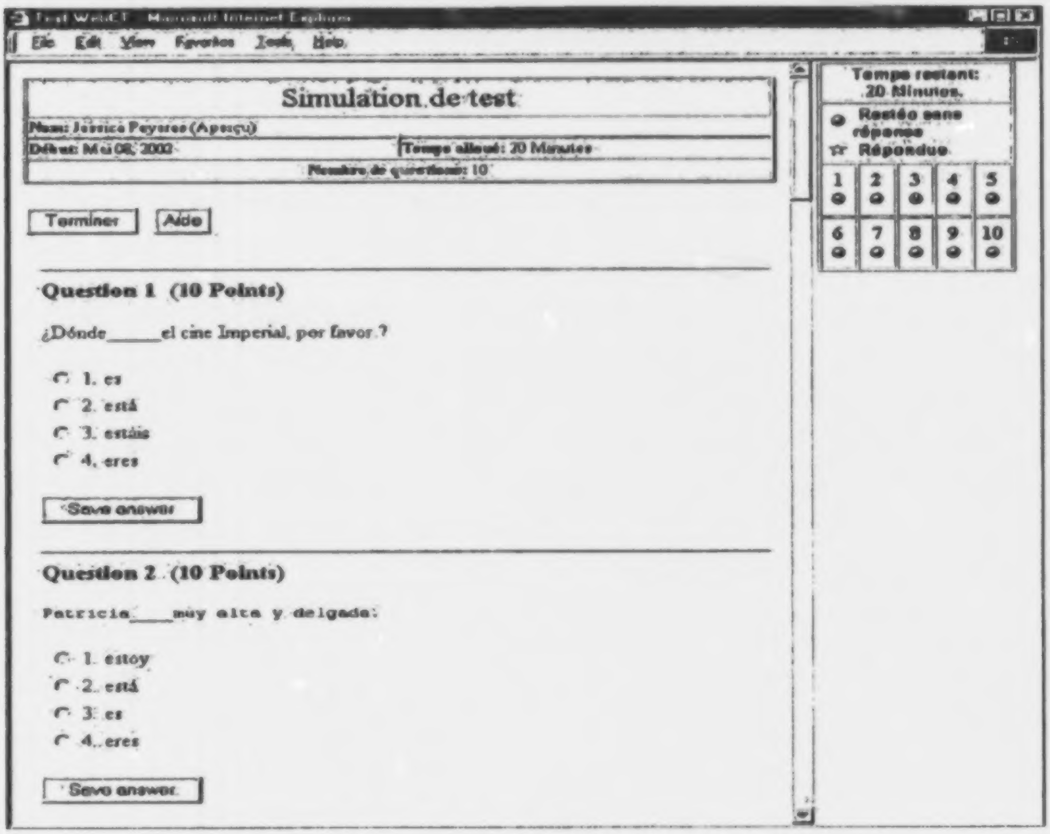
The language placement test

Taking into account the versatility that WebCT had allowed in the virtual classroom production, the next project was the placement test. Up to that point the Spanish language department had only a written test that took considerable time to correct and a laboratory technician who had the task of distributed the paper version and collecting it at the end of the 60-minute limit. Several obvious problems were encountered with this option: unnecessary photocopying costs, impossibility of testing students with a different language capacity or different areas of language competence (reading comprehension, writing, listening, etc) and the time spent in the tedious manual correction oh each copy. To resolve all these problems, 3 different versions of the placement tests were developed: an basic, intermediate and advanced test in order to better evaluate a candidate's language ability.

One of the most robust component of the WebCT architecture are the evaluation tools. These include self-tests, surveys, and quizzes with a variety of question types, giving instructors unlimited flexibility in how they choose to incorporate assessments into their courses. Creating separate version of the test, much in the same as different courses, the students could be evaluated, have their tests corrected automatically and even have the opportunity to secure an inscription with a link to the Registration office. This option was very welcoming from the students' part and from the institution because the administrative costs and time usually involved in these operations were cut almost by 90%. Apart from all these advantages, different types of questions could be incorporated into the placement test: multiple choice, fill in the blanks, open questions and matching columns A to B. Images and sounds made the test more powerful. With all these options, new sections could be much more easily be evaluated: listening and reading comprehension, spelling and writing. With this tools, we could also

BEST COPY AVAILABLE

make an instant analysis of the questions were the most difficult ones to answer and obtain graphics that compared the individual scores to the scores of the whole group that sat for the placement test. Figure 2, below, shows what the placement test looks like:


Test WebCT - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Terminer
Aide
Save answer
Save answer
Temps restant: 20 Minutes.
Restée sans réponse
Répondue
1 2 3 4 5
6 7 8 9 10

Simulation de test

Nom: Jessica Peyares (Apesçu)

Début: Mai 08, 2002 | Temps alloué: 20 Minutes

Nombre de questions: 10

Question 1 (10 Points)

¿Dónde_____el cine Imperial, por favor ?

○ 1. es
○ 2. está
○ 3. estáis
○ 4. eres

Question 2 (10 Points)

Patricia____muy alta y delgada.

○ 1. estoy
○ 2. está
○ 3. es
○ 4. eres

Figure 2: The language placement test

Conclusions

After careful analysis of the students' responses, we were able to have a very important feedback from the students' part. We are extremely pleased with the advantages that this technology offers In a rather direct way, WebCT has allowed to offer new, compelling ways for faculty and students to engage in a process of teaching and learning that is interactive, of relatively simple utilization and able to reach "virtual communities" without any physical border. This created an e-learning environment where everyone can participate: students, teaching assistants, administrators and institutions as a whole. Among the most significant advantages, WebCT has enabled e-learning in Spanish at our department.

References

Alderson, J. C., Clapham, C. & Wall, D. (1995). *Language test construction and evaluation*. New York: Harvard University Press.

Bachman, L. (1990). *Fundamental considerations in language testing*. Oxford, UK: Oxford University Press.

BEST COPY AVAILABLE

Exploring Science Education Using Handheld Computers and Data Collection Tools

Raymond M. Rose
Concord Consortium
United States of America
ray@concord..org

Abstract Small inexpensive handheld computers could play an important role in education in the next decade. They pose a way to address the digital divide. But they also offer more applicability for some of the advantages they bring to general computer use. One significant development, Smart Probes, could be the launching point for a whole new set of handheld applications. Concord Consortium has been developing the smart probe concept with help from NSF. These, the next generation of data collectors could lead the way in changing the way students experience science.

In the rush to bring modern information technologies into schools, one group of technologies is being overlooked that can greatly improve learning. While current desktop computer and network technologies are beginning to realize the huge impact they could have on education, other extremely valuable information technologies are not being used or even being considered.

Small, inexpensive, **handheld computers** and their associated communications channels and software tools could play an important role in education. The computational power and communications capacities of handhelds are increasingly impressive. Many pack the raw computer power of desktop computers only few years old while having increasingly good communication channels, either through a wired cradle, infrared beams, or radio frequency radiation. These channels can be used with software tools for a broad range of sophisticated productivity and browser applications. These handheld technologies could greatly enhance learning in and out of schools.

Yet, this *"anytime, anywhere"* computing goes beyond just handheld computers. Ubiquitous, mobile devices such as phones, wrist bands, wearable devices and intelligent structures are bound to impact the future of education.

Bob Tinker, President, The Concord Consortium (http://usight.concord.org/what/)

Concord Consortium sees the small portable handheld computers as an ideal platform to connect sensors. Seven years ago we began experimenting with a number of configurations of portable computers as part of our NSF funded Scinece Learning in Context project. We started with Newton and eMate computers but as they were removed from the market a new plan evolved. We have done a lot of work with Palm computers, but have developed out new probes and software to be platform independent. We refer to these new sensors as Smart Probes.

Smart Probes

We believe that field-based data gathering is an important facet of student learning and the handheld provides the power and portability to make that a reality. But in going outside, we've found that it is important to take the fewest possible numbers of parts and wires. Extra interfaces or wires are all that more to set up on site and tend to get lost. A real-time graph is often essential, too, to allow students to see their dataset as it is collected. Ideally, the probe is part of the graphing display

device. As a practical matter, however, it is probably cheaper to have one that simply plugs in and can be reused with other computers back in the lab.

Complete microcomputers on a chip now cost under a dollar. This means that they can easily be incorporated into a sensor, making it a *smart* sensor. At very least, a smart sensor can have information about itself that it sends to any computer it attaches to. It can tell what kind of sensor it is, how accurate it is, and when it was last calibrated. It can also contain its calibration information and report its values using physical units like degrees, Newtons, or Joules. This saves the host computer from converting from the usual "raw data" inputs and also greatly simplifies classroom management. In the traditional model of data sensors, calibration data are stored on disk and are different for each probe. To avoid re-calibrating each time the sensor is used, the sensors need to be matched to the computer containing the latest calibration data. Not so with a smart probe that carries its own calibration. The smart probe is always ready, all it needs is to be connected to the computer.

Smart probes with calibration, other information, and physical outputs may not be revolutionary, but they certainly would be useful for a very small additional cost. In fact, the cost may be negligible, since the microprocessor that provides the "smarts" can also replace other electronics needed in "dumb" sensors. But the usability factor is something that is hard to put a price to. Smart Probes offer a convenience to teachers that far out weight any cost differential. The probes use very little power and are most frequently powered by the devices they connect to. The low power consumption means the smart probes are normally ready to be used even after sitting for months on a storage shelf. They are also unlikely to run out of power in the field in the middle of an experiment.

As a result of funding from a number of NSF projects we have developed CCProbe (http://www.concord.org/ccprobeware/ccprobe/ccprobe.html) and currently have 5 data sensors that are being tested in the NSF funded Technology Enhanced Elementary and Middle School Science. (http://www.concord.org/teemss/). The specific TEEMSS sensors are:

- fast response thermocouple temperature probe
- force probe (includes a detachable magnetic field sensor)
- smart wheel (0.5 degree angular resolution, max linear speed 5 m/s)
- voltage and current (watt and joule meter)
- light probe

The research plans for the TEEMSS project include both evaluation of the goal of the project: student learning of the science concepts, and also of the components of the project: the units, materials, and teacher training. That research has not yet been completed but commercial vendors have expressed interest in both CCProbe and some of the SmartProbes.

Learner's Lounge: Information Brokering for the Adaptive Learning Environment

Marcus Specht, Milos Kravcik, Leonid Pesin
Fraunhofer Institute for Applied Information Technology FIT- ICON
{specht, kravcik, pesin} @ fit.fraunhofer.de

Roland Klemke
bureau42 GmbH,
roland.klemke@bureau42.de

ABSTRACT

This paper describes extensions of the Adaptive Learning Environment (ALE) [3] for web-based authoring and learning. The system provides a new methodological approach to design education on the web. ALE is used to build a large knowledge base supporting Architecture and Civil Engineering Design Courses and to experiment a comprehensive Virtual University of Architecture and Engineering Design in the project WINDS. The system combines classical structuring of learning materials based on reusable and sharable learning objects with and indexing approach for browsing the learning materials based on a alternative structure called the course index. The course index is a collection of important concepts for a course subject or a whole domain. By the combination of the course index with an information brokering software we were able to introduce new features focusing on the integration of highly dynamic content into courseware and enabling organizations to build fast changing and highly dynamic learning communities with coaching and tutoring facilities.

Keywords

Web based learning, educational hypermedia, interactive learning environment, adaptive systems, e-Learning, information brokering, educational brokering

Introduction

In the recent developments of e-learning aspects of skill management and the integration of fast changing knowledge became more and more important. From our point of view especially the production of content for flexible delivery and the easy integration of reusable learning objects in personalized courseware is a key point concerning usability and acceptance of learning management systems (LMS) in organizations. In the last two years in the European project WINDS[1] Fraunhofer FIT developed a new LMS focusing on simple authoring tools for the production of highly reusable content. Currently we have released a version 1.2 of the ALE system and 21 european university partners prepare more than 20 on-line courses that should be used by students from october 2002. For reaching those goals we have taken into account several of the existing standards and semi standards on learning objects, learner models and their storage and exchange for example [4, 5]. We can build on our experience with development of adaptive hypermedia environments like ISIS-Tutor [6], ELM-ART [7] and ACE [2].

ALE produces individualized courseware for the students depending on their current state of knowledge, their preferences and learning styles. The author specifies the metadata according to which such adaptation methods like additional explanation, prerequisite explanation, comparative explanation, explanation variants or sorting can be implemented, taking into account the user model. In this way, the system can adapt the sequence of learning objects according to the chosen learning strategy. For instance, a concrete example can precede or complement an abstract statement if the student needs it. To reduce the cognitive overload of the learners various annotation techniques are implemented. As a difference to earlier adaptive learning management systems ALE also integrates the possibilities of using methods of user modeling and data mining for building expertise networks and supporting human resources management in knowledge management for organizations. High quality expert finding and colearner finding algorithms can build on detailed user and learner models from ALE.

This paper describes latest extensions of the integrated authoring and learning, a main aspect is the integration with an information brokering platform broker's lounge to integrate highly dynamic contents into a curriculum and support learners after finishing an online curriculum with explorative tools.

---

[1] Web based intelligent design system (WINDS) [1] is EU funded project in the 5th framework of the IST programme # IST-1999-10253.

Reusable Learning Objects Structure

The WINDS authoring tool supports authors in building independent learning objects and structuring them in a default course hierarchy. Nevertheless the underlying knowledge representation and storage allows for reusing and handling learning objects independently and combining them in new dynamically generated courses later on. This assures that the system is able to produce individualized courseware for students depending on their current state of knowledge, their preferences and learning styles. With *course units, learning units, and learning elements* course authors can create an arbitrary structured hierarchy of learning objects which also represent the default learning path for the students. The course authors can also specify relations between learning objects based on a subset of the Dublin core recommendations [8]. These include prerequisite relations, *part_of*, and *related_to* relations between course units, learning units, and learning elements. All these learning objects can be associated with a subset of the Learning Object Metadata defined in the IEEE LOM specification [4]. Learning elements as the leafs of the course hierarchy are built of single content blocks. A content block can either be a text segment (ASCII, HTML, other), a URL, or a file that is uploaded to the server. Every *content block* has a pedagogical role what gives additional possibilities for reusing and even recompiling dynamic learning elements from content blocks of different pages.

Additionally all learning objects in a course unit will be linked dynamically by the underlying index defined by the course authors. The index reflects a common understanding of the domain and the subject matter. The index terms are described by a term name, a description, synonyms, and relations to other terms. When the author publishes a learning object or previews it in view with terms mode the system parses all materials in this learning objects and stores occurrences of index terms in the database. This allows giving the learner different approaches for working through the learning materials.

The types of learning objects in ALE as well as detailed descriptions can be found in [9], [10], [11].

Authoring highly dynamic content

Facing increasing information overload, the individual effort for receiving important information, qualifying on hot topics and applying knowledge successfully in daily life becomes more and more challenging. Analyzing the information supply chain a key issue can certainly be seen in collecting and creating e-learning content that is "up to date". In rapidly developing domains authors often are confronted with the problem of getting together all recent developments and it is even more complicated to update their content rapidly without any programming knowledge and major multimedia production efforts.

By the combination of ALE for creating standardized learning materials with an information brokering system "Broker's Lounge" [12] we now enable the authors of online learning materials to integrate static learning materials with highly dynamic information from information brokering tools that monitor specified information resources in the inter- or intranet. These resources are monitored based on an ontology of important domain concepts and categories that can be initialized from the course index and can be extended in a full sized information brokering tool. By this we ensure a semiautomatic reduction of information quantity while still giving the author the control over the information quality included in course materials.

Now each course has four main parts:

- The *Units* folder includes all the learning units and learning elements forming the structure and content of the course.
- The *Index* is at the beginning a universal department index prepared in advance and chosen by the author who can enhance it. Administrators can create master indices that can be imported into single courses. Furthermore the systems allows teachers to export their indices to a standardized XML format that enables the system to directly integrate external documents or application in which theses index terms are used as annotation tags.
- The *Documents* are supplementary sources of information relevant to the course. Specialised portals with up-to-date materials can be referenced here. The possibility to view external documents enables the system to include highly dynamic information into the courseware.
- The *Dynamic Learning Objects* give the authors the possibility to integrate highly dynamic learning materials into their courses. The DLOs take the index terms as a base ontology for the Broker's Lounge to configure web-robots spidering the documents specified in the documents section. The robots can be configured with a time schedule configuration and in a variety of ways. Beside monitoring websites they can be used to spider online databases and information resources with authentication need or document repositories. This allows authors to integrate a wide variety of learning communities and shared document repositories into courses.

The course index can also be used to view external documents and learning elements with index terms highlighted and hyperlinked to the term's explanation. Therefore by browsing from learning elements to index terms and then to external documents, back to index terms and so on, the students have individualized learning paths based on their interests. Nevertheless the system can keep track of all inspected index terms, learning objects, and external documents to follow the students learning process.

Personalized Learner Profiles and Skills Management

Professional profiles develop fast in certain domains like media industries or other sectors which are based on short product cycles and fast changing technology. Even in traditional sectors like architecture by the integration of new technologies new professional profiles develop what has an important impact on education in universities and training in industry. From our point of view this is reflected by a stronger focus on skill management systems and their integration into LMS.

In the Learner's Lounge project we combined a educational brokering system and a LMS to support profile and skill management on different levels:

1. Interest profile management: Interest profiles that can be developed to support professional development in the long term view and integrate all types of educational offers from classical class room training to online learning with ALE.
2. Competencies, skills, and knowledge management for professional profiles: Based on a detailed analysis in the WINDS project a methodology was developed to build the WINDS skill grid that allows for a detailed definition of competencies, skills, knowledge and a classification of all learning objects in the ALE environment according to the grid. Therefore based on the specifications of the interest profile and the professional competencies a learner wants to achieve a dynamic curriculum can be compiled by the ALE system.

Conclusions and Further Research

The ALE authoring platform supports reusability of the learning objects and as a new feature the integration of highly dynamic contents. The created learning objects can be delivered in a variety of ways, from classical web-based training to combinations of classroom events and online seminars, or even as personalized books. Beside the possibility for cross media publishing and the flexible combination of learning objects in individualized curricula the indexing system and the connection of the learning objects allows for personalized coaching of students. Currently the system is extend to allow the integration of real time content and support situated learning scenarios in field trips.

References

[1] WINDS project: http://www.winds-university.org/

[2] Specht, M.; Oppermann, R.: ACE, Adaptive courseware environment, New Review of Hypermedia and Multimedia, 1998/4, p. 141-161.

[3] Specht, M., Kravcik, M., Pesin, L., Klemke R. & Hüttenhain, R. (2002b). Adaptive Learning Environment for Teaching and Learning in WINDS. Proceedings of Adaptive Hypermedia Conference (AH2002), Malaga, Spain

[4] LTSC IEEE: Draft Standard for Learning Object Metadata, IEEE P1484.12/ D6.1, 18 April 2001.

[5] Aviation Industry CBT Committee: AICC Guidelines & Recommendations for CMI, http://www.aicc.org/pages/down-docs-index.htm, AICC.

[6] Brusilovsky P., Pesin L. "An intelligent learning environment for CDS/ISIS users". Proceedings of the Interdisciplinary Workshop on Complex Learning in Computer Environments (CLCE 94). University of Joensuu (Finland), May 1994; p.29. http://cs.joensuu.fi/~mtuki/www_clce.270296/Brusilov.html

[7] ELM-ART project. Online at http://www.psychologie.uni-trier.de:8000/projects/ELM/elmart.html

[8] Dublin Core Metadata Initiative (DCMI) Documents, http://dublincore.org/documents/, DCMI.

[9] Specht, M. Kravcik, L. Pesin, R. Klemke (2001a): Authoring Adaptive Educational Hypermedia in WINDS. Proceedings of ABIS2001, Dortmund, Germany, October 8-10, 2001.

[10] Specht, M. Kravcik, L. Pesin, R. Klemke (2001b): Integrated Authoring Environment for Web Based Courses in WINDS. Proceedings of ICL2001, Villach, Austria, September 28, 2001.

[11] Specht, M., Kravcik, M., Pesin, L., & Klemke R. (2002a). Personalized Distance Learning in WINDS, Proceedings of Networked Learning Conference (NL2002), Berlin, Germany..

[12] Jarke, Matthias; Klemke, Roland; Nick, Achim; (2001): "*Broker's Lounge - an Environment for Multi-Dimensional User-Adaptive Knowledge Management*", in: HICSS-34: 34th Hawaii International Conference on System Siences, 3.-6. January 2001, Maui, Hawaii.

Social Justice

Abstract

The aim of this Intercultural and Cross-Cultural Teaching Portal is to establish communities of reflection and practice for diverse educators in P-12 educators who are teaching or preparing to teach in an educational environment. By coming together, we share our commitments and concerns as we review and recapture our experiences in facing challenges of educating everybody's children. We wanted to create spaces specifically where individuals of the same racial/cultural/ethnic backgrounds to communicate with and learn from each other. We also encourage intercultural and cross-cultural communications among teachers of different racial/cultural/ethnic groups. We raise questions such as how our cultures shape our vision of children's teaching and learning in general. More specifically, how our social and cultural identity helps to mold our interactions within the classroom.

The purpose of these forums is to facilitate discussions on multicultural education and social justice issues that may arise in classrooms and school communities. We realize that some groups feel more comfortable sharing with individuals whose worldviews are somewhat similar in nature. Although, we recognize that everyone bring a different set of values, attitudes and beliefs, we believe that some educators will feel more comfortable sharing in their own racial caucus group. Therefore, our position is that we develop racial/ethnic caucus groups so that, for example, Asian American educators who are teaching in intercultural and cross-cultural classroom environments can share their experiences as Asian and Asian Americans. We are interested in hearing from and engaging all educators nationally and internationally who are working in intercultural and cross-cultural school environments.

Our goal is to provide a forum where all educators are heard and their voices are liberated. We provide each forum where each group can share and express concerns within and across racial/ethnic and culture groups, as well as, a general forum for everyone. While anyone can enter any forum, we hold a position that each group be allowed to share comfortably based on their worldviews.

Higher Education's Challenge for Academic Excellence in the 21st Century: Can Old Profs Be Taught New Tricks?

Renee Wallace, PhD
Associate Professor
Department of Secondary Education and Foundations
Florida A&M University
United States
renee.wallace@famu.edu

Abstract: Teaching tenured faculty (old Profs) to integrate e-learning methodologies to enhance student learning and instruction in higher education is a formidable task. But, the task is not impossible. In 1997 Florida A&M University received national recognition when it was named the 1997 Time Magazine/Princeton Review College of the Year. Due to the institution's many recognitions, Florida A&M University has experienced more than a twofold growth in student enrollment over the past several years. This rapid growth has taxed both facilities and the ability of the faculty to deliver quality programs of instruction. Faculty began to inquire and look for opportunities and applications for creating e-learning opportunities. Pearson Education provided a vehicle to help us to begin to create an e-learning environment in the Colleges of Education and Arts and Science to enhance the tenured professors (old Profs) capabilities. Course Compass, BlackBoard, and WebCT have become three of the online technology vehicles for the delivery of instruction and creation of e-learning opportunities in both the College of Education and the College of Arts and Science. The e-learning environment has provided online technology coupled with many visual learning tools, and authorware tools that were not available in the traditional learning setting. The wave of enthusiasm has crossed over to other disciplines. Technically savvy faculty are requested to share the e-learning (new tricks) pedagogy with there tenured professors (old profs).

Computer technology, like any other educational tool, can be used to further educational productivity in several ways. It can help professors do a better job of introducing and reviewing basic information, thus increasing the efficiency of traditional instruction, and indeed, many efforts, both publicly and privately supported, now pursue this goal.

Some of the most fruitful applications of computer technology derive from its capacity to present educationally powerful, dynamic visual images. Having several representations available allows a better match between students and the subject matter. Thoughtfully designed computer software can present multiple dynamically linked representations in ways that are impossible with static, inert media such as books and chalkboards.

For many faculty , acquiring the knowledge and skills necessary to teach for understanding involves a subtle but important shift in beliefs. Reinforced by the structure and culture of their departments and institution, many tenured faculty believe their role is to transmit knowledge, as formulated and presented in textbooks. To engage students in a process that includes forming, testing, and critiquing hypotheses, faculty must accept the value of a more flexible set of professor and student roles, and adopt a broader view of knowledge, teaching, and learning. One central aim, therefore, must be to identify the materials, resources, and supports that will help tenured faculty to make these adjustments and use the online environment effectively.

The e-learning environment as a new mode of learning promises to transform the experience of the classroom in a number of fundamental ways: by augmenting traditional textbook materials with online resources and content portals; by enhancing customary "chalk and talk" lectures through the use of rich multimedia and interactive content; and by extending student discussions beyond the walls of the classroom via a wide range of new communications platforms supporting inter classroom collaboration.

According to McKinsey & Co., a New York management-consulting firm, almost half the teachers in the United States lack adequate computer training. Given this lack of technical savvy, it is not surprising that although many teachers use computers personally, only 20 per cent use them regularly as an integral part of their classroom instruction (Bulkeley, 1997). Larry Cuban (2000) offers the following insights on the real underlying issues in a recent article in *Education Week*. Cuban is convinced that teachers are not taking

BEST COPY AVAILABLE

advantage of new tools to the extent that they could for several reasons: contradictory advice from experts; intractable work conditions; demands from others; the inherent unreliability of new tools; and policymakers' disrespect for teachers' opinions (see Bulkeley).

Despite the availability of graphical, "point and click" software tools, the process of creating and posting web pages on the Internet remains an intimidating prospect for many faculty. According to the research firm IDC, less than 1 percent of the U.S. population has taken a course online. Yet, online learning has appeal for traditional as well as non-traditional students, and university faculty members are increasingly expected to integrate technology use (including use of the Internet) into their instruction. Rather than teaching in a purely online format, many of these teachers are creating "hybrid" courses that include some online content and activities within a traditional class format.

Ironically, while colleges and universities are striving to be on the cutting edge of technological advancement in hardware, the lecture remains the dominant pedagogical method. This method of learning uses the professor (old dogs) as a "sage on the stage," a font of knowledge from which students drink passively. Learning is then judged in terms of the students' ability to regurgitate the knowledge that they have consumed. Unfortunately, many faculty (old dogs) today still cling to this traditional pedagogical model.

One can often hear from tenured faculty (old dogs), “I do not know how to use a computer”, “I have been teaching for 20 years, I did not need a computer then and I do not need one now”. “I do not see what I can use a computer for”, “I have students that know more about computers than I do”, “I cannot type”, and./or “I feel totally inadequate when it comes to utilizing the computer.” *Techfear* is rampant among faculty (old dogs) . The fear of using a computer, the fear of not knowing what to do with it, and the fear of being left behind in this technological age are very real. There are so many applications, so many hardware choices, and in general, so many uses that this fear is overwhelming many of our colleagues. The first thing we have to do is alleviate the fear. Our goal was to help tenured faculty (old profs) integrate a new technology into their curriculum and accustomed teaching style (new tricks).

At colleges and universities the use of the Internet and Web for learning and teaching is causing a major change in the landscape of education. Building upon decades of computer networking activities (e.g. e-mail and bulletin board systems), the Internet has produced phenomenal growth in the extent and scope of online education. For some faculty at Florida A&M University online education has created a new paradigm for teaching and learning different from the traditional classroom experience.

We have found that online courses can also allow students who might not participate in a traditional class discussion to engage both their professor and fellow students in dialog. Asynchronous online discussions (in which students participate on their own time, not necessarily in real-time with each other) can permit more thoughtful responses from students because immediate replies are not required. Textbooks and other resources can be consulted and cited in posted responses. Every student can potentially be asked to respond to a question posed by the professor, via discussion group or e-mail. These outcomes are difficult to achieve in a traditional classroom setting, but realistic for an online course, once materials and activities are available on the Internet. For that task, online courseware e.g., Black Board, WebCT, CourseCompass, ect. can be invaluable.

Course content can be entered either online in the web browser or uploaded (like Word documents saved as HTML/web pages). Course announcements can be posted, a class calendar created, discussion forums and chat rooms created, as well as "digital drop boxes" for submission of student assignments. Students can be added and assigned to groups for project purposes, and can post work on group web pages as well as correspond with the professor and classmates. Assignments can be posted, grades assigned for students to view after logging in, and a "virtual classroom" created allowing for real-time interactions between instructor and students. These interactions are not limited to text chat, but can also include use of an electronic whiteboard.

The distinguishing advantage of online courseware, according to many FAMU faculty who have used it, is its ease of use (new tricks). Setting up the course options does not require programming or coding of any type. Files do not have to be "uploaded" to a web server using another program: everything is done by typing, pointing, and clicking within the web browser. Internet users with a modest amount of computer experience can utilize Blackboard, Course Compass or WebCt to start creating their own online course materials in a comparatively short time, compared with that required to post and upload web pages created with tools such as Frontpage or Dreamweaver.

But the most important overall impact of online courses is the emphasis they place on critical thinking and discourse. The one thing that happens in all online courses, regardless of the discipline, is that students communicate a lot more with each other and with the professor. They discuss ideas, analyze, evaluate, argue, debate, and question.

While no one can predict the future with absolute certainty, it does appear that online learning will continue to grow in popularity in the years ahead. Many companies and investors are literally banking on this trend. Eduventures.com Inc. predicts the higher education e-learning market alone (not including K-12 education) will grow from $4 billion to $11 billion by 2003.

Thankfully, online courseware services like those described here is helping to make the transition to a web-based or hybrid course (new tricks) a much less painful experience for faculty (old dogs). For many, the process will prove to be not only challenging and rewarding, but also a lot of fun, (new tricks) as students are provided with new educational opportunities thanks to the proper use of technology tools in the hands of skilled faculty (old dogs)..

The work accomplished so far suggests that the answer to Higher Education's Challenge for Academic Excellence in the 21st Century: Can Old Profs Be Taught New Tricks? Is a resounding yes, e-learning can play a substantive role in developing a new breed of old profs with new tricks for the 21st century.

References

Bulkeley, W. (1997 November 17). Technology: What we've learned. *The Wall Street Journal*, pp. R1-R32.

Hawkins, J. (1997, March 21). Dilemmas of technology in education. [Address to the Harvard Graduate School of Education] Cambridge, MA.

Video Festivals

A demonstration of exemplary pedagogies designed for low-budget producers and low-tech learners

Lisa Holstrom, Ed.D.
University College
University of Cincinnati
Cincinnati, OH USA
Lisa.Holstrom@uc.edu

Abstract: Many producers of video do not have the resources to replicate the high-production value of many commercial videos, but prefer the visual delivery of content over a text-based course. This presentation demonstrates how video can capture various pedagogies and instructional methods and incorporate them into a complete e-learning environment. Designed for low-budget producers, this high-quality, engaging, and interactive combination of Blackboard and video is perfect for low-tech learners.

Pre-recorded, one-way video has been used for educational purposes for over half a century, and its lack of interactivity has bothered instructors for almost that long. The infamous "talking head" was often accompanied by a series of worksheets and assignments that afforded students little timely feedback from an instructor and no interaction with other learners. For students who needed education but lacked university access, this inadequate system was the only recourse.

With the advent of the Internet, instructors have embraced the interactivity component of email, discussion boards, and chat rooms. Streaming video, often two-way, has allowed instructors to put a face on their teaching and provides students with immediate feedback while providing instructors with the non-verbal cues that are absent in text -based e-learning.

Unfortunately, a gap exists between the technology skills and capabilities of many learners and the skills and computer capabilities needed to be successful in this highly interactive Internet environment. Streaming video is only effective over fast equipment and lines with high bandwidth. Although innovations may facilitate the delivery of this multi-modal distance education in the future, there's a population of low-tech learners that need accessible education now.

Which brings us back to the strategy of using low-tech, pre-recorded video with Internet interaction as a vital component of the instruction. Educators recognize the advantages of video: It pulls learners together around a visual prompt (Stigler 2002; Finn 2002); because video utilizes more senses, learners retain more knowledge (Osciak & Milheim 2001; Lewis 1997); and adults enjoy learning in an environment that appeals to multiple intelligences (Brougher 1997). The Internet action wraps around the video because educators realize the old paper-and-pencil exercises are insufficient. "Unless the videos are followed by discussion and practice, they turn into a 'one-shot deal' and lose their effectiveness" (Lauro 1995, p. 65). The Internet has become the vehicle through which discussions are facilitated; particularly for distance learning, these ediscussions can promote a sense of community that is often a void in the elearner's experience.

In these truly multi-media, multi-modal learning environments for low-tech learners, video takes center stage. This presentation addresses the challenges of producing low-budget video that surpass the appeal and interest of the "talking head" while maintaining the pedagogical integrity of effective classroom instruction.

Developed for the Early Childhood Learning Community at the University of Cincinnati, over 500 hours of live-to-tape video comprise a complete Associate's degree. Faculty was told to dream of the ideal classroom instruction. What would it look like? What would it sound like? After careful planning, each instructor was videotaped modeling their effective pedagogical approach to video learning. As administrators, we have found the results to be fascinating and enlightening. Students have found the lectures concise, relevant, interesting, and thought-provoking.

This presentation will showcase the various pedagogies that faculty chose to implement in their lecture series. From incorporating commercial video (with appropriate permissions) similar to "Masterpiece Theatre," to a set and discussion that replicates the familiarity in the popular women's show "The View," faculty deliberated and collaborated until they arrived at a pedagogy that fit their topic. They captured on film a once-in-a-lifetime presentation of theory and practice applications.

For example, the faculty member taping the Math and Science in Early Childhood Education demonstrated many activities and manipulatives that would have been inconvenient and expensive to repeat every quarter in the traditional classroom. The English instructors, who were initially adamant that teaching composition through video was pedagogically impossible, did a light-hearted dyad discussion around the various common problems they see in students' writing and addressed these issues with both forethought and humor. Guest speakers who would certainly be unavailable every quarter for "repeat performances" were utilized and their expertise was captured on tape.

These examples and more will be viewed because this type of pedagogical creativity is crucial to the production of low-cost video for low-tech learners. The presenter will subsequently lead a discussion around the various pedagogies employed, the planning and logistics that went into each type of video presentation, and the corresponding Internet interactivity that makes this program unique. Student quotes will be offered to attest to the effectiveness of this approach to e-learning. Of particular interest to many participants will be the manner in which this program has been deployed to appeal to low-tech learners. Furthermore, the video showcased here can be replicated without a large investment in production equipment or time.

References

Brougher, J.Z. (1997). Creating a nourishing learning environment for adults using multiple intelligence theory. *Adult Learning*, 8 (4), 28-29.

Finn, L.E. (2002). Using video to reflect on curriculum. *Educational Leadership*, 59 (6), 72-75.

Lauro Jr., D.R. (1995). Five approaches to professional development compared. *THE Journal*, 22 (10), 61-66.

Lewis, C.S. (1997). Interactive multimedia brings new possibilities to adult learning. *Adult Learning*, 8 (5/6), 23-6.

Osciak, S.Y. & Milheim, W.D. (2001). Multiple intelligences and the design of web-based instruction. *International Journal of Instructional Media*, 28 (4), 355-361.

Willis, S. (2002). Creating a knowledge base for teaching. *Educational Leadership*, 59 (6), 6-12.

Virtual Field Experiences for Pre-Service Teachers

Patty LeBlanc, Ph.D.
Department of Education, Stetson University USA
pleblanc@stetson.edu

Elizabeth Heins, Ph.D.
Department of Education, Stetson University USA
eheins@stetson.edu

Abstract: This video is one in a series of teacher training modules based on real-time teaching in a 3rd and 4th grade classroom, beginning on the first day of school. Video data were captured during two-way interactive videoconferencing sessions between Stetson University, Bethune-Cookman College, and Bonner Elementary. Pre-service teachers at both institutions observed the target classroom on a regular basis using videoconferencing technologies and a variety of observation forms. Student and faculty reactions and insights were captured on video to augment written comments. The videotapes were then edited to create modules for undergraduate and graduate teacher education. A handout will be disseminated directing participants to the T3 website, where they will find information on videoconferencing, the data collection process, classroom observation forms, descriptions of the teacher training modules, and other resources available to educators.

In June 2000, the Department of Education at Stetson University received a grant awarded by the U.S. Department of Education to support the integration of technology into pre-service teacher education. Located in central Florida, the T3 project is a consortia of five key partners: Stetson University, Bethune-Cookman College (an historically black college), Volusia County Public Schools, the Florida Independent College Fund, and Time Warner Communications. The purpose of the T3 project is to prepare pre-service teachers to effectively infuse technology across the curriculum to enhance teaching, learning, and student achievement.

Using T3 grant funds, two-way interactive videoconferencing capabilities were established at Bonner Elementary to enable pre-service teachers at Bethune-Cookman College and Stetson to "peer into" an elementary classroom in order to unobtrusively observe real-time teaching. Bonner Elementary is an inner city school located in Daytona Beach, Florida. The teacher, Ms. Carol Colucci, participated in a summer technology boot camp at Stetson and subsequently volunteered, along with her 3rd and 4th grade students, to be the videoconferencing test case for virtual field experiences with our pre-service students. The trials and tribulations of videoconferencing are discussed in previous presentations (see http://www.stetson.edu/t3/resources.htm).

Typically, teacher education faculty at Stetson and B-CC schedule virtual field experiences at specific times to view a specific lesson in a specific content area. In this way, faculty can direct the students' attention to a particular strategy, skill, or learning construct as the focal point of discussion about the observation. Pre-service students were thus exposed to a commonality of experience that cannot be replicated in other types of real-time classroom observations. In addition, faculty and students could observe Ms. Colucci and her students at any time during the school day in the professional development centers at both campuses. Some faculty required students to make a certain number of virtual observations in their courses using classroom observation forms [see http://www.stetson.edu/t3/resources.htm]. Pre-service teachers were also encouraged to ask Ms. Colucci questions through videoconferencing before or after a lesson or by email if the question would interrupt student learning time. We are confident that what our students saw during the virtual field experiences was the regular stuff of everyday classroom teaching.

In addition to real-time videoconferencing, SVHS video data were gathered in Ms. Colucci's class, beginning on the first day of school. These data were subsequently compiled, edited, and used as the basis for pre-service teacher training modules and for graduate education. The video to be shared in this presentation will consist of real-time teaching and pre-service teachers' observations about the lessons. A handout will be disseminated directing participants to the T3 website, where they will find information on videoconferencing, the data collection process, classroom observation forms, descriptions of the teacher training modules, and other resources available to educators.

Acknowledgements

The T3 project is funded by the U.S. Department of Education as part of Preparing Tomorrow's Teachers to Use Technology Initiative (PT3). The project will receive $967,263 over three years, which is 42% of the total cost of the project. The T3 consortium will contribute $1,343,060 (58%) of the total project costs over three years.

An Online Digital Video Library to Use as a Knowledge Base for Teacher Education

Problem

Geoghegan (1994) reported that despite U.S. expenditures of $20 billion on instructional technology in higher education between 1970 and 1994, no more than 5% of faculty use technology other than a substitute for the blackboard or overhead projector. In addition, he estimated a 15% saturation level in the diffusion of technology among higher education faculty. Many plausible explanations for this lack of infusion (Massy & Zemsky, 1995; Shields, 1995) exist; however, an intervention exists to help address the problem—appropriate modeling.

The Need for Modeling

Teacher education students and teachers need to see many examples of standards-based instruction to overcome their "apprenticeship of [miseducative] observation" (Lortie, 1975), and there is considerable agreement about the need for modeling in both preservice and inservice teacher education (Ball, 1990, 1997; Rahal & Melvin, 1998; Schuman & Relihan, 1990). Observing teachers in the class is one way to see models, but there are limitations to this approach. The primary limitation is the logistical infeasibility of having the time to visit other classrooms and seeing a variety of quality lessons.

Solution

The use of a digital video library (DVL) containing electronic models of exemplary teachers and supporting resources provides an easily accessible online resource anytime, anywhere. A DVL is much more than a technologically advanced counterpart to physical libraries. The DVL is just one example of the broader category of digital library (DL). Digital collections often include traditional written materials but can also encompass resources as varied as animations, music, and video clips and can provide significant opportunities for user interaction.

DVL and Pedagogy

Implementing the DVL in teacher education learning environments provides substantive learning opportunities and models technology infusion. The DVL provides a shared experience (or "anchor") for teacher educators and preservice teachers to discuss and analyze with a partner and/or group in a unique combination of learning tools. Using the DVL, teacher education students and instructors move easily from a video clip of classroom instruction to a list of software tutorials to a lesson activity designed to employ curriculum and national technology standards. They are able to observe classroom instruction without leaving their own classroom or homes, and they are able to compare conclusions and reactions to the video clip. Teacher education faculty benefit from use of a DVL. Scheduling demands can often make faculty development and independent learning difficult to accomplish. A DVL provides anytime, anywhere instruction for teachers who want to learn more about new technology tools and promising practices in technology infusion.

Community. A DVL can help to foster a sense of community between users, even if those users are separated by distance and time. A commentary engine allows users to contribute to the resources of the DVL and learn how other users have responded to the information. Shared experiences allow DVL users to have something in common when discussing technology infusion issues. The DVL allows a group of instructors, students, or administrators to access and evaluate the same information and examples.

Interaction. The DVL is a highly customizable tool, and developers can give users a high quality experience. DVLs offer a variety of searching operations, refined navigational methods, and intuitive interfaces. A DVL gives the user a higher degree of interaction with the materials than a traditional library or a simple Web page can.

Materials Management. The organization and hierarchies of a DVL offer a solution to problems with materials management and archiving. Resources (e.g. expert commentary) are linked and digitally stored in a DVL, using metadata. A DVL not only offers an efficient system for managing resources but it can make them more valuable. Learning objects are exponentially more useful when they are identified, described, collected, distributed, and shared.

DVL Presentation

This session will present digital video lessons of PK-12 teachers modeling the National Educational Technology Standards (NETS) for Students and teacher education faculty modeling the NETS for Teachers. Presenters will (a) briefly describe the video production cycle, (b) provide a brief overview of the design and development methodologies, (c) discuss DVL innovations, (d) present four examples of the available online digital video lessons and (d) propose the DVL as an instantiation of Hiebert, Gallimore and Stigler's (2002) call for a teacher education knowledge base.

References

Ball, D. L. (1990). Breaking with experience in learning to teach mathematics: The role of a preservice methods course. *For the Learning of Mathematics—An International Journal of Mathematics Education, 10* (2), 10-16.

Ball, D. L. (1997). Developing mathematics reform: What don't we know about teacher learning – but would make good working hypotheses. In S. N. Friel & G. W. Bright (Eds.), *Reflecting on our work*, (pp. 77-111). Lanham: University Press of America.

Geoghegan, W. (1994). *What ever happened to instructional technology? Reaching mainstream faculty*. Proceedings from the 22nd Annual Conference of the International Business Schools Computing Association, July 17-20. IBM Academic Consulting.

Hiebert, J., Gallimore, R., & Stigler, J. W. (2002). A knowledge base for the teaching profession: What would it look like and how can we get one? *Educational Researcher, 31* (5) 3-15.

Lortie, D. C. (1975). *School teachers: A sociological study*. Chicago: University of Chicago Press.

Massy, W., & Zemsky, R. (1995). *Using information technology to enhance academic productivity*. Educom, Interuniversity Communications Council Inc. Wingspread Enhancing Academic Productivity Conference, June. Available at: http://www.educom.edu/program/nlii/keydocs/massy.html

Rahal, B. F., & Melvin, M. J. (1998). The effects of modeling mathematics discourse on the instructional strategies of preservice teachers. *Action in Teacher Education, 19* (4), 102-118.

Schuman, D. R., & Relihan, J. (1990). The role of modeling in teacher education programs. *Reading Horizons, 31* (2), 105-112.

Shields, M. A. (1995). The legitimation of academic computing in the 1980s. In M. A. Shields (Ed.), *Work and technology in higher education: The social construction of academic computing* (pp. 161-187). Hillsdale, NJ: Lawrence Erlbaum and Associates.

Creating a computerized multimedia Chinese language lesson from authentic web text, using the KEY 4.0 software (for both PC and Mac)

1. Description of the KEY 4.0 software

The new (2002) KEY 4.0 program from the Ottawa-based developer cjkware.com inc. is a software system for writing, learning and teaching Chinese (Japanese and Korean word processor included). KEY 4.0 is available for the PC (all Windows versions) and as "MacKEY 4.0" for the Macintosh (OS 9 and OS X). Originally a word processor for Chinese, this new version includes several innovative authoring, teaching and learning features for the Chinese language.

For example, when Chinese character text from an outside source - such as the Internet - is copied & pasted into the KEY edit screen, the boundaries of the Chinese words are automatically reconstructed, thus laying the basis for analysis and comprehension of the Chinese text through the built-in

- Chinese/English dictionary (with Tool Tip lookup),
- "Pinyin With Hanzi" feature (automatically providing a second line of Pinyin with tone marks for the Chinese character text),
- Text To Speech,
- Automatic glossary-building,
- The Timed Reading Module that automatically creates multimedia lessons, and
- The ability to create hidden annotations, even for multi-part grammatical structures, that can be viewed through the Annotation Tool Tip.

2. Objectives of the session

The session is intended to introduce the most recent computer- and internet-based instructional strategies for the Chinese language, taking advantage of the newly (2002) added multimedia authoring, teaching and learning functions of the KEY Chinese software. The objective is to demonstrate certain interactive software-based algorithms that

- Enable learners of Chinese to analyze and comprehend authentic Chinese text in electronic format, such as from the Chinese web,
- Enable teachers of Chinese to automatically generate a dynamic multimedia lesson from static Chinese text in electronic format, such as from the Chinese web,
- Represent a tool for automatically converting any foreign-language Internet text into a foreign-language teaching/learning format.

In the contexts of FLA (Foreign Language Acquisition) and SLA (Second Language Acquisition), the session shows a way to complement classroom-based instruction with a human teacher and print-based teaching material with supplementary software-based teaching- and learning techniques.

3. The intended audience of the session, and prerequisites

The session will be of interest to anyone who deals with electronic text, such as Internet text, that is written in a foreign language, either for comprehension of the contents, or for learning the foreign language. In particular, it will be of interest to language learners and teachers, because it illustrates the principle of automatically converting static text into a dynamic multimedia lesson. Although the demonstration uses examples from the Chinese web, it is not necessary for the audience to know Chinese. On the contrary, in order to show the efficiency of analytic computer-based comprehension, learning and teaching tools like KEY, the session gets its point across even better to those members of the audience who do not know Chinese. During the interactive session, the participants will have the opportunity to use the software tool to analyze a randomly chosen text passage from the Chinese web, and run the passage as a learning lesson.

4. Overview of the interactive session

To reflect the real-world computer learning environments, the software will be demonstrated on two different operating platforms: KEY 4.0 on a PC with Windows 2000/XP, and MacKEY 4.0 on a Macintosh computer with OS 9 and OS X. The session centers on the KEY 4.0 features for analyzing and processing Chinese text from outside sources (email, Internet, other Chinese software etc.), and creating interactive multimedia lessons using authentic Chinese text, through the Timed Reading module. Assuming that a learner / teacher of Chinese wants to capture and analyze text from a Chinese web page, and also use it as learning / teaching material, these features are demonstrated by first randomly selecting a Chinese text on the Internet. We start by copying & pasting the Chinese character text from the web into the KEY edit screen; in detail, we

a) Select (=highlight) the Chinese web text displayed in our browser, and "copy" it on the clipboard;
b) "Paste" the text into the KEY screen;

c) Select (=highlight) the text, and from the KEY Format menu choose "Hanzi with Pinyin". This displays a second line with the Pinyin-with-tone-marks equivalent of the Chinese character text. We can see from the word segmentation of the Pinyin transcription that the word boundaries were automatically reconstructed when the text was copied & pasted into KEY;

d) Use "Text To Speech" to listen to highlighted passages;

e) Use the "Dictionary tool tip" to display the meaning(s) of the Chinese words and their Pinyin pronunciation;

f) Check "Read tool tip with Text To Speech" (on the KEY View menu) to hear the Mandarin Chinese reading of the words;

g) Convert the Chinese text into a dynamic, interactive multimedia lesson, by press the "TR" (Timed Reading) button on the KEY toolbar, and specifying the various "checks" we want to include in the lesson;

h) Run the multimedia lesson in an interactive mode;

i) Use the Annotation feature to annotate certain words, grammatical particles, multi-part structures etc.; hide the annotations, and retrieve them with the "annotation tool tip".

j) Automatically build a Chinese/English glossary for our Chinese text, by:
   - Copying/pasting the text beneath itself, so we have it on the screen twice;
   - Using "Return" to segment the second copy of the text into words, one at the beginning of each line;
   - Clicking "Convert To Glossary" (Format menu), which automatically provides the pronunciation and the English meaning for each term, arranged in columns.

Detailed demonstration of the interactive learning features of KEY 4.0

The session concentrates on the two most recent enhancements to the KEY software package: the "Timed Reading" module and the "Annotation" feature. These features constitute a CALL (Computer Assisted Language Learning) tool for improving Chinese language reading and comprehension skills. By segmenting a Chinese text passage, such as text from the Internet or teacher-generated KEY text files, into manageable syntactic units, the Timed Reading module allows the reader of Chinese to practice word segmentation, phrase comprehension, eye movement, and thus enhances overall reading efficiency.

For learners and teachers of Chinese: Automatic authoring of multimedia lessons with the TR button on the KEY 4.0 toolbar:

- Write, or copy/paste the text you want for reading practice (from a Chinese website, or other electronic source). Press the TR button on the KEY toolbar, which automatically segments the text into manageable portions and takes you directly to the Reading Timer panel, where you can set the various options (like Pinyin, Tones, Sound etc.). Clicking on "Start" will begin the automatic reading cycle. Choose this fast way to time-read a Chinese text if you want to accept the default segmenting of the system.
- If you wish to manually segment the text, do not press the TR button, but click on "Select Timed passage" on the KEY "Edit" menu. Enter your preferred segment length and click OK to view the segmented text, and make changes in the segmentation if necessary. With the segmented Chinese text on a yellow background displayed on the KEY screen, click on the item "Reading Timer" (on the KEY "View" menu). This brings up the Reading Timer panel on which the display time per Hanzi can be set (scale from 100 ms - 3 sec per Hanzi), together with other Timed Reading parameters.
- Notes on the Reading Timer panel:
  a) The punctuation delay applies to comma, semicolon, full stop, question mark and exclamation mark; it does not apply to the Chinese serial comma "dunhao".
  b) If "Display Word Boundaries" is checked, a GREEN half space is inserted between the Chinese words, to assist the reader in recognizing the word boundaries in the text.
  c) A Read-aloud practice mode can be set by checking "Sound check": in this mode, another phase is added to the Timed Reading of each segment, during which the reader hears the segment read out aloud by the TTS module of KEY.
  d) With "Pinyin check" enabled, another practice phase is added to the Timed Reading of each segment, during which the reader sees the Pinyin-with-tone-marks version of the segment displayed in a second line above the Hanzi text.
  e) With both "Sound check" and "Pinyin check" enabled, the loud model reading through KEY and the Pinyin-with-tone-marks transcription of the segment go hand in hand, in the additional phase.
  f) Checking "Enable Tool Tip" activates the Chinese/English tool tip dictionary. This allows the reader to query the English meaningof a Chinese word by moving the mouse pointer onto the word (DO NOT CLICK, just hover). While the tool tip window with the English meaning is displayed, the timer is temporarily halted.
  g) If you have made annotations to the text, you may want to enable "Annotation Tool Tip", which will display the annotations when pointing at the annotated word.

In summary, enabling all features in the checkboxes of the Reading Timer panel allows the learner to thoroughly analyze a Chinese text passage, within the self-imposed time constraints of the Reading Timer. Thus, the Timed Reading module of KEY is an interactive learning tool for reading and comprehending Chinese text, by teaching word boundaries, pronunciation, Pinyin-with-tone-marks transcription and the English meaning in a dynamic and integrated multimedia lesson.

Poster Sessions

Promoting Web-Enhanced and Web-Based Courses by Focusing on Technology Integration in Higher Education

Jason T. Abbitt
University of Idaho, College of Education, USA
jtabbitt@uidaho.edu

John C. Davis
University of Idaho, College of Education, USA
jcdavis@uidaho.edu

Michael R. L. Odell
University of Idaho, College of Education, USA
mirodell@uidaho.edu

Abstract: The University of Idaho has been engaged in promoting the development of web-enhanced and web-based courses through a multi-stage effort to promote the integration of technology is higher education. This project specifically focuses on providing faculty development, technology enhanced facilities, and individualized assistance to higher education faculty as a means of integrating technology in higher education courses. Using technology enhanced facilities, faculty training is provided on classroom equipment, personal technology and software, and instructional design using an online learning system developed at the University of Idaho.

This poster session will provide information regarding faculty training workshops and individualized assistance, facilities improvements, and a demonstration of the integrated online learning system in use at the University of Idaho. Information regarding the evaluation and impact of this program will also be made available.

Introduction

It is becoming commonly understood that one challenges facing technology integration in higher education, specifically web-based technology, is a lack of training and development time (Bonk, p. 10). Further, many higher education faculty do not feel comfortable using online course systems and tools (Bonk, p. 6). When planning the PT3 program at the University of Idaho, the College of Education faculty and staff developed a strategy to address this problem and further impact the integration of technology into courses taken by pre-service teachers.

Beginning in 1999, the PT3@UI program at the University of Idaho was funded by the US Department of Education to promote the integration of technology in the pre-service education program. The PT3@UI program was to include continual faculty training, facilities improvements to develop several technology enhanced classrooms, and specific training on an online learning system developed at the University of Idaho.

Description of the PT3 program

Faculty training for the PT3 program has centered around providing basic and advanced training to faculty members on various software programs and training on the equipment now available in the technology enhanced classrooms. In year 1 of the program, faculty self-selected either basic or advanced training in productivity software and web development software. Year 2 of the program continued these efforts by providing additional training on the development of web-based materials to those ho had attended the basic skills development in the previous year. Faculty members who attended the workshops were provided with a stipend and copies of the software that was used.

Facilities improvements have been ongoing throughout the PT3 program. In six classrooms in the College of Education and other buildings on campus, SmartBoards, projection units, and computer systems were installed. These classrooms were designated as teaching classrooms rather than computer labs to promote their use in teaching of course rather than simply as student computer labs.

One of the overarching goals of the PT3 project was to promote the development and use of web-based technology as an enhancement to traditional on-campus courses. As faculty developed their technology proficiency, they were further trained on instructional design for web-enhanced courses and the integrated online learning system developed at the College of Education. In addition to providing valuable web-based tools for courses, the use of the online learning system into the PT3 program also provided an opportunity to involve faculty in the further improvement of the online learning system. The result of this collaborative effort was a significantly improved online learning system designed with specific faculty needs in mind. This learning system is now in its second major release at the College of Education and is also being used in other institutions and programs around the United States.

The work of the PT3 program represents the level of institutional involvement that can have a significant impact on the integration of web technology into higher education courses and also is representative of an efficient, effective, and relatively low-cost program that can support faculty development and web technology development at an institution of higher education.

Description of Poster Session

The PT3 program at the University of Idaho is a unique program that has promoted the integration of web-based technology by directly addressing faculty needs. This poster session will largely focus on the lessons learned during this program and the efforts that positively and negatively impact the further integration of web-based technologies. The intent of this poster session is to share information and experience with others involved in similar endeavors and to further disseminate the experience and expertise gained by the program.

References

Bonk, C. J. (2001). *Online Teaching in an Online World.* CourseShare.com. Retrieved March 15, 2002, from the World Wide Web: http://www.courseshare.com/reports.php

Using Discovery-Based Online Learning in the Teaching of Computing

Dr. Ken Abernethy and Dr. Tom Allen
Department of Computer Science
Furman University
United States
ken.abernethy@furman.edu, tom.allen@furman.edu

Abstract: This paper reports on the creation of a set of interactive Web-deployed discovery-based learning modules to enhance student learning in an introductory computing course for non-computing majors. The modules created apply a discovery-based methodology in a way that transfers exploratory activities to asynchronous pre-class activities (delivered via the Web).

Introduction

Our introductory computing course is intended for students not planning to major in computer science. In such as course, it is important to integrate a sound conceptual understanding of topics along with practical, hands-on experience of using computing applications [Abernethy and Allen (1999)]. Merely training students to use specific software applications is to transfer a skill with an extremely short shelf life. It is more important to understand why things work the way they do, and we believe students should be exposed to a variety of seminal ideas from the enterprise of computing. Research in cognitive psychology has demonstrated that a command of facts is important, but that the expert has an understanding that supercedes a mere recall of facts. Experts differ from novices in at least three important aspects. First, experts have mastered a greater amount of content knowledge or technical detail about their subjects. Secondly, experts have an understanding of the relationships of important concepts rather than just isolated facts. In short, they know what is important and how things are related. Finally, experts can apply their knowledge to new instances in order to solve problems.

Incorporating Discovery-Based Learning

While we cannot expect to convert our students into instant experts, we might expect to improve their understanding of difficult subjects by modeling the processes by which expertise is accumulated. The goal of discovery-based learning is to introduce a subject by activities in which the student constructs an understanding of the subject based on these activities. Research on discovery-based learning suggests that students learn better and retain more with this approach [Duschl, (1990), Osburn and Freyberg (1985), and National Science Foundation (1996)]. Discovery-based learning involves a three-phase learning cycle: exploration, invention, and expansion. The exploratory phase provides an introduction to the topic that incorporates both an exposition along with activities that will model the later "invention" phase. In our case, these are delivered asynchronously via Web. The second phase is an organized in-lab team-based activity whereby students must apply what they have learned in the exploratory phase to new and different instances. The role of the instructor is that of facilitator. The expansion phase is incorporated in the lecture classroom where concepts are reviewed and related. In addition, the students are expressly asked to summarize key ideas learned.

Some Example Discovery-Based Learning Modules

What we present are the results of several iterations of our modified version of discovery-based learning as applied to learning about computing concepts. First of all, we have chosen topics that would benefit from a more technical development. For example, students can appreciate better how the Internet disseminates information if they understand more about the problems of transferring data from one point to another. Similarly, it is easier to comprehend the limitations of numeric representations on computers, if one understands the design choices for encoding numbers as data. Following are selected examples of the modules we developed. Clearly it isn't possible to portray the interactive nature of these modules in a static paper, so the reader is encouraged to consult the associated Web site http://s9000.furman.edu/nsf-ccli/entry.html to see these and other modules in their interactive online format.

Doing the Math: Computers and Binary Numbers

In this module, students are introduced to the design factors involved in representing integer values on computers. In the activities of this module, students are asked to explore the creation and use of positional and nonpositional number systems, the processes of encoding numbers in the binary system, converting between binary and decimal representations, and representing and manipulating signed numbers.

How the Internet is Organized

In this module, students are introduced to some of the details on how the Internet is organized as a store-and-forward packet switching network. They examine why store-and-forward switching is more efficient than other methods; the problems of identifying end-systems; and, how Internet routing works.

Exploring Technology for E-Commerce

In this extensive series of learning units, students are introduced to the basic technologies underlying electronic commerce. Each learning unit is partitioned into five learning modules each of which consists of a number of lessons containing interactive expository material as well as hands-on invention activities.

Assessing the Results

How effective were the integrated learning styles for students in introductory computing? On the whole students reported that they believed the learning modules were "more interesting" and made learning "easier." However, while subjective assessments carry some significance, they are usually not reliable measures of achievement. For this reason, a comparative study of two sections of the same course was used as a basis for assessing whether the discovery-based learning modules had any real impact on student learning. The evidence collected does support the hypothesis that students exposed to integrated teaching methods employing discovery-based learning do acquire a deeper and richer understanding of the material compared to those who learn by the traditional method of readings and lectures.

References

Abernethy, K. and T. Allen (1999), *Exploring the Digital Domain: An Introduction to Computing with Multimedia and Networking*, 730 pages, Brooks/Cole Publishing Company, Monterrey, CA.

Duschl, R. (1990), *Restructuring Science Education*, Teacher's College Press, New York.

Osburne, R. and P. Freyberg (1985), *Learning in Science*, Heinemann Publishers, Auckland, NZ.

National Science Foundation (1996), *Shaping the Future*, NSF Document #96139, Washington, DC.

Acknowledgements

Supported by National Science Foundation CCLI grant# 9972356. The authors thank the NSF for this support.

TITLE: Cost Effective Real-Time Video Conferencing for Instructionand Collaborative Learning in Music and the Performing Arts Via Next Generation Internet powered virtual laboratory environment

Bringing together master artists and performers either individually or in a group, to assist developing artists or performers either individually or in a group in a cost effective way poses a significant problem. Considerable barriers exist some of which are: the number of performers, cost of travel, rigid schedules, time required and availability of suitable sites. Use of the Internet2Next Generation Internet (NGI) test-bed Abilene and state-of-the-art but affordably priced video streaming gear and TV production and sound equipment have been piloted so as to deliver the teaching, training, and monitoring in a virtual classroom to develop minority musicians by master performers of a symphony orchestra.

This paper will describe the significant problem of providing training and exposure to a representative number of African-Americans and other minority musicians that can facilitate their professional aspirations toward membership in a symphony orchestra. This paper will describe the principal collaboratants to the pilot project, i.e., Florida A and M University, a historically black public university also a connector to the Internet1 Abilene Project, The New World Symphony Orchestra also an Internet2 affiliate and Star Valley Solutions, Inc. also an Internet2 corporate members. .

The goals and objectives of the pilot will be presented and a detailed look will be taken at the problems that need to be solved to realize these goals and objectives. The virtual classroom and performance center established in the pilot served as a teaching and learning environment for two organizations five hundred miles apart. The New World symphony selected professional artists consisting of five members was located in Miami, Florida and the one hundred ten members of the Florida A&M University Symphony Band was situated in their campus practice hall in Tallahassee, Florida. The critical issue of the bandwidth to support high-speed video streaming between the sites was addressed via a OC3 connection to the Abilene network from the FAMU campus and a DS3 connection from the New World Symphony.

Using kodecs furnished by Star Valley Solutions, Inc. the technical staffs of the New World Symphony and Florida A&M University sought to establish a video streaming rate that provided high quality video and high fidelity audio. This presentation will reveal to readers and attendees the lessons learned in selection and acquisition of digital television production equipment that is affordable and of high quality which can be packaged into a light-weight, portable television production system. It will also discuss the required testing; and configuration for optimum video streaming quality and the conservative use of bandwidth so that the e-learning delivery system can be established within circuits and wide area network connections that is much more prevalent and affordable for the high speed application than the NGI environment used in the pilot project thereby ensuring that this e-learning approach can be more easily replicated. The results of a survey of the New World Symphony performing musicians and the students and faculty of the Florida A&M Symphony band will be provided. The survey results will be analyzed to ascertain important questions of effectiveness of the e-learning laboratory and satisfaction with the virtual classroom environment established in the pilot project. Finally video excerpts of the live virtual laboratory application for E-learning will be shared with participants at the presentation..

Is the Integration of CALL into Language Curriculum affected by the environments surrounding it?

Ibrahim Suliman Ahmed.
Faculty of Medicine-International .I.University-Malaysia
Ibhims20002@yahoo.com

Technology affects our live in various ways (Ahmed, 2001:321). As language teachers, our goals are to encourage our students to participate in language talking and communicate with each other as well as with the native speakers (Ahmed: 2002). During this era we need to use the technology in our class for their advantages, but the environments surrounding us play an important role in using CALL effectively. Therefore are any factors that may assist us in our implementation of Computer assisted Language Learning into class such as students attitudes? And in the contrary are there any factors that may prohibited us from using CALL in language class such as our budget, university authorities towards the use of technology in the class, and the teacher attitudes along sides the CALL materials and others factors. This study will try to answer all these questions as well as investigate all the possibilities that might help in improving integration of CALL in the class. The study will provide some suggestion for further studies.

References:

Ahmed .I.S (2001) Exeter University conference; CALL (Computer assisted language Learning). The Challenge of change-September 1-3 "Internet based Teaching of Arabic as a Foreign Language 321-326"-Published by Elm Bank Publication Exeter 2001-British Library Cataloguing in publication Data Available: ISBN 1-902454-13-8

Ahmed.I.S (2002) " The role of the language teacher during the era of Technology with Emphasis on Arabic Language. A Paper of presentation of NCOLCTL National Council of Organizations of Less Commonly Taught Languages. Maryland University-USA.

Biographical Information:
Ibrahim Suliman Ahmed obtained his degree from Omdrman Islamic University in 1986. Arabic Language and Lite. MA in teaching Language to non Arabic Speakers from Khartoum Inter Institute 1993. Diploma of Education (Curriculum) University of Khartoum 1994. Med part one (1) University of Khartoum 1994-1995. He worked at Sudanese higher secondary schools from 1987-1993 and at Sudan University of Sciences and Technology 1993-1995. Since 1995 he has worked at International Islamic University-Malaysia as Lecturer of Arabic Language. Present paper in CALL conference in international conferences such as UK. Has many papers have been accepted in international conferences in France USA, Belgium.

INFORMATION TECHNOLOGY AND MEDICAL STUDENTS AT SULTAN QABOOS UNIVERSITY

By

Akinyemi, A.; Al-Kindi, M.; Al-Rawahi, Z.; Al-Rawas, O.
Sultan Qaboos University
Post Office Box 39, Alkhoudh, PC 123, Sultanate of Oman
Email: akinyemi@squ.edu.om

Abstract

The present study was designed to investigate the medical students' readiness for web-based learning in terms of their information technology (IT) perception, computer literacy and accessibility to computer facilities. Sixty-five students (13 males and 52 females) were used in the study. Results showed that most students were favorably disposed and 95.4% of students were minimally IT literate. On their access to computers, there were many option, however, the university facilities ranked highest (90.8%) of all options. Many students (67.7%) are willing to take additional computer courses to benefit from the WebCT mode of instructional delivery.

Introduction

Sultan Qaboos University has embarked upon the infusion of technology into teaching and learning as a matter of policy through its adoption of the WebCT and other learning technologies. The College of Medicine is in the process of going online with a redesign of an aspects of its curricula in case based learning of the respiratory system to complement the traditional mode of instruction. Increasingly, people have come to realize that traditional instruction is not any longer adequate for contemporary Medical education practice. Similarly, it is inconceivable that traditional systems will be able to meet the needs of higher education in many countries, developed or developing. Distance education will indisputably be the recourse of higher education to satisfy the increasing need of this sector. Education anywhere, anytime, has been made real through the virtual learning technologies which have revolutionized the practice of many classrooms in many institutions.

Technology is consciously proffering solutions to educational problems in all sectors. Rapid advances in networked communication and the relative ease with which the "hypertext" media can be created are revolutionizing distance learning programs and such programs are becoming a normal part of the education practices of many universities (Schair and Kruegar, 2001). E-learning is a growing concept in higher education and its activities are the consequence of the advances in media technology. Web-based learning is not only ideal for learners at a distance but also offers a range of learning opportunities for full-time, on-campus undergraduates (Ryan et al. 2000). Grabinger (1996) calls for a number of strategies to adopt the new assumptions about thinking, learning, instruction and achievement that can lead to rich learning environment for active learning (REALS Educators and the proponents of computer-based education therefore need to ensure not only an environment that is conducive for active learning, but also one that is minimally susceptible to distractions that prolong learning time. The College of Medicine at SQU has put a case-based learning in respiratory system course online to complement the usual face-to-face, traditional education. Many other benefits accrue from e-learning as evidenced in Akinyemi, et al, 2002.

Objectives of the study

The objectives of the study were to assess S perception and attitude to IT, present level of computer literacy, and rate accessibility to computers and computer facilities (Labs and Internet Cafés).

Results and Discussions

Sixty-five students (13 males and 52 females) in the fifth year of College of medicine completed the questionnaire out of the ninety served (72% return). Results and discussions are presented in three categories according to the objectives of the study.

Perception, Attitude and Feelings about Computers

Figure 1 shows results relating to the affective dimensions of the study on the medical students' perception, feelings and attitudes toward computer learning. On the whole, S were generally positive in their attitude to computer learning as evidenced by the 61.5% negative score on 'dislike for computers' and the 67.7% score on the willingness of students to 'take additional courses in computers'. However, responses to items relating to their preferences for 'conventional teaching' (50.4%) and 'live lectures' (66.1%) suggest the need for proper orientation of students before the full scale adoption of e-learning.

Computer Literacy and Awareness

Figure 2 shows the present level of S computer awareness and literacy. A total of 95.4% responses indicated that they had used computers before and over 57% indicated that they had taken computer related courses. Except for e-commerce, S had used computers for 'chats, email, e-voting, e-discussions, Internet, and minimally for teleconferencing, and web-conference'. While probing further into S proficiency in computer use, it was found out that their expertise was limited to basically word processing. Students' Internet and email use seem to be most predominant with less than 20% claiming to be totally ignorant and unfamiliar with these two computer facilities. This finding has further been confirmed by the fact that over 43% of the medical students respondents have e-mail addresses.

Accessibility to Computers

Figure 3 below shows S responses on the various ways through which they have access to computers. Data indicates that 35.4% own computers, 58.5% have access in their homes, 90.8% have access to University facilities, 53.8% have friends who own computers and 23.1% can have access to Internet Cafes on the commercial basis. This item is especially important in view of the limited access of S to University computer facilities because of the large S population and high demand for the Computer laboratories. Other possible local sources like the commercial Internet Cafés scattered in major cities of Oman will complement the institutional facilities to make web-based education viable at SQU.

Conclusions

In investigating the readiness of S in the College of Medicine to engage in e-learning, student's attitude and level of IT literacy, are crucial for success in the proposed new web-based medical curricula at SQU. The current low level of IT literacy by students and their willingness to take courses in computers, to boost e-learning underscore the need for curricula modification to include basic skills in computers early in the S university program. However, S preference for the traditional face-to-face instruction, based on the results of this study, will be the focus of further research and enlightenment activities. Responses to S access to computers/Internet Cafes has revealed the need for the University authority to improve on the available infra-structures in time for the implementation of the new web-based curricula.

References

Akinyemi, A., Osman, M. T., and AlKindi, M. (2002) Implementation and Perspectives of WebCT at Sultan Qaboos University. Center for Educational Technology, Unpublished Research Report `.

Grabinger, R. S. (1996) Rich Environments for Active Learning. In Jonassen, D. H. (ed). Handbook for Research for Educational Communications and Technology. New York: Simon & Schuster Macmillan.

Ryan, S., Scott, B., Freeman, H. and Patel, D. (2000). The Virtual University: The Internet and Resource-Based Learning. London: Kogan Page.

Schair and Kruegar, (2001) Using New Learning Technologies with Multimedia, IEEE Multimedia, July-September, 2000.

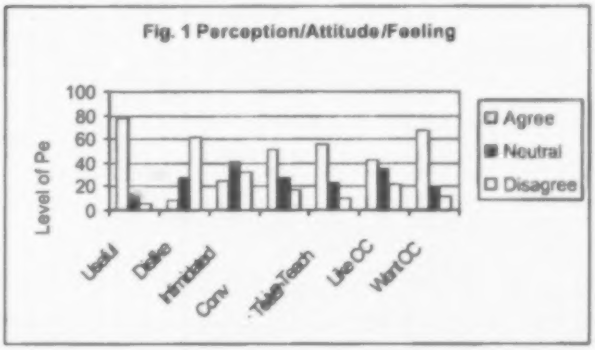


Fig. 1 Perception/Attitude/Feeling

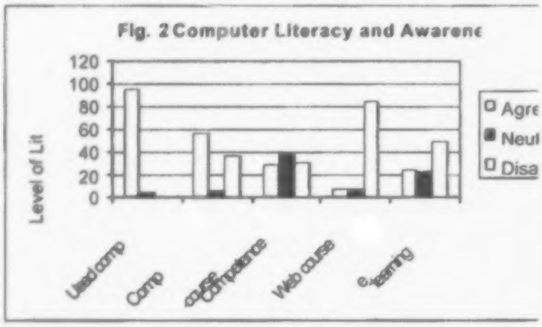


Fig. 2 Computer Literacy and Awarene

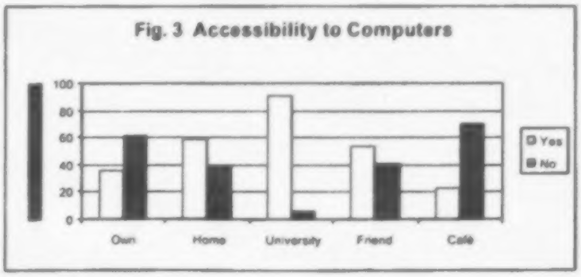


Fig. 3 Accessibility to Computers

Faculty Adoption of Technology: The End User as the Determinant

Ahmed Ali

Abstract

The article talks about the concerns of faculty regarding integration of technology into instruction. It is based on a study about a faculty training project at a Midwestern university's college of education. The faculty training project involved the mentoring of faculty by graduate students in Instructional Technology. Based on the training experiences and interviews conducted with some faculty members, their perceptions regarding technology and its adoption were examined. The six-month project was a one-on-one mentoring program of faculty by doctoral students in Instructional Technology under the supervision of the Director of the Instructional Technology program. The article reveals factors contributing to slow adoption of technology by faculty and provides recommendations for increasing integration of technology into instruction by faculty. The article concludes that for faculty to use and apply technology, training in technology should be provided before availing technology.

Introduction

During the last decade of the 20th century, there was a revival of the calls for education to meet the needs of society. Schools and colleges came under increasing pressure from society and from advancements in technology sweeping across the country. Not since Sputnik was launched had there been a need for educational institutions, particularly institutions of higher learning, to adapt to changes. At the core of this need was technology, notably computers and the Internet. There were calls for universities to incorporate technology into their programs so that they could adjust to events in a global society.

As the goal of educational institutions is to produce individuals who become productive members of society, administrators and teachers tend to use any strategy or tool that can help them accomplish this goal. Lately, technology's potential to improve learning has been recognized, and there is widespread incorporation of technology into teaching and, more importantly, into learning (Maier et al., 1998).

Various approaches have been utilized to help faculty use technology. From workshops and seminars to using technology students to help faculty adopt technology, increasingly effort is expended to encourage faculty to be an active part of this trend in educational institutions.

Methodology

As part of this effort to help faculty integrate technology into their teaching, I participated in a faculty training project at a Midwestern university. The faculty training project involved the mentoring of faculty by graduate students in Instructional Technology. Based on the training experiences and interviews conducted with some faculty members, their perceptions regarding technology and its adoption into the educational setting have been examined.

The six-month project was a one-on-one mentoring program of faculty by doctoral students in Instructional Technology under the supervision of the Director of the Instructional Technology program. Participant faculty had limited skills or knowledge of technology, and for those who had technology skills, the skills were fast becoming obsolete in the face of rapidly changing technology. The training involved skill development in technology and instructional design.

The training was conducted in a learner-centered, constructivist environment, where the faculty decided what and how to learn. The mentors were in place to help guide the faculty. Faculty participation was voluntary, and the training was individualized, attuned to each individual's needs and abilities.

As part of the preparation for the faculty mentoring, mentors had a 2-hour weekly meeting that provided a forum for preparation and sharing of individual mentoring experiences. A listserv was maintained where mentors posted weekly reflections on their sessions with faculty. This was useful, as it provided an overall picture of faculty attitudes towards technology, their technological skills and competencies, their adoption and use of technology, and their perceptions regarding the integration of technology into their teaching. As the mentor of one of the faculty members, I observed the activities of the faculty member during the entire mentoring sessions. This experience provided first hand information on the attitude and skills of faculty towards technology. Personal and situational interviews conducted with six faculty members provided information about their experiences, perceptions, and utilization of technology, both for personal and professional work.

Appropriateness

As faculty occupy a central position in educational settings, their views and ideas pertaining to technology integration are important. There is a need to justify the suitability of technology before it is embraced. Brackett (1998) argued that the benefits of technology might not be realized if appropriate designs and teachers' skills and interests are not in place prior to the introduction of technology. He posited, "it's a mistake to put technology at the center stage as we plan and execute educational reforms. Technology should hover shyly in the wings, ready to lend its power, but only as needed" (p. 30).

Brackett was in agreement with Gardner (1998) who proposed that prior to using technology, there should be a reason to consider the need and the way to use it and only thereafter should it be introduced. Gardner cautioned educators against blindly believing in technology as the solution to educational problems and as an aid to performance. He stated that "many technologies-from slide projectors to TV-have been touted as the solution to American education. Yet these technologies have had remarkably little impact on mainstream education. When plugged in, they are all too often simply used to 'deliver' the same old 'drill-and-kill' content" (p. 33). Technology should be put to use as and when needed, and faculty should greatly determine such use. Technology should not be introduced for technology's sake.

Faculty

Teachers are inevitably becoming part of the movement towards technology use in classrooms. To be able to actively perform and remain skilled, technology skills are increasingly becoming important (Valentine, 2000). Faculty play an important role in integrating technology into instruction. For faculty, incorporating technology means using it as a tool to effectively transmit information to students.

Faculty should not lag behind students in technology proficiency. Preservice teachers should show competency in current technology before they enter the field, while in-service teachers should undertake individual initiatives to update their skills, including participation in workshops and other in-service training in technology. But emphasis should be placed on the best ways to integrate technology with teaching and learning. Valentine (2000) reported the *Education Week* (1) survey found that training teachers how to incorporate technology into their curriculum was more effective for technology integration into the classroom setting than teachers simply acquiring technological skills.

Slow Adoption

The study revealed that generally, faculty members have demonstrated positive attitudes towards technology and its integration into instruction. They view technology as helpful to teaching and learning. They recognize the potential of technology, particularly computers and the Internet.

Faculty participants stated that technology is a significant learning tool that diversifies teaching and learning strategies, facilitates research by increasing access to resources, and increases communication between faculty and students and administrators. Although they were aware of the role of technology and its increasing adoption in educational settings, some faculty members displayed little enthusiasm to adopt it. Even for faculty who were very positive about technology, their use of technology did not match their recognition of its significance. Some faculty members used technology more for personal enrichment than professional development. Computer use was more common for email and Internet search than curriculum or instructional-related work.

Adoption of technology by faculty is slow (Olsen, 1999). A number of factors, including those identified below, contributed to the slow adoption. Many faculty do not have the skills to use the technology they are provided or required to use. With the aim of integrating technology into their programs, administrators ignore faculty's abilities, skills, and interests to use these technologies. This has led to machines lying idle in faculty offices or being underutilized. One faculty member stated that he used his computer once a week or once every two weeks only to read e-mail.

Lack of or limited technical support for faculty undermined widespread the use of technology by faculty. Although faculty were not given training before technology was provided, even for those who learned on their own, continuous support was limited when provided. An absence of a full-time technical support person dedicated to faculty or support persons not competent with the varying needs of faculty creates less interest for technology integration. Thus, it becomes difficult for even full-time faculty support technology specialist to be conversant with the multiple needs of the faculty; yet faculty are under pressure (albeit mostly indirectly) to use technology either from students or administrators.

BEST COPY AVAILABLE

Lack of confidence contributed to faculty's limited use of technology. Faculty were concerned that if they incorporated technology into their instruction, there was the possibility that students may know more about computers than the faculty. Teacher did not want to appear ignorant in front of their students. Possibilities of technical problems discouraged some faculty members from using the instructional lab of the college.

The fast pace of technology innovation did not augur well for its espousal. Two participants felt they did not need to learn about technology at this point of their career. As using technology requires continuous skill development, faculty found this to be time consuming. One faculty member said continuously updating technology skills consumes time that would be better spent on research work, saying, "If the technology I use today will be useless tomorrow, what is the point of learning it…I better spend more time on what I am used to than learning new skills, which are not only demanding but which I might not use." Several faculty members consider technology to be an add-on to their already busy schedules and commitment.

Being used to traditional instructional styles derailed efforts to adjust teaching styles to accommodate technology. Using technology as part of teaching and learning leads, in many instances, to change in instructional styles where there is more student involvement in the teaching and learning, with the possibility of eventually leading to learner-centered instruction, thus diminishing the role of the faculty. This possibility created resistance from faculty because they considered it a threat to their positions and indispensable status. Thus, faculty would prefer an old, didactic teaching style that guarantees the supremacy of their position rather than incorporate a tool that undermines this supremacy.

In planning for and adopting technology, there is the tendency for institutions to consider faculty needs to be secondary to that of students and staff. There was the perception that with regard to technology, faculty were not prioritized despite their status. A faculty member said, "When institutions gauge their level of technology use, they measure, for example, student-computer ratio," ignoring faculty. This perception created indifference, if not hostility, to technology by some faculty.

Limited concern for individual faculty needs in the provision and use of technology was an issue. Faculty are treated under one umbrella, without individualizing the needs, abilities and interests of individual members. There was the general assumption that hardware and software that worked for one faculty member also worked well for other faculty members. One faculty member posited she is using a Macintosh computer, which is not her preference but which has been provided to her, and thus she had no alternative but to use it. Another faculty member told me how "irrelevant" programs were taking up space on his hard drive that he never used or had no need for.

Another concern rose about the emphasis given to technology. Faculty viewed technology to be nothing more than a tool for teaching, just like the chalk. They could not comprehend why there was too much fuss about technology, complaining it was draining resources meant for research, faculty, and curriculum development. In scaling its significance, they considered technology to be supplemental to instructional and research activities and curriculum development. While recognizing the computer technology's potential, they stated technologies, like radio, TV/video, and typewriters, were used for a long time and argued that it has not created a "problem." On the contrary, they have happily incorporated them into their teaching.

Suggestions

The concerns of the faculty about use of technology call for reassessment of the current practices of technology implementation. To facilitate access to and use of technology by faculty, the following recommendations are helpful:

The current strategy of just providing technology without concern for the end-user needs to change. The focus should be the ability of users to use technology rather than providing machines, which might end up being idle shells in offices. Faculty should be trained to be able to use technology before it is provided.

Technology support should be provided to faculty. Technology support has often been limited to hardware support. Faculty require both hardware and software support, and faculty support personnel should be competent in both.

Faculty should have the freedom and the will to use technology in their classes. Administrators should not pressure faculty to adopt technology. This runs the risk of being counterproductive to student learning. Technology introduction should be gradual, without hastily introducing faculty to technology that they do not comprehend.

Faculty technology centers would be ideal if faculty are to comfortably use technology. This would provide a forum for faculty to share their experiences and learn more about technology that is not available in their offices. In the past, faculty members were not comfortable using technology centers because they did not like to mix with students and staff in such centers. Where faculty-only centers might not be feasible, online support, discussion forums, and listservs dedicated to technology issues could be set up for faculty.

There is a need for greater institutional support. For proper technology integration, administrator backing and support for faculty is crucial. These include employing adequate technology assistants, allowing as many faculty members as possible to sit in technology committees, ensuring technology does not take away resources from faculty research activities, and allowing for greater flexibility in instructional styles and curriculum to accommodate individual teachers' needs and concerns.

Conclusion

Use of technology by faculty at colleges, though increasing, is not widespread. Many faculty members lack the opportunity, training, or motivation to use technology. Adding on to this situation is the unplanned provision of technology while training in the use of this technology is limited, if not lacking. Faculty members' limited use of technology has primarily to do with technical, personal, and instructional factors, which, if addressed, can increase technology use by faculty. Most important is that for technology to be successfully used by faculty, there is a need to change the focus from providing technology first to training faculty first. Whether it will be used for instruction or other purposes, the end user should determine whether and how technology is used.

References

Brackett, G. (1998). Technologies don't change schools–caring, capable people do. In J. Galin. & J. Latchaw (Eds.), The dialogic classroom: Teachers integrating computer technology, pedagogy, and research. Urbana, IL: National Council of Teachers of English.

Gardner, H. (1998). Can technology exploit our many ways of knowing? In J. Galin. & J. Latchaw (Eds.), The Dialogic Classroom: Teachers integrating computer technology, pedagogy and research. Urbana, Ill: National Council of Teachers of English

Knowles, M., Hohon, E., & Swanson, R. (1998). The adult learner. Houston, TX: Gulf Publishing Co.

Maier, P., Barne, L., Warren, A., and Brunner, D. (1998). Using technology in teaching and learning. London: Kogan Page Limited.

Olsen, F. (1999). Faculty wariness of technology remains a challenge. The chronicle of higher education. [Online]. Available: http://chronicle.com/free/99/10/99102101t.htm [2000, October 21]

Valentine, C. (2000). Preparing teachers for the high-tech classroom. In D. T. Gordon (Ed.), The digital classroom: How technology is changing the way we teach and learn. Cambridge, MA: Harvard Education letter.

BEST COPY AVAILABLE

Teaching the Course “Introduction to the Information Society” at the University of Cyprus: a Pilot Methodology.

Panagiotes S. Anastasiades
University Of Cyprus,
Department of Computer Science
Cyprus
Vice-President of the Permanent Scientific Committee on Social Issues of the Greek Computer Society
panas@ucy.ac.cy

Abstract: The introduction of the course “Information Society” by the Department of Computer Science at University of Cyprus, aims at familiarizing the students with one of the most important priorities of the European Union at the beginning of 21st century. This work contains an analysis of the necessity, the targets and the key points of the course to be introduced. Our attention will be focused on the development of a hybrid learning model, which will be based on the optimum combination of open and distance learning, the development of an interactive internet site and conventional teaching.

Introduction

In an era that everything around us is changing at incredibly fast rates, the contemporary human being as well as the social structures that he has built during the ages, are trying to cope with the new demands that are being created. Computers (P/Cs) are at the peak of technological development, as they constitute the most characteristic advanced party of the new age. The basic relationship between the human being and information is reversed (Anastasiades, 2000a, p. 22). The information nowadays travels through networks towards people who are looking for it from a fixed geographical point via their personal computer. Over the last years the Information Society has been one of the primary issues on the political agenda of the European Commission (COM(94) 347/2 final). The Information Society is based on the informed citizen, on the person who knows the advantages and the challenges of the new era, as well as the ways with which he will seize the opportunities which will be presented to him (IST, 2000). The introduction of information and communication technologies into education significantly changes the structure and operation of education as it has been until now (Berge & Collins, 1995). The basic relationship between educator – learner is reversed (Anastasiades, 2000b), as through electronic networks the educational process is transferred to learner's private space, no matter how many kilometres separate the learner from the educator. Through teleconferencing learners can attend organized units of classes and lectures from anywhere they choose and are able to intervene, to ask questions, to exchange notes, reading lists, etc. With a PC and the necessary multimedia applications, a learner can participate in the educational process, acquire knowledge in which he is interested, evaluate his learning ability or even be evaluated from the distance learning centre which will be able to certify his/her knowledge (Ellsworth, Jill H. (1994). A hybrid-learning environment is one in the context of which we try to combine in the best possible way new technological applications – that set the educational procedure free from its ties in time and space – and the respective pedagogical references to the basis of the traditional educational procedure school of thought [http://www.cs.ucy.ac.cy/~panas/UCY/EPL011-IS/AA_Home_IS.htm]. The hybrid learning environment is a conceptual and functional integration of traditional educational methods and new modern approaches.

Working out the teaching methodology

The proposed course will attempt an extensive and in-depth presentation of the Information Society (IS) framework being formed up. Expounding in full all those factors that will help record and demonstrate the size and importance of Information Society will be our first priority. Objective of the first instructive part is to provide the necessary outline of subjects that will assist the students get familiar with the concepts of IS. The audience gets familiar with concepts like the electronic government, open and distance learning, teleworking, new economy, digital enterprise, electronic commerce, telemedicine, digital TV etc. The teaching of the course “Introduction to Information Society” is based on a teaching methodology which is part of the endeavor to implement – under real circumstances – a hybrid learning model with the characteristics we described above. The whole endeavor is based on the optimum combination of the main characteristics of the conventional educational environment, the educational aspect of the Internet and the asynchronous transmission in an Internet environment.

The implementation of this pilot endeavor follows these steps:

?. Preparation – familiarization of the students: Practically none of the students who attended the course was experienced in the use of the new educational technologies in their curricula. Their familiarization was therefore deemed necessary, and was achieved by readjusting the arrangement of the course.

Meaning, the philosophy and the sequence of the first series of lectures were primarily directed to the requirement of getting the audience familiarized with the basic characteristics of the new educational environment.

?. Development of an Internet site for the course: the students were fully familiarized with the use of the Internet as a means of information and communication in relation to their courses. Additionally, they were encouraged to use the pages of the course on the Internet [12], where, in addition to educational material, bibliography and useful links, they could see and download the lecture slides, create virtual chat rooms etc.

C. Development of pilot videotaped courses: once the teaching of the subject "Learning and Information Society" was complete, the audience was properly prepared to work under real conditions, experiencing the concept of the learning hybrid environment. The lectures for two subject parts were videotaped this way, and the students could see them by visiting the page of the course on the Internet.

D. The teaching methodology worked out provided the following: The students attend the videotaped delivery of the course through the Internet, which substitutes a scheduled lecture in the amphitheater. The students attend the course at the place of their choice, e.g. from the lab or their house, at a predetermined period of time, e.g. two days. At the end of the videotaped course delivery, the students were supposed to undertake certain assignments (in the form of questions and subjects given by the instructor), which they would present to the class at the next scheduled lecture. Thus, there would be enough time for discussions, presentation of studies and interchange of different views and approaches.

?. Evaluation Methodology: A model for the evaluation of the hybrid learning methodology is developed at three levels: Exante, Ongoing, Expost. Students and instructors record the pluses and the minuses of the whole endeavor, suggesting alternative methods and approaches.

F. Evaluation of Students: The evaluation of the course includes three stages: The first stage includes the carrying out of a major assignment by groups of students on subjects related to the course. On the second stage, there will be an evaluation of short research endeavors following the videotaped lectures. At the end, the grading of the students gets finalized once they take a written final examination.

Conclusions

As part of this work, we saw a presentation of the most important steps for the establishment of a hybrid-learning environment at a pilot level. The characteristics of the new teaching model can be summarized as follows: The classroom ceases to be the principal place where knowledge is transferred from the teacher-transmitter to the student-receiver, and is transformed into an open and creative place for discussion, pursuit and combination of different scientific approaches and views. The instructor, not having to worry about covering the material to be taught, will be able to act undistracted as the coordinator of an educational environment of unlimited scope. The students will experience their participation in the classroom as active and leading elements of the educational process in its new form. The page of the course on the Internet changes from an area of updating, communication and information to an area of instruction through the use of asynchronous transmission techniques.

References

Anastasiades, P. (2000a). *In the Information Age.* A.A Libanis, Greece, Athens

Anastasiades, P. (2000b) 'The school in the information society. The new role of secondary level teachers'. *Proceedings of the Annual Seminar on 'Computing in secondary education', February 2000b*, Athens, Greece.

Berge, Z., & Collins, M. (1995). Computer mediated Communication and the Online Classroom in Higher education, *Computer –Mediated Communication Magazine*, .2 (2).

Ellsworth, J.H. (1994). *Education on the Internet.* Sams Publishing, USA, Indianapolis.

European Commission, COM(94) 347/2 final.

IST 2000 Final Report, Nice, France.

A Swedish net-university – visions of desirable societal developments

Mats B Andersson

Media Technology and Graphic Arts, Royal Institute of Technology (KTH),
Lindstedtsvägen 5, 10044 Stockholm, Sweden,
tel.: +46-8-7906000,
e-mail: mba@nada.kth.se or mats.b.andersson@ilu.uu.se

Proposal

The paper presents a study of the Swedish net-university established in 2002. The organisation is in its infancy and is very much in a vague shape. A public authority was established 1 mars and the beginning of educational activity is planned to the autumn semester, according to political statements.

The Swedish net-university is not a new seat of learning; it is just an organisation that promotes and coordinates other universities network distributed education. It is to inform and market courses by a web portal, develop network supported distance education and generate more knowledge and experience in that subject.

This study has a focus on ideas on the emerging organisation, its aim and purpose. Politicians and member of the board in the authority, what thoughts do they have? What visions do they have? In what sense can this organisation support flexible education? What task should the Swedish net-university have in the Swedish academic infrastructure? What emerging needs is it supposed to be a solution of? The research is grounded on statements, by studying documents, letter of intent, and structured and open-ended interviews.

Assessment of Understanding: a Case Study

K. Baniulis
Associate professor, Computer Networking Department,
Kaunas University of Technology, Lithuania
kazysba@pit.ktu.lt

V. Reklaitis
Professor, Graduate School of Information Systems,
University of Electro-Communications, Japan
vytas@is.uec.ac.jp

Abstract: Testing is being increasingly used in elearning settings at higher education institutions. Computer Assisted Assessment (CAA) is seen as having limited skills testing and assessment possibilities. In this paper an innovative use of the TestTool for assessment of skills and understanding is discussed referring to assessment practice in "Data Structures" subject.

Introduction

Testing is being increasingly used in higher education institutions. It is seen as appropriate way for assessment knowledge acquired in knowledge-based subjects with recall and recognition skills predominating. Technical and technological studies are based mainly on knowledge building via the real understanding how process or construction works as a whole. The real understanding comes up through achievement of certain level of subject knowledge, as well as through developing skills. Computer-Assisted Assessment (CAA) environments currently in use help mainly to assess level of knowledge, but have limited skills testing and assessment possibilities.

What we are seeking is a means of assessment appropriate for learning through knowledge building. In other words, we look for a means to provide a possibility for students to manipulate with subject mater elements, to trace students' actions during their manipulations and to assess their capabilities according to the task solved. We made an attempt to approach this problem by developing our TestTool, which was designed at Kaunas University of Technology as web-database e-learning system for self-learning and assessment.

In this paper an innovative features of the TestTool are discussed - an authoring and use cases of so called 'graphical construct' question type, which extends the TestTool functionality beyond a typical testing of knowledge but allows to view assessment as a step of knowledge building and testing for understanding. The TestTool usability has been investigated in class experiments delivering "Data Structures" module for CS undergraduates.

A Point of View on Testing Question Types

The range of question types being used in CAA settings is rather narrow with a great predominance of multiple choice questions (MCQs). Because the ease of realization, there are numerous CAA systems, which employ a set of question types aimed at recalling, matching terms or simple concepts, filling gaps, etc. But, such a question types, though realized through different interfaces, have a similar formative influence on learning outcomes as MCQs.

We think, that the only way to achieve academical credibility of testing at higher education level lies in radical changes and introduction of new forms and types of test questions. Obviously, that leads to the construction of new CAA engines capable to analyze and evaluate the more complex forms of answers provided by students. Such systems certainly are more complex in terms of implementation, authoring of test questions, usage, maintenance and so forth. But, along with advancements in ICT there is no other way than to distinguish between the use of technology for knowledge construction versus knowledge memorization and reproduction.

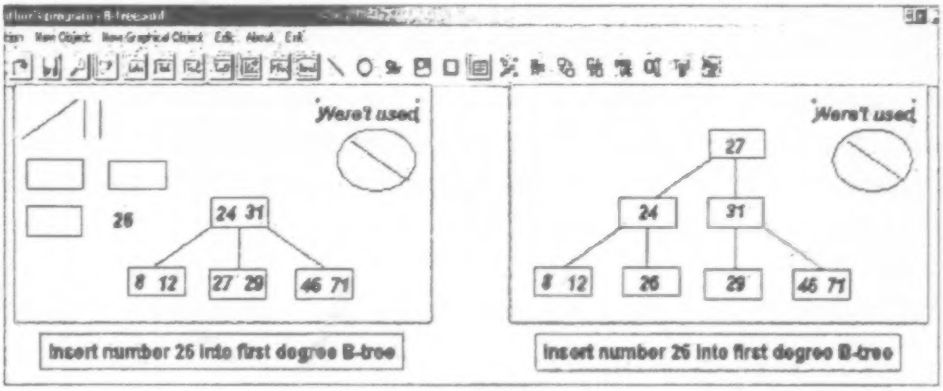
The TestTool assessment engine, along with traditional types of questions, is capable to deal with a new question type addressed to assess real problem understanding rather than recalling and looking for correct answer among a few predefined alternatives. We call this type of question as 'graphical construct'. The concept of the 'graphical construct' question is in giving a student a task to create or assemble a correct construction from a set of objects spread in constrained area on the screen, called a 'graphical panel'. The content of a test question is to build up a correct construction from the objects given within the panel, avoiding a selection of the correct answer from the predefined ones. Behind the scene there is a fully correct construct created by the subject author, which is used by assessment engine when student submits his answer version.

A software engineer having a task to implement the concept of the graphical construct question actually must find out a compromise between realizability and meaningfulness of test situation. In other words, it is a trade-off between meaningfulness of the test question and possibility to check automatically the correctness of the answer to it. We came up to one such compromise in the design of graphical construct question.

Tests for "Data Structures" Module: a Case Study

TestTool has been used when delivering "Data Structures" module at KTU. Within that module we take a basic data structures and explain data processing using various graphical representations. Our intention is to stimulate reasoning and to assist students in understanding data transformations when dealing with various data structures, and also to have an ability to assess their learning outcomes. We are going to show how graphical construct question could be used to create test situations, which require students to demonstrate reasoning activity in order to design a correct answer, and therefore such a testing can be interpreted as testing for understanding.

As an illustrative example we take a task of insertion of a new element into B-tree retaining it's consistency as a B-tree. By making use of graphical construct question we came up to the following instructional design, which is rendered by task authoring interface on Fig. 1. The display is split into two parts: left-hand side is a graphical panel area where question or task situation should be created, and right-hand side is correct answer area. Both must be created by author. When saved, they are stored separately as XML files in a database. Taking a test student receives only a task situation and is asked to construct his answer using a set of given elements and to move all unnecessary elements into the 'Weren't used' area.



Insert number 26 into first degree B-tree

Insert number 26 into first degree B-tree

Fig. 1. Task situation and it's solution (author's view)

Depending on initial Btree and element to be inserted, the insertion may cause a re-building of the tree caused by overflow, which in turn may cause recursive overflows, split and growth of a tree up to the root. Comparing the task situation on the left and anticipated answer on the right, one can see that student must accomplish a sequence of constructive actions in order to build a correct answer. It should be anticipated, that there are rules and heavy restrictions on actions to be done. Only owing to that, however, the correctness of answer can be checked automatically by the TestTool engine.

A number of task-solution situations, along with MCQ type questions, related to a certain data structure like Ordered and Orderable Lists, Stacks, Queues, Binary Trees, AVL Trees, B-trees, Hash Files, Index Files have been created for "Data Structures" module. Referring to the results of self-testing and final assessments carried out in real conditions of module delivery for a two flows of students during two years we do argue that TestTool graphical construct facility, if used with meaningful instructional design, allows us to test and assess students for real problem understanding. Such an opinion was pointed out by many students.

BEST COPY AVAILABLE

Online Writing as a Form of Electronic
Communication in a Second Year Biology Course

Michael K. Barbour and Michael A.J. Collins
mbarbour@nf.sympatico.ca / collinsm@mun.ca

Memorial University of Newfoundland
St. John's, Newfoundland, Canada A1B 3X9

Abstract - This paper considers student use of an online discussion forum in a second year Biology course and how that participation may be an indicator of increased student success in the course. The authors discuss how participation in the online discussion forum is a form of public writing in which the students need to have an understanding of the topic about which they are writing. It is this practice of writing with a clear understanding that may increase students' success in the course and not simply the use of online communications.

Introduction

One area where computers have made a significant impact is in the realm of computer-mediated communication or electronic messaging. According to Zack (1995), the term electronic messaging includes "several modes of computer-mediated communications, including electronic mail, electronic talk or chat, computer conferences or bulletin boards, and electronic document exchange." (p. 206) This definition is very broad in its scope and for the purpose of this study, electronic messaging will be limited to electronic mail, messages sent to an electronic listserver, and posts to a web-based discussion forum.

The course considered in this study was Biology 2040 – Modern Biology and Human Society I (Human Biology), a large enrolment second-year, non-major Biology courses which is regularly offered in on-campus lecture, off-campus correspondence and Web-based formats. During the period 1997-1999, student contributions to a Web-based discussion forum and e-mail messages sent to the instructor were collected. An analysis of these data was undertaken to determine whether or not a relationship existed between the use of electronic messaging and the final course grades of the students. A comparison of the performance of students in the different instructional formats of Biology 2040 is described in Collins (2000a).

Student Achievement and Electronic Messaging Usage

Collins (1995) found that the electronic bulletin board had fostered "student-student interaction and student-professor interaction… of course student-professor interactions through computer conferencing will never be a total replacement for face to face interactions, but computer conferencing does provide another channel for such communication." (p. 189) More recently Collins (2000a) illustrated that while there was hardly any difference between the final course scores of e-mail users and non-users, there did seem to be a positive relationship between the level of web forum use and final course scores.

Collins (2000b) found that in the web-based version of Biology 2040 during the Spring 1996 semester, there seemed "to be a relationship between the level of web forum use and final course scores." More specifically,

> that very frequent users achieved an 'A' for the course while frequent users achieved 'B's. It is interesting to note that those achieving 'C's and 'D's in the course were either infrequent users or did not post notes to the forum at all. None of the three students failing the course posted notes. There is, therefore, a relationship between web forum use and final course scores with very frequent users achieving higher marks, while students not using the web forum are more likely to fail. (p. 7)

The results in this study based on a larger number of students reinforced to those found in the previous study.

Since this earlier study examined just one individual class, the present study included all classes for which we had had during the period 1997-99. These data are illustrated in Table 1.

Table 1 - Frequency of use of the web forum and final letter grade

	Course grade				
Level of use	A	B	C	D	F
Very frequent	2	0	0	0	0
Frequent	1	2	0	0	0
Infrequent	18	10	4	1	2
None	21	17	7	2	4
Totals	42	29	11	3	6

Unlike the relationship between the letter grade achieved and the level of electronic mail use, which is discussed in Collins and Barbour (2001), this table indicates a clearer relationship.

> [Table 1] shows that the relationship between the letter grade achieved and the level of web forum use is even clearer than for e-mail use. Only 'A's were very frequent users, and only 'A's and 'B's were frequent users. Only about one third of 'C's, 'D's and 'F's were infrequent users while two-thirds made no use of web forum. Students achieving an 'A' in the course were much more likely to be web forum users (21 of 42) than 'B's (12 of 29), who, in turn were more likely to be users than 'C's, 'D's, and 'F's (only 7 of 20). (p. 7)

Both this study and Collins (2000b) lend credit to the notion that students who participate in online discussion forums have a greater chance of success in the course than students who do not participate.

This notion may be explained by findings from two different areas of research. Over a decade ago, Chickering and Gamson (1987) put forward the concept that interaction is a key mechanism in enhancing learning. This concept could be applied to this study if one were to include electronic messaging as a form of interaction. However, a second area of research may prove a greater relationship. There is a growing body of research that indicates that students who write about their subject learn that subject better. One such piece of research is Moore (1993), who has shown the connection between writing in Biology and higher course scores as others have demonstrated for other subject areas.

Collins and Barbour (2001), speculate that while email messages are often short messages about non-content queries which are 'private' and only for the instructor's eyes, postings to the web forum are 'public' and open to the scrutiny of all class members. Students are more likely to be careful and deliberate about what they write on the web forum because they are for public consumption. (p. 8)

Conclusion

While there was no apparent relationship between the use of electronic mail and student grades, this study found a positive, but not conclusive, relationship between the number of times students posted to the web forum and the grade that the student received. Students who received 'A's and 'B's in the course were more likely to be "frequent" or "very frequent" users of the web form, while students who received 'C's, 'D's and 'F's were more likely to be "infrequent" or "non-users."

The positive relationship with posts to the web forum and not electronic mail seems to confirm the assertion by Chickering and Gamson (1987) and Moore (1993) that interaction and public writing are key mechanisms in enhancing learning. This is based upon the premise that contributing to a web forum is a carefully planned, deliberate writing activity on the part of the student.

Selected Bibliography

Chickering, A. & Gamson, Z. (1987). Seven Principles for Good Practice in Undergraduate Education. American Association Higher Education Bulletin, March, 3-7.

Collins, M. (1995). Using Electronic Bulletin Boards with College Biology Classes. The American Biology Teacher, 57 (5), 188-189.

Collins, M. (1998). The Use of Email and Electronic Bulletin Boards in College-Level Biology. Journal of Computers in Mathematics and Science Teaching, 17 (1), 75-94.

Collins, M. (2000a). Comparing Web, Correspondence and Lecture Versions of a Second-Year Non-Major Biology Course. British Journal of Educational Technology, 31 (1), 21-27.

Collins, M. (2000b). The Importance of Electronic Communications in Successful Web-based Courses. *International Conference for the Electronic Business, Science, and Education on the Internet*, Scuola Superiore G. Reiss Romoli, L'Aquila, Italy. (CD-ROM).

Collins, M. & Barbour, M. (2001). Some Characteristics of Student use of Electronic Communications in Second-Year Science Classes. *International Conference for the Electronic Business, Science, and Education on the Internet*, Scuola Superiore G. Reiss Romoli, L'Aquila, Italy. (CD-ROM).

Moore, R. (1993). Does Writing About Science Improve Learning About Science? Journal of College Science Teaching, XXII (4), 212-217.

Zack, M. (1995). Using Electronic Messaging to Improve the Quality of Instruction. Journal of Education for Business, 70 (4), 202-206.

Does Web-enhanced Instruction Increase Student Satisfaction with Curriculum?

Sherry Batson
batsonsl@hal.lamar.edu

Connie Ruiz
Family & Consumer Sciences Department
ruizcs@hal.lamar.edu

Amy Pemberton-Shows
Family & Consumer Sciences Department
pembertoar@hal.lamar.edu

Paula Nichols
Education Technology Center for Distance Learning & Professional Development
nicholspa@hal.lamar.edu
Lamar University, Beaumont, Texas 77710, USA

Abstract: The purpose of this study was to determine if student satisfaction would increase with web-enhanced instruction. This study was conducted at Lamar University, Beaumont, Texas, USA, during spring 2001. Two courses relying upon slide presentation, Architectural History and Art Survey, were selected for the study. Combined enrollment was 48 students. The first half of the semester was taught in the traditional manner. At mid-semester a questionnaire was administered to determine student satisfaction with the traditional method of teaching. Then students were given access to a web page containing the remaining semester slides (visual images) and instruction about accessing the web page and progressing through the visual images. At the end of the semester, another questionnaire was administered. Both questionnaires revealed 53% were satisfied with the teaching method. Although an increase in student satisfaction was not detected, a majority of the participants expressed a positive opinion of having visual images on a web page. Each instructor, encouraged by students' responses, decided to enhance other courses by providing visual images on a web page.

Introduction

In 1990, only a decade ago, the Internet was a virtually unknown concept, beginning as a communications link among computer facilities (Teh, 2000). However, with the development of user-friendly software, a new era of communication technology emerged for the masses. Internet technology has been compared to the invention of Johann Gutenberg's movable type. Not only has the cost of information distribution been driven down but the wealth of knowledge shared has increased a thousandfold (Wallin, 2000). The fact that we are now able to connect distant peoples, assemble and use diverse learning resources, and provide enhanced access to educational opportunities is more powerful and far-reaching than we could have imagined a decade ago. Educators are now incorporating resources that the Internet has to offer, adding web-enhanced instruction and/or web-based instruction to traditional classroom pedagogy.

Problem Definition

Traditionally, in courses that require viewing slides projected in a classroom, many students have experienced frustration when attempting to listen for important information, write notes, and hurriedly sketch images to remind them of the slides. In addition, not having slides conveniently available outside regular class hours has hindered the review process, and may have negatively affected student performance on exams. Web-enhanced instruction could provide solutions to these problems and increase student satisfaction. If it could be shown that web-enhanced instruction increases student satisfaction, instructors may be receptive to incorporating this technology into their teaching methods.

Methods

The subjects invited to participate in this study included students enrolled in two courses: Architectural History and Art Survey, for the Spring 2001 semester at Lamar University, Beaumont, Texas. Course content depends on students viewing images from slides projected in the classroom. Students are tested on knowledge retained from lecture material pertaining to these slides.

Two instruments were used to determine student satisfaction. The first, administered at mid-semester, collected demographic information and assessed student satisfaction with traditional course delivery and content. A web page was created and made available to students for the second half of the semester. The web page contained the remaining semester visual images. At the end of the semester, student satisfaction with course delivery and content was determined using a second instrument. Ratings from the two questionnaires were compared, using students' t-test for correlated groups. StatView (SAS Institute, Inc., 1999) was used for data analysis.

Results

All 48 students indicated that they had access to a computer and the Internet. They also indicated that they had experience accessing Internet web sites, web pages, and email.

Several items on the questionnaire were used to measure overall student satisfaction: 1) interest in the class, 2) willingness to recommend the course, and 3) level of satisfaction. Both the pre-questionnaire and post-questionnaire revealed that 53% of participants were satisfied with the curriculum. A majority (68%) of students agreed that the web page enhanced the effectiveness of the educational material and lecture. Approximately 75% of those responding agreed that learning and retention was enhanced by accessing the web page and that the web page benefited learning. On the post-questionnaire, 42% of students agreed that access to the web page allowed them to concentrate more on the lecture in the classroom. One-fourth of the participants indicated that their grades improved with the addition of the web page.

Course instructors were optimistic about incorporating a web page into their curriculum, and felt that having this resource available would have a positive effect on student learning. This study provided an opportunity to incorporate technology into the classroom. Both the instructors and students were pleased to have this option available to them. As the new semester began, each instructor acquired assistants to have visual images from their other courses incorporated into web pages.

References:

Teh, G. P. L. (1999). Assessing student perceptions of Internet-based online learning environments. International Journal of Instructional Media, 26(4). 397-402.

Wallin, J. (2001). Web-based education coming of age. Sky and Telescope: 101 (1), 77-81.

1999. Statview (version 5.0.1) [Computer software]. Cary, NC: SAS Institute, Inc.

Prospectus for: E-Learn World Conference

Topic: New Roles for Teachers/Learners

Title: "From Campus to Cyberspace: The Transition of Classroom Faculty to Distance Teaching Roles"

In an increasingly digitized society, the role of faculty is undergoing profound change, As more teachers make the transition from the classroom to technology-assisted mentoring of students at a distance. How are these faculty making this shift, what is their perception of their new roles, and what do their colleagues and students think? A study of fifty faculty teaching distance education courses at six institutions reveals useful information and offers valuable insights for both administrators overseeing these shifts in instructional roles, as well as for teachers involved adapting to the change from face-to-face relationships with students to mentoring academic progress of learners they may never meet. The survey reveals that while those making the transition are generally satisfied with their new roles, and feel their students recognize their contribution as distant educators, their classroom-based faculty colleagues continue to view distance education with skepticism. There are no more dramatic phenomena taking place in higher education today than this shift in how institutions and their professoriate provide education across time and space.

Biography: Michael F. Beaudoin, Ed.D. is currently Professor of Education at the University of New England in Maine; where he serves a faculty mentor in a distance education masters degree program.; he also is an online adjunct faculty for Carl von Ossietsky University of Oldenburg, Germany, where he maintains a research/writing collaboration with colleagues at the Centre for Distance Education. He is recognized for developing numerous innovative academic programs utilizing alternative instructional approaches to serve adult learners, including successful distance education programs at two institutions. He is actively engaged in research, writing, presentations, evaluation and other professional activities relating to the field of distance education.

Dr. Beaudoin can be reached at:
University of New England
11 Hills Beach Road
Biddeford, Maine 04005
Phone: 207 283 0171 X2685
Fax: 207 294 5942
mbeaudoin@une.edu

Young Adult Literature: Creating an online companion to an on-campus course

H. Timothy Blum: Albany Co. School District, University of Wyoming Lab School, Laramie, Wyoming, U.S.A. tblum@uwyo.edu

Dr. Barbara Chatton: University of Wyoming, Professor College of Education, Laramie, Wyoming, U.S.A. bchat@uwyo.edu

Dr. D.J. Yocom: University of Wyoming, Chair Department of Special Education College of Education Laramie, Wyoming, U.S.A. djyocom@uwyo.edu

Abstract: The task of creating an online course that mirrors the content material found in on-campus course offerings is difficult, but allows students constrained by distance and time to take advantage of courses required for advanced certification. Care must be given to present the material in a manner so that students with diverse abilities and learning styles will be able to benefit from the content information. The course must promote student / instructor, as well as student / student interaction.

References:

Blum, H.T., Lipsett, L.R., & Yocom, D.J. (2002). Literature Circles: A tool for Self-Determination in One Middle School Inclusive Classroom. *Remedial and Special Education*, 23(2), pp. 99-108.

Daniels, H. (1994). Literature Circles Voice and Choice in the Student-Centered Classroom. York, Maine. Stenhouse Publishers.

Hooper, S. & Hokanson, B. (2000). The Changing Face of Knowledge. *Social Education*, 64(1), pp 28-31.

Kimball, L. (1995). Ten Ways to Make Online Learning Groups Work. *Educational Leadership*, 53(2), pp 54-57.

Morgan, G. (2001). *Thirteen "must ask" questions about e-learning products and services.* Web document (http://www.mcbup.com/research_registers).

Pinch, W.J.E. & Graves, J.K. (2000). Using web-based discussion as a teaching strategy: bioethics as an exemplar. *Journal of Advanced Nursing*, 32(3) pp. 704-721.

Rutter, L. & Matthews, M. (2002). *InfoSkills: a holistic approach to on-line user education.* Web document (http://www.emeraldinsight.com/researchregisters).

Text:

Wyoming is a huge state with a small population and one four-year College located in the extreme Southeast corner of the state. The difficulty of travel, time involved, and cost make online learning practical for many Wyoming residents. In the last three years the UW Outreach enrollment has increased by nearly 50%, during that same period of time online enrollments have increased almost five fold (University of Wyoming Outreach enrollment report 2002).

Teachers in Wyoming represent a group for which continuing education is required for re-certification. Reliable online instruction has a certain appeal for teachers who cannot readily travel or have difficulty in scheduling blocks of time required for on-campus course offerings. Online course offerings allow students to enter the classroom at their convenience, eliminate the need for travel and time related expenses, and allow students to participate in content related questions while by-passing the ritual and ceremony surrounding social interactions in face to face gatherings (Pinch & Graves, 2000). Using computers to deliver content material to students is cost effective, but still requires instructors who can adapt dynamic classroom conditions and maintain a flexible approach to different student needs (Hooper & Hokanson, 2000).

Online courses must offer more than convenience. Robust online courses make allowances for individual learning styles and levels, encourage learners to apply new content material to their existing knowledge, create opportunities for students to interact, and build relationships (Morgan, 2001; Pinch & Graves, 2000; Rutter & Matthews, 2002). Successful online courses involve students in building cohort relationships through interaction and allow for self-paced learning (Kimball, 1995; Pinch & Graves, 2000; Rutter & Matthews, 2002). Effective online courses address the needs of individual students, provide content material appropriate for students, summarize and synthesize information, and allow feedback (Kimball, 1995; Rutter & Matthews, 2002). Online courses will not replace campus based courses and face-to-face interactions with teachers, but they will augment university offerings. For computer based courses to be effective there will need to be an effective instructor who can adapt classroom conditions, in an electronic medium, and demonstrate flexibility in the face of diverse student needs (Hooper & Hokanson, 2000).

In order for an online course to be effective it must involve the student in many activities that are present in face-to-face instruction, dialogue, feedback, scaffolding, and activities that promote the application of knowledge to new situations. Offering a successful online course in Young Adult Literature requires content material that addresses the effective elements of computer based instruction mentioned above, while giving the student an opportunity to engage in discussions that build on their base of knowledge. This application of content material to an individual's real life is one of the major advantages found in a literature circle discussion format used in the face- to-face classroom (Blum, Lipsett & Yocom, 2002; Daniels, 1994) and built into the online version of the course. Other activities require students to respond to threaded conversations, respond to colleague responses, make reflective journal entries, and take part in real time chat rooms to discuss Young Adult Literature.

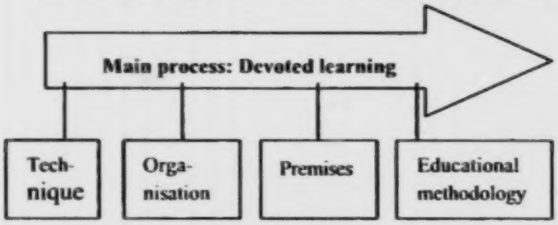
At the University of Wyoming the Young Adult Literature course was designed to utilize the online format employed by the Outreach School. The course was also designed to address the content material covered in the on-campus version of this course. The challenge has been to use the e-college format to provide content material to students while promoting discussion, reflection, and construction of new enhanced knowledge bases for teachers interested in learning more about Young Adult Literature for use in their classrooms.

BEST COPY AVAILABLE

Evaluation of the VR-project In Helsingborg, Sweden

Authors: Hans Espling, Lennart Bolin, Lena Hannersson, Kersti Adler, Kristian Lindgren,
Irene Lundmark, Claes Rube, Magnus Johansson, Fredrik Hansson
Authors Affiliation: Project team at the Local Education Department
hans.espling@gy.helsingborg.se
lennart.bolin@komvux.helsingborg.se

Abstract
During the school year 2001 – 2002 a project team is working with a project with the aim of delivering a virtual unit for the comprehensive upper secondary school in Helsingborg.
We are in the middle of the implementation phase and the project will be at its end in the beginning of June when our students have completed their courses and received their certificates.
We have defined a number of deliverances, which the overall purpose of the project is divided into. In the report (see http://www.learnit.helsingborg.se/) we have delivered descriptions of the educational methodology and a proposal for an operating organisation. We have carried out a market survey but have adopted a "wait and see plicy" when it comes to market strategy. The project-team has consciously chosen not to take a decision on a technical platform, in the purpose of avoiding the project becoming a "technical project". Instead we have unprejudiced tested different technical environments. We also deliver four courses; all of them ready to start. Furthermore the report contains a description of premises needed for the e-school.



Example of supporting processes

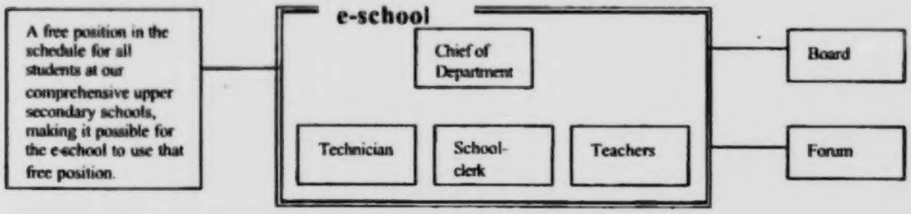
Key terms in educational methodology

1. Educational methodology

The main factor for a successful e-school is that the pedagogy is formed and adjusted according to the conditions. The experience during the project is that the pedagogical basis is the same in flexible learning as it is in all other forms of educational methods. What is important in planning and realization in this form of education is to develop a procedure in such a way that we estimate how a number of key terms will distinguish the education. During the project period a number of such key terms have clearly been crystallized (see figure above). So the experiences are that flexible learning demands flexible education and that we pay great attention to the key terms in the figure when we create courses and educational packages for the e-school.

2. Operating organisation

The e-school is meant to be a special unit, under the Local Education Department, where all students at our comprehensive upper secondary schools must have opportunities to study. It must be established that students will only be studying separate courses at the e-school. The student still belongs to the school where he/she has a regular place. Teachers connected to the e-school shall have most of their duties at their ordinary school and a smaller part at the e-school. In order to make the e-school work there must be a distinct organisation. The team-group suggests that a small but powerful organisation is created as follows in the figure:


A free position in the schedule for all students at our comprehensive upper secondary schools, making it possible for the e-school to use that free position.
e-school
Chief of Department
Technician
School-clerk
Teachers
Board
Forum

BEST COPY AVAILABLE

3. Market survey

In the local school-debate and in the document "Engaged Learning for everybody" from the local school committee, there are a number of demands for an increased possibility to choose courses and to create more individual education. In January 2002, we made a market survey among students in Helsingborg (upper secondary level) with the purpose of investigating whether the wishes from the students have been fulfilled. Our investigation, done in cooperation with the HELGE-group (a group for contacts between students and the schools), shows that about 30% of the students do not have the possibilities of studying the courses they want to. Up to 57% of them say they have not the possibilities of studying at their own speed. A realization of the aim of the VR-project is a solution that will provide for the requirements from the students.

4. Market strategy

If the government committee of Helsingborg decides to start an e-school, there will be an immediate need of marketing the e-school. The information should be directed towards the following main groups:

- pupils and students at lower and upper secondary school
- parents
- study counsellors
- headmasters
- teachers

The information can be spread through existing channels of communications since the courses offered by the e-school is also the courses offered by the regular school. Other groups in the society can also use an e-school and the information shall therefore also be spread to companies and organisations.

5. Premises

One of the ideas with the e-school is to make the education independent from *time* and *space*. On the other hand, as our experiences from the project-period points out, it is out of the question to run this type of education on upper secondary-level without "face to face" contacts. We will make it clear that our experience is that it's necessary to carefully plan the amount and regularity of meetings with the students. How "the face to face" contact is organised depends on the aim and plan of the course

The project-team wants to make it absolutely clear that one of the conditions for success is that an "e-school centre" is created. The students must know where the school is situated, in the real world as well as on the web. That's where they know they can get help with their studies. There's also an important social aspect from the students point of views.

The experience is also that it takes a lot of cooperation between teachers in order to get the concept working. An e-school centre would work as a natural place of meetings for teachers as well as students.

6. Summary

After a short acquaintance with the concept we call e-learning, you may think it's a school that is completely virtual and a place where the students are hanging over computers in order to learn the contents of a course. But the e-school we intend to build is neither such a school nor a school for only distance education. No, it will be much more than that. It will be, on one hand, everything from electronic support in the traditional education for all students at one time, till on the other hand, an advanced concept on a web site where most of the course is available. As an overall theme we have the principle that there must be a number of social contacts between students in every course.

It's also important to be aware of that e-learning works all right for most of the students if it is made the right way. For a smaller group of students this way of educating is less suitable. The market survey shows a great interest for this form of education and it is maybe realistic to think that 10% of our students will study a course at the e-school during his/her stay at the upper secondary level. In order to get an overall structure of the e-school there is a need of a joint basis. This consists of a shared view on educational methodology, a distinct organisation, an e-school centre and a technical platform. A decision to launch an e-school is also a decision for this basis to be built.

Good effects that we did not see at the beginning of the project-period are that a good platform for cooperation has been created with teachers from the different schools. A cooperation across the borders of subjects has also taken place, when methodical aspects have been the common factor. The courses must be analysed in every detail when adjustment to e-learning is done. Experience shows that the e-school can work as a bridge between schools and groups of teachers.

Designing and redesigning the WebCT part of the undergraduate course "Teaching and Learning with Music Technology"

Marie-Michèle Boulet
Full professor
Faculty of Music
Universite Laval
Casault building #3312
Quebec, CANADA G1K 7P4
marie-michele.boulet@mus.ulaval.ca

Abstract

This paper describes the content of the first release of the undergraduate course MUS-19673 Teaching and Learning with Music Technology developed on WebCT. Results of the students' assessment are then presented with their main concerns about the environment. Then, the redesign of the whole content is discussed. The students' assessment of this modified content are then presented.

Introduction

"WebCT (short for Web Course Tools) is an integrated set of tools for developing and delivering interactive course or course components over the Web" (Friesen, 2000, p.3). This tool is the one prescribed for the whole University Laval. Note that, before retaining it, members of a committee, from which the author was a member, first tried several platforms during the academic year 1999-2000. The next year 2000-2001 was characterized by a WebCT pilot project implying professors giving courses in various disciplines. The author was one of them. The course was the undergraduate course MUS-19673 Teaching and Learning with Music Technology, a mandatory one for the program of Bachelor in Music Education and an optional one for the others undergraduate programs of the Faculty of Music. The lack of equipments available to the students forced the professor to use WebCT to deliver course components instead of developing a fully interactive course. There were 30 students using this release of the course.

The components of the first year of use

As the author was aware that the adding of a Web tool does not mean any enhancement of the course because, as mentioned by Heines (2000), "... the determination of what really works is so difficult", she used what we will call several "content prescriptions" found in the literature (such as Anderson, Tolmie et al.,1993; Chen and Rada, 1996; Cherry, Fisher et al., 1989; Dwyer and Baker, 2000; Friesen, 2000; Mohageg, 1992; Williams and Webster, 1999; Wright and Lickorish, 1994). She also integrated what was said as being "obviously helpful even if not empirical evidence found" during the so numerous sessions and workshops she was enrolled to.

When designing the content, we took care at several criterias mentioned in the literature such as:

- The courseware provides information that accurately represents the topic.
- The courseware screen layout is easy to understand.

- The courseware content is presented clearly.
- The text information is presented clearly.
- The pictorial information is presented clearly.
- The graphical information is presented clearly.

The icons used in the main window are not the ones provided within WebCT. This design choice was assessed by the student as being a very important one. Because the professor was repeatedly said that it was a "must" to put the learning materials on WebCT, such as the different parts of the course notes, the content of the Powerpoint presentations made during each classroom meeting, the course plan the description of the exercises to perform, etc., it was done. Students found it was not convenient to have to download them and then, to have to print this teaching and learning material; moreover, they did not want to be forced to load on WebCT to have an access to this material.

Students found very useful the presentation of the topics that will be done during each meeting with the group (3 hours a week during 15 weeks = 3 credits course at Universite Laval). An example is presented at Figure 3. They did not like the "book-like" table of contents presentation though.

Lessons learned from the assessment of the first year release

As said above, we learned that students absolutely don't like to be forced to use WebCT to get access to the learning materials. On the other side, they suggested us to put several banks of examples that would complement, in a dynamic way, several aspects of the course content (for example, the principles of interface design or evaluation of a CAI tool in music). Students wanted that many examples and counterexamples of the applications for music teaching of a design principle be available. In the same way, they wanted that several examples and counterexamples of analogies that can be used to help a student to understand a particular musical language concept be presented. They also mentioned that visual synthesis of the information contained in a section would be very useful.

Students mentioned that the use of Mnemonic words would have helped them to actually become comfortable with the navigation within WebCT. So, instead of using a wordy table of contents, they would have prefer the use of Mnemonic words aiming at helping to make the link with the more formal course notebook and the presentation and activities performed during the classroom meetings (both assessed as being the heart component).

Students insisted to ask for real examples, i.e., real existing softwares, existing interfaces, real bad combinations of colors or good combinations of colors, etc.). Regarding when they prefer to have access to any WebCT content, most preferred to be able to have a look on the examples, simulations, etc., before the classroom meeting. The quizz section was totally suppressed and replaced by a forum of exchange of findings made by the students on a topic or another.

To summarize what we learned after this first year, we found that students would prefer that WebCT be used as a complementary tool and mostly to present what can't be effectively presented on paper. Because of that, we thrown away large parts of the site and began a complete redesign of the whole thing.

Implementation of Java Applet Solution for e-Learning in Physics

S. Boutiche
Dpt. of Physics, University of Bechar
08000 – Bechar, Algeria
e_learning_1@hotmail.com

Abstract: Developing courses in physics for conventional learning is a task variably complex, which consists generally in gathering and putting in a predefined pedagogic order a set of data (lectures, papers, courses,...) susceptible to be presented either directly/orally (classroom, conference, ...) or indirectly (book, article in a review, ...). In parallel to the course presentation, an experimental work/description -if available- is quite indicated to support the theory on which the study is rested.

The process to be followed to develop ecourses (or more generally eresources) for e-learning in physics is somewhat more complex since it requires -in addition to the above pedagogical considerations- a software solution designed for the accessibility mode (local PC, intranet, internet, ...) and adapted to the pedagogical goals to reach.

It is the purpose of this communication to present a java applet solution as a model for an e-learning course in physics via the internet and to show its high performances compared to conventional learning solution.

Introduction

Up to now, it is not easy to find in the specialized media of e-learning a consensual definition of what e-learning is and the problem becomes more acute if it is question to search a standard definition of e-learning in fields as varied as commercial sciences, medicine or physics. This is certainly due to the fact that elearning is an emerging science which is not yet fully integrated into our "conventional" systems of education. At the moment each elearning solution is a response to specific needs defined by the pedagogic goals of the studied subject within the physical limits of the elearning solution provider. In this context, it is the purpose of this communication to present in the following a model of an e-learning solution for higher education in physics implemented with the help of java applet solution (graphic interface of java language program).

Implementation of java solution for physics courses

The study of any subject in physics consists often in solving equations to obtain solutions susceptible to give information about the evolution of the studied system. Solving for example some equations of the fundamental principle of dynamics for a particle yields information about its position in space, its velocity, its acceleration and many other parameters. By integrating these data in a software solution, it becomes possible to simulate the exact motion of such a particle/system. If in addition our software solution is object oriented as is the case of java applet technology (of Sun Microsystems) the solution becomes "visual" and any parameter can be represented graphically.

On the other hand, it is easy to admit for the pedagogic output that a graphic representation carries more information when it is animated than when it is not. Then the possibility to simulate a visual motion in real time is of capital importance since it confers our elearning solution the possibility to be in the same time a course with a high level of pedagogic performances and a reliable e-device for an experimental work.

To illustrate this let us compare briefly our java applet (e-device) with a real device when the simple pendulum motion is studied.

Pedagogic comparison

In the classic device, the physical parameters or mathematical objects (such as the thread stress, acceleration vector,...) are not "visible" and are accessible to our perception only through equations. With the help of our e-device or e-pendulum not only such objects can be easily represented but their evolution in real time can be shown. With such e-device, the teacher task is certainly less laborious and the student more receptive to the studied subject.

Economic comparison

The cost of our e-device, is certainly lower than the cost of the conventional device for at least two reasons:

-The production cost of an e-device is lower

-The consumption cost of an e-device is also lower

Example

The java applet is an object with which it is possible to interact and the number of the offered functionalities is determinant for the e-learning solution quality. To have a maximum of functionalities, I have divided in two equal parts the applet surface: the left side of the applet (Image 1) constitutes the command panel which contains buttons, checkboxes, ..and in the right side of the applet one can observe the evolution of studied system. All applets that I have designed are constructed upon this model. I show in the image bellow, how a command panel is designed and the main interactive actions are sequenced: 1, 2, 3,..When the 3rd button is clicked, the e-pendulum starts its motion. It is possible to vary the thread length by writing the needed length in the corresponding field. If checkboxes are checked, the corresponding objects are shown (see checked boxes in Image 1).

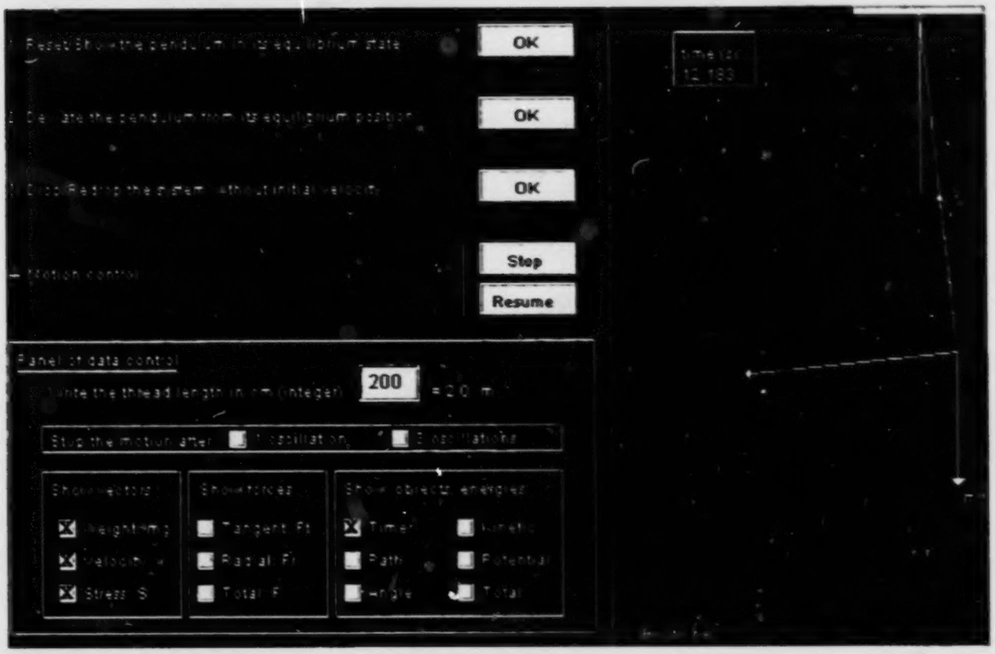

Reset:Show the pendulum in its equilibrium state
OK
Deviate the pendulum from its equilibrium position
OK
Drop/Release the system without initial velocity
OK
Motion control
Stop
Resume
Panel of data control
Write the thread length in cm (integer)
200
= 2.0 m
Stop the motion after
1 oscillation
3 oscillations
Show vectors
☒ Weight
☒ Velocity
☒ Stress S
Show forces
☐ Tangent Ft
☐ Radial Fr
☐ Total F
Show objects, energies
☒ Time
☐ Path
☐ Angle
☐ Kinetic
☐ Potential
☐ Total

Image 1: Command Panel (left) with screen of observation (right) of java-pendulum

Conclusion

Java e-learning solutions are characterized by two fundamental elements: low cost of production and consumption with a high pedagogic output. Consequently it is not difficult to predict for the near term that the java solution will take a prominent place in any educational system.

BEST COPY AVAILABLE

Instructional Design for E-Learning

Switching Sides of the Desk:
Two Instructional Designers Discuss Their Teaching Experiences

Introduction and Background

Mary Lynn Brannon and Barbara Brazon worked together in the Penn State University system as Instructional Designers at different campus locations. Their primary role was to work with faculty to incorporate new technologies and pedagogical approaches. They had worked with and advised faculty on such areas as collaborative learning, use of Internet technologies, groupware, and the team building process.

Barb Brazon is now a faculty member in the newly formed School of Information Sciences and Technology. Mary Lynn Brannon has continued in the Instructional Design position but has also taught in the Human Development program.

Ms. Brazon had prior teaching experience but the teaching role was new for Ms. Brannon. Moving from the design phase to the implementation phase brought the process full circle and helped us to better understand some of the faculty challenges.

Teaching Technology Skills in a Human Services Course

HDFS 302 – Leadership and Technology Skills for Human Services Professionals

HDFS 302 is designed to develop skills and competencies in communication, collaboration, team building, problem-solving, critical thinking, empirical inquiry, technology/information data management and leadership. To develop these skills and competencies students participate in assignments that require students to work in teams live and at a distance via electronic communication to accomplish goals and objectives. The assignments are built around content areas utilizing role play, cased-based learning and presentations focusing on topics from the human services field. Students select local agencies to interview and present to the class on these agencies. Students are required to use technology tools in all their assignments. Each assignment focuses on a tool, such as MS Word, PowerPoint, Excel, and Front Page. Students are also required to use the web for research and properly cite print and electronic sources; and evaluate web sites.

Mary Lynn Brannon team taught this course in Fall and Spring 2001-02 semesters. She was the technology expert and her colleague, a domestic violence counselor, was the content expert. Together they developed assignments that coupled the content area of human services with technology. A case was written that required students to utilize the technology, communication skills and research skills. The students, working in groups, presented on a local human services agency. The project had to incorporate use of Excel, PowerPoint, interviewing skills, and a group portfolio with an individual research paper from each students and examples of web research. The students completed the course by designing and publishing a professional/personal web page.

Hybrid Learning in the IST Curriculum

Background on the Information Sciences and Technology Degree Program

In May 1998, an Information Sciences and Technology Strategic Planning Group recommended that Penn State University should create a School of Information Sciences and Technology (IST). In March 1999, the University Faculty Senate approved curricula for both baccalaureate and associate degree programs. Forty-three new courses were approved.

Since the initial offerings in Fall 1999, the School of Information Sciences and Technology has focused on developing a strong interdisciplinary foundation for the major. The undergraduate IST curricula are common across the nineteen Penn State campus locations. A total of 2200 students have enrolled statewide in the forty nine courses now offered in the degree programs. The first baccalaureate degrees were conferred in May 2002.

Meetings are held with the school's faculty and administrators fromall campus locations offering IST programs three times a year. Course development efforts have been a key ingredient for these meetings. The rapid growth and deployment of the program has also been aided through the Solutions Institute. The Solutions Institute was formed to enable quality and consistency. Four online courses are currently being delivered (IST 110, 210, 220 and 250). The courses have been designed with a modular, problem-based approach so that each can be offered wholly online or by using elements in a face-to- face fashion.

IST 210 – Data Organization – Barb Brazon

The online version of IST 210 was designed to be used as a hybrid model that supplements the faculty experience and resources with online materials. This course approach examines not only the construction of a database using a programming language, but the implementation and utilization of Management Data Software. The course has a theoretical component that examines the database tools, and the implications of data security and public issues surrounding maintaining and disseminating information from a database.

During the Spring 2002 semester, Barbara Brazon taught this course in a hybrid fashion using both the online materials and a textbook. The course was conducted in face-to-face meetings throughout the semester along with weekly lab sessions; this was done to familiarize the students to the course tools, to develop teams, and determine competency and mastery of course material. After these meetings, the students worked both independently and on team projects. Students worked through assigned labs and read through the course materials online and in the book. Subsequent meetings throughout the semester were to review and to conduct demonstrations of material and concepts presented online or in the book. A variety of assignments allowed for team and individual assessment, as well as individual and group testing.

Lessons Learned

As instructional designers we advised faculty about the types of strategies available to incorporate into their teaching styles. As instructors in the classroom we were able to experience first hand how these strategies could be implemented with varying degrees of success.

The areas that we found particularly challenging were:

- Group dynamics
- Student motivation to work actively and independently
- Evaluation of team process
- Assessment of team projects
- ESL student writing assignments
- Different levels of technology skills
- Assessment of teaching effectiveness

We have looked at the faculty role through the Instructional Designer's eyes and it has helped us to greater understand the demands from the faculty perspective. It has also proved to be both exciting and humbling and we would recommend this experience for anyone in a faculty support role.

A Real-Life Paradigm Example of Designing and Delivering a Successful Hands-on Online Learning Experience for Members of a University Task Force on Technology-Assisted Education

Dr. A.-M. Brinsmead and Ms. Joan Gordon, CE, University of Toronto

Focus

The focus of the online learning experiences via web browsers on laptop computers in Task Force on Technology Assisted Education members' U of Toronto's offices for one hour on each of two consecutive days was to provide first-hand, high quality experiences in synchronous learning (in real time) and asynchronous learning (not in real time) within two of the School's existing online courses, **Advanced Professional Translation & Spanish for Professionals** and **Great Masters of Art** To this end, under the direction of Director Dr. Mary Barrie, University of Toronto's School of Continuing Studies used two Internet-based educational tools that were "best-in-kind" due to their flexibility in being able to deliver effective pedagogy, educator-learner interaction and academic administration.

Goals

- Provide hands-on experiences to Task Force members of real online learning experiences using some of the best instructional media in distance teaching in courses offered at the University's Continuing Studies' division. (A number of Task Force members had no previous online learning experiences.)
- Offer two high quality approaches to Internet delivery of optimal learning experiences in order to assist Task Force members in developing a framework within which to answer the questions raised by the university's future involvement in distance education: -Should U of T offer both credit and non-credit courses by distance education? –Should U of T develop and deliver its own courses? -What services are required – instructional designers, IT experts, etc.–– to support faculty in the use of instructional distance media?

Methods

A team of "mentors" comprised of the academic management staff from the School of Continuing Studies, coordinated by the head of the division, Dr. Mary Barrie, CFO and educator John Rawle, and ourselves (the authors of this paper), assisted Task Force members on laptops in their respective offices throughout the 1-hour online learning experience presentations. In addition to creating the instructional design and authoring and administrating the two online continuing education courses to be experienced by Task Force members, we co-delivered the presentations in fulfilling the roles of online educator and online senior administrator. In **the Advanced Professional Translation & Spanish for Professionals'** course, Anne-Marie moderated -- in the real time Chat environment in Prometheus-- a discussion on language and cultural etiquette for English speakers travelling abroad. In the Great Masters of Art course, Anne-Marie delivered --in real time-- a 5-minute lecture on Rembrandt and Monet by means of two-way audio- and video- communication in Centra Symposium, with a Q & A follow-up in real-time via text and audio chat amongst Task Force members regarding the value of the learning experiences and the questions they raised.

Results

The response to the online learning experiences' presentations were decidedly positive. The participants were impressed with how well-organized and thoroughly interactive and engaging these online learning experiences' presentations were, and with a modicum of technical difficulties. One participant said that this was the smoothest presentation of an online learning experience he had seen since he joined the U of Toronto in 1994. All participants were enthused by the "anywhere, anytime" delivery of substantial learning content materials on the wireless, "Personal Assistant" Palm Pilots. Participants preferred the asynchronous online learning environment over that of the synchronous audio chat environment because with the latter "we're not there yet", as participants articulated, in terms of synchronous, real time, TV-like quality of video- and audio- conferencing for delivering lectures and participating in discussions in real time. One reason for this is that Internet 2 bandwidth, which is not yet universally available, is required in order to receive TV-like quality of two-way video- and audio-conferencing. Participants found that, in particular, the learning experiences that they enjoyed in the asynchronous online learning environment had given them a comprehensive perspective on how teaching online with a virtual classroom approach --both "in real time" with live text chats and "not in real time" with the other features within the asynchronous online environment-- would be compatible and of comparable quality standards to those of U of T faculty's teaching as it is currently conducted in the in-class environment. High educator-student interactivity online was seen as a critical component of any technology-assisted education originating from the U of T. Many communicated that they believed that now they were better informed to make some of the Task Force on Technology-Assisted Education's decisions that were before them.

Summary

The Director of Continuing Studies summed up the results of this initiative by saying that this project, undertaken by Continuing Education on behalf of the university, one of the university's divisions at the forefront of online and distance education delivery with its programs in Business, Professional & Entrepreneurial Studies' certifications, its Professional Translation online certifications, and its web-enhancements of in-class Arts & Humanities programs, has provided a service to the university that is not insignificant and that is useful in practical terms. In Joan's role of Administrative Project Manager for and Anne-Marie's role as Educator in the Task Force members' experiences, we concluded that the university's senior management Task Force members were able to begin to grasp a more comprehensive understanding of what it means to learn optimally online for the adult learner. In coordinating a team of eighteen comprised of: mentors to the Task Force members, IT experts, and administrative staff providing back-up support at the School's "Command Central" before, during and after the presentations, we learned that in such a online learning experience project, you leave no eventualities to chance but have contingencies for all aspects of the experience being provided. For any university providing to senior university management online learning experience demonstrations such as this one, it is important to make ensure that the desired outcomes are informed decisions regarding asynchronous and synchronous software applications and acquiring university-wide competency in using such applications for online instructional design as well as effective and satisfying online teaching and learning, and to leverage human resources and activities in support of future university policies with regard to technology-assisted education. It is our view that, with our Continuing Education division's having delivered two sound and technically error-free "hands-on" learning experiences online to university senior managers, the university is now better equipped to steward its investment in Technology-Assisted Education.

The Impact of an E-Learning Environment on Students' Self and Peer Assessment.

Herman Callaert*, Saskia Litière*, Monique Maelstaf‡
Center for Statistics*
Office for Educational Services‡
Transnationale Universiteit Limburg
Belgium
herman.callaert@luc.ac.be

Abstract: This case study shares the experience of a first time introduction of an e-learning environment into an existing university curriculum. Students in biomedical sciences could choose, at the end of their third year of university study, among several elective courses. One of them was a course on effective communication, taught in the bioinformatics / biostatistics module. Classical contact hours in this course were drastically reduced through the use of an e-learning environment. The first exposure of on campus students to such an environment led to some noteworthy observations. For collaborative work, students made only minimal use of an electronic discussion forum, and preferred physical attendance in sessions organized by themselves. On the other hand, reflection on their own performance, as well as self and peer assessment, were substantially facilitated through the use of an electronic portfolio. Confidentiality, immediate feedback, and permanent accessibility may have played a key role.

Introduction

This paper reports on work in progress and wants to share experiences with similar experiments carried out elsewhere. The instructional innovation was carried out in an elective course. Hence participating students formed a self-selected group, and no control group was available at the time of the study. Any indication of possible interesting findings should therefore be substantiated by further investigation.

The change in students' attitude should be related to their cultural background as well as to the instructional and technological innovation. Most students at our university feel that they are personally responsible for their study results, and they translate this into "working hard on their own". They are not used to interrupt the instructor, they are shy at asking questions in public, and they rarely engage spontaneously in lively classroom discussions. Their preference for particular electronic communication methods is almost surely influenced by this cultural and educational background.

The physical environment plays an important role too. This study is about young full-time students, age 20, living and working on campus during the week, and going home every weekend (distances in Belgium are small). Moments of physical contact for discussion and group work can quite easily be organized.

Important also is the structure of the course, which is taught in an "all exclusive" system, where the academic year is divided into blocks of approximately 5 weeks. During such a block, only one "course" is taught, and students are expected to work full-time on it. Such a course can have different forms, and often runs as a multidisciplinary project. In the present study, the course on "effective communication" is a capstone course in the bioinformatics / biostatistics module.

Methods

The instructional innovation included cooperative learning. For some tasks, groups were assigned by the instructor. At other occasions, students were asked to work in groups, but were free to choose the size and the composition of the groups. They were also asked to report on their decision process in such situations.

The technological innovation included the introduction of Blackboard as an e-learning environment. It was mainly used as a means of communication at different levels. It contained practical information about staff and office hours, a calendar, a detailed description of the objectives of the course, the assignments with due dates, and additional course documents.

Apart from the email facility, a structured discussion board was set up, with a forum for each main topic of the course. Also electronic groups were created. They often reflected the actual composition of the groups in which students were working together. But there was also a "personal e-group", having as members only the particular student, the instructor (a senior statistician), and a senior colleague in educational psychology. The T.A., who was a younger person in the same age range as the students, had no access to this personal e-group.

Results

Students had to write reports and give presentations on professional topics like the use of decision trees in screening for breast cancer, the meaning of p-values, the design and analysis of clinical trials, etc... They organized themselves for working in subgroups, decided on place and time for meetings, and tried to divide the workload evenly among each other. During this whole process, students preferred face-to-face contact rather than the use of an electronic discussion forum.

Students were also asked to reflect on their own study strategy and on the dynamics of the group process. They had to write this down in a journal, placed in their personal e-group. This e-journal writing has played a major role in their learning process, in their evolution in self and peer assessment, and in the feedback for the instructor towards course design. The introduction of "impersonal" technology (e-journal writing) seems to have created a non-threatening environment for non-talkative and rather shy students. The direct and open style of the reflection about their own performance and about the group process was often amazing. Similar results have been observed in other experiments (Chance 1997). The e-journal writing also helped students to get aware of the evolution in their personal learning process, as they gradually linked their performance more and more to the set of objectives of the course. At the same time they also started using a checklist (provided by the educational psychologist) concerning emotional factors, such as social skills, assertiveness, and empathy. The reflection on their own performance, which started as an activity to promote reflective learning, helped to develop self evaluation skills, making students able to more accurately judge the effectiveness of their own strategies (leading to better products too).

The e-environment was supplemented by regular classroom contacts, with direct self and peer assessment of the reports and the presentations. At the beginning students were very reluctant about peer assessment and refused "to score each other". Formative assessment however seemed feasible and it didn't take long before the need for precise and objective criteria arose. Students then were asked to agree as a group on a set of self-chosen criteria to be used for further peer assessment. This strategy worked quite well, peer assessment became less threatening, and students made serious progress along the way. The ongoing reflection on the whole process, as written down in their e-journal, might have played an important role too. Receiving real-time feedback (Lovett & Greenhouse 2000) but also giving real-time feedback on other students' work might make learning more efficient. Learning how to do this can be stimulated through simultaneous use of face-to-face interaction and e-journal writing.

References

Chance B.L. (1997). Experiences with Authentic Assessment Techniques in an Introductory Statistics Course. *Journal of Statistics Education* [Online], 5 (3).

Lovett M. C., and Greenhouse J.B. (2000). Applying Cognitive Theory to Statistics Instruction. *The American Statistician*, 54,196-206.

Revitalizing Native American Cultures through Virtual Museum Projects

The richness of American Indian culture is widely recognized and of great interest to Native and non-Native people alike. Many cultural and historical artifacts of Native life are spread across the collections of museums and private holdings. Such holdings may be viewed on site or, increasing, electronically through virtual museums. Still, many tribal members have limited access to their own cultural heritage and may be excluded also from interpreting these objects even when publicly displayed.

Native people today are a modern people, but many are alarmed at the loss of the traditional ways and the Native languages that connect them to their ancestors. As the oral tradition falters in an age of mass media, Native elders wish to have some record made of their knowledge. At the same time, there are sacred aspects to Native traditions that should not be shared with others outside their communities. Native people have also been afflicted by the appropriation of their cultural practices by non-Natives, a violation of cultural property rights that is much like the violation of intellectual property rights. Today Native Americans are seeking ways to counter these trends and to revitalize their cultures as they enter the twenty-first century.

As part of the self-determination efforts by American Indian tribes in the last half of the twentieth century, many institutions have evolved that help to address the critical issues for cultural revitalization. Tribally controlled schools and colleges have been created to improve the academic achievement of Native Americans by teaching in culturally relevant ways that value and validate traditional Native knowledge. Tribal schools have culture programs designed and taught by Native people that explicitly teach tribal history and traditional languages, lore, and arts. Tribal museums and archives have been created to maintain and display collections that tribes have acquired within their communities and from repatriation efforts. Tribal museums have also been involved in efforts to increase access to their collections through virtual museums. Tribal culture centers are institutions that develop a variety of programs that bring community members together to share and celebrate in traditional ways.

The Smithsonian National Museum of the American Indian (NMAI) has one of the largest collections of Native American artifacts in the world. It cares for over a million items for the public, but primarily for Native Americans. The NMAI seeks to find ways to serve its Native and non-Native clientele as it attends to the issues of access to cultural items, a revitalization of traditional knowledge and Native languages, and the appropriate use of cultural property.

The Four Directions project was a six-year education project funded by a U.S. Department of Education Challenge Grant (see http://www.4directions.org/). Its goal was to develop technology-supported curriculum and learning projects for culturally responsive teaching. The project partners included nineteen tribally controlled K-12 American Indian schools, four universities, and two museums. Even though financial support for the Four Directions project ended in September 2001, many of the project partners have been working to continue its goals. The University of Texas at Austin and the Smithsonian National Museum of the American Indian were two of the Four Directions partners that are still seeking ways to work together to continue the Four Directions mission.

In 1999, the Four Directions project began to develop its first virtual museum project in partnership with the National Museum of the American Indian. Another Four Directions partner, the University of Texas at Austin, took a leadership role in the planning and implementation of the virtual museum project. Over a two-year period, three of the Four Directions schools sent teams of students, teachers, and community members to develop a Virtual Tour of the National Museum of the American Indian (see http://www.conexus.si.edu/VRTour). In order to give the most immersive virtual museum experience that was feasible from a K-12 project, the virtual tour made extensive use of QuickTime Virtual Reality media to show the museum environment and the objects on display. The Native American students researched the items of the exhibit with the help of community members, teachers, museum staff. They then wrote the essays that accompanied their virtual exhibits, giving the Native American voice to the virtual tour.

From the NMAI Virtual Tour experience, a Four Directions model of virtual museum projects evolved. The model conceptualizes virtual museum projects as partnerships between Native American schools and museums that operate within three overlapping and interacting activities: cultural responsive teaching, cultural revitalization, and cultural collaboration:

- ***Culturally Responsive Teaching*** — Virtual museum projects are culturally responsive because they teach through the culture of the child to bring community concerns and values to the center of the teaching-learning process. Students are motivated to excel because they are doing important, original work to recover and preserve their heritage. They gain from the knowledge of museum professionals and the wisdom of community elders. They develop skills in research, writing, social studies, science, mathematics, information literacy, and cutting-edge information technology.

- ***Cultural Revitalization*** — A common concern among Native American peoples is the recovery and preservation of their cultures and languages. Much of what remains of traditional material cultures resides in museum collections far from Native American communities. Virtual museum projects provide a way for communities to "digitally repatriate" precious items of cultural heritage. In the Four Directions Model, virtual museum activities also take place in the Native American communities. Students research and record local materials that supplement the museum's resources for the virtual museum. Local resources such as oral histories, cherished heirlooms, traditional stories, dances and songs, native language and contemporary arts get combined with museum materials to present the vision of a vital, living culture.
- ***Cultural Collaboration*** — Although museums aim to preserve heritage and educate the public, Native Americans sometimes object to the way museum exhibitions appropriate cultural property. Native Americans often want the public to have access to authentic knowledge of their histories and cultures, but they also believe that some aspects of their cultures should not be shared with outsiders. Virtual museum collaborations can provide a venue to address thorny issues of cultural property rights, to design protocols for cultural collaboration and to decide levels of access.

In the last two years of the Four Direction project, nine virtual museum projects were conducted with eleven of the Four Directions schools in partnership with ten museums. The Four Directions Model for virtual museum projects could not be applied completely in some of these projects, but it became a valuable standard that guided their design.

The National Museum of the American Indian has begun to apply the lessons learned from its experience with the Four Directions project to its own program. In August, 2001, the NMAI brought a team of students and community members from Pine Ridge Reservation to create a virtual exhibition of Lakota history and culture for use in the Little Wound Tribal School culture program. In addition to using QuickTime VR media and still images, the Little Wound participants also created audio commentary in English and Lakota language for the virtual exhibition. The NMAI has plans to conduct similar programs with tribal schools, colleges, museums and culture centers several times a year.

To continue its partnership with the National Museum of the American Indian, the University of Texas is now seeking funding to continue its involvement with Native American virtual museum projects as a way of revitalizing Native cultures. These projects will refine and extend the Four Directions model.

The poster session will provide a display and handouts on the past and current efforts in virtual museum projects that have been conducted by the National Museum of the American Indian, the University of Texas and the Four Directions project. Samples of the virtual museums will be accessible on laptop computers for conference goers to experience.

The poster session presenters will include **Mark Christal**, a graduate researcher on the Four Directions project and a doctoral candidate at the University of Texas; **Paul Resta**, professor in the Instructional Technology program and director of the Learning Technology Center at the University of Texas and Principal Investigator for the Four Directions project; **Loriene Roy**, professor in the Graduate School of Library Information Science at the University of Texas and Four Directions partner; and **Marty Kreipe de Montaño**, manager of the Cultural Resource Centers of the Smithsonian National Museum of the American Indian and Four Directions partner.

Light Bridge: Employing Internet2 in Support of Pre-Service Teacher Education

Brett Christie, Ph.D.
James Fouché, Ph.D.
School of Education
Sonoma State University
United States of America
LightBridge@sonoma.edu

Abstract: Though bandwidth size continues to increase significantly, there are few projects or resources that fully capitalize upon the potential. High-bandwidth-enabled uses of technology can enhance teacher education and create more engaging learning in K-12 classrooms. A challenge facing California is that there is very little content that has been developed specifically to utilize Internet2 for teacher education or learning in the K-12 classroom, despite the fact that substantial resources have been devoted to the Digital California Project for establishing a statewide, high-bandwidth network among schools, colleges, and universities. However, there are emerging programs that utilize this resource for its potential contribution to educational and professional development content. This paper discusses one example, *Light Bridge*, a project funded by the U.S. Department of Education program, Preparing Tomorrow's Teachers to Use Technology. Examples of *Light Bridge* endeavors include using digital video-based lessons in a web-based environment to help teacher educators better prepare pre-service teachers through more engaging and authentic means.

High-Bandwidth Augmentation of Teacher Education

Increased bandwidth is enabling increasingly innovative and exciting ways of using technology to enhance teacher education and create more powerful and engaging learning in K-12 classrooms. A challenge facing California is that there is very little content that has been developed specifically to utilize Internet2 for teacher education or learning in the K-12 classroom despite the fact that substantial resources have been devoted to the Digital California Project for establishing a statewide, high-bandwidth network among schools, colleges, and universities. However, there are now a small, yet growing, number of programs designed to utilize this resource for its potential contribution to educational and professional development content. One example is *Light Bridge* (www.sonoma.edu/lightbridge), a project funded by the U.S. Department of Education's program, Preparing Tomorrow's Teachers to Use Technology (PT^3). *Light Bridge* is one of 15 catalyst grants awarded by the USDE for 2001-2004. Examples of *Light Bridge* endeavors include using digital video-based lessons in a web environment to help teacher educators better prepare pre-service teachers through more engaging and authentic means. These resources are also appropriate for practicing teachers seeking examples of current and effective teaching techniques to add to their repertoire.

Light Bridge is a consortium led by the School of Education at Sonoma State University. The School of Education has 550 teacher education students annually and 90 full and part-time faculty. Specific goals of *Light Bridge* are to:

- Strengthen teacher education programs through the development of rich video content offered via the next generation of the Internet.
- Establish a student teacher support and supervision system that assures high quality support and assistance at a distance.
- Disseminate teacher education video content, online resources, and student teacher support and supervision system.

Specific examples of *Light Bridge* activities include developing and maintaining rich visual teacher education content; piloting the use of video conferencing for teaching, supervision, and mentoring of pre-service teachers;

and capturing the classroom performance of pre-service teachers for analysis and criticism by mentor teachers and university supervisors over the network.

In its formative stages, the *Light Bridge* site was developed with feedback gained from an extensive usability study. Sonoma State University students, faculty, and staff participated in usability tests that helped determine layout and design features and characteristics that were useful and desirable. In addition, these subjects also viewed video samples that were purposed toward web-based instruction on a particular topic. This also yielded helpful data in guiding *Light Bridge* content developers toward higher quality videos and lesson content for the web site.

Another important feature of *Light Bridge* is the extensive videography training for faculty content developers. Workshops totaling 30 hours were focused on videography in classroom environments. These workshops ranged in topics and skills from basic lighting and background, to the more complex issue of acquiring desirable audio. The latter proved to be the most critical and a challenge that had to be met head-on. We quickly determined that, without quality audio, there would be very little usefulness of the video or content in this format. In addition, all content developers participated in extensive iMovie training, led by an Apple representative. In addition to simply going through the steps of iMovie, content developers brought in footage they used for iMovie editing practice, which was then screened for peer-feedback. This proved extremely useful, as it made the workshops highly authentic -- each faculty member went through the learning process in a context that was specific to their project. After this series of workshop, we held subsequent meetings with the sole purpose of each content developer screening their latest work to the rest of the group. This proved to be effective for feedback and enhancement of the work being developed. An added effect is that it helped to keep the content developers' workflow moving forward toward our target completion dates.

The final issue to be addressed was how best to format and store the content and videos, and whether to use streaming or progressive download approaches. In addition to discussion with experts on campus, *Light Bridge* directors attended QuickTime Live in February 2002. QT Live was very useful for learning the latest in digital video development, editing, compression and decompression, and web streaming. As a result, we were able to finalize these specifications for our project and make arrangements for post-production and posting to the web. One key decision that was made was not to stream, but rather to use progressive download ("Fast Start"). This allows the videos to be played immediately. Also, if a user wants to save the video file, they are allowed to, as the videos and content are public domain.

Over the course of academic year 2001-2002, *Light Bridge* deliverables include: 15 web-based video and content lessons; 300 pre-service teachers taught in part through this method of instruction, and; 42 practicing student-teachers supported through videoconferencing as a means for interaction between the university supervisor, student-teacher, and resident teacher. Over the 2002-2003 academic year and beyond, these numbers are projected to reach approximately 60 web-based lessons, 2,800 pre-service teachers taught, and 150 student-teachers supported by videoconference meetings and supervision. An expanding network of collaboration and dissemination will accomplish this. Finally, a self-authoring tool for the web site will allow educators with an interest in developing such content to make submissions of video-based lessons for preliminary acceptance to the *Light Bridge* web environment. This content will be temporarily displayed on the *Light Bridge* web site in a section titled "The Screening Room." Content will then be peer-reviewed by a team of evaluators and feedback given to the author(s): To be accepted in its current state; To be slightly revised as requested, then resubmitted, or; Not acceptable or inappropriate to the project.

A unique and helpful feature of the *Light Bridge* web site is that the video and content lessons can be accessed by searching on a number of variables: topic; grade level; or standards. In addition to the California Standards for the Teaching Profession, *Light Bridge* supports implementation of the International Society for Technology in Education (ISTE) Standards for Teachers. *Light Bridge* lessons not only cover specific subject matter areas and topics, but also include the infusion of technology in various lessons. It is the goal that visitors to the site will be able to search by ISTE standard to find a lesson that demonstrates infusion of a particular technology and standard into teacher education. Through, *Light Bridge* we have started to fill the void of viable educational content to be delivered by California's Internet2.

Assessing the Processes of Online Teaching and Learning: A True Measure of Assessment

Patricia Comeaux
Professor
Department of Communication Studies
University of North Carolina-Wilmington
United States
comeauxp@uncwil.edu

Ele McKenna Byington,
Associate Professor
Department of English
University of North Carolina-Wilmington
United States
byingtone@uncwil.edu

Introduction and Analysis of Research Literature

We know, from our experience and from the research literature, that successful online teaching and learning involves computer-mediated communication processes and in which students and teachers are actively and reciprocally engaged in the process of knowledge construction, creating and sharing meaning, theory-based applications and situational problem solving. Although scholars use different terms—collaborative learning, problem-based learning, social constructivism, small group learning—they are essentially describing online teaching and learning as reciprocal processes in which knowledge is created and negotiated in a communal space by members of groups involved in authentic real-world situations. (Brandon & Hollingshead, 1999; Byington, 2002; Comeaux, 2002; Comeaux & Nixon, 2000; Hiltz, 1998; Hiltz et.al. 2000; Kloldner & Guzdial, 1996; Koschmann et. al. 1996; Moller, 1998; Romiszowski, 1997; Rovai, 200; Turoff, 1999).

Furthermore, this is the kind of learning and interaction that is known to be of value for the educated individual for the twenty-first century. As Dede (1996) asserts, "Educators must help all students become adept at distanced interaction, for skills of information gathering from remote sources and of collaboration with dispersed team members are as central to the future American workplace as learning to perform structured tasks quickly was to the industrial revolution" (p. 30). And as Romiszowski (1997) so clearly articulates, "the employable adult of the future must develop the skills of thinking critically and reflectively. . . the known effective learning strategies for the development of such skills involve intensive interaction [through computer-mediated conversations] not only with content structured into knowledge networks, but with other people (both 'masters' and other 'apprentices' who have an interest in the specific knowledge domain" (p. 34).

Thus, as educators we *must* critically assess the characteristics and the quality of these valued and known processes of online learning. In other words, we must develop assessment tools that will evaluate the processes of computer-mediated conversations in which students are actively engaged in thinking reflectively and critically as well as problem- solving with others of like-minded knowledge and interest. In essence, we must focus on process rather than outcome. This type of learning is best understood from the participant's viewpoint and as Koshmann (1996) articulates, "learning can best be understood 'as a distributed, ongoing social process, where evidence that learning is occurring or has occurred must be found in understanding the ways in which people collaboratively *do* learning and *do recognize* learning as having occurred" (p. 42, italics added).

Purpose of Poster Session

Therefore, the purpose of our poster session will be to present numerous assessment tools, which have been developed specifically to evaluate the processes of online learning. These tools have been developed and used by online instructors who adhere to the philosophy of learning described above. Examples of such tools include:

- Rubrics that assess the quality of computer-mediated communication (CMC)
- Online participant interviews designed to ascertain met and unmet expectations
- Online participant interviews designed to ascertain perceptions of course goals and objectives and of learning processes
- Tools for assessing the characteristics of instructional design conducive to critical and reflective thinking.
- Tools for assessing particular courses
- Tools for assessing student progress during the semester

References

Brandon, D. P. & Hollingshead, A. B. (1999). Collaborative learning and computer-supported groups. *Communication Education*. 48 (2), 109-126.

Byington, E. M. (2002). Communicating: The key to success in an online writing and reading course. In P. Comeaux (Ed.), *Communication and Collaboration in the Online Classroom: Examples and Applications* (pp. 192-206). Bolton, MA: Anker Publishing.

Comeaux, P. (Ed). (2002). *Communication and Collaboration in the Online Classroom: Examples and Applications*. Bolton, MA: Anker Publishing.

Comeaux, P. & Nixon, M.A. (2000). Collaborative learning in an internet graduate course: A case study analysis. *WebNet Journal: Internet Technologies, Applications & Issues* 2 (4), 34-43.

Dede, C. (1996). The evolution of distance education: Emerging technologies and distributed learning. *The American Journal of Distance Education*, 10 (2), 4-36.

Hiltz, S. R. (1998). Collaborative learning in asynchronous learning networks: Building learning communities. *Proceedings of WebNet '98 World Conference on WWW, Internet and Intranet*, 1 (1), 1-7.

Hiltz, S. R., Coppola, N. Rotter, N., Turoff, M. (2000). Measuring the importance of collaborative learning for the effectiveness of ALN: A multi-measure, multi-method approach. Journal of Ascronous Journal Learning Networks 14 (2). Available online at http://www.aln.org/alnweb/journal/14_issue2/le/hiltz/le-hiltz.htm.

Kolodner, J. & Guzdial, M. (1996). Effects *with* and *of* CSCL: Tracking learning in a new paradigm. In T. Koschmann (Ed.), *CSCL: Theory and practice of an emerging paradigm* (pp. 307-320). Mahwah, NJ: Lawrence Erlbaum Associates, Publishers.

Koschmann, T. (1996). Paradigm shifts and instructional technology: An introduction. In T. Koschmann (Ed.), *CSCL: Theory and practice of an emerging paradigm* (pp. 1-23). Mahwah, NJ: Lawrence Erlbaum Associates, Publishers.

Koschmann, T., Kelson, A. C., Feltovish, P., J., & Barrows, H. S. (1996). Computer-Supported Problem_Based Learning: A principled approach to the use of computer in collaborative learning. In T. Koschmann (Ed.), *CSCL: Theory and practice of an emerging paradigm* (pp. 83-119). Mahwah, NJ: Lawrence Erlbaum Associates, Publishers.

Moller, L. (1998). Designing Communities of Learners for Asynchronous Distance Education. *Educational Technolgoy Research and Development*, 46 (4), 115-122.

Romiszowski, A. J. (1997). Web-Based distance learning and teaching: Revolutionary invention or reaction to necessity? In B. H. Kahn, (Ed.), *Web-Based Instruction* (pp. 25-37). Englewood Cliffs, NJ: Educational Technology Publications.

Rovai, A. P. (2001). Building Classroom community at a distance: A case study. *Educational Technology Research and Development*. 49 (4), 33-48.

Turoff, M. (1999). Education, commerce, communications: The era of competition. *WebNet Journal: Internet Technologies, Applications & Issues*, 1 (1), 22-31.

KMi
Knowledge Management Interactive, Inc.
5025 Arlington Centre Blvd., Suite 240
Columbus, Ohio 43220

Phone: 614.326.6304
Email: info@kmionline.com

KMi provides comprehensive eLearning solutions for both corporations and higher education. From interactive learning modules and learning management system solutions, to a full range of planning, implementation and hosting services, we offer the support necessary to assure access to quality education and training.

eLMS – Learning Management System

KMi's eLearning architecture, **eLMS**, is a complete solution for flexible registration; content management and delivery; communications and user tracking.

- Web-Based User Management System
- Performance Tracking
- Assessment-Based
- Flexible Content Integration
- Database Driven
- Bandwidth Efficient

eLearning Content Development

KMi offers a variety of content presentation solutions to meet the specific needs of our clients.

- IPA - Integrated Playback Architecture (An online presentation format that incorporates audio, video, text and content slides.)
- eModules
- eCourses

KMi is experienced in developing learning environments that provide an outcomes-based, stimulating and interactive learning experience.

- Modularized Content Development and Delivery
- Integration of Assessment-Based Learning
- Video and Audio Supported Content
- Dynamic Multimedia Presentation of Materials
- Web-Based User Management System
- Content Language Translation Services

Technical Support Services

KMi offers a variety of support and helpdesk services. The KMi call center operates on extended business hours, five days a week. Service levels can be provided from administrator to end-user, and is managed by a trained support staff. Our technical support team has direct access to production servers, which means faster response times in addressing technical issues.

- 800 number support lines
- forms and email support services
- direct access to all necessary resources to address any issue

Hosting and Maintenance

KMi has developed a customer-centered solution that provides a robust, stable, and reliable environment backed by high industry standards in equipment and connectivity. Our service is supported by:

- Industry Standard Components
- OC12 fiber into front and back of building using 2 different network carriers
- Redundant Internet backbone connections over separate carriers
- DS3 connectivity
- Dedicated 100 megabit Ethernet switch port per customer
- 24/7 Network Operations Center with on-site personnel
- Climate Controlled Data Center
- Dual Diesel Generator Power Backup
- Fire Extinguishment System

KMi's Knowledge Base Components

Efficient and seamless sharing of best-practice information, curriculum and other assets is a vital ancillary benefit of KMi's eLMS. The eLMS Knowledge Base allows users to:

- categorize and share documents
    - by state
    - by author
    - by topic
    - by title
    - by date
- post information alerts and updates
- invite and schedule meetings between states
- manage collaborative events
- communicate directly via the site
- organize member contacts

The Knowledge Base and its related communication tools can be organized in user groups to determine who can view particular content. State administrators may hold rights to view all content, where learners may be limited in what they have access to view. All features can be set to prompt other users of new entries into the Knowledge Base via email.

KMi will provide this system **free of charge** when five or more states utilize the eLMS system.

Selected Clients

Accenture
AEP
Boehringer-Ingelheim
Fisher College of Business, The Ohio State University
KLA Tencor
Shell

Delivering video streamed library orientation on the Web: technology for the educational setting

by Karmen N. T. Crowther and Alan H. Wallace
University of Tennessee Libraries
Knoxville, Tennessee, USA

As college and university libraries prepare to meet the challenge of delivering quality services to an increasingly divergent 21st century population, traditional methodologies for providing those services also are changing. The development of the Web has greatly increased the electronic options that libraries now have available for service delivery. Despite the fact that libraries have been among the first on many campuses to use new Web-based technologies, one such technology, streaming media, has been little used. Yet it holds considerable promise for instruction and orientation, especially to the burgeoning number of remote library users on campus and in distance education programs.

We envision a number of library applications of video streaming. For example, one of our recent projects is a brief introduction to the UT Libraries that serves as a public relations tool. It shows prospective students, their parents, or anyone interested in the Libraries the facilities and services available to our users.

Video streaming may also be used successfully in library instruction, especially for multisection classes with similar assignments. We are currently working on an in-depth orientation for our freshman English classes at the University of Tennessee. These typically serve as venues for an introduction to the library, the catalog, and database searching techniques. Using video streamed presentations for such basic instruction will allow students to view the orientation day or night, whenever appropriate or convenient. In fact, any user new to the library or wanting a refresher could view such orientation. It has the added appeal of presentation in a medium that is familiar to and liked by students. To accompany these streamed tutorials we are developing online quizzes to be completed at the end of the instruction. This library orientation project is the primary work we will be sharing with others during the conference.

For the future we anticipate applications of video streaming to library instruction for upper-division and graduate students, even for faculty. By using a video streamed presentation for general orientation, one that could be viewed before a classroom session, class time could be spent on more specialized needs. Tutorials for especially challenging research materials could be created as video-streamed files. Any or all of these video-streamed applications would be useful in teaching distance education students how to do library research. Even in-house training for student assistants or library staff could be done effectively with video streaming.

As campuses turn increasingly to Web-based instruction, we consider video streaming to be yet another way that college and university libraries can be visible and accessible to our students and faculty wherever and whenever they need us.

Does Personality Type Effect Online versus In Class Course Satisfaction?

Richard Daughenbaugh, Ph.D. and Daniel Surry, Ed.D. and Mohammed Islam, MS IDD
BSET Department

Lynda Daughenbaugh, Ed.D
C & I Department

The study seeks to determine if different personality types express more or less satisfaction with courses delivered online versus those delivered in the classroom. This study employs two online surveys: the Kiersy Temperament Sorter(KTS) which sorts each respondent into a personality type based on 4 dimensions: Extrovert /Introvert; Sensing/Intuition; Thinking/Feeling, and; Judging/Perceiving, and a course satisfaction instrument (CSI) developed by the authors. Both the KTS and responses to the CIS will use descriptive and inferential statistics to determine if a correlation exists between personality type and course satisfaction. Subjects are college students in both online and in class courses. Conclusions drawn from this study will identify personality types which express satisfaction with online courses and to identify and modify areas of online courses that have low satisfaction ratings for different personality groups.

E-Learning for choral music ensembles: Evaluation of a contextual approach for enabling pre-service teachers to design and implement online learning experiences for choirs

James F. Daugherty
The University of Kansas

Survey data suggest that teachers lack sufficient preparation and background to incorporate substantive electronic learning into their teaching contexts. The Office of Technology Assessment of the U.S. Congress (1995a, 1995b), in one of its last reports, reveals that while over 50 per cent of teachers feel comfortable with traditional computer applications (e.g., word processing, tutorials, games, publishing), less than 10 per cent consider themselves competent to use more involved formats such as electronic network collaboration, problem solving applications, or multimedia. In a similar vein, the National Center for Educational Statistics (1999) reports that only 20 per cent of teachers feel prepared to integrate electronic learning into their classrooms.

Bosch and Cardinale (1993) find that many pre-service teachers have not experienced useful models that embody instructional use of computers in their undergraduate courses and field experiences. Baron and Golman (1994) indicate that pre-service teacher education tends to focus on less sophisticated computer skills that do not lend themselves to problem-solving applications or higher-order thinking skills. A recent study released by the Milken Exchange on Educational Technology (1999) finds that of 416 teacher preparation institutions surveyed, most report that technology use is not integrated into regular coursework or field experiences.

Benefits and dimensions of electronic learning for enhancing choral music rehearsals and choral music education courses have been identified and discussed by Daugherty (1999). Strategies associated with web-based rehearsal notes and links, web forms, electronic portfolio assessment, audio and video files, discussion boards, and electronic collaboration can relate "knowledge of" to "knowledge about" music making in creative ways that foster the active participation and reflection of each singer. Yet, students who, as learners, may favor such online engagement in their own education at the undergraduate level appear to have little clue how they, as teachers, might design such electronic learning opportunities for eventual use in their own classrooms and rehearsal contexts.

Methods and Procedures

This study extends an investigation by Daugherty and Daugherty (2000),which examined self-reported attitudes and abilities of pre-service teachers regarding the design and implementation of electronic learning opportunities for choral music ensembles. Over a period of three years, university students enrolled in a choral methods class , working toward certification as music teachers, participated in an electronic learning project as part of the course requirements. A particular focus of the project was to design electronic learning experiences in conjunction with the National Standards for Music Education and specific examples of choral literature suitable for school choral ensembles.

Specifically, the project sought to gauge the effectiveness of using models or templates that could readily be adapted for use with various real-life contexts and objectives. In other words, rather than teach technology per se, the project posed a problem: how to provide opportunity for choral singers to learn in a manner consistent with the National Standards for Music Education using choral literature the ensemble was then rehearsing. Pre-service teachers were invited to respond to the problem by brainstorming ways that technology could assist their instructional goals. Participants were also asked to dream of ideal learning opportunities, without concerning themselves with whether or not they had the technological skills to implement such opportunities in practice. Each of the three classes determined in this manner that synchronous rehearsal time should be spent for the most part in actual ensemble rehearsal of the literature, but that asynchronous electronic learning modules could enhance and make these rehearsals more efficient.

Six fifty-minute class periods were devoted to the project, including brainstorming ideas, constructing the modules, and sharing the finished products. The class met 45 times during the semester. The smartChoir project, then, encompassed 13.33 per cent of total class time. All participants learned to read and write very basic html in a synchronous class session. The purpose of such instruction was to enable them to know how to "steal" code and fix any common problems that may arise in the use of such mid-range WSIWYG software as BBEdit and Netscape 6. Thereafter, each participant learned how to implement such electronic learning components as web pages, basic html, hyperlinks, audio and video files, web forms, bulletin boards, etc., only he or she they needed them to further self-chosen instructional goals for a particular piece of choral literature.

Results

As indicated in Table 1, prior to this project the a majority of students described themselves as "totally lost" about how to design and implement electronic learning opportunities in a choral context. Interestingly, all students had previously had a one semester course in music technology required of all music majors. Following the project, however, a significant majority of students described themselves as "competent" (either "somewhat competent," "competent," or "very competent") to implement electronic learning in their teaching contexts.

Table 1

Participant Reponses Before the E-Learning Project

	Totally lost	Uncomfortable	Somewhat Competent	Competent	Very Competent
Respondents	22	14	6		
Percentage	52.38	33.33	14.29*		

*Compare to national estimates(OTA/NCES) of 10-20%

Participant Reponses After the E-Learning Project

	Totally lost	Uncomfortable	Somewhat Competent	Competent	Very Competent
Respondents	0	2	24	11	5
Percentage		4.76	57.14	26.19	11.91*

As Table 2 suggests, participants in this project responded favorably to the use of such a contextual approach for the design and implementation of electronic learning for choral ensembles and to their own intentions of incorporating such learning into the classes they would teach.

Table 2

Choral music teachers can learn to design and implement online instructional modules by following a pattern/model such as the one I used on my project:

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Respondents	0	1	1	22	18
Percentage	0	2.38	2.38	52.39	42.85

I will likely incorporate some form of online instruction into the choral music classes I teach.

	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Respondents	0	1	2	19	20
Percentage		2.38	4.76	45.24	47.62

Participants were also asked in a pre-test/post-test format to define in their own words the following terms: browser, server, ftp, hyperlink, html, .jpg, .wav, www. Whereas less than 10% of participants successfully defined all terms prior to the project, 100% defined the terms successfully following the project.

Discussion

Results will be discussed in terms of the feasibility of using a contextual approach to teaching teachers how to design electronic learning opportunities for music ensembles, and the use of templates to implement the web-based technology they wish to incorporate into such opportunities. Implications for teaching technology across the teacher preparation curriculum, rather than as an isolated technology course, will also be addressed.

HAMTUTOR: Author tool to develop adaptive multimedia courses

C. de Castro[1], F. Alcantud[2], A.Castro Orbea[1], C. Romero[1]
[1]Departamento de Informatica y Análisis Numérico, Universidad de Cordoba
14071 Campus de Rabanales, Cordoba, España
cdecastro@uco.es

[2]Departamento de Psicología Evolutiva y de la Educación Universitat de Valencia
Estudi General Avd. Blasco Ibañez, 21 46010 Valencia

SUMMARY

An author system has been developed as a programming language of easy use, on the basis of a prescriptive instructed model with probed efficacy along the development process. This tool has been designed in such a way that users, without programming knowledge but experts in corresponding subjects, can use it and perform their adaptive multimedia courses and distribute them by distance educational systems.

Analysis of the prototype course developed using the adaptive multimedia author tool (HamTutor).

The author language HamTutor is a high level- programming system, i.e.: with both structure and significance close to human language. In our case, it must contain all required elements to allow the design of a distance educational course. In consequence, the developed tool allows, at least, the performance of e-learning courses with two navigation ways (Alcantud, F. & Tormo, M.J. 1997).

The e-learning-course user can be any Internet user. Navigation along Web pages or Internet can be carried out in either, free or guided way. HAMTUTOR enables the students to navigate along contents by these two navigation ways, according to their own choice (free way) and depending on their educational level (tutorial way).

Using the tutorial way, the student is limited to follow the instructions or advices given by a virtual tutor. In this form, the student only has to do that indicated by the tutor, at any moment. The only navigation options for the student are to go away or to go back along the different stages and concepts, to change the theme or lecture, to change to the free way, to see his evolution along the contents-tree and to exit (Romero C. 2002).

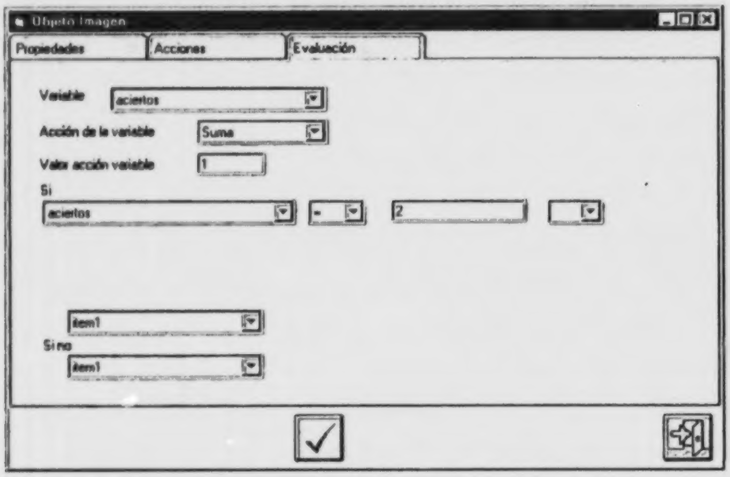
Concerning to the contents presentation, this tutorial way always gives an explanation of the subject and then, it proposes to carry out a Tutor-guided exercise.

The student of a HamTutor-developed, interactive multimedia course can navigate for himself along course contents and get the different tools and services given by the application. The possible options would be:

- To navigate along themes and lectures of the course in a free way, using an intelligent assistant from the tool-selection menu.
- To change of Section (Tutor, Practical, Summary, Glossary, Videos, Bibliography).
- To accede to different available tools and options (Notebook, Posit, Historian, Sound/Video Configuration, Intelligent tutor, Virtual world, Internet)

Evaluation system and navigation control

The information needed for the adaptive system to modify the learning sequence is obtained from a evaluation of the student knowledge level (Alcantud, F. 1997) . By using this information, we can break the sequence and transform our course in a non-lineal one. It is to say that, from the n concept we do not need to go to the n+1 concept. Depending on the knowledge level, we can encourage the student learning taking him to a x explaining concept before return to the n+1 concept, or we can go directly to the x+1 concept. In summary, it will allow the teacher to state the learning route for the student according to his competence level. With this objective, an evaluation system for the student competence has been designed so that the way through the different learning steps will be conditioned by such a valuation. To get it, a number of numeric variables are created in association to the evaluation items as above indicated in the example. Once these variables are made, each item is associated to an action so that the selected answer or the activity execution can modify the variable value and then, by means of a logical ratio, we can conduct the student to the desired item, concept, complementary lecture, etc. as is illustrated in the following example (Fig. 1):



Variable: aciertos
Acción de la variable: Suma
Valor acción variable: 1
Si: aciertos = 2
item1
Si no: item1

Fig. 1: Evaluation Interface

REFERENCES

Alcantud, F. (1997) Instructional Design for Tele-learning courses. Contribution to Expectise and Telechance Transnational Horizon Project.

Alcantud, F. & Tormo, M.J.(1997) La teleformación: Una experiencia en la Universidad de Valencia. En Alcantud, F.(co) UNIVERSIDAD Y DIVERSIDAD, Valencia.

Romero C. , Rider, J.J, de Castro C. (2002). Tutor Asistente para entornos virtuales de enseñanza. ADIE.

This work has been supported by FEDER/MCYT

BEST COPY AVAILABLE

The Activating Learning Experience Supported by ICT

Toby De Loght
Prof. dr. Peter Van Petegem
Department of Education
University of Antwerp
Belgium
toby.deloght@ua.ac.be, peter.vantpetegem@ua.ac.be

Abstract: The starting point of this contribution is the concept of Powerful Learning. It contains 6 characteristics which we transformed into a structured model. The centre of the model consists of student-centered education and its accompanying coaching component. Surrounding the centre, there are three satellites: Content, problem-based learning and collaborative learning which are linked and in constant interaction with each other and the centre part. The improved concept was used in different teacher education programs at the University of Antwerp. Much attention goes to putting every component into practice and how ICT-supported course materials created value in shaping the curriculum within the boundaries of the concept.

Introduction

The approach of PLE has been applied in 3 courses from 2 different teacher education programs. One program is a professionalization course for teachers. The other program is a general teacher education program. These two groups are very diverse in motivation. The reasons why students attend the courses vary from learning to talk to a group of people, just getting an additional degree, learning new and interactive teaching methods, to becoming a good teacher in a secondary school. These differences show up in the way people study or the way they evaluated the course offerings. Depending on their personal course objectives, students tend to apply a different learning style.

A model for Powerful Learning Environments

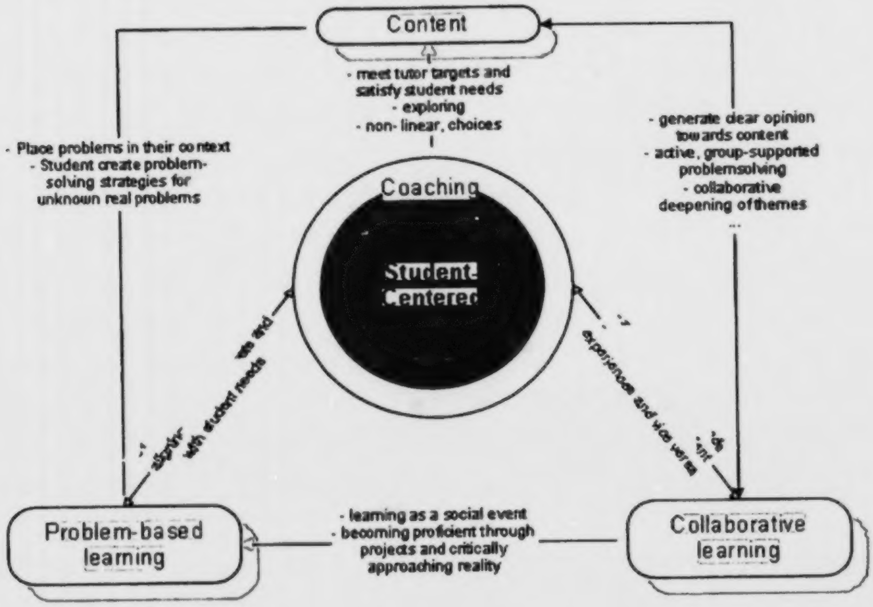
The concept of *Powerful Learning Environments* (PLE) by De Corte (1996) started from constructivist views on learning. Learning is basically characterized as a constructive, cumulative, self-controlled/self-directed, goal-oriented, context-bound and co-operative process. We transformed this basic set of characteristics in a working model to innovate the existing teacher education programs.

The depicted model (Fig. 1) sees different types of learning as a constant flow of interactions. Restructuring courses this way should attract as many different types of learners as possible, through activating them. Important to the whole story is the use of the basic competencies of Bloom's taxonomy (Anderson, 2001). We try to address all competencies and let them appear in different form, through coaching activities, simple content offering, problem-based learning, and ICT-supported collaborative learning, in order to make the courses as diversified as possible. (Brandt, 2002)

Student-centered

A teacher education program targets at acquiring the necessary skills, enabling students to perform well as future teachers. Putting students in the centre from the beginning makes them feel important and having responsibility. It eases giving coaching and guidance to students throughout the course. Student-centered working is a goal itself in this approach, since the purpose is to actively involve all students in learning activities and take advantage of their personal learning objectives and needs.

However, a student put in the centre thus becomes responsible for one's learning or even failure. A coach has to help people feel comfortable with the new way of working. Students have to stop absorbing factual knowledge and start constructing knowledge through exPLEration of resources.


Content
- meet tutor targets and satisfy student needs
- exploring
- non- linear, choices
- Place problems in their context
- Student create problem-solving strategies for unknown real problems
- generate clear opinion towards content
- active, group-supported problemsolving
- collaborative deepening of themes
...
Coaching
Student-Centered
with student needs
experiences and vice versa
Problem-based learning
- learning as a social event
- becoming proficient through projects and critically approaching reality
Collaborative learning

BEST COPY AVAILABLE

Web-learning: aspects of a new paradigm.

Orlando De Pietro, Francesco Appratto
Dipartimento di Economia e Statistica - University of Calabria
Via P.Bucci cubo 1C - 87036 Arcavacata di Rende (CS) - Italy
depietro@economia.unical.it
fappratto@economia.unical.it

Abstract: In this paper we discuss a new e-learning paradigm, the w-learning, which is based not only on the possibility of obtaining contents on demand, but it integrates traditional learning activities with web communities communication model. In the second part paper deals with w-learning technologies and, in particular, focuses on multi-tier web architectures, on XML and on metadata.

The support of ICT is becoming indispensable for conferring a high quality level in learning contents and a strong effectiveness in teacher's communication language; in particular Internet is becoming the primary way of communication among people, so e-learning and distance learning models are developing into a new and more complete paradigm that we can define web learning (w-learning) and that bases its communication structure and its services on the World Wide Web. Somebody considers the web a sort of "chaotic world" not only technologically but also about communication style, retaining fundamental to simplify user and communication interfaces and considering users of e-learning platform as consumers who have to obtain "products" (learning objects and contents) in an pre-ordered and rapid way. This way of projecting reveals great negative aspects: it deletes all free, inter-personal and interactive forms of communication which characterize Internet communities and it also defines a not flexible and hierarchical schema of relations among teachers and students. We can call this e-learning structure "hierarchical top-down paradigm"; the role of the latter is limited to contexts as company training or content on-demand by payment, where are very important: the precise definition of what user asks and the perfectly agreement between asking and answering; the rapid and effective accessing to contents; the possibility of requesting tutoring.

In high schools, colleges, universities and open collaborative working environments it's necessary changing from top-down model to w-learning, which is characterized by the presence of web-communities, with joint (peer-to-peer) collaborative forms of communication, and by the osmosis between learning environments and Internet. In this new kind of paradigm, users are Internet members and learning environment is a sub-domain of Internet, which can assume form of web-portal: Internet is then a new communicative paradigm applied to learning activities and the learning web portal isn't only a collector of services, but it's an immaterial place where it's hosted web-community life. The learning web portal has to support four primary communication forms: content and media on demand; synchronous multimedia broadcasting (for example using H.323); tutoring on-line, which is a synchronous and bi-directional activity between tutor and learner; collaborative and peer to peer communication among learning community's members, giving students permissions for uploading and sharing contents. It's evident that in top-down model the unique form of communication is asymmetric (one-to-one or one-to-many), whereas in w-learning, even if knowledge on demand has a primary role, all communicative paradigms present on Internet are collected and integrated into complementary (and not redundant) way. In this sense applying ICT to learning activity isn't only a way for helping remote users acquiring on-line all didactical material (resolving a lot of logistic problems), but it has two fundamental advantages: there is an increasing in didactical quality, because using an hypermedia language (audios, videos, texts, animations, etc.) there is a better meaningful clearness; students don't passively receive contents given by teacher, but they can value critically didactical material downloaded from web portal, by discussing with other community members (teacher, tutor, students).

Today there are available powerful cheap tools which can be used for multimedia broadcasting and multi-point web-conference: RealNetwork's RealSystem and Microsoft's Windows Media technologies have their plug-in in a great part of home computer, moreover there are other popular software tools that make easy representing learning object into various forms, using the simple textual media (see doc, pdf, html files) or using complex kind of animation movie (Flash and Shockwave animation, Java applet, etc.). In this case the problem isn't the possibility of representing contents in a multimedia form, but, paradoxically, the great variety of ways for doing it. The questions that instead we have to analyse and to resolve are: data creation, data storing and data presentation/selection. In w-learning paradigm their solution is more difficult because learner is very active and he doesn't limit himself to simply downloading files, but he researches, analyses and selects contents. If in the first phase of learning process it's better for students observing teacher's directives (in particular the teacher decides arguments order and their presentation bgic), in the second and final phase, instead, learner has to use researching and analysing tools for operating a critical synthesis of didactical material and for learning knowledge contained by it. W-learning platform must give tools for: designing ,teacher side, didactical contents; researching and analysing contents and data (using technologies for indexing learning objects); permitting collaboration activities and contents sharing between tutor and student or among w-community's members.

A web interfaced infrastructure for learning services can't be based on a single tier architecture where contents are statically defined, using a fixed form preventively chosen, and are presented to users without any dynamic elaboration. It's instead necessary adopting a multi-tier architecture characterized by dynamic management of business logic and presentation logic. In this way users' requests are analysed and elaborated just in time, so the answer can also refer to the last changes in the database where data are stored; moreover there is a higher level of flexibility and modular organization of elaboration process, distinguishing the storing domain from the business logic domain and from the presentation logic domain.

The principal multi-tier schemas can be implemented are: a dynamic processing of users' requests based on software modules (CGI, ASP, JSP or PHP pages) which receive HTTP requests, elaborate them and finally send HTML pages by HTTP responses; a data elaboration pipeline where contents are extracted from database, elaborated, translated into XML form and, in the last phase, there is the final translation into the form presented to user (for example by XSL binding).

It's clear that the second type of architecture is more modern because distinguishes semantic analysis of contents from the communication language used for presenting them to users. Another advantage is that XML data can be interpreted every time and everywhere because this language is software technology independent and data can be exported without having semantic problems; moreover XML permits easily implementation of multi-channel architecture, where there is the need of adapting output data to channel bandwidth and to terminal equipment used by user. In this case XML documents can be dynamically translated into a hypermedia and his complexity can de adapted to the specific transmission channel used: for example presentation logic modules can output a WML page, used in WAP mobile application, or a SMIL page, for complex hypermedia communication, or a simple HTML page; the most important things is that this doesn't influence data elaboration operated by preceding sections.

W-learning is characterized by the possibility given users of researching and analysing contents by powerful specific tools that point data stored into platform. In this case it's fundamental using indexing technologies and researching algorithm for extracting not only learning object but also part of them. For example we can obtain not only the link to teacher's lesson that is stored in the platform, but we can also request a link to a specific point of the lesson. For achieving this purpose, system developers need binding metadata to learning object, so that their semantic structure is clear, not subject to misunderstanding and unique. Scientific researching in this field is very active and has developed a great number of solutions (RDF, IEEE LOM, IMS): it may be useful choosing one metadata standard and using it. For obtaining a correct binding between data and metadata, teachers need specific tools, characterized by visual and friendly interface, which permit them creating learning object. In more complex case can be direct collaboration between the teacher and the technical team that works on presentation logic side. Particular difficulties can be found on indexing audio-video didactical material which is distributed on demand, asymmetrically and asynchronously: a possible solution can be developed creating a set of labels for each multimedia document; each label is a couple formed by a short textual legend, which shortly illustrates content, and by a little set of keywords, which defines the semantic context of the specific part. The SMIL can instead be used for multimedia synchronization; this language is moreover natively supported by some broadcasting server.

In this paper we have focused our attention on the basic and fundamental aspects of w-learning paradigm, explaining system architectures, technical features and new didactical methodologies. In particular we have stressed how ICT can give a strong effectiveness and clearness to teaching activity. For more details about our researching activity, the full text of the work and other news about the researching state can be required.

An On-Line Undergraduate Medical Genetics Laboratory

Miguel DeArce, Department of Genetics, Trinity College Dublin, Ireland, mdearce@tcd.ie

Teresa Logan-Phelan, Centre for Learning Technology, TCD, Dublin, Ireland, tlgnphln@tcd.ie

Ruaidhri Power, Department of Computer Science, TCD, Dublin, Ireland ruaidhri@netsoc.tcd.ie

Abstract Laboratories are the paradigm of scientific learning, where scientists 'discover' things. But often, such creative activity does not transfer well to the scholastic environment. Many standard ('wet') laboratory courses suffer from an intrinsic didactic deficit, as they seldom yield levels of learning or student satisfaction to match the investment. Our on-line 'Medical Genetics Lab' is inspired on constructivist learning environments, where students engage with a variety of cognitive tools that simulate a laboratory environment to obtain specific learning goals. The course contains original simulations of electrophoresis and is designed to supplement standard 'wet' labs, but illustrates a wider range of samples and procedures than would be frequent in these, thus making choice possible. Course content and learning tools (some original to this course, some borrowed) are described. The course was assessed by a class of 25 3rd year Genetics undergraduates at Trinity College Dublin, and is available free at http://www.tcd.ie/Genetics/staff/Miguel_DeArce_GE3095/Index.html

Introduction

Undergraduate laboratory sessions are meant to impart two types of knowledge; 1) 'manual skill', for instance, how to set up an electrophoresis rig, and 2) 'analysis skill', i.e. how a given problem can be solved with a technique, and how the results should be interpreted and integrated in the context of the problem. If lab sessions are not to be seen merely as mechanical repetition ('type 1' knowledge) of a set of instructions, it is essential that they capture the original experience of 'discovery by experimentation' ('type 2' knowledge), and that they make possible the recreation of this experience at will under the constraints of the academic timetable and the pressures of large numbers. We considered that in the transfer from the professional practice to the scholastic environment, the 'type 2' knowledge gained from the laboratory would seem to suffer a process of degradation, and that we should attempt to recover for the scientist in training the ever-fresh educational value that the laboratory has for the professional. This surely must mean; variety of problems, scope for judicious choice, immediacy of results, and guidance with their interpretation and professional context, i.e., an inter-disciplinary approach. Constructivist learning environments (Jonassen 2001, Jonassen and Carr, 2000), with their underlying philosophy of 'teaching by doing' have the potential to re-establish the educational balance in this case. This presentation describes an attempt to enhance (or in some situations, replace or create anew) a set of standard laboratory sessions on Medical Genetics with the assistance of on-line teaching (DeArce et al, 2002)

Course Contents and Assessment

Medical Genetics laboratory courses for undergraduates aim to illustrate human DNA variation associated with pathology. The strength of this association can vary, from simple genetic linkage, to a disease-causing mutation. Judging the DNA variation by size alone, this can be large enough to be visible under the microscope (as studied in cytogenetics), or small enough to involve just one base change, in which case it can be visualised using electrophoresis, including sequencing. It is peculiar to medical genetics to study how diseases segregate in families, i.e., the analysis of pedigrees. The possible effect of a mutation on the structure and/or function of the protein it encodes should be undertaken next, followed by an understanding of the role of the gene product in the pathways where it may be involved. This brief outline determined the contents of our course, divided into four chapters; 1) ***Cytogenetics***, to deal with chromosome abnormalities, 2) ***Pedigree analysis*** to extract information from family trees where a disease is segregating, 3) ***DNA sequence analysis***, including several forms of ***electrophoresis*** used to reveal sequence mutations, and 4) ***Protein sequence analysis*** to reveal the possible structural or functional effects of mutations. Table 1 enumerates contents in more detail.

Chapter	Cognitive Tools	Related cases	Learning goals
Cytogenetics	Photoeditor Colour picker Pathology databases Patient group websites.	20 photographs of banded metaphases from normal, cancer, constitutive and prenatal disease.	Karyotyping, (standard + varieties of FISH and multicolour karyotypes), chromosomal disease.
Pedigrees	Bayesian calculator in a Java applet.	>25 pedigrees illustrating patterns of inheritance, from recent literature.	Linkage, risk calculations, genetic counselling, modes of inheritance.
DNA lab	Original code (in php) simulating five types of electrophoresis, including Southern blots and DNA sequencing. Restriction enzyme analysis...	8 families where cystic fibrosis is segregating (12 mutations), plus 4 families with fragile X syndrome.	DNA segregation, mutation types,(including dynamic), compound heterozygotes, denaturing gels and other ways of mutation detection, PCR.
Protein lab	3D viewer.	External databases, including sequence and structural data, metabolic pathways, mutation ...	Structure-function relationships, primary, secondary, tertiary structure...

Table 1.- Learning elements in 'Medical Genetics Web Lab'. All non-original software or data are freeware, in the public domain, or are used with the explicit permission of the author.

The course was presented in Trinity term 2002 to a class of 25 3^{d} year Genetics undergraduates at Trinity College Dublin, on five one-weekly sessions at the public computer rooms, lasting 3 hrs each. Student assessment was through a written report submitted as an illustrated WORD document. The students' assessment of the course was obtained through an anonymous questionnaire after the last session, and is summarised in Table 2 below. We are encouraged by the positive opinions expressed by the students.

Item	Response (15/25 respondents)
Time required	10 – 20 hrs after class (for the four exercises selected, one per chapter, i.e. 2.5 - 4 hr/exercise, which is more than the time required for 'wet' lab sessions.)
Did you read the contents?	Yes (all respondents). Some said that reading was essential as text contained clear indications about the nature of the problem or tool.
Contents quality	Very good (4) but hard to read (2). Good, interesting (9)
Guidance quality	Very clear (7), sufficient (5). Some times confusing (3).
Opinion on this on-line course	Useful (6), gives better scope than lectures (2), interesting and novel (1), very informative (1), worked well (1), prefer lectures (1), was really impressed with this tool (1).

Table 2.- Summary of students responses to course assessment questionnaire.

References

DeArce M, Logan-Phelan TM, Power R (2002). Medical Genetics Web Lab. Eur. J. Med. Gen. 10, Suppl, 171.

Jonassen DH, Carr CS (2000). Mindtools: Affording multiple knowledge representations for learning. In 'Computers as Cognitive Tools' Vol 2, Ed. SP Lajoie, Lawrence Erlbaum Associates, Mahwah, New Jersey.

Jonassen DH (2001). Constructivist Learning Environments.
http://www.coe.missouri.edu/~jonassen/courses/CLE/index.html

BEST COPY AVAILABLE

Thesis and Dissertation Propagation Utilizing PDF and the WWW: A Versatile Tool for Research and Higher Education

Phillip Diol
Department of Industrial, Interior, and Visual Communication Design
The Ohio State University
United States
diol.16@osu.edu

R. Brian Stone
Department of Industrial, Interior, and Visual Communication Design
The Ohio State University
United States
stone.158@osu.edu

Abstract: Adobe's Portable Document Format (PDF) is a versatile communication tool whose potential has not yet been fully realized in higher educational applications. PDF can play an important role in the way we go about conducting research and disseminating information. This poster presentation will outline the rewards of utilizing PDF as a multidimensional information tool in a research, distance learning and classroom setting. Various underused functions of PDF will be illustrated within an academic context.

Introduction

Exchanging research papers and ideas prior to the emergence of the Internet was often an arduous and slow process. It normally required a physical interaction that necessitates the emancipation of time and space logistics for both parties. Electronic mail and the WWW have alleviated this strain considerably, but not without shortcomings. System, platform, software and font dependence often results in a *lossy* exchange of data transmission and design as well as limiting the media used. Adobe's PDF has addressed these deficiencies by providing a way of packaging material developed in several applications into one standard format, readable by software that is free and easily available. The result is a *lossless* document with postscript printing precision, stable design integrity, and the ability to incorporate interaction and rich media. Higher education has been slow to embrace this versatile tool, partly due to tradition, culture and misinformation.

Presentation

The format of theses and dissertations has remained unchanged for over 100 years. The constraints of this format do not allow for the inclusion of rich media such as video animation. It also does not accommodate the ease and flexibility of non-linear narrative and referencing as seen with hypertext media?

The true potential of the PDF's capabilities may soon come to fruition at The Ohio State University, as well as other peer universities around the world. OSU is now moving towards exclusive electronic submission of dissertations and theses. The immediate benefit of using PDF is the advantage of being able to directly store and retrieve an electronic document with a fairly small file size. This format allows students to include hyperlinks and bookmarks within their document, thus making it easier to scan, reference, and navigate. PDF also gives students the option to incorporate dynamic elements such as audio, video and simulations, not attainable with traditional static forms of delivery.

Whether in a classroom or distance learning setting, PDF can enhance the teacher-student relationship. PDF may be used as a screen-based presentation medium as well as a printed document, offering students a very flexible option when delivering or documenting their research. An instructor who utilizes PDF in their regular classroom correspondence will be able to efficiently archive the student's thesis iterations and respond with direct feedback, with the ease of placing a "sticky-note." With feedback being a pivotal part of effective college teaching, PDF allows for effective distance learning interaction for all creative disciplines that have been hindered from previous methods of communication. For example, visual communication students can design using their own tools, submit their work electronically without alterations in the exchange, and quickly receive pinpointed feedback

Conclusions

It would benefit higher education to incorporate PDF as a communication standard for academics and research. Graduate degree candidates would be provided a richer arsenal for theses and dissertation completion, teachers and students can be empowered in the classroom, and distance learning for creative arenas can be realized or enhanced.

It is the intent of this poster to present the features and benefits of utilizing PDF as a multidimensional information tool. A variety of applied examples within an academic context will be outlined including dissemination methods and techniques, asynchronous teacher-student interaction, distance learning, integration of rich media, document archiving, and version tracking.

Building Bridges: An experiment in Informal Education and Technology

Jorge Valardan[1], Débora Carius
LNCC-Laboratório Nacional de Computação Científica
Av. Getúlio Vargas, 333 - Quitandinha - Petrópolis -RJ
CEP: 25651-070 Caixa Postal: 95113 - Tel. +55 24 2233 6000 -Brasil
E-mail: valardan@lncc.br, carius@lncc.br

Fabiano Cruz, Fabricio Ayres
Universidade Católica de Petrópolis -Depto de Informática
Rua Barão do Amazonas, 124 -Centro - Petrópolis - RJ
CEP 25685-070 - Tel.: + 55 24 2237-7112 - Brasil -E-mail: fabiano@appi.com.br, fayres@mailbr.com.br

Armenio Cardoso
Cepel – Centro de Pesquisas em Energia Elétrica
Avenida Um, s/n - Cidade Universitária - Ilha do Fundão
Rio de Janeiro - RJ - Brasil - Cep 21941-590 - E-mail: armenio@cepel.br

Marcelo Carius
Universidade Estácio de Sá - Depto Informática
Campus Petrópolis - Rua Bingen 50, Petrópolis,
Rio de Janeiro - Brasil -E-mail: carius@acol.com.br

Adriana Pereira Medeiros[2]
PUC-RJ –Departamento de Informática da PUC-RIO
Rua Marquês de São Vicente, 225 22453-900 Gávea Rio de Janeiro RJ
Tel: + 55 21 3114-1512 e 3114-1513 - Brasil - E-mail: adri@inf.puc-rio.br

Marcelo de Matos Mayworm
Núcleo de Computação Eletrônica
Universidade Federal do Rio de Janeiro
CCMN - Bloco C - Caixa Postal: 2324 - CEP: 20001-970
Cidade Universitária - Ilha do Fundão -Rio de Janeiro - RJ Brasil -E-mail:mayworm@compuland.com.br

Thais Ferreira
UFRJ – Escola de Comunicação (ECO-UFRJ) - Centro De Filosofia e Ciências Humanas - CFCH
Av. Pasteur, 250 - Fundos - Praia Vermelha - Rio de Janeiro
Cep: 22240-290 tel 55 (21) 3873-5080
E-mail: thais_mferreira@yahoo.com.br

Abstract:In this new age of technology we face nowadays demands new experiences concerning education. Traditionally the word education means being connected to a educational institution. In this brief paper we summarize the initiative that our group undertook three years ago trying to build a different educational structure devoted to widespread technological knowledge based upon volunteer work. In this paper we present an introductory background , describes the methodology used on the project concerning the educational and technological aspects and present results obtained from the project

Introduction

---

[1] Bolsista do CNPq - Brasil

[2] Bolsista do CNPq - Brasil

In this brief paper we describe a small initiative that our group undertook three years ago in setting up a *structure that could keep up with this new reality of generate work force that matches the needs of government, private companies and others organizations.* We mixed aspects of educational theory like cooperative learning and informal learning connected with Internet technologies like email and discussion groups basically. The focus was basically oriented to advanced technologies like Object-Oriented Modeling, Java programming and Database modeling. We think that just introducing computer technology at school without rearranging the social aspects could be a misleading track. Informal education is a wonderful way to experiment with Internet technology. The group is composed essentially of volunteer professionals from the academic and industrial world that work everyday with these advanced technologies and are willing to contribute at the societal level.

Methodology

Every sunday we meet having classes from 9 AM to 15 PM. Nowadays we focus on the following courses: Java programming, Object-Oriented Modeling, Database Modeling and XML. The public is formed basically from the community, not being necessarily connected with a educational institution.This promotes a high motivational atmosphere. In general it is a very informal way of working and learning, and most of the classes uses cooperative work as their main educational tenet. This mixture have worked very well, because there is no stress concerning tests, and the students get much more involved in the process, as they see that can apply the knowledge in their professional lives. Nowadays we are using Internet tools like email and discussion groups, which facilitates the virtual communication during the week.

An extra activity in the form of a one day workshop is organized every three to four months. These events are partially sponsored by companies and local universities and its main guideline is connect the students with really important professionals in the field of information systems. They also foster the creation of a knowledge community. The last event was related to linux [One Day Linux].

Conclusions

Several results arosen from this experiment. The instructors have the opportunity of teach developing their own methodology and get much more confident on their work. At the moment the group concentrates on the modeling of a few tools like a portal and a learning management system. Our last internal statistics registered around 120 people working together in our community, and more than a hundred that had participated in some sense of the training.

References

One Day Linux, http://virtual01.lncc.br/one_day/linux

Domingos, Jorge R.V., (2001), *"New approaches concerning teaching differential equations in basic courses of engineering"*, COBENGE 2001, Porto Alegre,Brasil, 2001

Domingos, Jorge R.V.,(1998).*"A Study concerning Cooperative Learning"*, Master Thesis,
PUC-RJ, Rio de Janeiro, 1998.

Finkel Donald L., Monk G. Stephen,(1997)." *Teachers and Learning Groups: Dissolution of the Atlas*

Complex", Readings in Cooperative Learning for Undergraduate Mathematics, 1997, MAA Notes number 44
UNESCO, (1995)"Documento de Politica para el Cambio y el Desarrollo en la Educación Superior", 1995

Java-based Tele-collaborative Environment

Abdulmotaleb El Saddik
School of Information Technology and Engineering (*SITE*)
University of Ottawa
800 King Edward, Ottawa, Ontario, Canada, K1N 6N5
Tel: (613) 562-5800 x 6277, Fax: (613) 562-5664
elsaddik@site.uottawa.ca

This work presents a software framework designed to provide transparent synchronous collaboration environment. The objective of this work is to develop a generic framework that can be easily integrated into other similar systems. The system supports not only Java applications and applets, but also Java Media Framework player allowing sharing multimedia applications in a transparent way. At the meantime, we developed client synchronization for the system in order to minimize the network transmission latency and let all the clients see the same view of the shared application at the same time. In our design, we add a session recorder to the system. The collaboration server is responsible for recording events while clients send events to others through it.

The approach behinds our concept, underlies the following requirements:

- No restrictions in the source code are required to share an applet. Both AWT and Swing-based applets should be supported. A solution restricted to only one kind of components is not acceptable.
- Applications using the standard Java-Core API should be supported.
- No new API should be developed.
- As less as possible of the network's bandwidth should be consumed.

The practicality of our architecture is proven by an implementation. We have developed a collaboration system, called JASMINE (Java Application Sharing in Multiuser INteractive Environments), which facilitates the creation of multimedia collaboration sessions and enables users to share Java applets and applications, which are either pre-loaded or brought into the session "live". The system also provides basic utilities for session moderation and floor control. Our approach applies to both applets and applications and hence these terms are sometimes used interchangeably in this document.

Figure 2 illustrates a sample screenshot of a typical JASMINE session. It shows the client's Collaboration Manager and some shared applets and applications running in the session.

As can be seen from figure 1, JASMINE consists of many utilities that enable multimedia viewing and sharing. The following section briefly describes these utilities.

Joint exploring of Java applets and/or applications

Users can use any applet on the web in a collaborative way. All they need is to specify the URL of the applet in an appropriate URL field or get it from a configuration file.

Joint Web browsing & Presentation

Using whatever java-based whiteboard, which can be used for shared color drawings, one has the ability to bring up presentations. Using Java-based browser, users at different locations can surf the web together. JASMINE is capable of bringing slides from the Web server and displaying them. These slides can be PowerPoint slides saved in HTML format, or simple sequences of images.

Pictures

JASMINE is capable of bringing up images in JPEG or GIF format from the Web server and displaying them inside the whiteboard. The users can then annotate on these images and start a discussion. The built-in locking mechanism of JASMINE is used to forbid modification of the same object at the same time by more than one user.

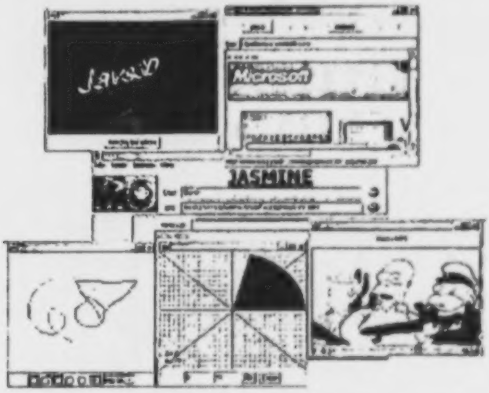


Fig. 2. A screenshot of a sample JASMINE session

Chat

JASMINE also facilitates user conversations by a having a shared chat space which can be used by participants to exchange textual massages. The chat space is useful in cases where audio access is not available.

Video

A very useful feature of JASMINE is its ability to play any JMF (Java Media Framework) supported video format. The video could be stored anywhere on the Web. When a user opens a video file and starts playing it, the video data is streamed down to all participants, decoded in real-time (processor permitting), and displayed on their JMF-based video player. Users can also play the video frame-by-frame.

Moderation

Managing a shared session is a very important ability, especially for telelearning. An instructor can use this ability to moderate a session, as in the real world moderation of a classroom or meeting.

History

The latecomer support lets latecomers get the current state of the shared application. However, sometimes latecomers may also be concerned about what events have happened before they join the session. Therefore, it is necessary to have a session recorder to record all the events happened since the beginning of the session and to replay these events on clients' demands. A session recorder is added to the JASMINE and as a result every client (not only latecomers) can replay all the events happened since the session began.

Download:

A trial binary version can be downloaded from the following website:
http://www.site.uottawa.ca/~elsaddik/abedweb/downloads.html

BEST COPY AVAILABLE

Accessibility Challenge to U.S. Government's Information Technology Initiatives

U. Yeliz Eseryel, School of Management, Syracuse University, United States uyeserye@syr.edu

Abstract: Section 508, an amendment to the Rehabilitation Act of 1973, establishes standards for electronic and information technology accessibility for Federal agencies. These standards provide criteria that spell out what makes products accessible to people with disabilities, including those with vision, hearing, and mobility impairments. To achieve such standards major changes in how we design must be instituted. However, Section 508 provides only general standards and the rest is open to interpretation. Moreover, due to the overabundance of technologies the task becomes too challenging. Besides, there is no one tool that can ensure total accessibility.

Introduction

Section 508 is an amendment to the Rehabilitation Act of 1973, published on March 31, 2000. It establishes standards for electronic and information technology accessibility for Federal agencies. These standards, cover various means of disseminating information, including computers, software, and electronic office equipment. They spell out the criteria to make these products accessible to people with disabilities, including those with vision, hearing, and mobility impairments.

The Section 508 of the Rehabilitation Act Amendments of 1998 requires the Architectural and Transportation Barriers Compliance Board (Access Board) to publish standards that set forth the definition as well as technical and functional performance criteria for electronic and information technology. The standards affect the Federal agencies' and the companies they work with; in development, procurement, maintenance and use of Information Technology.

Basically Section 508 requires all information that is available to individuals without disabilities to be available to the individuals with disabilities, too. To achieve such standards, major changes in how we design must be instituted. These standards provide criteria specific to various categories, including:
Software applications and operating systems
Web-based Intranet and Internet information and applications
Functional performance criteria
Information, documentation, and support.

Managerial Implications for Agencies

The enforcement of Section 508 began on June 21, 2001. Yet, many of the government organizations aren't still "508 compliant". Part of the reason is because the task is quite challenging. To make the matters worse, Section 508 determines only general guidelines, leaving the rest to interpretation. Government organizations are not only striving to serve the public in the best possible way, but also trying to foresee and avoid possible future lawsuits. Fortunately for the citizens and unfortunately for the organizations, accessibility is not a one-time effort. This means that not only do the organizations have to deal with the management of hundreds of Web pages and oversee contractors for usability and accessibility issues, but also, they have to do it on a regular basis.

The second reason why it is very challenging for organizations to be "508 compliant" is related to the abundance of technologies used by the users of Information Technology. For instance, the users use of different versions of browsers and software. Unfortunately, the tool organizations use to evaluate the accessibility of their web sites may enable one user to access the full content while disabling the total access of another user.

The IT companies did recognize the possible benefits that Rehabilitation Act in 1998. Companies are quickly founded to do Web accessibility consulting. Some built tools to validate accessibility and repair software. Some suggest that accessibility should be checked by human eye and some advocate the use of software instead. There are many tools, services and resources beginning from couple of hundred dollars to thousands of dollars. The choice of technology and tools become very important when the sheer number of web pages and software to be checked is considered.

Unfortunately, there is no one tool that ensures that one website or software is totally accessible. Human judgment is very important but depending solely on human judgment may be very inefficient. Furthermore, not every organization has the resources to hire a person or buy very expensive software and services.

The best solution for every government organization or government contractors is to first decide on the resources they have: Financial resources and time and expertise. After determining how much money can be tied every year for accessibility, agencies should decide whether they could allocate full time employees with sufficient expertise. Many government agencies also chose to form special departments or discussion groups focusing on Accessibility issues. The reactions to accessibility can go from using free accessibility tools to hiring consultants to creating an agencywide lab that will test different technologies. The basic lessons to keep in mind are:

- Accessibility isn't a one time effort,
- Accessibility requires planning, strict policies, guidelines and guidance
- No tool can solve the accessibility, human interaction and judgement should also be used.
- Even if consultants may be used, the ultimate responsibility lies with the agency.

Making the World a Softer Place: Healing Through Cyber-Stories

The development of the website, "Band-Aides and Blackboards" was informed by the needs of a diverse audience of children (both medically compromised and healthy), teachers, health professionals, and parents. Designed to house the stories of children with chronic illness and disability in order that healthy peers might better appreciate the nature of their lives, this Internet space is fundamentally a portal to their experiences, and to their prescriptions for making the world a softer place. It is the evocative, passionate, and often poignant words of children that hold the power to effect societal change.

The website offers children a forum to tell their stories—to share their words, and through them, their worlds.

In the Beginning

The website began with an invitation to children and their parents to participate as 'experts' of Band-Aides, with the hope that the children would submit stories for publication on the site. The data gathered in response to the invitation provided a peek into the nature of the their lives, and the themes drawn from that data reflected the complex reactions children have to disabling medical conditions.

Children with the physical stigmata of their medical conditions or treatments are very sensitive to the response of others to their "differences." Because electronic exchanges are blind to appearance, they provided a mechanism for these children to communicate freely without worrying how their appearance might filter an understanding of their words. Because the children did not need to "show their faces," the stories had the advantage of being true to their lived experiences. For example, one child responded to the questions posed without having previously received permission from his parents—permission required of children for inclusion on the site. When requested to ask his mother or father to take a look at the permission page and send consent, such permission was received with an addendum from his mother expressingamazement at the candor of his story. "Ever since Tyler lost his hair, he's been very private about his feelings. Yet he told you just how he felt." When barriers of time, space and visibility were removed, a cloak of anonymity was fashioned that providedhim a cover of safety from which he could freely tell his story.

While the advantages of electronic communication with children are clear, its limitations are important to address. For instance, there was no foolproof way of ensuring that the stories received were authored by the children. Or that the permissions given were composed by the parents. In addition, the written word is incapable of communicating the nuances of language that the nonverbal component of face-to-face interactions might have provided.

The Field of Dreams

Expectations of receiving many positive responses from children after invitations were posted were greeted with a resounding thump. Yet here, finally, was a forum for youngsters to voice their narratives. Like in the movie, the "Field of Dreams", this 'cyberspace' was built, yet the children did not come. Reflection on what seemed a dismal failure prompted a more aggressive publishing strategy. The site was submitted to all major search engines and announced on many disease-related sites. Large health care sites, several education and health care 'listservs', and over 100 elementary schools were contacted through e-mail. They were encouraged to review 'Band-Aides', and were informed of the resources that the site had to offer.

Informed Consent

The process of informed consent involved securing both parental permission and child assent. Because there are dangers associated with an Internet presence, a page was constructed that explained both the risks and benefits to parents (parent.html). Children requesting that their stories be told were assumed to be giving their assent to such participation on the website. Once both parental permission and child assent were assured, an electronic dialogue ensued, with focused questioning designed to flesh out the stories the youngsters submitted.

Initial Content Development

In an attempt to provide visitors with a sense of the experience of children with chronic illness at the onset of site development, data were collected from hospitalized youngsters about the experience of re-entering school after extended absence. Some of their comments were published on a page titled, "People Say and Do the Strangest Things" (teasing.hml), and others in a story fashioned around the data gathered about the first day of school for an eight-year-old recently diagnosed with diabetes, "Sally Goes to School" (sally.htm). These 'patients' were further offered the opportunity to serve as 'tour guides' on a series of pages designed to provide an introduction to the hospital. The hospital tour empowered them to communicate to their classmates their expertise about such clinical paraphernalia as pulse oximeters, oxygen masks, traction, and intravenous infusions (hospital.html).

In addition, some children shared 'tips' for health care providers, educators and parents when they did not have parental permission to submit narratives. These anonymous tips were crafted into separate pages. The cyberspace was growing, and the children were claiming it as their electronic home. The field of dreams was becoming a field of possibilities as they told their stories, shared their poetry, and revealed that the medical challenges they claimed did not define who they were as children.

The Growth of a Dream

Originally directed to an audience of elementary school children, their teachers, parents and health care providers, Band-Aides… received many stories and some powerful poetry from adolescents. This age diversity of childhood 'experts' suggested a need to divide the site into a section for 'kids' and another for 'teens' in order that the language used might be appropriately directed to each group. The teen introduction and invitation to participate were designed with that audience in mind. And the site grew.

Soon, requests to share stories were received from adults who grew up with chronic illnesses and disabilities. The stories communicated a wisdom borne of serious challenges and remarkable resilience. Because the counsel these adults brought to the site was of such great value, the site was further divided into a section for adults. They had 'been there, done that', and the suggestions they offered were applauded by youngsters growing up with illness. The adult pages soon expanded beyond individual narratives to include exemplars of parenting, tips from the children for parents, teachers, physicians and nurses, and additional Internet resources for that diverse audience.

Stories and Then Some

The narratives received were filled with passion, humor, frustration and loneliness. They revealed significant strength, and they communicated significant problems secondary to the social response of others to 'differentness'.

Too often, health professionals co-opt patient stories by translating them into the specialized jargon of disease talk; acronyms, laboratory values, algorithms of medication dosing. Even when diseases are effectively treated, patients may be left alone to struggle with the integration of the experience of illness into a coherent sense of self. The stories of the children argue against Because of the degree of stigma apparent in so many of the stories, pages were crafted around the nature of and response to teasing in an attempt to empower children with effective strategies for coping with it. One such page featured healthy youngsters advising children about how to deal with insensitive comments from their peers. These 'teasebusters' provided hints informed by both lived experiences and uncanny wisdom: "The thing is", one of them said, "everybody gets teased, so you just have to blow it off and don't let it bother you. Otherwise it'll get worse." (teasing2.html). Narrative discourse

As visitors to Band-Aides provided comments and suggestions, the site grew. Siblings wrote of their challenges growing up in the shadows of illness, (sibs.html); imagery was offered at the request of a mother whose son was dying of rhabdomyosarcoma, (yardin.html); lesson plans were constructed to offer teachers some guidance in curricular use of the site for elementary and middle school students, (sampler.html); poetry was written to translate medical jargon into language acceptable to children (e.g. leukemia.html), an orientation was constructed to the hospital for parents, (orient.html), and many interactive pages were offered to engage children as they visited the pages.

Many visitors to the site requested specific advice, much of it available on line, but seemingly hidden like needles in the haystack of the web. The most substantial page of Internet links was developed for teachers, so that they might better support students who come to school with significant medical problems. (http://www.faculty.fairfield.edu/fleitas/healthed.html)

Evaluation

Evaluation of the site involved requests for feedback of its structure and content from experts in web development and professionals in health care and education. As a result of structural feedback, navigation was improved, colors were used in a more complementary fashion, contact information was available on each page, forced music was eliminated and user-controlled audio files were employed, and alternative text was provided for all graphic images. As a result of content feedback, links were provided at the end of each narrative to allow readers easy access to disease specific information at credible health sites, terms were defined in developmentally appropriate language, and additional pages were developed to address needs defined by parents, teachers and health care providers.

Evaluation is ongoing, with letters from the following constituencies serving as a major vehicle for assessing the degree to which the audience-specific objectives have been met. A sampling of their letters follows:

- Healthy Children and Youth: The objective was to appreciate classmates growing up with medical-related differences. "I have wondered for a long time what kids feel like when they have serious medical problems. Your site helped me to understand. I also know now that if I ever meet someone who has an illness, it will be okay to ask them about it. It also makes me feel good to know that if I ever get very sick (which I hope I never do) I would have somewhere to go to for support outside of family and friends.
- Children and Youth with Medical Challenges: The objective was to become empowered as experts in this health education, and as a result, to experience less stigma in social situations. "I have become friends with people I never would have imagined, people from all over the country who are different in many ways--but similar in one. All in all, the site has helped me so much to know that there are other people who are out there with similar stories--other people out there to offer support to, and other people out there who understand what its like to be "the sick kid at school". I am a better person because of Band-Aides".
- Health Professionals and Educators: The objective was to appreciate the 'patient's voice' when studying disease entities. "I find that I am very apprehensive with the disabled students at my school. I like them, I talk to them, but somehow I am afraid of offending them in some major way. Unfortunately, I probably confuse them with my strangeness. I guess it's kind of guilt that I do not have to walk on crutches and wear braces, or depend on a wheelchair and deal with deformities. Or to adapt and deal with blindness and deafness in a visual and hearing discriminative world. I am floored! I am so happy to find your site. This is the kind of thing I have been looking for!"

The evaluation of the site continues, with plans to explore behavioral differences in children using the site in the curriculum with children not so exposed. Band-Aides and Blackboards is indeed a work in progress.

Interactive Simulation of Patients – An advanced tool for student activating learning in medicine

Uno G.H. Fors, Dept. LIME, Karolinska Institutet, Stockholm, Sweden, Uno.Fors@lime.ki.se
Rolf A. Bergin, Dept. LIME, Karolinska Institutet, Stockholm, Sweden, Rolf.Bergin@lime.ki.se

Abstract: During the years a large number of simulation systems have been developed for medical students. Many of these systems are designed for programmed instruction or other less student activating methods. However, we want to promote student activating learning methods allowing students to train clinical problem solving in a "natural" simulated environment. The ISP system is constructed in such a way that it might simulate virtually any part of the interaction between the patient and the users, including interactive video based dialogue using natural language, a full physical examination and laboratory tests. This system has been applied in courses at a number of Swedish Universities and also at Stanford School of Medicine.

Introduction

A large number of more or less interactive simulation systems have been developed during the years. Many of these systems are designed for programmed instruction or other user-controlling applications (Bitzer & Bourdreaux 1969, Bergin 1974). However, the pedagogical ambitions at the Karolinska Institutet have repeatedly and clearly been expressed as to promote the students abilities to solve problems, to promote the students beliefs in their abilities to solve problems and to present as clinical and integrated problems as possible. In the area of casesimulations, we have been developing student - activating learning systems since the 1970's (Bergin 1974). A new series of advanced simulation tools were developed at Karolinska Institutet in 1990:s, called Interactive Simulation of Patients, ISP. These systems are constructed in such a way that they might simulate virtually any part of the interaction between the simulated patient and the users, including an interactive video based dialogue using natural language, a full physical examination and thorough laboratory tests. This system has now been tested, used and refined in several iterations and applied in courses at a number of Swedish Universities and also at Stanford School of Medicine in the USA. This presentation will describe and demonstrate the ISP system and also present results from a number of student courses.

Methods

The construction of the ISP system is based on standard tools used to implement simulated patient cases. Every patient case is constructed based on a mix of real and fictive patient history questions, clinical photos of professional models acting as patients, X-ray images of real but anonymous patients and a number of other sources. No real patient images or videos are used. A team of teachers and clinicians are cooperating to construct a detailed manuscript for the illness history function, consisting of a number of hundred common questions and their corresponding answer. All cases are based on a "normal" case with normal lab tests and physical examination findings, allowing the developing team to only change the few specific data for all new cases. Further on, since all data, including the patient history video clips, answers, questions, laboratory data, X-ray images and physical exam results are stored in a central development database, it is rather simple to create new cases out of the extensive material available.

The ISP system has been applied in a number of different course settings in Sweden and in the USA. Most of these have been using different versions of the system (that is available in Swedish and English) and during different course settings for refinement, initial prototyping and also in routine courses. However recent course set-ups within the Wallenberg Global Learning Network have studied educational implications for both learners and teachers, using the latest ISP version. More specific, the ISP system was compared with traditional paper based cases to study the possibility to present good educational cases to the students and assessed regarding student-activation and clinical problem solving. The paper based cases and the ISP cases were developed using the same scripts and were of similar level of difficulty.

Results

The ISP system, which is designed to be used in student groups, contains these main features:
- A natural language, free text driven, patient history function with responses by digital video

- A detailed physical examination including inspection, auscultation, palpation, reflexes and more
- A complete set of laboratory tests, including more than a thousand lab tests, X-ray images etc.
- A user adjustable log function that tracks all interactions and an individual user notebook
- An interactive diagnosis proposal function, promoting reflective thinking and reasoning
- A detailed feedback function with comments on the interview, ordered procedures and resources used
- An information central with literature references, chat site and an integrated Medline search engine.

All functions are freely chosen by the user and are available at any time and in any order.

The user enters the interview question in free text using the keyboard. The system is using a large set of videos, which corresponds to nearly a thousand different question possibilities. Using combination of clips and a "semi-intelligent" data base function, the simulated patient can "react" on repeated questions and other unwanted questions by either show frustration, by becoming angry and even leave the physicians office. The simulated patient can also to some degree "spontaneously" interact with the user, especially if the user does not ask any questions for a long time. The inexperienced user can also use a built in help function to select predefined questions from a list.

The physical examination is steered by the user selecting what type of examination wanted (inspection, palpation, auscultation, temperature, pulse/blood pressure or neurology) and which body part to apply the exam on. Laboratory tests are ordered from a lab menu covering more than a thousand different tests (Chemical, Pharmacological, X-ray and other imaging labs, Microbiology, Immunology, Endoscopy etc).

Diagnose proposals are given using free text. If within acceptable limits, a short description of the case is given, including background and differentials. If an incorrect proposal is given, a short feedback on that particular diagnosis is given, followed by a possibility to continue with the case. The user is also asked to motivate the diagnosis. The user can at any time call for feedback. However, to avoid revealing the actual case's correct diagnose before the user has entered a proposal, feedback is limited before diagnosis. Additional feedback is also given in respect to performed unnecessary or potentially harmful investigations and regarding the cost of lab tests. The case simulations available today are concentrated in five areas, representing central issues within the education and to areas where important discussions on differential diagnosis could be held. All together, more than 20 different cases are available today.

During the recent courses, 40 students participated in Uppsala, at KI and at Stanford. The evaluation revealed that the activity at all three sites were greater as compared with the paper cases. Students were more active and asked more relevant questions regarding the case in the ISP session than in the paper session. Teachers and students reported ISP cases as being much more real-life like and more stimulating to work with than the paper cases. Most students were very positive to the ISP based cases and most of them stated that they would like to have more cases like ISP in their future training.

Conclusions

Most case simulation systems available are restricted in freedom of use and seldom allow a totally free interaction, especially in the case of interactive illness history. They rarely provide the user with most physical examination procedures and laboratory tests available in a hospital of today, limiting the applicability in a real-life-like clinical student activating learning setting (Bergin & Fors, 1992, Fors & Bergin 1996). The ISP system has been developed with the focus on a more free and interactive system, allowing most procedures and interactions available in a real patient case to be performed by the user. During the years, the ISP system has been used in large number of courses at many different universities in Sweden and elsewhere with good results as measured by student and teacher opinions. In this study, it was indicated that ISP has a large potential as a student-activating learning tool. Since highly interactive systems like ISP seems to activate students more than traditional methods, we think that learning outcomes might be better in comparison with more simple systems. This is a field for further research, which we are focusing our ongoing work on today.

References

Bitzer, M.D. & Bourdreaux, M.D.): Using a Computer to Teach Nursing. Nurs Forum 8, 234-254, 1969.
Bergin, R.: Computers in medical education, Trans Swe Soc Med Sci 83, 69-73, 1974.
Bergin, R. & Fors, U.: Implications of a Problem-oriented Education on the design of Multi-media based Educational Software. Proceedings of the CTI Center for Medicine Conference, 30-31, 1992.
Fors, U & Bergin, R: Educational Aspects of Computer Aided Learning and Multimedia in Dentistry: The Karolinska Institutet Experience. J Cal Dent, 1 (1), 1996.

Learning Materials for German as a Foreign Language with an Emphasis on Integrating with Classroom Contents

Shinichi FUJITA, Yamato HARADA, Ming YIN, ChunChen LIN, Seinosuke NARITA
Waseda University
3-4-1, Okubo, Shinjuku-ku
Tokyo, Japan
fujita@narita.elec.waseda.ac.jp

Abstract: Until recently, most electronic materials for learning languages were developed standalone. Therefore, auxiliary materials were either developed only to play a subordinate role and insufficient in terms of quality and quantity, or required to be linked to available huge dictionaries on the market. When language learners could not solve given questions, they referred to these auxiliary materials which were considered thus rather unimportant. However, the authors feel that electronic materials need to have better auxiliary functions which provide learners with the exact information they look for, especially because they are often used as self-study guides without instructor's help. From this standpoint, the authors picked up electronic vocabulary and grammar materials that were used in an actual classroom, developed supporting e-materials that could work closely with them, and then measured the effects on learning. Here, the authors report the positive results based on the questionnaires after the one-year tentative implementation.

Introduction

In the past, the authors developed a classroom-aid system called "EDLIN (Educational system Developed for Learning on Internet and intraNet)" (see NAKAYAMA 2000) whose purpose was classroom support in LAN environment. EDLIN supported language learning in a computer room where every student was assigned a PC and realized an e-classroom by managing everything in an electronic format from student attendance to traditional classroom items such as blackboards, notebooks, textbooks and small tests.

As a self-study-aid system, the authors also developed vocabulary and grammar materials (see YANAGIDA 1999) that were available on the WWW and a system that provided classroom contents. The databases for the vocabulary and grammar materials were electronic versions of what the students used in a real classroom. Since the vocabulary and grammar materials were freely accessible from any computer with an Internet connection, the learners could always look up grammar and its detailed explanations, meanings and conjugations of vocabularies, example sentences, related words and etc. Also, the content providing system sent out recorded classroom videos which were synchronized with blackboard views on the EDLIN system. It served as a review source for the students and always allowed them to go back to the old classroom contents.

Using the above two systems in their learning, the students started to demand a drill type of materials for their class preparation and review. In language learning, it is important to learn knowledge such as grammar, but it is also necessary to remember that knowledge by using it repeatedly. For that purpose, a drill type of exercises is inevitable. In this project, the authors developed a system for those exercises that could be tried on the Web and integrated it into the existing classroom/self-study-aid systems.

For WBT (Web Based Training), it is important to provide knowledge related to given questions. Because WBT is often used for self-study purpose, it is necessary for the learners to obtain knowledge that helps to solve difficult questions they encounter, in which no instructor can help them face to face.

Up to today, WBT materials for learning languages have been developed standalone. Although auxiliary materials such as dictionaries and grammar books are offered in electronic forms, they are used as "subordinate" materials to "main" WBT materials, thus leaving their quality and quantity insufficient. Some auxiliary materials are designed to refer to huge dictionaries available on the market. These materials are satisfactory in terms of volume, but inconvenient to use especially for beginners due to their unnecessary information.

The authors developed the drilling exercise system and integrated it with the electronic versions of the vocabulary and grammar books that were actually used in the classroom, hoping to provide the learners with more useful information at an appropriate level.

The exercise system the authors developed this time is characterized as follows:

1. Since the exercises and the review materials (the vocabulary and grammar materials) are closely connected, it is possible to lead the learners to deeper understanding and more efficient learning.
2. The review materials are appropriate for the learners in both quality and quantity because they are electronic versions of what they use in the classroom.
3. It is possible to advise the individual students on their weaknesses if necessary, by saving their learning histories for every exercise and analyzing them. This function results in more effective learning.
4. By using multimedia such as animated/static images and voices, it is possible to provide the students with new learning methods that are different from traditional monotonous methods.
5. The teachers can offer self-made exercises on the exercise system by using the exercise editing system.

Abstracts of the exercise system

The exercise system offers four kinds of exercises.

1. Sentence composition exercises by rearranging word order
2. Vocabulary exercises
3. Exercises of four multiple choices
4. Listening exercises

The system also provides viewing learning history function for students and Management system for teachers.

Evaluation

The authors tentatively introduced the above mentioned exercise system in a German class that took place in a computer lab at Waseda University and assessed the effects by taking questionnaires. In this class, every student was assigned a PC.

As for the evaluation method, the authors first asked the students to use the exercise system and then collected their feedback by using a questionnaire page on the WWW. The number of valid responses was 85.

In Table 1, the authors show the five graded results in the five items: effectiveness for learning, operation, layouts, processing speed and sufficiency of the offered functions.

As shown in the table, every item was basically marked with four, indicating relatively high evaluation.

	1	2	3	4	5	average
effectiveness	0	6	10	46	20	3.98
operation	1	4	14	42	21	3.95
layouts	1	3	13	52	13	3.89
speed	4	4	17	42	16	3.75
sufficiency	2	2	16	46	16	3.88

Table1: Evaluation results for the exercise system

References

Makoto NAKAYAMA, Yusuke YANAGIDA, Shinichi FUJITA, ChunChen LIN, Seinoskue NARITA (2000) , "Integrated CAI System for Language Education", "WebNet2000 - World Conference on the WWW and Internet" , Oct.2000, Vol.1, pp.924-pp. 925

Yusuke YANAGIDA, ChunChen LIN, Seinoskue NARITA (1999), "Development of LAN-based Multimedia CAL System Using German Vocabulary Database", "ED-MEDIA1999 - World Conference on Educational Multimedia, Hypermedia and Telecommunications" , Jun 1999,Vol.2, p.1627

The Intellectual Indicating of the Question in WBT

Makio Fukuda
Faculty of Human Science
Osaka International University, JAPAN
fukuda@hus.oiu.ac.jp

Torao Yanaru
Faculty of Engineering
Toua University,JAPAN
yanaru@po.cc.toua-u.ac.jp

Back Ground

The e-learning is education used Video-Conference or WBT as a tool. WBT occupies the important position also in e-learning.

It is because it is the method for which WBT does not depend on the learning time or the learning place.

The importance becomes still higher by development of Personal Digital Assistant which has function the video recording and playing.

Most of WBT have adopted the system of the traditional CAI. The courseware which works on PC only moved to up to Web.

The so-called system of "Drill type CAI" is realized by WBT as it is. That is, WBT consists of questions which measure the explanatory note of the study item, and the learner's degree of comprehension.

This is the same structure as traditional CAI. Such structure cannot respond to an individual learner's understanding situation or point in question.

It can be said that this structure of the educational effect to the all learners is not large.

This research solves such a question, obtains the educational effect of WBT, and realizes "Intelligent CAI" corresponding to a learner's individual situation by WBT.

Outline

In order to perform this Intelligent CAI, in WBT, the correlation of an explanatory note and the question is set up beforehand. In process in which the learner advances study, after reading an explanatory note, it answers to the given question.

This method is performed per unit. And a computer evaluates the reply.

The process so far is the same as that of former type CAI.

In this WBT, it is dependent on evaluation of the reply result, and how to advance the following four study ways are set up.

1. When the learner understands very well, the learning system guides the learner to the following chapter.
2. When the learner understands in general, the learning system gives the learner some questions.
3. When the learner does not understand well, the learning system puts up the explanatory note again and gives the question for measuring degree of comprehension to the learner.
4. When the learner hardly understands, the learning system guides the learner to the chapter which can acquire fundamental knowledge.

By including these study ways in WBT, it enables the learner to receive automatically offer of the question according to individual degree of comprehension.

When it is considered that these four study methods are a student's understanding situations, it is expressed as S_1 to S_4.

The explanatory note of each study chapter is expressed as $C_1, C_2, \cdots, C_n$. The link place of the learning system to the understanding situation in each study chapter is expressed as $L(C_1, S_1) \cdots L(C_n, S_n)$

Table 1: The table of the link place corresponding to the chapter and the understanding situation

	S_1	S_2	S_3	S_4
C_1	$L(C_1,S_1)$	$L(C_1,S_2)$	$L(C_1,S_3)$	$L(C_1,S_4)$
C_2	$L(C_2,S_1)$	$L(C_2,S_2)$	$L(C_2,S_3)$	$L(C_2,S_4)$
$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\vdots$
$\vdots$	$\vdots$	$\vdots$	$\vdots$	$\vdots$
C_n	$L(C_n,S_1)$	$L(C_n,S_2)$	$L(C_n,S_3)$	$L(C_n,S_4)$

The link place corresponding to the learner's understanding situation in each chapter is determined by the logic based on a teacher's education strategy. We tried to make this logic program using the theory of Petrinet. Petrinet is because it is considered the optimal theory for corresponding to an uncertain situation like the learner's understanding situation.

Conclusion

Although we are developing this learning system now, to the learner's understanding situation and the ambiguous portion in instruction, we think that it cannot necessarily respond the optimal. Then, we are under the plan to add the fuzzy theory to this system as next stage of this research.

E-Learning Challenges: Digital Literacy and Creativity

Author: Marilene Garcia
Affiliation: Inter-Activa Educational Projects and Universidade de Belo Horizonte–Minas Gerais - Brazil
Email adress: marilenegarc@uol.com.br

Abstract
This paper is about the new expectations about E-learning in focus of developmdent of digital literacy with support of creativity.
For Glister (1997) digital literacy means "Proficiency in utilizing and manipulating information in online format and to process information from a variety of sources and formats so that one can create one's own knowledge path". In agreement with Glister, my thesis ist that E-Learning is per si a opened opportunity for development of many kinds of digital literacy and can be possible with emergent creativity. Dimensions of digital literacy include something more then instructional design for the content, more then pedagogical activities for students, or more then pedagogical goals for teachers. So the creativity must mean the way to get more then the tecnology can do for E-Learning.

Digital Literacy for E-Learning:

- New proposals for learning and teaching
- New ways of interating with others
- Emergent communities for educational proposals
- New attitudes and paths for educational interation and communication
- New social practices in educational communities

Creativity for Eletronic Education

Creativity is a complex process of generating ideas and it has to emphasize on eletronic education:
- Making a opportunity for innovation
- Making meaningfull new connections with usual things
- Making unusual alternatives, that your students are not expecting
- Mixing creative minds/ideas with technological support

Tools for E-Learning

The available and usual tools that teachers can use to make new connections and unusual things:
- www – Electronic educational enviromments
- Computer mediated communication: E-Mail, Chats, Newsgroup, etc
- Audio conferencing
- Document conference
- Desktop Video Conferencing
- Discussion List
- Interactive Multimedia
- Authoring systems
- Simulations systems
- Databases
- Course Editor Software
- Wordprocessing
- Metatools

Combination: Digital Literacy and Creativity for E-Learning

E-lerning has three principal components:
People – Teachers and students in collaboration context for learning
Educational Process – Pedagogical enviroment: resources, communication, content, goals and activities
Technologial Support – support for people and educational process
People + Educational Process + Technologial Support must be organized in a creative way to take meaningful action and to give good results.
People (in this case teachers) are not able yet to face the technological resources for E-Learning to make new decisions and to development innovative sinns.
Creative and multi-skilled persons are able to operate E-Learning products and tools, not only as users and but also as creator. There are meta tools (creation of other tools) available for this goal. Indeed they must deal with creative literacy skills.
Modes of communication (speech, writing, image, etc) have specific levels of representation in on-line educational enviroment and so People need specific knowledge and skills to deal with them. They envolve abilites and social practices related to the particular educational contexts and goals.

How People can Reach Creative and Multi-skilled Literacy for E-Learning Practices?

First level:Operate level – skills required to utilize electronic devices: softwares, several digital formats and hipermedia resources (Languages, tables, maps, diagrams, hipermedia navegation, etc), so people can be sure, to be able to do, to produce, to go further.
Second level: Communication/information/interactive level – skills required to participate of interacting in different types of commnunities, to change and produce information. The infomation can be dealed in multimodal forms: visual, writting and speech (visual, verbal, probelm oriented, communicative purposes).
Third level: Creative level – skills required to became a collaborator and a co-investigator in combining the other levels descripted above, to make creative choices and new decisions with focus on development of strategies for learning.

- Use the relevant discourse community
- Have a clearly defined learning purpose: Deciding where to go and where to begin
- Try to know better the audience
- Make good use of chosen resources and medium
- Find right people to change
- Dealing with time
- Choice and evaluating sources
- Dealing with metadata
- Dealing with multmodality
- Publish in hipermedia
- Searching for new tendences

Final considerations

Digital literacy and creativity can work together for E-Learning, when the educational proposal is looking for new answers with new resources for old teaching problems. The challenge ist to become a experts in innovation and to deal with common thing with a not common way, to start and to maintain a opportunity to go further on.

Bibliographical References

Glister, P. (1997) Digital Literacy. New York: Wiley.

Webstorming: Brainstorming in the Web

Alexandre Jesus da Silva Machado [1]
Susane Lopes Garrido [2]
Leandro Vaguetti3
Liane Margarida Rockenbach Tarouco [4]
Maria Suzana Marc Amoretti [5]
Rodrigo dos Santos Keller [6]

Interaction and EAD

The interaction matter is an essential point to be considered for the production of the software aiming the effectiveness in making decisions on line. It is therefore implicit a determinant behavioral character to spread information in case of interaction.

The interaction fundaments used in this study are the latest trends discussing the efficaciousness of education by means of new technology (PETTERS, 2001), pertaining to presence, half-present or at distance.

> *"It is good to vary, specially to frustrate the curiosity of the envious; hence they shall see the uniformity of our actions they shall take advantage of the foreseeing (...). It is easier to kill a bird that flies in a straight line rather than the one that does not (...).*
> *A real player shall never play the card that is expected by his opponent even less the desired one". (Gracian in Fayard; preface)*

The inference of the author (Gracian) makes us think about the importance of the development of new perceptions in relation to the other, expressing a different expectative, a change of what one has already lived. It is a phenomena of the necessity of change, of the unthought-of, the unpredictable leading to the construction of a new "Man". A MAN turned to the multiplicity perception, a being to be socially built for the acceptance of the differences. A Man that now inhabits a virtual environment and therefore needs more than ever an efficacious strategy of communication to survive.

We are facing a paradox, everything that was done strategically until today aimed the dominance. On the other hand, in the Western world nowadays, before this global virtual world, the way of thinking must be transformed to generate efficacy in the face of new problems. The reality of our times, more interconnected than ever in all different areas such as communication, information or simply forking off borders, does not allow segmentations .The problems are no longer individual problems, but collective; it is required co-operative solutions of systemic and complex nature because at the same time it depends on a part and on the whole.

Nowadays, the ideas of EAD, involving specially the virtual environment, are surrounded by paradigms that come from conceptions of present teaching and also from concepts of distant teaching that gives, in fact, a sense of distance but not disconnection.

The analysis of the environment, considering its conceptions of EAD (even turning the decision maker in specificity), make us believe in the idea of an EAD turned into what (PETTERS, 2001) calls "third generation" and because it is an ambivalent didactic (in the sense of overcoming the first two generations of EAD) has transformed its traditional conceptions of learning and teaching. This is because it offers orientation to the student (or user) that studies alone or with the help of didactic software, interactivity (as another means of making the construction of the knowledge more effective) and also making the database available in the search of information.

EAD Generations: The 1st generation is strongly based in the traditional paradigm of teaching and learning where learning happens by means of reading printed paper, guided studies and autonomous scientific work among others. The 2nd generation is based in the possibilities of teleconference. The 3rd generation of EAD, proposes an idea of interaction among the subjects; and among them the technology and knowledge, under the view of space and time, give the possibility of co-operation.

Interaction, while means for a better distant learning, shall be seen by the mentors of the virtual environment(aiming the education or not) as a cognitive strategy to promote autonomy, the exchange, the resolution of problems and decision making to propose the growth of the person towards a more dynamic view directed to a multiple and multicultural reality.

Vygotsky emphasizes the social interaction as a means of a better construction of meanings while for other authors, such as *Ausubel and Piaget, it is* emphasized the individual. As for *Vygotsky*, it is neither the individual nor the context that really matters but their interaction.

According to Garton *in* (MOREIRA, 1996)

> *"A definition of the social interaction means that there are at least two people exchanging information. (The pair is the smallest microcosm of the social interaction. It also implies in a certain degree of reciprocity and bi-directionality among the participants, meaning that the social interaction assumes active involvement (although not necessarily in the same level) of both participants from this exchange, bringing to them different experiences and knowledge in a quantitative and qualitative way."*

---

1 Professor of CTI/FURG. PhD in Computer Science in Education (PPGIE-UFRGS), ctiajsm@aol.com , http//www.ctiajsm.hpg.com.br

2 Professor of UNISINOS. PhD in Computer Science in Education (PPGIE-UFRGS), susanelg@terra.com.br

3 Master in the Program of Graduation in Computer Science(PPGCC), vaguetti@inf.ufrgs.br, http://www.inf.ufrgs.br/~vaguetti

4 Professor of Program of Graduation in Computer Science in Education (PPGIE-UFRGS), liane@penta.ufrgs.br, http//www.pgie.ufrgs.br/~liane

5 Professor of Program of Graduation in Computer Science in Education (PPGIE-UFRGS), suzana@pgie.ufrgs.br, http//www.pgie.ufrgs.br/~suzana

6 . PhD in Computer Science in Education (PPGIE-UFRGS), keller@pgie.ufrgs.br http//www.pgie.ufrgs.br/~keller

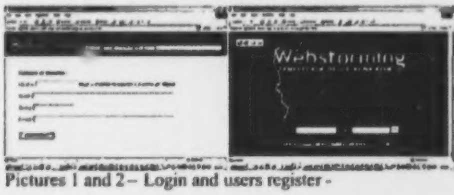
BEST COPY AVAILABLE

Web storming: Brainstorming in the web

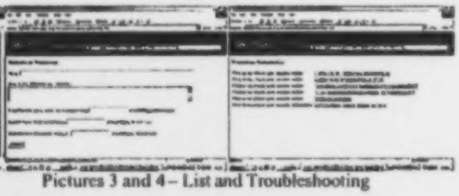
The tool proposed may be used in many situations, such as group dynamics, in which people with equal opportunities in an organized way, can give opinions about a certain problem, finding causes and suggesting solutions. Initially, the barriers found for development were the language choice and learning. The environment was developed with PHP and HTML languages and the software Dreamweaver and Fireworks.

The system is found at URL http://www.pgie.ufrgs.br/webstorming in continuous development and validation .

The user is able to register and log in to access the web (pictures 1 and 2), being able to use the troubleshooting or helping in solving some problems(pictures 3 and 4). When using the troubleshooting, the user defines three dates: the first to start the webstorming session, the second to indicate the deadline to register the ideas and the third to indicate the end of the voting session, to define the chosen ideas



Pictures 1 and 2 – Login and users register -


Pictures 3 and 4 – List and Troubleshooting

The user shall participate in the troubleshooting, registering ideas (picture 5) and at the same time verifying the ideas posted by other participants of the discussion. In picture 6 we are able to see the screen with ideas for the voting. When the deadline is reached for voting and registering, the environment shows the elected ideas with the respective number of votes.

In the environment developed, the main aspects of a conventional brainstorming session were maintained to guarantee the essence of the method. We shall observe that all participants are free to express their ideas, creating a nice environment to exchange different points of view, of the different persons, about different subjects searching for a consensual solution.

To the webstorming, the original idea of Osborn is attached, where mechanisms shall permit a decision making via web, adapting the known technique to a new reality of the virtual environment.

Conclusion and Future Works

The system is in the process of validation and some are being implemented in search for improvement. Below some future Works:

Limit one vote per participant in each session of the webstorming;

I) Allows the alteration or exclusion of users, problems and ideas;
II) *The deadline for the voting shall be sent via email, so that none forgets voting within the due date.*
III) After the voting ends, the environment shows the proposals that were most voted and shall make available a space for comments about the winner.
IV) The proposition chosen could be sent via email for all participants of the discussion that will know the results.

The webstorming is being tested by groups of some institutions, in search of data for analysis and improvement of the environment. It has proved to be, in tests done previously, a tool that can really help in the EAD environment, acting as a mechanism to help in the decision maker of the web. From simple actions such as the definition of date and place to meetings where people see each other, up to more important decisions, for example the choice of the subject in a colloquium. The webstorming was used then, as a means of making the ends meet.

In situations where there are no specific aims to obtain a final decision, the webstorming can also be used to help in the pedagogical characterization of team profile or even of participants. They can check the most discussed subjects in a chat, for example.

As new tests are being done, greater practical applications will be found for our software. In all of them, however the Idea of helping the users to make the ends meet in matters worked in virtual environment such as the EAD.

7. Bibliography:

Dictionary *on-line* de RH [http://www.guiarh.com.br/dicionario.html]
FAYARD, Pierre. **O Jogo da Interação.** Caxias do Sul: EDUCS. 2000
KOTLER, Phillip. **Administração de Marketing** . São Paulo :ATLAS . 1998.
MACHADO, Alexandre J. S; ROZADOS, Helen; ROCHA, Karla, SCHEID, Roberto. **Interações num Ambiente Virtual: aspectos ergonômicos de um trabalho cooperativo.** Porto Alegre, PPGIE, 2002.(Trabalho de conclusão da disciplina Seminário Avançado: caracterizar as práticas de trabalho para a ergonomia).
MAÇADA, Débora; TIJIBOY, Ana. **Cooperação e Colaboração: o nosso conceito**. 1997.[http://www.niee.ufrgs.br/cursos/topicos-ie/ana/conceito.html]
MOREIRA, Marco Antônio. **Teorias de Aprendizagem.** São Paulo:EPU. 1999.
PETTERS, Otto. **Didática do Ensino a Distância.** São Leopoldo:Ed. Unisinos. 2001.
TAROUCO, Liane et ali. Ferramentas de comunicação e sua influência no processo de tomada de decisão.[http://penta.ufrgs.br/~michelle/projetos.html]

BEST COPY AVAILABLE

From Turnstiles to Cyberspace:
Perceptions of Librarians in an Era of Transformation

Change is prevalent in most academic libraries at present. Faced with the ubiquitous innovations of the information age, the librarians' traditional role can no longer hold sway. While colleges and universities attempt to compete with technologies that cut into the bottom line of libraries, little (if any) attention has been given to the perceptions of librarians and how they are reacting to change both emotionally and behaviorally. Emphasizing the captivating quality of naturalistic inquiries, the proposed study intends to contrast the differing perceptions of main librarians and special librarians.

The initial aim of this inquiry was to find an answer as to why there was more student circulation at special libraries than at main libraries. At the surface level, it was obvious that users visit special libraries more regularly because large tomes, such as legal texts predating the advent of the Internet, could best be accessible in the stacks. In the search for understanding, various sources were reviewed to learn whether this trend was exclusively endemic to the setting under investigation.

After reviewing extant literature, however, the object of the inquiry shifted slightly. For the most part, the reviewed literature hardly revealed how librarians perceive new technologies as one of the most serious factors influencing the elimination of numerous jobs forcing them, in some cases, to return to school in order to upgrade their academic skills. The aim of this scholarly manuscript is twofold: to analyze the intellectual, social, and economic stressors shaping the emergent role of librarians; and to conduct an inductive, comparative analysis in selected sites by collecting information whose findings could possibly be transferable to similar academic library settings.

As a departing point, literature on the subject will be reviewed to determine whether the taken-for-granted role of librarians has changed as a result of new information technologies. Subsequently, the proposed case study will be framed within a fitting philosophical paradigm. Such correlation is crucial because it should guide the methodological direction the study may take. In fact, it is expected that the role of the investigator throughout the study will be that of a co-participant, and that the planned open-ended interviews will be interactive in nature. In this sense, the study may serve as a catalyst for possible institutional change. When appropriate, differences and similarities across the studied settings will be illustrated through recorded examples not only to show how the perceptions of librarians may be directly affected by those conditions, but also to substantiate how such perceptions and attitudes could either foster or deter the espousal of new research technologies within library settings by professors and students alike.

Consistent with the traditions of interpretative hermeneutics (Denzin & Lincoln, 1998; Erlandson et al., 1993) the contextual analysis resulting from this investigation (i.e., its ultimate discourse) will be open to review to promote meaningful change within the settings and possibly in similar institutions of higher education elsewhere. It stands to reason, then, that this philosophical correlate; namely interpretative hermeneutics, would appropriately correspond with the characteristics of the critical theory paradigm, for the overarching goal of the inquiry is to promote meaningful changes within the settings.

Creswell (1998) states that, "[v]ariants of critical theory abound in all of the social science disciplines, but central themes that a critical researcher might explore include the scientific study of social institutions and their transformations through interpreting the meaning of social life…" (p. 80). Within the critical theory perspective, the focal point of this instrumental case study will be the analysis of librarians' perceptions as these are influenced by information technologies.

Within the Symbolic Interactionism perspective, the findings may also provide some insights into the way librarians "act toward the physical objects and other beings in their environment on the basis of the meanings that these things have for them" (Denzin & Lincoln, 1998, p. 233). As expected, the findings should reveal how computers have redefined the role of librarians as well as influenced their perceptions. In addition, because there is an ostensible connection across philosophical stances whose goal is to promote [needed] social change, it is anticipated that the overall outcome of the inquiry will also show some characteristics of Action Research (Berg, 2001) given its projected methodological construct "where creating a positive social change is the predominant force driving the investigator and the research" (p. 179).

To the ordinary observer it may be obvious that more students visit special libraries more frequently than main libraries. However, treating such differences peripherally (i.e. via spreadsheets) would not necessarily explain why such disparate circulation patterns exist. To better understand the phenomenon at hand, the researcher is willing to dig deeper into the layers of these structures in order to study, document, and interpret elements that may account for such differences. Whereas a quantitative approach may fall short when analyzing this trend, the proposed research, framed within the qualitative tradition of inquiry, would be a more befitting investigative tool to use in this case.

As reviewed in extant literature, the pervading influence of the Internet has already redefined the role of librarians both nationally and internationally. Yet, when applied to specific microenvironments, this external influencing factor may not be the only culprit responsible for a decreased student circulation, especially at main libraries. Therefore, the emphasis of this inquiry is twofold: to explore how librarians perceive their emergent role in the midst of changes propelled by an era of digitization and to compare how such perceptions may vary according to social, economic, and intellectual differences across library settings.

The primary sources of data collection will include thorough transcribed interviews, running notes of site observations, and resulting memoranda. In addition, relevant data extrapolated from archived notes (mostly in the form of electronic messages) will be used to corroborate data collected from the previously cited sources and to assist the researcher in verifying such data by triangulating the findings (Creswell, 1998; Denzin & Lincoln, 1998; Milinki, 1999). It is anticipated that by employing the method of triangulation the confirmability, credibility, and ultimate transferability of this study will be enhanced. In addition, because the inquiry is not framed within a positivist framework, it is also predicted that its outcomes may not be necessarily generalizable to other settings, albeit possible structural similarities, because such findings may be exclusively descriptive of specific characteristics of the studied milieu.

Next Generation Courseware: Custom Learning Environments Integrating Research and Collaboration

CHEF Introduction

CHEF (for CompreHensive collaborativE Framework) is a framework designed to expand the paradigm and functionality of course management systems by taking the approach of working to support the activities of scholarly and learning communities over time, in addition to supporting the administrative efficiency we are mostly familiar with. The CHEF framework has been built using (as far as they have been known) and developing further the Open Knowledge Initiative's APIs. And CHEF is being developed as an open-source project, intended to be collaboratively developed, customized, and implemented at universities across the world.

The first CHEF implementation is a complete re-design of the University of Michigan's course management system and is called CourseTools.NG (for Next Generation). CourseTools.NG is currently supporting a second pilot semester of nearly a dozen courses with approximately 500 students.

CHEF Architecture in a Nutshell

CHEF is a Client/Server system. CHEF services run on one or more CHEF servers; clients use various means to communicate with the servers to access CHEF. CHEF is a multi-user system, and has features that surface the presence and activity of the current set of users to each other.

CHEF uses the practice of *separation of concerns* to introduce various metaphors used to organize the development and functionality of the system. These metaphors include *tools*, *services*, *interface technology*, and *portals*. CHEF also uses the *Model View Controller* practice, i.e., services handle all modeling while tools handle controller aspects and generate views which are rendered by a template interface technology.

CHEF Project Overview

The CompreHensive collaborativE Framework (CHEF) Project has as its goal the development of a flexible environment for supporting customized learning environments and collaborative work, and doing research on learning and collaborative work. This will involve the identification, design and development of a framework that can effectively accommodate various tools that are used in supporting collaboration, research and learning, and tools necessary for the study of collaborative work and learning. The framework needs to provide organization for the disparate functionality used to support research, collaborative and learning activities and be able to combine locally developed, commercial off the shelf and free off the shelf components.

The initial communities of use that CHEF is targeting include those involved in the scholarly activities of teaching, learning and research at the University of Michigan, and their students and colleagues involved in teaching, learning and research that are outside of the Michigan community.

CHEF is aimed at making available a set of functional elements that can be easily configured by users to accomplish a wide variety of activities. This framework will support existing and emerging capabilities, and will seek to make the integration of new functionality as easy as possible.

In our past and current work we have seen much commonality among the needs and tools used by people in research and teaching/learning communities, and we are seeing the emergence of frameworks for user configurable toolset delivery. CHEF will mobilize our experience, research and user feedback in the effort to develop a comprehensive framework to support these scholarly activities, and make this framework available for wide use through an open-source model.

Implementing CHEF: CourseTools.NG

CourseTools.NG is an enhanced version of the original UM.CourseTools, with improvements that will include greater customization options for users and better support for a variety of pedagogical approaches. Examples of these include individual personal portals (referred to as MyWorkspace) in addition to class portals, the possibility for authentic assessment and e-portfolios, and new capabilities like presence and configurable group collaboration space.

These changes are the result of feedback we have received from individual faculty members, students, focus groups, and surveys. The current pilot phase presents some of the basic CourseTools capabilities within a portal environment in order to gather usage experience which will further guide development efforts.

Proposal for

Supplemental instruction and assessment elearning of difficult OOP concepts

Kenton Graviss and Ghansham Manwani

Indiana University Southeast

New Albany, IN, USA

At Indiana University Southeast the computer science curriculum includes two beginning-level programming courses: C201, Visual Basic programming and C202, C++ programming. These are required for all CSCI majors and C201 is also taken by non-computer science majors from the Schools of Business and Natural Sciences. They are, however, very different in their approaches to programming. The first course (C201) teaches the imperative or sequential programming paradigm, while the 2nd course (C202) teaches object-oriented programming, OOP. There is a significant paradigm shift between these two approaches - one that student feedback has indicated is a difficult one for them to bridge. This is because of the significant differences in programming concepts and implementation details students need to master for writing the two different types of programs. Clearly, a need exists to supplement the normal instruction beginning computer science students receive to help bridge the gap in understanding between the two types of programming. This proposal describes an approach we think would be effective for providing the required supplemental instruction as our students transition from imperative (i.e., procedural) to object-oriented programming.

Specific objectives that will be accomplished.

To facilitate the problem-solving shift from one programming methodology and compiler to another, we propose developing and creating supplemental instruction using AVI / multimedia files accessible from a web page that would deliver the supplemental instruction from the Internet. Students will view graphically-detailed and presented supplemental instructions, including videos online to get additional coverage of the subject matter that is intended augment their understanding of the most traditionally difficult concepts for them to master. These concepts include,

- The Integrated Development Environment (IDE)
- C++ semantics and meaning (language development)
- Recursion
- Object-oriented design (classes, encapsulation)
- DMA (dynamic memory allocation)
- Function prototypes (modular design)
- Searches and Sorts
- Algorithm analysis

Specific instruction files, each requiring approximately ten to fifteen minutes to view by a student, will be produced using current PC-based and graphic and digital video processing methods and technology. The files will consist of both static and dynamic screen displays that will be sequenced together with appropriate voice-over and background audio relevant to the subject material. Each supplemental instruction file will be presented on a web page devoted to the C202 course sections in the Fall 2002. On the web page, after each file has been completed by the student, they will be given a short quiz to test their learning from the supplemental instructions. In addition, they will be able to "roll back" and review material in the files at their discretion to go over material and concepts requiring more time for them to assimilate.

Methodology employed to accomplish objectives

Multimedia files containing static and dynamic (i.e., video) display content that include voice-over instructions and explanations, graphics, and text that will be made available online immediately preceding or following coverage of the corresponding material in the C202 course. The screens and videos will be geared to going over and reinforcing object-oriented concepts in new ways and from new angles that will connect to students by virtue of the multi-sensual exposure and inculcation of the supplemental instruction presentations.

Evaluation process

Effectiveness of the supplemental online instructions will be measured in several ways. First, student learning will be measured in two of the Fall 2002 C202 classes online using a web-based quiz integrated into the web page and offered at the end of each of the online supplemental instructions. The third Fall 2002 C202 section will not have access to the online supplemental instructions, and will serve as the control group for this study. The intent here is to obtain early and ongoing measurements between two classes of the effectiveness of the online instructions in assisting student learning of the most difficult concepts of object-oriented programming. By comparing the quiz results for two classes we'll get an indication of the variation in effectiveness by class.

Second, pre-assessment / post-assessment tests will be given (without grading) to all C202 sections at the beginning and end of the semester to determine what they knew before and after taking the course. The test will contain multiple choice questions intended to determine what they know about C++ and object-oriented programming concepts, including the most difficult topics that the online supplemental instructions are designed to assist with. The test results will be compared to determine whether students receiving supplemental instruction score higher than those that didn't.

Third, a follow-up, qualitative learning survey will be conducted at the end of the semester in all C202 sections in which the students will be asked to quantitatively state (on a scale of 1 to 6) how much they think they know about the topics supplemented by the online instructions at the beginning and at the end of the classes. The results will be compared between those that received supplemental instruction and those that did not to get another measurement of the effectiveness of the supplemental instructions for student learning.

Required technology and media

PC-based audiovisual technology, and media to design and construct the multimedia files required for posting on the supplemental instruction web page. A Dell 4100 Dimension video-processing PC is the primary platform for this research. DV Storm© video processing system (hardware and software including Adobe Premiere 6.0) will be used for instruction file development. A digital video camcorder will be used to create the videos that will be an integral part of the online instructions. Students will also be able to access the files from the Internet at any convenient location and time.

Additional details

Screen graphics and videos will be prepared using scripts as guides to highlight and enliven the OOP material. The goal was to design the instruction files creatively so as to enhance student interest and retention of the subject material. Thus new and novel approaches to combining graphic design and video editing were used. Our intent is to examine the results of the measurements and determine the effectiveness of this approach for improving student learning. If proven effective, as we expect, this methodology could serve a similar function in other computer science courses and courses with detailed and difficult-to-grasp-at-first technical content, as in many natural science courses.

Developing Reusable Learning Design Resources

Barry Harper, Ron Oliver[*], John Hedberg, Sandra Wills, Jan Herrington[*], Garry Hoban, Lori Lockyer, Catherine McLoughlin[**] & Shirley Agostinho

University of Wollongong, Australia

[*]Edith Cowan University, Australia

[**] Australian Catholic University, Australia

Abstract

An Australian federally funded project, ***Information and Communications Technologies and their role in Flexible Learning***, aims to produce generic/reusable learning design resources to assist academics to create high quality, flexible learning experiences for students. This poster provides a summary of the project activities in order to achieve its purpose.

Project Aim and Deliverables

This project aims to produce generic/reusable learning design resources to assist academics to create high quality, flexible learning experiences for students. This is to be achieved by:

- Identifying high quality learning designs used in higher education;
- Selecting those that are suitable to be redeveloped in the form of reusable software, templates and/or generic guidelines; and
- Developing these reusable resources and making them accessible from a central web site (which will be hosted by DEST).

The term "learning design" refers to a variety of ways of designing student learning experiences, that is, the sequence of types of activities and interactions. The scope of a learning design may be at the level of a subject/unit or subject/unit components. This project is focusing on learning designs implemented with the use of ICT and how flexible learning opportunities for students can be afforded through the use of such technologies. The composition of a learning design, particularly when ICT mediated, has been informed by the work of Oliver (1999) and Oliver and Herrington (2001). Thus, for the scope of this project, a learning design, comprises three key elements: the content or *resources* learners interact with, the *tasks* or activities learners are required to perform, and the *support* mechanisms provided to assist learners to engage with the tasks and resources.

The project began in November 2000 and is structured against four milestones:

- *Milestone One (May 2001):* Development of the Evaluation and Redevelopment Framework
- *Milestone Two (November 2001):* Identification and documentation of learning designs that foster high quality learning experiences and that have the potential for redevelopment in a generic/reusable form.
- *Milestone Three (June 2002)*: Design of the final project web site and completion of development plans for the generic products to be produced.
- *Milestone Four (December 2002):* Completion of the development of generic/reusable learning designs in a more generic form and finalisation of the web site that will store these resouces.

Major Project Activities

Development of an Evaluation Instrument - Evaluation and Redevelopment Framework (ERF)

The purpose of the ERF is to identify ICT-based learning design exemplars that foster high quality learning experiences, and to determine whether these exemplars have potential to be redeveloped in a more generic/reusable form. (The instrumentation is available at www.learningdesigns.uow.edu.au.)

High quality student learning is purported by this project as having potential to be achieved by applying four key principles (Boud & Prosser, 2001) in a learning environment: *engaging* learners, acknowledging *context*, *challenging* learners, and providing opportunities for *practice*.

Applying the ERF to Learning Design Exemplars

The project has identified over 50 ICT -based learning design exemplars and 28 were selected for evaluation. An ERF evaluation iteam comprised international educational technology and/or pedagogy expertise. Two evaluators were allocated to conduct an evaluation for each learning design exemplar.

Developing reusable Learning Design resources

To ensure the learning design exemplars evaluated represent a range of learning designs, the project team has developed a Learning Design Categorisation Framework. A number of exemplars have been identified as suitable for redevelopment in a generic/reusable form. The project development process comprises activities such as designing and developing the web site and developing and evaluating the generic learning design resources.

References

Boud, D., & Prosser, M. (2001, April). *Key principles for high quality student learning in Higher Education—form a learning perspective* Paper presented at a workshop held on April 27, 2001 for the AUTC funded project: Information and Communication Technologies and Their Role in Flexible Learning, Sydney, Australia.

Oliver, R. (1999). Exploring strategies for on-line teaching and learning. *Distance Education, 20*(2), 240-254.

Oliver, R. & Herrington, J. (2001). *Teaching and learning online: A beginner's guide to e-learning and e-teaching in higher education.* Perth: Edith Cowan University:

Development of Chinese language multimedia teaching material with a partial perception system utilizing 3D virtual space

Hiroaki HASHIGUCHI, Shinich FUJITA, Da Yang, Ming Yin, Seinosuke NARITA
Waseda University
3-4-1, Okubo, Shinjuku-ku
Tokyo, Japan
hasiguti@narita.elec.waseda.ac.jp

Abstract: It is common for educational materials used in conventional language education to begin from such elementary structures as "Hello!", "This is a..." or "Is this a..?". However it has not been sufficiently explained, pedagogically, what we begin learning in such an order or at such a stage. On the other hand, it is important to consider how we acquired our mother tongue. If a foreign language learner can learn just as we acquired our mother tongue, it is possible for learners to study efficiently and memorize words or expressions. In this paper, I would like to explore the feasibility of connecting language education and spatial perception by using 3D virtual space.

Introduction

When looking from the perspective of language learning, the textbooks that we traditionally used to start studying a foreign language began from such greetings as "good morning" or "hello". And we move into what we call elementary grammatical studies such as, "This is a pen." or "Is this a pen?". In the particular case of Chinese, the first section of most textbooks begins with "hello" and "thank you". Then, in the following order, come "temporal expressions" to "place expressions", "aspect", "can do..." and "passive/causatives". However, with the advance of cognitive science and cognitive linguistics, it has become clear that many of the words generated in abundance in our linguistic lives have a very profound connection with our experience and recognition of space that surrounds us. For instance, in terms of visual function, we achieve recognition in order of "light", "color", "one dimension", "two dimensions" and "three dimension". By two to four year olds, it is generally said that such adjectives as "thick" or "thin", which describe an amount three dimensional space, are used less frequently than two-dimensional adjectives such as "long" or "short". In addition to this, it is also understood that we come to recognize the "fourth dimensions (time)" after we have recognized such things as space. This is because, such expressions related to space as "before" or "after" that involve such space as "day after tomorrow", "three days ago" or "four days after" are frequently converted in the concept of time. In other words, the expression of space becomes the core of various words. For these reasons, acquiring spatial expression, felt by mankind through the senses, is indispensable in learning languages. In this system, I have decided to justify this learning theory using courseware that utilizes 3D virtual space. Research and development of multimedia educational materials using computers have been carried out in various countries, and their functionality has been improving year by year. Most of them fully utilize such characteristics of the computer as image, voice and network. Above all, I will strive to create a more effective system in which one can acquire practical expressions through the senses, with the learner acquiring a foreign language successfully. I hope it will be of help to progress in and to change language education in the future.

In development

In terms of pedagogy, research focusing on using VRML has been carried out for educational materials that use 3D. However, the reality is that the movement of fine areas cannot be expressed sufficiently with

VRML. For instance, Wolfgang Broll and his associates have realized 3D space using VRML [1]. The picture in their system is easy to look at, on the whole, but animation in such fine, detailed parts as hand or leg movements is not sufficiently expressed. As this system is aiming for something where one can acquire words using the senses whilst experiencing realistic space, I have decided to use Director8.5 by Macromedia, where the realization of fine, detailed 3D space animation is needed [2].

The system

I will explore how much impact this system has by having learners who have never studied Chinese take all five lessons of this system, and then evaluating them. The learner is to experience 3D space as a newborn baby would, in line with the curriculum indicated in the following. In addition, by repeating the process of moving by him or her self or touching things, the student is to learn the language. Subjects for all five lessons will be prepared for the learners.

First lesson: New-born. One begins to recognize things that surround one.
As newborns, we gradually acquire words through use of the senses by understanding the situations and things that surround us. Based on this premise, the lesson will have the learners experience similar circumstances (Figure 1). For example, after birth, a baby first meets parents and siblings, and then performs such actions as drinking milk. If we do to so, we acquires appropriate words through the senses. This lesson will have the learner experience similar circumstances.

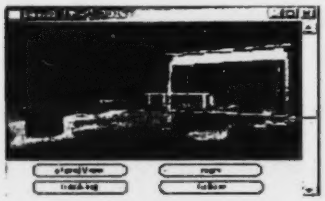


Figure 1 : Sample of this system

Expected result

There are two possible results anticipated here. First, learning time could be shortened. Secondly, it is conceivable, even with regard to such expressions as "temporal expression", and "localization of nouns", which were difficult to master in a traditional place of learning, that the learner will be able to form such expressions independently. This latter application, mentioned above, is something we see frequently in our daily lives. For instance, when we think of the expression, "up" or "down", if we have acquired the knowledge in 3D space through the senses that we climb a flight of stairs, when we encounter such a phrase as "pick up", we can imagine what it means immediately. In this way, expressions that have been acquired through the senses have a very wide range of application. Although "good morning" can only be used as a greeting, the expression "up" or "down" can be used in various phrases.

References

1: Wolfgang Broll "Using 3D to Support Awareness in virtual Terms on the Web", Webnet1999—Vol1.pp137-142, 1999

2: http://www.oshige.com

Building a Community of Learners and Encouraging Discussions in a Purely On-Line Course That is Quantitative in Nature

Jay S Holmen
Professor of Accounting & Finance
University of Wisconsin—Eau Claire
Eau Claire, WI, USA
Holmenjs@uwec.edu

Abstract: Teaching an on-line course can be challenging, especially one that is primarily quantitative in nature. How can we help the students to feel they are not alone, but rather are part of a community of learners? What do students discuss in a number-crunching course? Five elements were designed into the course to encourage student participation and a feeling of belonging. They are: 1) development of a personal homepage, 2) weekly discussion topics, 3) a course-long collaborative project, 4) a designated area to ask questions of the instructor, and 5) an area for the students to have open-ended, unstructured discussions.

Teaching an on-line course can be challenging, especially one that is primarily quantitative in nature. One challenge is the asynchronous nature of the course—the students are not communicating at the same time. How can we help the students to feel they are not alone, but rather are part of a community of learners? How can we prevent the course from feeling like 25 courses of 1 student each rather than 1 course of 25 students? A second challenge is in fostering discussion in a course that is primarily quantitative in nature. What do students discuss in a number-crunching course? This paper will discuss several approaches that have been taken in addressing these challenges as they relate to teaching an accounting course.

The Context

The course I teach is an accelerated, graduate only Principles of Accounting course offered to students seeking admission to an MBA program. Since the course is graduate level, all of the students are "adult learners." The students all have a common goal—admission to an MBA program. Since the course is a foundation course for further business study, the student population is more diverse than in similar undergraduate courses. The students all hold degrees in a non-business field.

The course is offered by a consortium of schools in the University of Wisconsin System. The pre-MBA foundation courses are all offered using on-line asynchronous delivery. Once admitted to an MBA program, most of the students will take a majority of their classes on a physical campus. The course delivery platform currently in use is BlackBoard 5.

Accounting is a subject that emphasizes quantitative skills. In a business curriculum, accounting is considered one of the three "number-crunching" topics (along with mathematics/statistics and operations management). The objectives of the accounting course are to 1) Demonstrate an introductory understanding of the rules, concepts and principles that guide accounting practice, 2) Demonstrate a basic understanding of the use of financial statement information and related industry information to make business decisions, and 3) Demonstrate an understanding of the managerial uses of accounting information for internal decision-making.

Design Approaches to Encourage Student Involvement

Five elements were designed into the course to encourage student participation and a feeling of belonging. They are: 1) development of a personal homepage, 2) weekly discussion topics, 3) a course-long collaborative project, 4) a designated area to ask questions of the instructor, and 5) an area for the students to have open-ended, unstructured discussions.

The first task students are asked to perform is to prepare a personal "homepage" within the BlackBoard coursesite. Students are asked to provide information about their work experience, their current position, and why they are taking the course. They are also asked to provide information regarding their educational background and hobbies and interests as well. Finally, they are asked to post a digital photo of themselves. The instructor posted his own personal information as an example, using a very informal style.

Students are expected to master a number of quantitative skills during the course. A number of "homework problems" are assigned to assist the student in this endeavor. The quantitative solutions to these problems are posted on the coursesite. The discussions among the students emphasize what importance the quantitative results have and how management and others use them in decision-making.

Student discussions occur in two parts. First, the student is asked to prepare an individual response to a question and to post their response by Thursday evening. The students are then asked to read the responses by their classmates and to respond a second time—this time by the following Monday evening. Examples of some discussion questions:

- What is the role of accounting in modern society?
- Why is consistency and comparability so important for financial reporting?
- What is the reason for accruals and deferrals in accounting? Assume that you need to present a concise explanation for your superior (who naturally knows little about accounting). Define the terms, describe why they are necessary, and give three examples.
- How does the time value of money relate to either a) your house mortgage, b) your car loan, or c) your car lease?
- Access the annual reports for Compaq, Dell, and Gateway. Describe the differences in the capital structures of these three companies.
- Why doesn't the accounting concept of 'product cost' include all of the costs identifiable with a product?
- What are different ways that costs could be 'assigned' to cost objects?
- Give an example of each of the following that you interact with on a frequent basis: Cost center, Revenue center, Profit center, Investment center

These discussions are the main method of building the community of learners. Over the span of the 15-week course the students get to know each other through the continual interaction. It is possible that they interact more than they would in a face-to-face course.

A major assignment in the course is designed to require the students to collaborate on a financial analysis of a publicly traded company. The project is split into three sections, each lasting approximately 4 weeks. Groups of three to four students are created (to ensure that students would be from all geographical areas rather than concentrated in one area). The workload is also assigned, with one student designated the editor for preparing the report. The editor position is rotated among the students for each section.

An excellent technique used to help students feel less isolated is a discussion area called "Raise your hand—ask the Professor." This is a spot where a student can post queries regarding homework problems and concepts for the instructor. This technique is helpful in two ways. First, the students realize they are not alone—others have the same questions they do. Second, questions are centralized for the instructor so they can be answered once. This helps prevent the course from becoming a burden on the instructor, answering the same questions over and over.

The final component is an open-ended discussion area called "The water-cooler." This is a spot where students (and the instructor) can talk about whatever is on their mind. During the spring semester a lengthy debate over the relative merits of all-inclusive Caribbean resorts stretched over several weeks. Needless to say, this has helped everyone relax in the course.

Student Reaction

In post-course evaluations, many students expressed trepidation prior to taking the on-line course. Numerous students were concerned about the quantitative nature of the course. After the course was completed, most of them expressed satisfaction with the learning environment. As one student commented in an e-mail "…this was my first course in the MBA program, and I really feel like I learned a lot more than I expected to, mainly through the commentaries and the real-life examples posted by others through the discussion board." It is this instructor's opinion that the explicit community building design elements are a major reason for the students' high satisfaction levels with a potentially isolating and intimidating quantitative course.

The Effect of Speech and Pointing Conditions on the Comprehension and Recall Performance in a Multimedia Presentation

Cholyeun Hongpaisanwiwat
Department of Computer Science
Thammasat University, Thailand
Email: chhong@cs.tu.ac.th

Michael Lewis
School of Information Sciences
University of Pittsburgh, PA
Email: mlewis@mail.sis.pitt.edu

Abstract: Forty students from the University of Pittsburgh participated in a study conducted to examine the effects of pointing conditions and voice types in multimedia presentation on comprehension and recall performance. No significant differences were found in comprehension for voice types or pointing conditions. Nonetheless, voice types had an impact to recall performance. The participants viewing the presentation with a human voice had better recall for "pointed out" objects than the participants viewing the presentation with synthetic voice. Although not significant, the pointing condition led to worse recall performance than the no-pointing condition. This may reflect the result of distraction.

Introduction

Multimedia presentation can provide an effective learning environment by utilizing human memory of visual and verbal resources to produce better knowledge transfer. Mayer (2001) has shown that verbal narration accompanying visual information can be simultaneously processed in working memory to help learners digest material. Sweller (1999) has shown that multimedia presentation can make technical material become easily understandable. However, there are few studies of the effects of attentional control or voice type in multimedia presentations.

Instructors frequently point to objects to draw students' attention to those that are crucial elements for a lecture, or to make a referential link. Faraday and Sutcliffe (1997) have shown similar effects for multimedia presentations in which objects to which the subjects' attention was directed by an arrow are better recalled.

The quality of voice used in presenting a multimedia lesson is another important determinant of comprehension. Even though advanced synthetic speech, known as text-to-speech, has been used in many applications such as telephony systems and reading e-mail, a human voice is generally preferred. Recent research has found that while comprehension of synthetic speech was significantly worse than human recorded speech; after people grew accustomed to the synthetic speech, the comprehension performances of both speech conditions became comparable (Lai, Wood, & Considine, 2000). The goal of this study was to examine the joint effects of synthetic and human speech, and a pointing symbol on comprehension and recall performance in multimedia presentation.

Methodology

In an effort to simulate a real-life situation, a finger symbol was used as a pointer. The study was a 2 (voice types: synthetic and human) by 2 (pointers: no-pointer and finger) between-subject design. The dependent variables were comprehension and recall performance of "pointed to" and "non-pointed to" objects.

PowerPoint slides from a conventional computer graphics course were used as the basis for the multimedia presentation. The script of each slide consisted of the instructor's narration and a sequence of locations to which the instructor had directed attention.

Forty University of Pittsburgh students who had never taken a Computer Graphics course were recruited as participants. Upon arrival, participants were told that they would be participating in a multimedia learning environment study. They viewed two sets of slide presentations. The presentations were set to run automatically without any intervention from the students. The participants were required to wear the headphones and were informed that they would be listening to a computer-generated voice for the presentation. When the first presentation stopped, the participants were given tests before proceeding to the second presentation.

Results

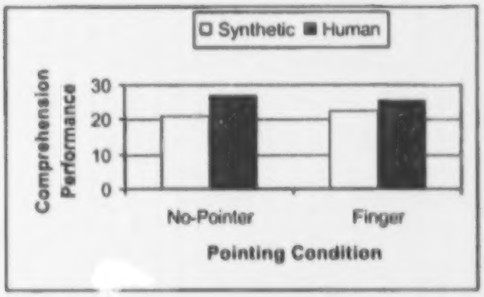


Figure 1: Mean values for comprehension by voice type and pointing condition

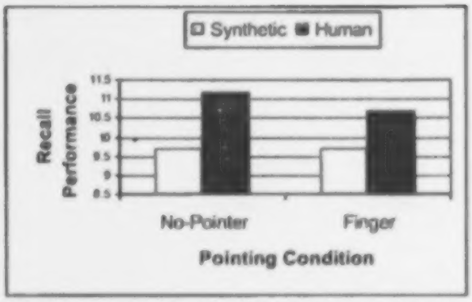


Figure 2: Mean values for recall performance by voice type and pointing condition

The result showed that neither voice type nor pointing had a significant effect on comprehension. Nonetheless, the participants listening to the human voice presentation had marginally better comprehension performance than the participants in synthetic voice condition ($F(1,39)=3.091$, $p=0.087$) as seen in Figure 1. The result also showed that listening to synthetic voice presentation caused poorer recall performance for both "pointed to" and "non-pointed to" objects ($F(1,39)=4.468$, $p < 0.05$). As seen in Figure 2, students viewing the presentation narrated by synthetic voice had poorer recall performance than students who viewed the presentation with human voice. Interestingly, pointing did not affect recall performance. Voice type was found to affect recall performance for "pointed to" objects ($F(1,39)=4.408$, $p <0.05$), but not "non-pointed to" objects. The results also showed no effect of pointing conditions on recall performances for "pointed to" or "non-pointed to" objects. Contrary to expectation, the performance of recall involving "pointed to" objects in the finger conditions were worse than the recall performance in the no-pointing condition ($F(1,39)=3.061$, $p=0.089$).

Discussion

This study did not support the previous findings that synthetic speech led to poorer comprehension than human speech. This is encouraging for multimedia applications because it is more efficient to synthesize speech than to store an exhaustive library of utterances. However, the human speech led to better recall performance than the synthetic voice. This may be because the synthetic voice required participants to pay more attention and spend more cognitive resources for processing audio information than visual information; as a result, the participants poorly recalled visual objects. In other words, this effect may reflect the interference between visual and verbal resources of which one resource demands more processing than the other when a source of information is unclear. In addition, since the content used in this study is somewhat specific in technical areas, the result may not hold across other content areas. Surprisingly, the use of pointing to guide attention led to poorer rather than better recall for the "pointed to" objects. We hypothesize that because the pointer remained visible on the presentation all of the time the pointer and its movements may have distracted the learners. A further study could eliminate this source of distraction by using a pointer which appears only when a referential point is made and is faded out when it is not necessary.

References

Faraday, P., & Sutcliffe, A. (1997). Designing effective multimedia presentations. *In Proceedings of the ACM Conference in Human Factors in Computing Systems --CHI'97 Conference Compassion (pp. 272-278).* NY: Association for Computing Machinery.

Lai, J., Wood, D., & Considine, M. (2000). The effect of task conditions on the comprehensibility of synthetic speech. *In Proceedings of the ACM Conference in Human Factors in Computing Systems --CHI'2000 Conference Compassion (pp. 321-328).* NY: Association for Computing Machinery.

Mayer, R. E. (2001). *Multimedia learning.* Cambridge, NY: Cambridge University Press.

Sweller, J. (1999). *Instructional design in technical areas.* Australian Education Review No. 43, Victoria: The Australian Council for Educational Research Ltd. (ACER). Press.

Ocean View and River Run: New Internet Tools For Facilitating Scientific Inquiry

While the science education community values inquiry-based science instruction, implementation at the K-12 level remains illusive. Public school science teachers often site problems with time, supplies and equipment as reasons for not implementing inquiry instruction. However, new Internet based Java Applets provide exciting new opportunities for teachers to implement inquiry into local environmental problems using massive data sets previously not available. These Internet based resources are user friendly, highly interactive and engaging for students at all levels. This session will model the use of two locally developed Java Applets designed to support inquiry instruction as called for in the National Science Education Standards (NRC, 1996).

A Visual Tool to Support Personal Management of Information on WWW

Akiko Inaba and Takanori Yamamoto
ISIR, Osaka University, 8-1 Mihogaoka, Ibaraki, Osaka, 567-0047 Japan
inaba@ai.sanken.osaka-u.ac.jp

Abstract: We have developed a visual tool to support personal management of information on WWW; MyBookMark. The MyBookMark realizes the following; (1) to adopt two-dimensions DMI like graphical depictions of Venn diagrams, in order to provide the overview of the bookmark-holders and simple operations both saving and searching bookmarks, (2) to allow users to save a bookmark in several folders, in order to reduce difficulty to select only one folder for saving it, (3) to provide flexible searching functions using the information about web pages, in order to make easy to find an intended bookmark, and (4) to treat the data of multiple bookmarks, which indicate the same web page, as unified data, in order to reduce confusion. The tool was valued at easy to use, convenience and useful by users

The Problems

When you save a link to a web page as a bookmark into "My Favorite" system, which is embedded in a popular web browser, have you ever had difficulty to decide which folder is suitable for a bookmark? Have you ever had difficulty not finding the bookmark which must have been saved into the system? In a bookmark management system like the My Favorite system, the bookmarks, which indicate the same web page, are often scattered here and there. Does it get confused? Due to the hierarchical structure adopted in such system, these problems are occurred. Do you feel easy to use such systems?
It seems to be difficult to construct a reasonable hierarchical structure to classify web pages. The hierarchical structure will work well in well-structured already-known world, but WWW is increasingly growing and ill-structured world. Moreover, there are so many web pages in different grain sizes; some pages deal with very specific topic, and some pages have a lot of information like an overview. If you save a page which has so many information, you may want to save it into several folders. For searching the bookmark, you will want the system to treat the bookmarks to the same web page as the same bookmark, even if they are in different places. Supposing a tool also offers flexible searching functions, it will be wonderful. Of course, it is also important the tool is easy to use, and its interface is seamless through all functions.

MyBookMark: A Visual Tool to Support Managing Information on WWW

To solve the problems, we have developed a visual tool for managing personally an increasing number of information on WWW; we call the tool "MyBookMark". The MyBookMark will work as a personal meta-database for WWW like the My Favorite system. Fig. 1 shows an example of saved bookmarks and information added to the bookmark. In the figure, there are three windows; (a) is the window of a popular web browser, (b) is the main window of the MyBookMark, and (c) is the window showing information added to a bookmark. The MyBookMark works as plug-in tool for Internet Explorer. Users can start the tool to click a button located in the tool bar of the browser. In the main window, there are several folders to save bookmarks; "HCI", "AI", "CSCL", "conference" and so on are labels for each folder. When the user click one folder (or intersection of several folders) in the window, the tool shows bookmarks which are saved in the folder(s) as a list in the green box; in this example, "E-Learn2002", "AIED2003" and so on are the title of the bookmarks which are saved in the folders "CSCL" and "conference". In (c), there is information added to the bookmark "E-Learn2002". Each bookmark has a title, an

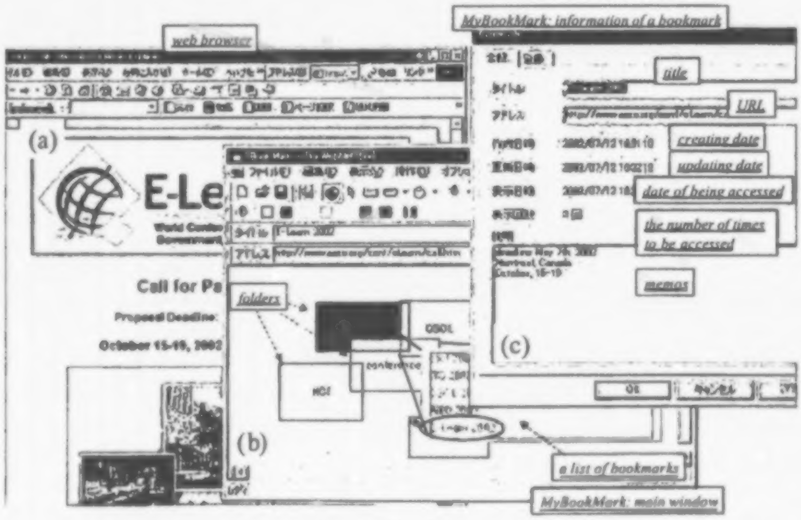


Figure 1: An example of saved bookmarks and information added to the bookmark.

BEST COPY AVAILABLE

URL, creating date, updating date, date of being accessed, the number of times to be accessed, and memos. Users can edit the title and memos, as they like.

The MyBookMark has several advantages as follows;

- *We can know instantaneously what folders are already made to classify bookmarks.*

The MyBookMark has one window in two-dimensions to arrange folders, save bookmarks, and search them. In the window, all folders are the same layer, and we can see the folders all together.

- *We can make, color, resize folders as we like, and arrange them any places in the area of the tool window.*

The MyBookMark has direct manipulation interface. We can make a folder by drawing a rectangle in the tool window. To change color or size of the folder, the window has buttons in its toolbar. We can locate the folders on any place in the window by simply dragging them.

- In the MyBookMark, data of multiple bookmarks, which indicatethe same web page, are treated as a unified data.
- *We can add memos to each bookmark.*

The memos can be used in searching phase mentioned below.

- *We can use flexible searching functions to find intended bookmarks.*

(1) The MyBookMark adopts graphical depictions of Venn diagrams to realize AND searching function. By making an intersection between two folders, users can get the list of bookmarks which are saved both the two folders.

(2) Users can use titles and URLs of saved bookmarks for searching. Moreover, they can use the information, like memos, creating date, and the number of times to be accessed, as searching cues. In the example of fig. 2 (a), the user creates keyword-searching area for memos; the keyword is "Montreal". To make intersection between the keyword-searching area and folders, the user can get bookmarks, which saved in the folders "conference" and "CSCL", and have the keyword in their memos.

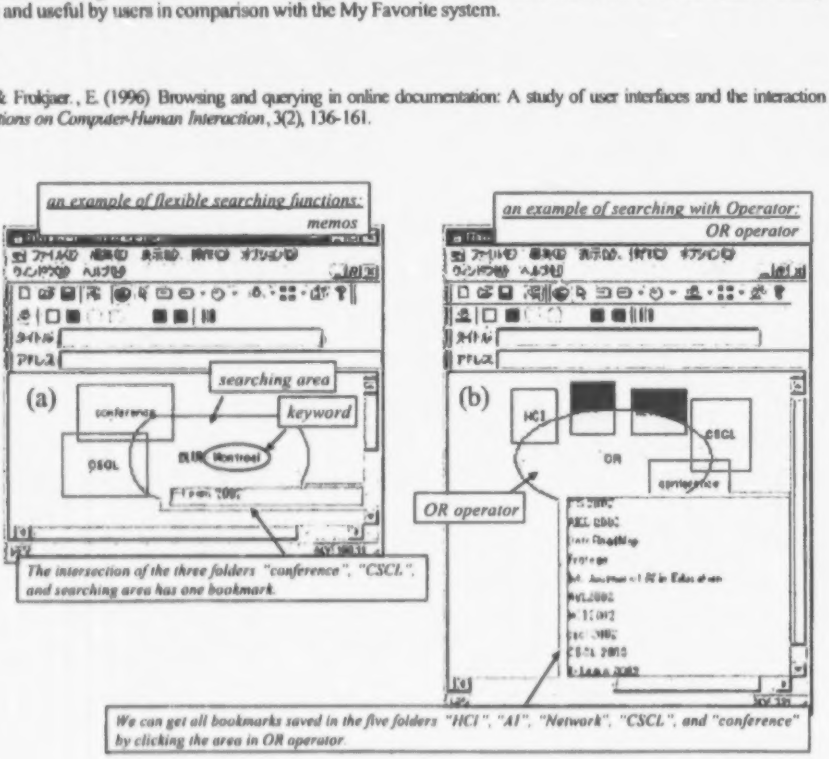
(3) A problem with this format is the limitations on the complexity of the expression. For example, a maximum of three query terms can be ANDed together in a standard Venn diagram (see Hertzum & Frokjaer 1996). To solve the problem, we prepare Operators. The Operators have three functions; AND, OR, and NOT. Users can do complex search with the operators (See an example in fig. 2 (b)).

Summary

We have developed a visual tool to support personal management of information on WWW; MyBookMark. The tool realizes the followings; (1) a seamless interface for saving and searching bookmarks by adopting a two-dimensions direct manipulation interface like graphical depictions of Venn diagrams, (2) searching cues added to bookmarks, and (3) flexible searching functions using information about web pages like titles, memos, and URLs. The tool was valued at easy to use, convenience and useful by users in comparison with the My Favorite system.

References

Hertzum, M. & Frokjaer., E. (1996) Browsing and querying in online documentation: A study of user interfaces and the interaction process, *ACM Transactions on Computer-Human Interaction*, 3(2), 136-161.



The intersection of the three folders "conference", "CSCL", and searching area has one bookmark.

We can get all bookmarks saved in the five folders "HCI", "AI", "Network", "CSCL", and "conference" by clicking the area in OR operator.

Figure 2: Flexible searching functions

BEST COPY AVAILABLE

The Formation of Experts in the Handling of the TIC. The Case of the Mexican Librarians.

Maribeth Johnson Díaz
Instituto Mexicano de la Administración del Conocimiento A.C.
México
maribeth.johnson@imac.org.mx

Abstract: The libraries have stopped being simple centers of resources and now are transformed into real information units, in where new forms of communication and information access are promoted as innovating systems are implemented in order to support the education-learning processes. In this context, the Mexican Institute of Knowledge Management along with the Public Libraries Board of the National Council for the Culture and Arts of Mexico are looking forward to create new expert Training Monitors to promote the better use and advantage of the ICT.

Introduction

The fast scientific and technological development during the last years has caused a transformation in the way to think and to communicate between us, lately changes that without doubting have significantly stroke its role that had had within the society in the public libraries. Actually, many of these libraries have stopped being simple centers of resources and now are transformed into real information units, in where new forms of communication and information access are promoted as innovating systems are implemented to support the education-learning processes.

In this context, the Mexican Institute of Knowledge Management along with the Public Libraries Board of the National Council for the Culture and Arts of Mexico are looking forward to create new expert Training Monitors to promote the better use and advantage of the ICT.

The experience which we want to share in this congress is about the first stage of this project. Stage integrated by the implementation of a workshop for the national librarians monitors.

Development of the Workshop

The intensive course was given during two weeks, with a 9 to 5 schedule, in which 20 instructors participated. Is important to mention that this group of monitors is responsible to enable the personnel of the public libraries of all Mexico.

The complete information of the workshop was available through Eduweb-IMAC (the Mexican Institute of Knowledge Management's website). Eduweb-IMAC is an e-learning platform which, through the net, promotes the use of telematics and asynchronous tools of communication and information to create virtual communities and the collaborative learning.

Introduction to Internet and its Main Tools of Communication

During this introductory phase, the participants cleared their doubts about the creation and fundaments of the Internet: At the same time, the participants learned how to open a free e-mail account , which would be constituted as an important communication tool for this course.

The rest of the course contents were integrated in three sections:

I. Introduction to the information society.
II. Information technologies.
III. Information products and services.

The workshop was developed with an intensive participation through the three discussion forums. During the course, the number of contributions grew in amount and quality. The participants shared their own experiences in order to get a feedback.

As a final exercise, they had to recreate the content and activities of their own workshops based in their new achieved know ledges.

The participants proposed to integrate into their programs the following:

- The public library and its new role in the information society
- Development of information skills for the librarians
- Evaluation of electronic resources
- Formation of library users
- Development of a social marketing program for the public libraries

Also, the instructors realize the necessity to count with a basic informatics kit to support their presentations, in order to be congruent with their speech and the used tools.

Conclusions and Recommendations

This workshop woken up different reactions among the assistants. There were some of them who face the possibility of a complete change of the way they taught. Others, recognized themselves like isolated professionals, but with a renewed interest to learn and update themselves; and some others showed their necessity to review the Mexican public libraries goals. However, the constant element, was the massive need to integrate themselves into the new working dynamics in order to develop and consolidate their projects.

As a result of all this, a new virtual community was integrated by all the participants of the workshop. The members must develop personal activities and lead their groups to encourage their communities.

Through the communication tools of the Eduweb-IMAC, as forums, e-mail and chat rooms the members of the community will keep in touch.

Creation of an Institutional Website.

Therefore the National Council for the Culture and Arts of Mexico realize the necessity to create its own website, which must to have three areas: Communication, Information and E-learning.

Communication

This area will be able to improve the communication between the main department's managers with their staff and with the main offices around the country.

Information

The creation of a Information Unit and a Resources Center will be a basic tool to share and exchange information but at the same time it will promote the construction of knowledge and the cooperative work.

E-learning

The integration of an e-learning platform will be helpful to trainee more people in less time by low cost. Through this new perspective, the distance education will become an excellent option encourage the ICT training.

Conclusion

This workshop is the beginning in the long way to transform and integrate the Mexican librarians into the Information Society. However, this first step to create new ICT Training Monitors will be able to reproduces and improve this new paradigm on which the Mexican public libraries are developing.

Successful Strategies: Collaborative Learning for Blended Courses

Claudine Keenan and Arthur Scott – The Graduate Center of Marlboro College

Abstract:

What are the best ways to collaborate in a blended environment that includes both onsite and online components? Instructors at The Graduate Center of Marlboro College have found that combining constructivist and situated learning approaches leads to successful collaborations among their adult students, enrolled in internet-focused master's degree programs. The instructors use role-plays, scenarios, story and case-based learning in both the onsite classroom and online. These situated learning approaches, when combined with constructivist methods such as team projects, virtual mentors, and peer review assignments, allow students of all learning styles and abilities to achieve stronger performance on their portfolio work. This paper will examine all of these approaches as they are applied in these environments, using a variety of synchronous and asynchronous technology tools, including FirstClass Conferencing, Instant Messaging, listservs, and WebBoards, among others.

Developing a Virtual Master of Engineering at UTS: a Case Study

Koosha, H

Faculty of Engineering, University of Technology, Sydney (UTS), PO Box 123, NSW 2007, Australia
Email: homa.koosha@uts.edu.au, URL: http://www.eng.uts.edu.au/~hkoosha

Madadnia, J.

Faculty of Engineering, University of Technology, Sydney (UTS), PO Box 123, NSW 2007, Australia
Email: j.madadnia@uts.edu.au, URL: http://www.eng.uts.edu.au/~jafarm

Anderson, T.

Faculty of Engineering, University of Technology, Sydney (UTS), PO Box 123, NSW 2007, Australia,
Email: tom.anderson@uts.edu.au

Abstract

This paper comment on the design and development of a completely Online-subject entitled *Managing IT in Engineering (MITE)*. Combined email, web-site and interactive-internet facilities using Blackboard software have been developed to provide an enhanced learning environment. The paper points to ways in which the experiences gained could be used for developing other subjects in a Master of Engineering course.

Keywords

Information Technology, global education, learner-focused education, Internet, life-long learning, reflective practice, engineering management

Introduction

Educational tools using information and communication technologies (ICT) offer flexible, interactive learning environments which educational institutions are using to provide high quality education customised to learner requirements. The needs of the student in the global environment include the fast exchange of information, which can facilitate more rapid learning.

Managing IT in Engineering

- The authors have increased their use of online teaching since early 1999 when they started with a website for online resources of teaching materials that was used in conjunction with traditional face-to-face teaching, and tutorials. The authors noticed that within tutorial groups the use of student teams encouraged students to take a deep approach to their learning. However student collaboration outside tutorials was insignificant, (Madadnia & Koosha, 2000).
- In 2000, the authors extended their use of online environments with a pilot model of a fully online subject with no face-to-face teaching. The flexible learning environment suited off-campus students. The students were mainly mature age, postgraduate with substantial work experiences in a wide range of fields including education, telecommunication, engineering, and management. They demonstrated their skills in management, ICT, and engineering by developing as an assessment task an ideal online subject. In partnership with students, the authors developed a common understanding of the techniques, which were perceived by students to improve student learning.

Guiding the development of the fully online subject was the authors' belief that:

- Students adopt different approaches (deep or surface) to learning, and the approaches adopted are strongly influenced by the teaching and learning design not applied technology (Ramsden, (1992); Prosser & Trigwell, (1999)
- Use of online learning environments can enhance student learning and skill development in research as suggested by Alavi, *et al* (1995); and Ives & Jarvenpaa, (1996).
- The use of teaching strategies such as student learning partnerships
- Can further motivate student participation in activities leading to enhanced learning, understanding, and research capabilities (Madadnia & Koosha (2000) and Madadnia et al (2001a-d).

Significant feature of the development of MITE proved to be the implementation of teaching and learning activities in virtual teams (VT). A VT is used by students for critical discussion with peers and facilitators. Katzenbach & Smith, (1993); Keen, (1990); Jarvenpaa & Ives, (1994); and Gorton & Motwani, (1996) have shown that such activities can lead to increased student satisfaction through enhanced learning and skill development.

The online delivery of MITE proved to be a creative learning environment and open to innovative thinking and suggestions. The web site access statistics indicate the level of involvement of the students. 56 off-campus students accessed different parts of the subject's learning environment 64,892 times (an average of 1160 hits per student). A breakdown of access data indicates that students used the software:

- 35.8% as an information resource to access learning materials (Content Areas),
- 36.7% for synchronised and asynchronised discussions with peers and facilitators (Communication Areas),
- 10% for discussion within their virtual teams (Group Areas), and
- 13.1% for student assignments, home pages, CV, journals and other similar student homework (Student Areas).

Students accessed the site around the clock, seven days a week, throughout the semester.

As part of subject feedback students were asked to compare and rate their preferred technologies to be used in an online Master of Engineering course at UTS. Table 1 provides student perception of a preferred degree delivery approach

Techniques and technologies	Relative score
1. Interactive Learning Environment (Blackboard software)	100
2. Online voice and video (no interaction)	83
3. FTP and bulletin boards	82
4. E-mail	79
5. Block mode delivery and face to face teaching.	67
6. Corresponding (Paper based) course	57
7. CD ROM	40

Table 1. Preferred Degree Delivery Technology

In considering the students' ranking of technology it should be remembered the student were off campus & mature aged. The ranking is also based solely on the students' perception of the ability of each technology to meet their needs. It does not take into account other factors, such as cost or feasibility.

Conclusion

The trend in education is to provide flexible courses, which train, educate, and develop skills. In this paper we have presented evidence of student perception of delivery techniques used at UTS that suggest an interactive Blackboard (UTSonline) type delivery is the best when accompanied with an appropriate learning design, a conclusion supported by Biggs (1999), and many others.

References

1. Alavi, M., Wheeler, B. C. & Valacich, J. S., (1995), Using IT to reengineer business education: An exploratory investigation of collaborative telelearning, MIS Quarterly, vol. **19**, pp 293-312.
2. Biggs, J., (1999), Teaching for quality learning at University, Buckingham: Open University Press
3. Gorton, I. & Motwani, S., (1996), Issues in co-operative software engineering using globally distributed teams, Information and Software Technology, vol. **38**, pp 647-655.
4. Ives, B., & Jarvenpaa, S. L., (1996), Will the Internet revolutionize business education and research?, Sloan Management Review, vol. **37** (3), pp 33-41.
5. Jarvenpaa, S. L., & Ives, B., (1994), The global network organization of the future: Information management opportunities and challenges, Journal of MIS, vol. **10** (4), pp 25-57.
6. Johnson, D. W., & Johnson, R. T., (1989), Cooperation and competition,: Theory and research. Edina, MN: Interaction Book Company.
7. Katzenbach, J. R., & Smith, D. K., (1993), The discipline of teams,. Harvard Business Review, pp 111-120.
8. Keen, P. G. W., (1990), Telecommunications and organizational choice, In J. Fulk & C. W. Steinfield (Eds.), Organizations and Communication Technology (pp. 295-294), Newbury Park, CA: Sage.
9. Madadnia, J., & Koosha H., (2000), Development of a learner-focused engineering subject, Proceedings of the International Conference in Engineering Education (ICEE2000), Taiwan, ISSN-1562-3580.
10. Madadnia, J., Koosha, H., & McKenzie, J., (2001a), Development of a learner-focused, sustainable-engineering subject, Australasian Journal of Engineering Education, vol..9 (2), pp179-193
11. Madadnia, J., Koosha, H., & Mckenzie, J., (2001b), A collaborative partnership approach to virtual research supervision, Australiasian, Association of Engineering Education (AAEE), QUT, Brisbane, 26th-30th of September.
12. Madadnia, J., Koosha, H., &.Housego, S., (2001c), In search of techniques to improve student learning in an online engineering subject (Students perception), Australiasian, Association of Engineering Education (AAEE), QUT, Brisbane, 26th-30th of September.
13. Madadnia, J., Koosha, H., & McGregor, H., (2001d), Developing Virtual Teams in an Online Engineering Subject, Australiasian, Association of Engineering Education (AAEE), QUT, Brisbane, 26th-30th of September.
14. Prosser, M., & Trigwell, K., (1999), Understanding learning and teaching: The experience of higher education, Buckingham: Open University Press.
15. Ramsden, P., (1992), Learning to teach in higher education, London, Routledge.

Developing of Assessment Techniques in Learner-Focused Online Subjects

Koosha, H

Faculty of Engineering, University of Technology, Sydney (UTS), PO Box 123, NSW 2007, Australia
Email: homa.koosha@uts.edu.au, URL: http://www.eng.uts.edu.au/~hkoosha

Madadnia, J.

Faculty of Engineering, University of Technology, Sydney (UTS), PO Box 123, NSW 2007, Australia
Email: j.madadnia@uts.edu.au, URL: http://www.eng.uts.edu.au/~jafarm

Abstract:

Ever increasing demand for quality learner-focused, lifelong virtual courses necessitates a careful consideration and attention to effectiveness of *assessment techniques"*. This article describes how virtual assessments were developed and evaluated in a completely online subject. The virtual students were involved in development and selection of virtual assessment techniques including online self, peer, and the instructors' assessments. Most students were satisfied with the outcome of virtual assessment.

The authors noticed that learning about significance of virtual assessments could be attained to the satisfaction of more students if sufficient time is spent on introducing the role of virtual assessment in enhanced learning.

It was realised that assessment in virtual environment can enhance student learning and need to be considered in the development of a learner-focused subject.

Keywords

Virtual assessment, IT, elearning, global education, learner focused education, Internet, life-long learning, reflective practice, engineering management,.

Assessing Students

Ever increasing demand for quality learner-focused, lifelong virtual courses necessitates a careful consideration and attention to effectiveness of *"assessment techniques"* (Biggs, 1999). Assessment is fundamentally about helping students to learn and teachers to learn about how best to teach them, (Ramsden, 1998). Assessment is about getting to know our students and the quality of their learning. (Rowntree, 1977).

The University's surveys by Course Monitoring and Improvement System Analysis and Data between 1998-2000 have identified assessment as the top priority area for enhanced learning. The second priority was using virtual tools such as UTSOnline as an additional medium for assessment. At our university, the rollout of e-learning opportunities for students has been rapid, from one pilot subject with 550 students in 1997, to over 500 subjects with 16,000 students in 2001. These opportunities have afforded increased flexibility in time and location of learning for students, and in many cases has also afforded qualitatively different learning experiences. In recognition of these achievements, the e-learning initiative at UTS won an international and a national award in 2000.

The challenge is developing an effective assessment, which would enhance student learning in a virtual environment. Brown and Dove (1991) have highlighted the significance of involving students in peer assessment. The Authors have also developed a distinctive and innovative approach to the integration of e-learning into teaching and learning, and student assessments (Madadnia et al. 2001a-d). The authors' surveys of their virtual students in their two completely online subjects, Managing IT in Engineering (MITE) and Project Management Support Systems (PMSS) have shown that engaging students in the learning assessment has

- Improved student understanding of assessment criteria".
- Reduced strains on the relationship between the assessor and the assessed.

- Improved team working and collaboration between students instead of competition.
- Made assessment a fun rather than a burdensome tedious one-way process with little real learning.
- Generated benefits in students' both enhanced learning by doing, and satisfaction which can justify the time and energy assessments take.
- Assisted students to learn through assessment as an integral part of learning process rather than regarding it as a separate and discrete event.
- Assisted student to consider assessment as a teaching, or skill development activity rather than a testing device, and therefore contributes to the learning process.
- Appreciated the significance of team assessment since teamwork is often the nature of working in any industry.
- Provided opportunities for more people to take part in the assessment process with maximum interchange between learners themselves as well as educators.
- Built trust and confidence in students allowing them to take a risk and feel that they are will be supported if they make a mistake in peer assessment.
- Reassured that the emphasis in assessment is on developing, rather than a simple "right or wrong".

However the authors experiences have indicated some shortcoming in engaging students in assessments such as:

- Students avoided passing judgement on their peers or gave everyone the same "mark". It was difficult to assess virtual team performance in parallel with individual contributions.
- There is no simple formula to solve these kinds of problems. It is against this background, however, that the paper suggested the particular approach towards more learner involvement in the assessment.

References

1. Ramsden, P., (1998), Learning to lead in higher education , Routledge, N.Y 10001.
2. Biggs, J., (1999), Teaching for quality learning at University, Buckingham: Open University Press
3. Brown, S. and Dove, P., (1991), Opening mouths to change feet: some views on self and peer assessment, in Brown, S. and Dove, P. (Eds.), Self and Peer Assessment, Standing Conference on Educational Development Paper 63.
4. Madadnia, J., Koosha, H., and McKenzie, J., (2001a), Development of a learner-focused, sustainable-engineering subject, Australasian Journal of Engineering Education, Vol.9 No 2, pp179-193
5. Madadnia, J., Koosha, H, & Mckenzie, J., (2001b), A collaborative partnership approach to virtual research supervision, Australiasian, Association of Engineering Education (AAEE), QUT, Brisbane, 26th-30th of September.
6. Madadnia, J, Koosha, H., & Housego, S., (2001c), In search of techniques to improve student learning in an online engineering subject (Students perception) ",Australiasian, Association of Engineering Education (AAEE), QUT, Brisbane, 26th-30th of September.
7. Madadnia, J., Koosha, H, & McGregor, H., (2001d), Developing virtual teams in an online engineering subject, Australiasian, Association of Engineering Education (AAEE), QUT, Brisbane, 26th-30th of September.
8. Rowntree, D., (1977), Assessing Student, London: Harper & Row

EDUCATORS EXPERIENCES and LESSONS in E-LEARNING

Koosha, H.

Faculty of Engineering, University of Technology, Sydney (UTS), PO Box 123, NSW 2007, Australia
Email: homa.koosha@uts.edu.au, URL: http://www.eng.uts.edu.au/~hkoosha

Anderson, T.

Faculty of Engineering, University of Technology, Sydney (UTS), PO Box 123, NSW 2007, Australia,
Email: tom.anderson@uts.edu.au

Madadnia, J.

Faculty of Engineering, University of Technology, Sydney (UTS), PO Box 123, NSW 2007, Australia
Email: j.madadnia@uts.edu.au, URL: http://www.eng.uts.edu.au/~jafarm

Akpolat, H.

Faculty of Engineering, University of Technology, Sydney (UTS), PO Box 123, NSW 2007, Australia
Email: hasan.akpolat@uts.edu.au

Abstract

Online education is receiving increasing attention from community and government in Australia. The authors have initiated the development of two subjects completely online. The subjects are delivered via UTSOnline (or Blackboard), a learning management software, which provides a range of tools to assemble and manage e-learning resources. This paper presents the authors' reflections on their experiences and concludes that e-learning can be effective as a sole delivery strategy as well as a complimentary approach to face to face teaching.

Keywords

IT, e-learning, online education, learner-focused education, Internet, reflective practice, engineering management

Introduction

There have been significant development activities in the area of online-education using multimedia and web based interactive learning modules in science and engineering. Online education employs information and communication technologies to engage students in interactive learning and assessment activities, both vitally important aspects of teaching as outlined by Kadiyala et al (1998). Research shows that student acceptance and usage of educational multimedia is high and off-campus students undertake activities related to their study when the benefits are well communicated to them (Madadnia et al., 2001a - d). However, some academics consider that too much effort is required to use the Internet as a teaching and learning environment. (Reuther & Meyer, 1997).

Authors' Views

Managing IT in Engineering (MITE) and Project Management Support Systems (PMSS) are two completely online subjects, which the authors jointly teach. The subjects are offered to on-campus, off-campus and off shore students.

The online environment is perceived by academics to fall into three categories namely *delivery*, *economic*, and *communication* (Reuther & Meyer, 1997). The main outcome of the first two perceptions is a "load up the existing materials" approach. These perceptions see online teaching as merely a delivery mechanism. The authors believe the real value of online delivery is obtained by embracing the capacity of the medium to enhance communication. Thus the main task of academic staff is not to provide the subject content but to design the teaching and learning activities that engage the students and lead to deep learning and development of desired student attributes and learning outcome.

The authors' two online subjects involve a range of activities to achieve these goals including:

- Establishing virtual teams and confidential team discussion areas
- Online quizzes with automated grading for self evaluation
- Discussion topics on chat boards
- Frequent monitoring of students' work, posting "seeding questions", encouraging continuous individual participation and collaboration.
- Online tutorials in real time

The authors' personal experience, based on subjective evidence suggests that students do engage more with the material and in more critical ways through undertaking these activities. We are confident that an appropriately designed virtual learning environment can provide the same or a greater level of enhanced learning as a well designed face to face learning environment. In the authors' opinion the importance of developing critical learning can not be overstated. Electronic information on the web has none of the traditional safeguards of printed works that offer some security and confidence about origin and validity. The growth of the web means that students of the future must be much more media literate and able to use judgement and analytical skills to interpret and understand the relevance and possible bias of enormous quantities of readily accessible information.

An advantage offered by online delivery is the ease of communication across cities and national boundaries. The ability to establish teams of students from varying locations and culture to undertake group activities is considered an important benefit of the use of the technology.

In short term, the authors believe UTS is moving towards being more of a mixed-mode institution where a combination of face-to-face and online teaching will result in students attendance on campus being less than at present. Our experience of completely online delivery suggests that e-learning offers a tool to enhance face to face courses whilst providing students with greater flexibility in both time and place of study.

Conclusion

The authors believe that the best way forward for the development of e-learning is for universities to embrace a mixed mode approach. There are courses and faculties that may well be readily adapted to an e-learning environment and may go completely online. However, the use of e-learning as a tool to enhance face to face teaching appears to offer benefits for every subject and course irrespective of discipline.

In the future the authors see their roles as educators to involve supporting students in understanding their educational needs, working with them to select suitable online/traditional/external/internal resources and courses, and then working with them to integrate these into a cohesive whole. A shared responsibility by student and teacher for all aspects of the learning experience will need to be understood by students.

References

1. Kadiyala, M., & Crynes, B.L., (1998), Where's the proof? a review of the literature on effectiveness of information technology in education, ASEE/IEEE Frontiers in Education Conference
2. Madadnia, J., Koosha, H., & McKenzie, J., (2001a), Development of a learner-focused, sustainable-engineering subject, Australasian Journal of Engineering Education, vol. 9 No 2, pp179-193
3. Madadnia, J; Koosha, H, & Mckenzie, J., (2001b), A collaborative partnership approach to virtual research supervision, Australiasian, Association of Engineering Education (AAEE), QUT, Brisbane, 26th-30th of September
4. Madadnia, J, Koosha, H., & Housego, S., (2001c), In search of techniques to improve student learning in an online engineering subject (Students perception), Australiasian, Association of Engineering Education (AAEE), QUT, Brisbane, 26th-30th of September
5. Madadnia, J; Koosha, H. & McGregor, H., (2001d), Developing virtual teams in an online engineering subject, Australiasian, Association of Engineering Education (AAEE), QUT, Brisbane, 26th-30th of September
6. Reuther, A.I., & Meyer, D.G., (1997), Analysis of Daily Student Usage of an Educational Multimedia System, ASEE/IEEE Frontiers in Education Conference

Data driven inquiry practices: Teachers' perspectives

Ravinder Koul, Ph.D.
Penn State University--Great Valley
Room 212E, SSB
30 East Swedesford Road
Malvern, PA 19355
USA
Email:
RXK141@PSU.EDU

The paper will summarize my findings on teachers' conceptions of the nature, role and purpose of assessment, and factors that influence the integration of different dimensions of assessment. The research participants are in-service teachers enrolled in the "Teacher as Inquirer" course in a graduate level teacher-leadership program at an institution of higher education. The content of the course focused on the following four dimensions of assessment: 1) *policy dimension* (how state and federal policies affect testing and assessment by encouraging and requiring it, and by regulating the use of educational tests and information based on them); 2) *measurement dimension* (the reliability and validity of content, measures of assessment, and grading policies and their social consequences); 3) *curricular and instructional* dimension (alignment of assessment with content, state and national standards, benchmarks, and performance assessment tasks); and 4) *equity dimension* (appropriate accommodation for the effect of a disability or of limited English proficiency on subject matter). Teachers actively engaged in inquiry on what would constitute "strong" assessment practices, that is, practices that integrate the four assessment dimensions. In both face-to-face and on-line discussions, teachers were asked to consider the following questions: To what extent their school wide assessment practices reflect each of the four dimensions of assessment? To what extent their school's assessment practices have changed in relation to the teaching of standards? How can teachers use assessment data to make well-informed, school-specific instructional decisions? What are the impediments?

Each participant identified an assessment problem of school wide importance and implemented a solution at the building/school/district level. Using a Reflective Action Planning Model (see Frost et. al., 2000), teachers outlined a detailed plan of action integrating each of the four dimensions of assessment. The action plan included each of the following steps (Frost et. al., 2000): *Collaboration and consultation* with peers and administrators in school, *systematic inquiry* into assessment issues (data gathering, analyzing, evaluating, and discussing), *professional learning* (mastering new skills, staff training, and developing personal understanding of assessment), and *documenting the process* (electronic portfolio, collecting evidence). Course participants prepared a portfolio documenting their work, which included critical narrative to describe their experiences with data driven inquiry practices. ANGEL, a web-based course management system, enabled course participants to be involved in numerous threaded on-line discussions. ANGEL's collaborative tools facilitated argumentation, persuasion and consensus building around the purpose and function of assessment. Using constant comparison method, data was analyzed to assess teachers' conceptualizations of "strong" and "weak" assessment practices and influence factors.

Professional Development for Mentoring Interns and Teaching English Language Learning Students in the Mainstream Classrooms through the Use of a Website

Over the past 10 years, the English Language Learning (ELL) student population has grown dramatically, particularly as compared with the relatively static pattern of total school enrollment. Recent estimates by the National Clearinghouse for English Language Acquisition & Language Instruction Educational Programs indicate that the number of ELL students has increased by 104% over the past ten years, more than any other group of students in the U.S. today. During that same period, by comparison, the growth in enrollment of children from English-speaking homes has been relatively flat, increasing by only 13.6 percent (NCBE, 1999). "Diversity has thus become the norm rather than the exception for U.S. classrooms." These demographic trends make it essential to consider the needs of these students at all levels of our educational system.

To address these demographic changes, the National Council for the Accreditation of Teacher Education (NCATE) devotes its fourth standard to diversity and in particular to the importance of teacher education programs providing "extensive and substantive" field experiences that "help candidates confront issues of diversity that affect teaching and student learning and develop strategies for improving student learning and candidates' effectiveness as teachers" (National Council for the Accreditation of Teacher Education, 2001, p.31). Cooperating teachers at school sites function as mentors and supervisors of teacher interns and beginning teachers (O'Dell & Huling, 2000). Despite their influence on the intern's growth in teaching, the cooperating teacher receives very little sustained, job-embedded professional development (Silva, D. & Dana, N.F. 2001; O'Dell & Huling, 2000; Sergiovanni & Starratt, 1998). Given the influence teacher interns' field experiences have on their teaching, universities concerned with providing a teacher work force versed in working with diverse learners must attend to cooperating teachers' professional development needs regarding such learners.

Preparing All Administrators, Teachers, and Counselors to work with linguistically and culturally diverse students (PAACT), a project of The George Washington University's Graduate School of Education and Human Development (GSEHD), has made developing cooperating teachers expertise in working with ELL students a primary project objective through its "Mainstream Cooperating Teacher Development" initiative. This three-year initiative is one of several that brings faculty expertise to bear on the reforms universities must undertake if they are going to prepare mainstream education personnel to work with diverse learners. The Mainstream Cooperating Teacher Intern Development Project directed by Dr. Patricia Tate, Assistant Professor of Elementary Education and Director of the Office of Laboratory Experiences (OLE), develops the potential of mainstream cooperating teachers to mentor interns to work with English Language Learning (ELL) students. The goal of this study is to develop improved support structures for cooperating teachers through technology and through professional development.

During the first year of the project, data was collected from a select group of teachers who attended either one half-day pilot test session or one of two full-day focus group sessions. Sixteen cooperating teachers who also had experience in working with ELL students in subject matter classrooms participated in the study. The focus groups provided insights into the multiple challenges facing mainstream cooperating teachers.

Cooperating teachers offered recommendations for the development of a web-based support system to help them address the challenges they had expressed in the areas of working with ELL students and mentoring interns. They recommended a site that offers information and resources as well as opportunities for interaction with other cooperating teachers and with interns. They expressed a need for examples from other mainstream teachers of their experiences in working with ELL students and what they learned from those experiences. They also recommended that suggestions for communicating with ELL students' parents and for conducting parent-teacher conferences be available. The participants expressed the need for information about different cultures, including information on educational systems in different countries and community resources that could support them in their cross-cultural work with ELL students and parents.

Furthermore, the participants recommended that the mentoring portion of the site should include current terminology, methodologies and curriculum used at the university, and the university's expectations of and evaluation criteria for interns. The site should assist interns by including templates for their evaluation, a timeline of assignments, and a current listing of web-based resources containing curricula and lesson plans organized by grade level and/or subject area. Finally, the focus group participants recommended that the interactive portion of the site provide opportunities to post questions and concerns and allow for the discussion amongst cooperating teachers, interns, and university faculty.

As a result of these focus groups, a website for cooperating teachers has been developed allowing for inquiry into and reflection on the various roles of the cooperating teacher in mentoring interns, including the role they play in providing constructive opportunities for interns to work with ELL students in mainstream settings. Staff from PAACT and OLE have used the cooperating teachers' major challenges as organizational categories for the site. Thus, "Developing Relationships with Families," and "Building Relationships with Interns" are two areas of the site clients may visit to obtain resources. The site is accessible at: http://www.gwu.edu/~cooptchr

This website was developed by using the "Dreamweaver" program and also incorporates media such as video clips which provide information about the website's content. As defined by Carr (2001), on-line learning is a reciprocal process of meaning-making within a community of Internet users committed to increasing their knowledge and furthering their understanding of a particular subject area, topic or theme through accessing information, entering into collaborative investigations, participating in synchronous on-line chat, and contributing to bulletin board discussions (Carr, 2001). At the heart of on-line learning is the assumption that knowledge is not a given but is constructed. Moreover, adults have myriad life experiences that can (and should) be used as a resource for learning (Knowles, 1984). In addition, the use of the Internet in training involves shared learning and professional collaboration as the core functions. This is why cooperative teachers will be confronted with a website that is in the process of development. What it becomes is not pre-ordained but rather a consequence of the insights, learning, discussions, material contributed by the cooperating teachers, interns, faculty and other interested citizens.

Tony Carr supports the use of the World Wide Web to extend and augment the face-to-face training.

Disadvantages of training teachers using a website are as follows:

- Participants require computers with Internet access.
- Being on-line is expensive particularly if the participant has a slow modem, processor or insufficient RAM.
- On-line learning can be alienating.

On the other hand, there are a number of benefits that training teachers using a website can provide:

- The removal of geographical and time constraints.
- Demonstration that knowledge construction and meaning making are almost invariably collaborative in nature.
- An opportunity to test and refine theory, perceptions, material within a broader community.
- The utter destruction of the fallacy that knowledge and, therefore, power is invested in one individual or group of individuals.
- An opportunity for individuals, educators or non-educators, to increase their knowledge and furthering their understanding.
- An extensive listing of resources where information can be found, as well as opportunities for interaction with other teachers and interns.
- Opportunities to post questions and concerns and allow for discussion among teachers, interns, and faculty.

In addressing whether computer-based instructional technology is effective, research has found efficacy, however, any more replicative and exploratory studies are needed. Esther (1995) in reviewing literature on computer assisted instruction (CAI) and learning style, found that CAI

BEST COPY AVAILABLE

can significantly improve the learner's achievement and attitudes while decreasing necessary instructional times. Kulik and Kulik (1991) in examining a large number of studies found that computer-based tutorials produce improvements in learning outcomes on an average of 20 percent greater than average. Simulation, interactive video, hypertext programs, bulletin boards and networks have also been found to enhancing learning (Cronin and Cronin, 1992; Khali and Shashaani, 1994; Kulik, Kulik and Schwab, 1986; Schlecter, Bessemer and Kolosh, 1992). In summary, there is a good research for demonstrating that instructional technology often optimizes learning. Milheim and Martin (1991) in studying learner control motivation, attribution and informational processing theory, identify learner control as an important variable in developing the pedagogy/androgogy of websites. It is beneficial to generally maximize learner control as it increases relevance to learning, expectations for success and general satisfaction contributing to heightened motivation. (Keller, 1987). Using computer-based instructional technology helps learners focus on the "needto-know", and provides opportunities to jump to the "like-to-know"(WAVE). Motivation is never a problem when simulations and labs offer learning on "as needed" basis (WAVE, 1997).

In the spring of 2002, the focus group cooperating teachers were invited to preview, critique, and provide feedback for the developing website. Cooperating teachers gave the following advice concerning the website. They suggested that the font should be bigger, bullets should be added and the length of the text should not be too long. In general, they were excited about the outcome of the website and felt empowered to implement this vast content in their daily practice of teaching and supervising interns. We, in collaboration with our cooperating teachers, are continuously updating this website and are excited to continue and improve our work in the future.

Resources

Carr, T. (2001). Using the Internet for In Service Training. Available: http://generalupdate.rau.ac.za/infosci/conf/thursday/Carr.htm

Cronin, M.W. & Cronin, K.A. (1992). A critical analysis of the theoretical foundations of interactive video instruction. Journal of Computer-Based Instruction, 19(2), 37-41.

Glickman, C.D., & Bey, T.M. (1990). Supervision. In W. Robert Houston (Ed.), Handbook of research on teacher education (pp. 549-568). New York: Macmillan.

Guyton, E., & McIntyre, J.D. (1990). Student teaching and school experiences. In W. Robert Houston (Ed.), Handbook of research on teacher education (pp. 514-534). New York: Macmillan.

Keller, J.M. (1987). Development and use of the ARCS model of motivational design. Journal of Instructional Development.

Khalili, A. & Shashaani, L. (1994). The effectiveness of computer applications: a meta-analysis, Journal of Research on Computing in Education, 27(1), 48-61.

Knowles, M.S (1984). Andragogy in action. Accessed: November 14, 2001. http://www.gwu.edu/~ed232i/lect12.htm

Knowles, G.J., and Cole, A.L. (1996). Developing practice through field experiences. In F. B. Murray, (Ed.), The Teacher Educator's Handbook: Building a knowledge base for the preparation of teachers (pp. 648-690). San Francisco: Jossey-Bass.

Kulik, C. C., & Kulik, J. A. (1991). Effectiveness of computer-based instruction: An updated analysis. *Computer in Human Behavior, 7,* 75-94.

Kulik, J. A., Kulik, C.C. & Schwab, B. (1986). Effectiveness of computer-based instruction in adult education, Journal of Educational Computing Research, 2(2), 235-252.

Milheim, W.D. & Martin B.L. (1991). Theoretical bases for the use of learner control: three different perspectives, Journal of Computer-Based Instruction, 18(3), 99-105.

National Council for the Accreditation of Teacher Education. (2001). Professional Standards for the Accreditation of Schools, Colleges, and Departments of Education, Author: Washington, D.C.

National Clearinghouse for Bilingual Education (1999). State elementary and secondary LEP enrollment growth and top languages, 1999-2000. Author: available: http://www.ncbe.gwu.edu/ncbepubs/reports/state-data/2000/index.htm.

Schlecter, T.M. & Kolosh, K.P. (1992). Computer-based simulation systems and role playing: an effective combination for fostering conditional growth, Journal of Computer Based Instruction, 19(4), 110-114.

Sergiovanni, T.J., & Starratt, R.J. (1998). Supervision: A redefinition. Boston, Massachusetts: McGraw-Hill.

Silva, D., & Dana, N.F. (2001) Collaborative supervision in the professional development school. Journal of Curriculum and Supervision, 14(4), 305-321.

WAVE Technologies International, Inc. (1997). Learning: The Critical Technology A whitepaper on adult education in the information age. Accessed: November 14, 2001. http://www.u.arizona.edu/ic/edtech/wave.html

BEST COPY AVAILABLE

Automatic Problem Generation for the Pilot Training

Larisa Soldatova
Faculty of Systems Engineering, Wakayama University
930, Sakaedani, Wakayama, 640-8510, Japan
Tel.: +81-73-457-8473, Fax: +81-73-457-8112
E-mail: larisa_soldatova@yahoo.com

Masato Soga
Faculty of Systems Engineering, Wakayama University
930, Sakaedani, Wakayama, 640-8510, Japan
Tel.: +81-73-457-8457, Fax: +81-73-457-8112
E-mail: soga@sys.wakayama-u.ac.jp

The approach for automatic generation, comparison, and classification of control problems is discussed. Any problem is considered as uniform task to transform a given state from a set of initial states into a state from a set of target states. The problems differ merely in the development of their solving processes. For automatic problem generation (APG) is used a method "generato-and-test computations". For the automation of the processes of analysis of the solution of control problems and generation of new problems the research prototype of the tracer interpreter is developed. The pilot tasks formed by APG are recommended by experts to train pilots of the aviation of the Pacific Navy of Russia.

Key words: **Pilot Training, Problem Comparison/Classification/ Generation, Production Systems.**

1 Introduction

In paper [2] we described the model of studying problem, which can be used to compare, to classify and to generate the uniform problems, solved by general method.

Let us consider the modification of this model in the case of the exercises (actions), made by operators, for instance on a flight simulator, to control of moving objects or technological cycles in accordance with the clear set of instructions.

2. Classifications and Generation of Problems for Pilots

The APG (automatic problem generator) for generating of problems with assigned characteristics and with taking into account the specific features of the use of a flight simulator in the process of instruction, we checked on an example of teaching pilots of approach landing. The trainee has the following task: to fly an aircraft following the assigned path in the multidimensional space (by number of parameters specifying the state under observation), considerable deviations from which are eliminated in accordance with the rules to be studied. It is assumed that the necessary preliminary knowledge are already mastered by the pilot up to the moment of the beginning of instruction.

In the example the predetermined trajectory is an extended-space landing option, the initial state is the aircraft's bypass over the take-off/landing strip, and the final state is a moment of landing at the beginning of take-off/landing strip. The process of fulfilling of the piloting problem of approach landing may be in the following basic states: the turn, the horizontal flight, the descent, the holding an outer/inner locator, ready/not ready to landing. Furthermore, additional states, which are the result of external actions and errors of the pilot, are possible. The process of fulfilling the exercise falls into the final state, if up to the moment of passage into the state deviations of current values of state variables from required values are less than allowable. In this case the problem is considered as fulfilled. The allowable actions of the trainee are as following: reduction/increase in altitude/speed of flight, corrective turn to the left/right, reduction/increase of roll to the left/right, the continuation of the turn of the horizontal flight.

The actions of the trainee are modeled by indeterminate production system contained 59 rules. For the automation of the processes of the analysis of the solution of problems, their classification, comparison, and generation of new problems the research prototype of the tracer interpreter is developed. The interpreter of production rules is simulated on the base of the interpreter of Prolog. For the problem generation the generator of the parameter and the tracer interpreter as a solver are used. If assigned and calculated classes on some step are the same, then the generated problem is approved, otherwise the additional cycle of the generation of the parameters and checking occurs.

4 Conclusions

As a result of application of the considered approach to generate problems of control for pilots it was possible:

- to formulate various classes of tasks with the given properties which take into account a specific character of training on a simulator, to exactly determine preliminary knowledge and skills of the trainee required to master a new procedure;?
- to form as a result of classifications the sets of tasks which ensure a cover of the subject area, to ensure their greater variety and step-by-step complication;?
- to ensure a reliable registration of wrong actions of the trainees, an impartial assessment of the level of flying skill.

The tasks received with the help of APG are recommended by experts to train pilots of the aviation of the Pacific Navy of Russia

References

1. L'vov A.Ya. *The Procedure of the Execution of Export and Check Flights* - Naval Aviation, 1978. (In Russian)
2. Soldatova, L. *Comparison of the Problems of Complicity/* Proceeding of ICCE'99, 7th International Conference on Computers in Education, IOS Press, V. 2, pp. 169-171.

The IQ FORM research project develops a supportive learning environment for the Virtual University of Finland, a consortium of all the Finnish universities. The IQ FORM gives information about learner's qualities e.g. learners' strength profiles and motivational structures as well as social navigation during their virtual studies. The objective of the presentation is to demonstrate shortly the IQ FORM tools and discuss the research connected to the IQ FORM project. (http://www.edu.helsinki.fi/iqform/). The tools developed are 1. IQ FORM - intelligent questionnaire for self-assessment, 2. Tutoring package 3. Learning diary.

This particular study explores what is meant by mediation in virtual learning environments. The theory of mediated learning experience of Reuven Feuerstein is the background for this research. Mediation can be broadly defined as an intervention method intended to improve the adaptability and flexibility of learners in new learning situations. In a netbased learning environment, the learner is usually the one who has to do the adaptive work. Can learning skills be modified through mediation in technology based learning environments?

The purpose of the research is to find out, if the IQ-FORM has mediative elements, which support students. Feuerstein's five first criteria of mediation (1) Intentionality and reciprocity, (2) transcendence, (3) mediation of meaning, (4) mediation of feelings of competency and (5) mediation of regulation and control behaviour are studied. Research data is collected through thematic interviews of students using the IQ-FORM at the Northern Carelia Polytecnic and the University of Helsinki. The initial results of the student experiences are going to be presented in Montreal.

References

Bandura, A. (1986). Social foundations of thought and action. Englewood Cliffs, NJ: Prentice Hall.

Bandura, A. (1987). Self-efficacy: The exercise of control. New York: W. H. Freeman and Company.

Covington, M. & Beery, R. (1976). Self worth and school learning. New York: Holt, Rinehart & Winston.

Covington, M. & Omelich, C. (1979). Are causal attributions causal? A path analysis of the cognitive model of achievement motivation. Journal of Personality and Social Psychology, 37, 1487-1504.

Feuerstein, R. (1990). The theory of structural cognitive modiafiability. In Presseisen, B. (Ed.). Learning and thinking styles: Classroom interaction. Washington DC: National Education Association.

Feuerstein, R. & Feuerstein, S. (1991). Mediated learning experience: A theoretical review. In Feuerstein, R., Klein, P. & Tannenbaum, A. (Eds.). Mediated learning experience: Theoretical, Psychological, and learning implications. Tel Aviv and London: Freund.

Feuerstein, Ra. S. (2000). Dynamic cognitive assessment and the instrumental enrichment program: Origins and development. In Kozulin, A. & Rand, Y. (2000). Experience of mediated learning. An impact of Feuerstein's theory in education and psychology. Amsterdam: Pergamon.

Garcia, T., & Pintrich, P. R. (1991, April). Student motivation and selfregulated learning: A LISREL model. Paper presented at the annual meeting of the American Educational Research Association,
Chicago, IL, (ERIC Document Reproduction Service No. ED 333 006).

Gardner, H. (1983). Frames of mind. The theory of multiple intelligences. New York: Basic Books.

Gardner, H. (1993). Multiple intelligences. The theory in Practice. New York: Basic Books.

Gibbons, J. (2001). Knowledge in action. Philosophy & Phenomenological Research, 62(3).

IQ-Research group (2001a). A test based on Gardner's multiple intelligence theory "What kind of person am I? Department of Education, University of Helsinki.

IQ-Research group (2001b). Three test sets adapted from motivation tests developed by P. Pintrich and P. Ruohotie, A test about the students view on herself as a student, a test of learning strategies and a test about cognitive functions. Department of Education, University of Helsinki.

Haskell, R. (2001). Transfer of Learning. New York: Academic Press.

Jonassen, D., Dyer, D., Peters, K., Robinson, T, Harvey, D. King, M & Laughner, P. (2000). Cognitive flexibility hypertexts on the Web: Engaging learners in Meaning making in Khan, B. (Ed.) (2000). Web-based instruction.

Kozulin, A., Feuerstein, Ra & Feuerstein, R. (Eds.) (2000). Mediated learning experience in teaching and counseling: Proceedings of the international conferences on "Model of Teacher Training" and
"Advancement for Youth at Risk".

Kozulin, A. & Rand, Y. (2000). Experience of mediated learning. An impact of Feuerstein's theory in education and psychology. Amsterdam: Pergamon.

Leber, J. (1995). Conductive education and the mediated learning experience theory of Feuerstein. European Journal of Special Education, Vol. 10, 2 (1995), 99.124-137.

Pintrich, P.R. (Ed.) (1995). Current issues in research on self-regulated learning: A discussion with commentaries (Special issue). Educational Psychologist, 30 (4).

Pintrich, P.R., & Garcia, T. (1991). Students goal orientation and selfregulation in the college classroom. In Maer, M.L & Pintrich, P.R. (Eds.). Advances in motivation and achievement: Goals and selfregulatory processes, Greenwich, CT: JAI Press, (Vol.7), 371-402.

Shapiro, L. & Swartz, G. (2000). The role of intention in self-regulation. In Boekaerts, M., Pintrich, P. & Zeidner, M. (Eds.). Handbook of self-regulation. Academic Press.

Specht, M. (1998). Adaptive Methoden in computerbasierten Lehr/Lernsystemen. Dissertation. The University of Trier.

Sternberg, R.J. (1985). Beyond IQ: A triarchic theory of human intelligence. New York: Cambridge University Press.

Vygotsky, L.S. (1978). Mind in society. Cambridge, MA: Harvard University Press.

Zimmerman, B. J. (1994). Dimensions of academic self-regulation: A conceptual framework for education. In Schunk, D.H. & Zimmerman, B.J. (Eds.). Self-regulation of learning and Mediation in Virtual Learning Environments 137 performance: Issues and educational applications, 3-21. Hillsdale,
NJ: Lawrence Erlbaum.

Zimmerman, B. J. (1989). Models of self-regulated learning and academic achievement. In Zimmerman, B.J. & Schunk, D.H. (Eds.). Self-regulated learning and academic achievement: Theory,
research, and practice, 1-25. NY: Springer.

Zimmerman, B. J. (1990). Self-regulated learning and academic achievement: An overview. Educational Psychologist, 25(1), 3-17.

Zimmerman, B.J. (2000). Attaining self-regulation. A social cognitive perspective. In Boekaerts, M., Pintrich, P. & Zeidner, M. (Eds.). Handbook of self-regulation. Academic Press.

Alternative Communication Methods in Online Settings: A Study of Demands and Effects

Matthew Leavitt, J. Michael Spector, Peter Gray, Noorazah Reduan & Radha Ganesan
Instructional Design, Development & Evaluation
Syracuse University, Syracuse, NY USA
mcleavit@syr.edu

Abstract: This study focused on the effects of communication in online settings (synchronous, asynchronous, and e-mail) on learning outcomes, time on task, and resources. Three university courses were studied; each at a different level (graduate, undergraduate-upper/lower division), and each conducted entirely on-line using Blackboard or WebCT course management software. Activity logs and the course management software were used to collect data from students, faculty, and staff regarding the time spent on-line and off-line communicating and completing various other tasks. Students were asked before and after the online course how the course would/did compare to a traditional classroom course. Areas included topics such as difficulty, time spent, enjoyment, convenience, pace, and workload. Preliminary findings indicate: no significant difference in learning outcomes; time demands vary significantly with the primary method of communication; considerable differences in on-line time on task for students within each course; substantially more instructor time required than in traditional courses.

Online learning is relatively new, but it is rapidly growing both in and outside university settings (Rosenberg 2001; Spector & Anderson 2000). Many important questions remain unanswered or unexplored, including which approaches and methods are optimal in terms of cost and learning effectiveness in various settings and situations. Relevant differences in variables likely to effect our understanding of what works best and why with regard to online learning include the following (Branch & Fitzgerald 2001; Kearsley 2000; Pea 2000; Salmon 2000):

1. Differences in audiences (on-campus undergraduate and graduate students, off-campus adult learners, students and teachers in remote schools, etc.);
2. Differences in learning situations (home access via modem, high-speed access on campus and in the workplace, no web access, time constraints, etc.);
3. Differences in course setting/approach (web support for campus courses, completely online courses for remote learners, residency and distance learning combined, etc.);
4. Differences in communication methods (asynchronous threaded discussions, synchronous forums, video-conferencing, etc.);
5. Differences in instructional strategies (structured learning activities, discovery learning, problem-based learning, etc.);
6. Differences in learning goals (conceptual knowledge, understanding complex relationships, procedural training, etc.); and
7. Differences in tools and technologies (web-course management systems, courseware authoring tools, interactive simulations, etc.).

It is unlikely that any single approach, method, tool, or perspective will be appropriate for all audiences, situations, and desired outcomes. Taxonomies around these seven dimensions can be constructed to guide the instructional decision making process, but important information in many cells is missing, including how cost effective a particular technology or approach is in achieving a desired goal with a particular community of learners.

The focus of this Mellon Foundation Cost-Effective Use of Technology in Teaching study was on the cost effectiveness of online courses, especially with regard to the communication dimension. Relevant data included resource requirements (including non-recurring costs of system setup as well as the recurring costs of staff support); time burdens placed on course designers, instructors, and students; as well as overall learning outcomes. Faculty from the Syracuse University School of Education, The College of Arts and Sciences, and the Maxwell School collaborated in this study. The three courses involved were: Instructional Design (graduate level), Geography of Latin America (upper division undergraduate level), and World Religions (lower division undergraduate level).

The data collection effort was designed to create the possibility of suggesting that within the context of a particular course and learning activity that a particular e-collaboration technique was more or less effective or more or less burdensome. Data were collected for at least two online offerings of each course. In the Instructional Design case, data was also collected for a classroom-based counterpart course. The three e-collaboration techniques most commonly used at Syracuse University are:

1. Collaboration only with a tutor/teacher via asynchronous means (minimal e-collaboration via email);
2. Asynchronous threaded discussions with topics posted (modest e-collaboration); and
3. Synchronous forum groups with semi-structured small group assignments and goals (more elaborate e-collaboration).

All three courses studied utilized modest to elaborate e-collaboration techniques. Each course maintained an asynchronous course discussion board, which was the principle communication technique for the World Religions course. All three courses also involved intensive email exchanges and chat sessions at least twice during the semester, places at points in each course that most naturally corresponded with course activities (e.g., chat sessions for project work, reports, and exam preparation).

Overall findings suggest no significant difference in terms of learning outcomes between the classroom-based and online version of the Instructional Design course, although there were significant differences in terms of instructor time demands (higher for the online course); students in the online setting perceived greater time demands as well. Instructors in all of the online courses reported significantly increased time demands compared with their classroom-based experiences. Instructor reports of the quality of student work and course grades suggest no significant differences in terms of learning outcomes, although all instructors reported that the threaded discussions seemed to be generally better than classroom discussions.

Students reported that taking an online course was more convenient than taking a classroom course. Several of the participating students were able to participate from remote locations across the country and the world. In many other respects, students feel that their experience closely parallels their expectation for an online course. Their experience found only slight or modest variation from the demands of a traditional classroom course. Exceptions appear to be idiosyncratic to the course or student, and may be a reflection of individual course demands, student expectations, and professor expectations.

References

Branch, R.M., & Fitzgerald, M.A. (Eds.) (2001). *Educational media and technology yearbook, 2001*. Syracuse, NY: ERIC Clearinghouse on Information and Technology.

Kearsely, G. (2000). *Online education: Learning and teaching in cyberspace*. Belmont, CA: Wadsworth.

Pea, R. (Ed.) (2000). *The Jossey-Bass reader on technology and learning*. San Francisco: Jossey-Bass.

Rosenberg, M.J. (2001). *E-learning: Strategies for delivering knowledge in the digital age*. New York: McGraw Hill.

Salmon, G. (2000). *E-moderating: the key to teaching and learning online*. London: Kogan Page.

Spector, J.M., & Anderson, T.M. (Eds.) (2000). *Integrated and holistic perspectives on learning, instruction and technology: Understanding complexity*. Dordrecht: Kluwer.

Using Multi-Media Technology to Teach Foundational Courses in Western Civilization

A demo/Poster Session Proposal for the E-Learn Conference, October 15-19, 2002, Montreal, Canada

By David Walter Leinweber, Ph.D.
Associate Professor of History
Oxford College of Emory University

Abstract

Teaching foundational surveys in Western Civilization at Oxford College of Emory University has afforded me the opportunity to create an extensive library of multi-media materials to aid in classroom learning. I would like to conduct a poster/demo session at the E-Learn Conference in Montreal in which I could display some of these course materials for Conference participants. These materials would include: multi-media presentations setting thematically organized art works to correspondingly appropriate music; a color, glossy printed book of my PowerPoint lectures from my foundational survey course, *Western Civilization through the Reformation*; a Coursebook used by students, based on my PowerPoint lectures/presentations; a video I made on King David, in conjunction with the Teaching, Learning, and Technology Institute of Oxford College of Emory University; course syllabi; student journals; student papers; examinations; student feedback.

Proposal

I would like to sponsor a poster/demo session at this Fall's E-Learn Conference in Montreal, Quebec. This session would display various course multi-media course materials I have successfully employed in my Western Civilization courses at Oxford College of Emory University. In this course, I converted my "yellowed-notes" history lectures into PowerPoint presentations that integrated all the maps, art, quotations, architecture, and topical points of the old lectures into a much more precise, efficient, and discrete format.

A a primary item, the poster/demo session would show the nucleus of my History 101: Western Civilization through the Reformation course: the PowerPoint lectures, and the accompany Coursebook that students purchase for use throughout the semester. I have prepared a glossy, color printed textbook to display these lectures (250 pages). This would be a primary item in my proposed poster/demo session. I have a printed, "handout" version of the PowerPoint lectures that students purchase from the College bookstore. The PowerPoint "Handout" printing mode provides space for students to take notes as they follow along with the PowerPoint lectures. The Coursebook to accompany the PowerPoint lectures has made the course run much more smoothly than in the old days of chalkboards. Students can follow lectures with clear major points delineated, as well as any selected quotations drawn from literary sources, and art, architecture, and maps. Moreover, students can read the Coursebook as a course text, and also see precisely where future lectures will go. This helps them to read the corresponding traditional history textbook – Harrison, Sullivan, and Sherman's *A Short History of Western Civilization* – more intelligently.

Second, I would show, from my laptop and a digital projector, multi-media presentations I have incorporated into the course. Each running about five minutes, these multi-media presentations were also prepared on PowerPoint. They add an important flavor to the course. These multi-media presentations incorporate hundreds of classic art, architecture, and portrait images into thematically organized presentations, set to appropriate music. Some of the presentations topics include "The Virgin Mary," set to Schubert's "Ave Maria;" "The Nativity," set to "For Unto Us a Child is Born," from Handel's *Messiah*; Scenes from Dante's Inferno, set to Faure's "Requiem;" "Tragic Suicides of Classical Literature, " set to "Dido's Lament," from Henry Purcell's 1697 baroque opera *Dido and Aeneas*; "The Islamic World," set to sufi chanting of the Koran; and a beautiful, bittersweet presentation on Judaism, set to the "Hativka." I also have occasionally employed more current music, including a presentation on Barbarian Europe set to Led Zeppelin's "Battle of Evermore," and a presentation on romantic images of the "East," set to Led Zeppelin's "Kashmir." Students have almost universally enjoyed these presentations, finding them a welcome break from my lectures (hmmm). Also, I showed several of these presentations at a faculty development at Oxford College of Emory University during the academic year of 2000-2001.

Third, I would show a video/DV I made while a participant in the Teaching, Learning, and Technology Institute at Oxford College of Emory University. This video is on the "Mythic King," King David from the Bible. "Mythic Kings" was also a special topics course I taught this past Spring semester, 2002, here at Oxford College. It was done using Final Cut Pro, on a Mac. The Mythic Kings video fused the commentaries and perspectives I brought to the table from my own study of history, with the extensive collection of images and sounds I had compiled. It shows how the history of a ancient near eastern king – and an arguably obscure one in a purely historical sense – became one of the more enduring figures in western literature, art, and music.

The video also served as a demo for student projects in the Mythic Kings course. Students were able to see my vision of a multi-media essay, in which traditional essay writing blended in with the powerful possibilities of computer technology. Students were invited to make a video, though some choose the less arduous task of compiling major multi-media presentations, using PowerPoint technology. The approach also worked well with student papers, many of which used desktop publishing and graphic images to take their papers a step beyond the basic, printed-text college term-paper. The King David video was also shown to a faculty development session here at Oxford College of Emory University in February, 2002, where it was very well-received.

The poster/demo session would also include course syllabi, examinations, student journals, and student feedback, available for perusal by conferees at their leisure. Students write in journals subsequent to each class. The journal assignment specifically suggests that students not only reinforce the content of each class session, but also thoughtfully address larger issues raised by the art, architecture, music, and literature made accessible by the multi-media format. The journal entries must be at least 250 words, and can be hand-written.

Also, examination formats can also dovetail onto the integrated media made available by PowerPoint lectures. While students do take two fairly traditional multiple choice examinations, and write a major term paper, essay examinations can also ask students to reflect on the thematic historical issues and problems illustrated by art, architecture, music, librettos, oratorios, and literary texts. I often show a multi-media presentation to students as a part of the final, and ask them to write several paragraphs highlighting themes raised in it. For example, the final examination for this past semester, Spring, 2002, concluded by showing a PowerPoint presentation on the Islamic World, as well as one on "barbarian" Europe. Students were then asked to compare and contrast the presentations, discussing the important themes they raised with regards to Western Civilization. This affords them the opportunity to discuss larger issues and problems, while still being grounded in the course's factual content. In this regard, students responding to such an essay question typically highlight religion, geography, political systems, and thought as major topical points.

The multi-media course materials I have prepared for my History 101 course have been very positive additions to my teaching of Western Civilization. Students have invariably commented positively about them on student evaluations. I would truly appreciate the opportunity to share my positive experiences using technology in the college-level classroom with other professionals and colleagues.

I thank the E-Learn organizers for considering this proposal.

A WYSIWYG editor for a web writing course

Ting Wen Liang, devin@mail.wtuc.edu.tw

Wenzao Ursuline College of Languages, Taiwan

Department of Computer Science and Engineering, National Sun Yat-Sen University, Taiwan

Shiao-Chuan Kung, sckung@mail.wtuc.edu.tw

Wenzao Ursuline College of Languages, Taiwan

Chu-Sing Yang, csyang@cse.nsysu.edu.tw

Department of Computer Science and Engineering, National Sun Yat-Sen University, Taiwan

Abstract

This paper describes a what-you-see-is-what-you-get (WYSIWYG) editor to support a web-enhanced writing class. The primary objectives of this editor is to enable teachers to mark assignments submitted by the students on line and to facilitate students' peer review of each other's work. This is a module supplementing an existing writing platform for students of English as a foreign language. The original application provided discussion forums and allowed the construction of electronic portfolios that integrated students' drafts, final papers, and teacher's corrections. For the online correction component, we have used the IFRAME label and DHTML scripts to construct an editor that supports WYSIWYG functions to allow teachers and fellow students to offer comments, to add standard correction symbols, and to mark the erroneous sections of students' papers using only the web browser.

Introduction

We developed the online writing platform and added the online marking component in response to a need to mark a large number of papers submitted by students in a web-enhanced English as a foreign language (EFL) writing course. It is not uncommon for an EFL teacher in Asia to be facing classes of 30 to 50 students. In the process of correcting papers, most teachers use standard correction symbols, make strike-through lines, underline words or phrases, highlight words or add comments between the lines. These tasks can be easily done with a pen on paper or with a word processor, but impossible to do with using a web browser. The text areas in the forms of HTML documents do not support styles, let alone other functions such as auto numbering or word counting. It is possible for teachers to use word processing programs like Microsoft Word to mark the sections or sentences needing correction with different colors. In order to do this, the teachers must download them, correct them, and upload them again. For the teacher, this three-step procedure is inconvenient and opens up the possibility of losing papers or uploading them to the wrong places. It is also inconvenient for the student author and his or her peers to view each other's works. Embedding the necessary functions into a web editor so that teachers can correct papers and students can view the papers on line would facilitate the review and correction of the assignments and increase the efficiency of the online writingplatform.

Technical aspects of the system

The objective of our project was to design an online editor embedded in an Internet browser. This would be part of an online writing platform for students to submit papers for evaluation and discussion by peers and teachers. Standard forms in HTML do not support styles in the text areas. We incorporated a self-contained WYSIWYG HTML editor in the web page with editing capabilities. Using this editor, no additional plug-ins are required. The teacher and peer editors can control their output using HTML forms, correct students' papers using styles, colors, strike-through lines, underlines and give comments. The actual program is implemented using Apache (version 1.3 or higher) as a Web server, MySQL as the database server running on a FreeBSD operating system machine, PHP as the programming language on the server side, and DHTML/HTML/JavaScript to provide the user interface on the client side. The system was tested using MSIE 5.0-6.0. It does not work in Netscape because Netscape does not support the part of DHTML that this module needs.

Formative Evaluation

A formative evaluation of the writing platform in conjunction with the WYSIWYG editor shows that they indeed can help meet the pedagogical goals of process-oriented communicative writing. The instructor of the course found the system to be an invaluable tool that supported the teaching strategies used in her EFL writing class and allowed for the construction of electronic portfolios. The writing platform and WYSIWYG editor made possible the smooth completion of resource sharing, process writing and peer-reviewing activities, all essential components of the curriculum. It drastically reduced the amount of time the teacher spent on menial paper-shuffling and record-keeping tasks. One drawback of the system is that it requires the instructor to be constantly online when marking the papers.

48 college students enrolled in a required college freshman writing course at a college in Taiwan participated in formative evaluation of the system. They were all English majors and place at the intermediate or high intermediate level of language ability. During the academic year starting in fall 2001, they used the system to complete all their writing assignments. The students wrote narrative and descriptive paragraphs, comparison/contrast essays, definition essays, and argumentative essays. They also discussed their classmates' work asynchronously and peer edited each other's papers.

Small group interviews revealed that all students believe the system to be reliable and easy to use. Even though not all the students prefer writing with a computer to writing with paper and pen, they all admit that computers facilitated the processes of editing and revising. The best part of the system in their view was being able to check online which papers they had submitted and which they had not. Peer editing had been a new activity they all approached with apprehension and reluctance. However, after the teacher's repeated modeling of the behavior and the thinking process involved, the students' gained confidence and increasingly appreciated its value in their learning process.

Networked Portfolio System and Students' Learning Effect

Eric Zhi-Feng Liu
Dept. of Information Management
Ming Hsin University of Science and Technology
Taiwan
totem@mis.mhit.edu.tw

Abstract: Portfolio-assessment is a systematic method for collecting and commenting on samples of work submitted by students. Moreover, these samples of collected work are able to display or explain in greater depth of the learning processes followed by a particular student. Peer-assessment has suitable reliability and validity, enhances a student's high level thinking abilities and motivation to learn, and this makes it an excellent assessment strategy by which to evaluate adults. This system incorporates two distinct types of function; one focuses on peer-assessment, the other involves the design of portfolio-assessment (included self-assessment and portfolio). Author would demonstrate the learning curves of different assessment strategies of students, students' most favorite type of work and some limitations of this study.

Introduction

System developed in this study is based on the concept of portfolio- and peer-assessment (Liu 1999), and aims to apply these educational learning strategies to science education. It is hoped that the use of Internet would allow us to overcome the obstacles of location and time. In this way, interactions outside the classroom is richer and deeper, and therefore is geared more towards helping students' learning.

Those teachers who wish to make a break with the assessments provided by traditional "quantitative" marking or pen and paper tests might consider the use of portfolio-assessment. By their nature such portfolio-assessment is a form of authentic assessment, and has long been widely used in the fields of art and writing (Paris & Ayres 1994). The possibility of using portfolio-assessment in education is a recent trend of instructional and learning strategy. The purpose of a portfolio-assessment is to record and bring together in a targeted way evidence of a student's learning process, insights, abstracts, performances, work and self reflections, and to submit these to assess the gains and progressions of the learning of students. As such, this should be regarded as a formative assessment in each learning stage and a summative assessment in a summary of students' gains and progression.

In a practical point of view, it is unlikely that most instructors who use this system would have a strong IT background, it has been designed to take into consideration the ease of future promotion. It is therefore organized in such a way as to enable instructors to independently manage the entire curriculum. It seeks, as much as possible, to take account of whatever situations may arise, providing a range of functions that instructors would find useful. To that end, this system is wrapped up in a simple graphic and user-friendly interface, making the system management much easier for instructors.

Findings

Quantitative results in this study are divided into two portions. The first portion considers the learning curves of six assignments of self-, peer- and instructor-assessment in a whole semester. The second portion is to observe the students' preferred learning tasks in this study.

The learning curves of six assignments of self-, peer- and instructor-assessment in a whole semester

In the first, author reported the learning curves of self-, peer- and instructor-assessment in these six works (Fig. 1). Author found the peer-assessment is closer to instructor-assessment than self-assessment. This result agreed with previous researchers' finding (Lennon 1995). Addressing cultural comparisons among Chinese and Latino Americans, Carson and Nelson (1996) found that in peer assessment, Chinese-speaking students' preference for group harmony prevented their critiquing peers' work. In this study, authors also found that students also tend to give their peers and themselves a great high score.

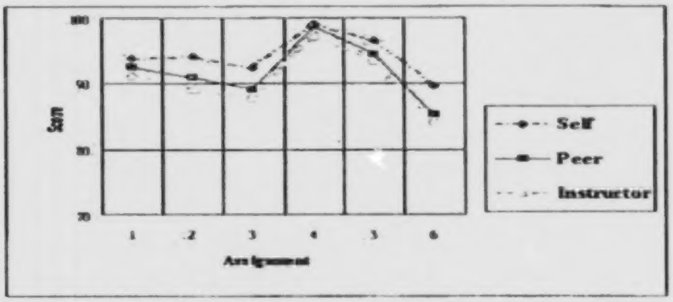


Figure 1: Learning curves (Mean score) of each assessment

The students' preferred learning tasks in this study

Author distinguished the work into open-ended writing assignment and programming project and asked the students to pick up one of the most favorite and fruitful wok. The result indicated that most students do favorite and learn more from the programming task (61, Chi-square=95.08***, df=4) than other five writing assignments (16, 9, 9, 12, and 2). Maybe this result just showed the natural character of computer science students.

Limitations

This study has been applied to undergraduate students undertaking an operating systems course at a research-oriented university in northern Taiwan. Students are almost consisted of seniors, juniors and some sophomores. Applying the same method to other subjects would not necessarily yield the same results, particularly for freshmen lacking the necessary academic skills and discipline.

Author has not mainly focused on the qualitative evidences of the progress of learners but there still are some quantitative results to show the learning curves of students and students' preference. Author would do a more deeper and qualitative researches in order to enrich the study of learning effects of this system in the near future.

Acknowledgments

The author would like to thank the National Science Council of the Republic of China for financially supporting this research under Contract Nos. NSC 90-2520-S-009-002 and NSC90-2520-S-009-003.

References

Carson, J. G., & Nelson, G. L. (1996). Chinese students' perceptions of ESL peer response and group interaction. *Journal of Second Language Writing*, 5, 1-19.

Lennon, S. (1995). *Correlations between tutor, peer and self assessments of second year physiotherapy students in movement studies*, in S. Griffiths, K. Houston, & A. Lazenblatt (Eds.), Enhancing student learning through peer tutoring in higher education: Section 3 - Implementing (Vol 1, 66-71). Coleraine, Northern Ireland: University of Ulster.

Liu, E. Z.-F. (1999). *Networked peer assessment system: an analysis of student segments*, a thesis for the master degree of Computer and Information Science of National Chiao-Tung University.

Paris, G. S., & Ayres, R. L. (1994). Becoming reflective students and teachers with portfolios and authentic assessment, American Psychological Association.

To Propose an Algorithm for Team Forming: Simulated Annealing K Team-Forming Algorithm for Heterogeneous Grouping

Eric Zhi-Feng Liu
Dept. of Information Management
Ming Hsin University of Science and Technology
Taiwan
totem@mis.mhit.edu.tw

Abstract: In recent studies, some researchers were eager for the answer of how to group a perfectly dream team. There are various grouping methods, e.g. random assignment, homogeneous grouping with personality or achievement and heterogeneous grouping with personality or achievement, were proposed. Some instructors could put some students in a team better via their experiences than some algorithms. And some algorithms would match students perfectly but in chance teams assigned by instructor also good enough. This phenomenon would stay continuance until a baseline algorithm is to be proposed as a baseline of comparison. Based on the above discussions, I have proposed a team-forming algorithm for heterogeneous grouping that could be used by other researchers to compare with.

Introduction

This algorithm was revised from K team-forming algorithm (Liu et al. 2002a), which similar to K Means clustering algorithm (Kaufman & Rousseeuw 1990), and simulated annealing K team-forming algorithm for homogeneous grouping (Liu et al. 2002b). In K Means clustering algorithm, it put closer data points into one of the K (1< K < total number of data points) clusters by distance measure. In K team-forming algorithm, also it put K similar students into a homogeneous team by distance measure used by K Means clustering algorithm. In simulated annealing K team-forming algorithm, author try to improve the answers gained from K team-forming via gradually searching the lowest variance or optimal answer. The simulated annealing process is a cooling process from high temperature (e.g. 100) to low temperature (e.g. 0). In higher temperature this algorithm would be with higher probability jumping from local optimal, and then in lower temperature this algorithm would gradually converge to a solution, which would be an optimal solution or a solution closer to optimal.

Author has revised the code of simulated annealing K team-forming algorithm for homogeneous grouping to simulated annealing K team-forming algorithm for heterogeneous grouping. There are two possible ways of revision. The first way is to keep minimum inter-group variance. If there are nine students (with the following status: 1, 2, 3, 4, 5, 6, 7, 8, 9) and classify three students as a team, then the solution of minimum inter-group variance should be (1, 4, 7) (variance=9), (2, 5, 8) (variance=9), and (3, 6, 9) (variance=9). The minimum inter-group variance is abs(var([1 4 7])-var([2 5 8])) + abs(var([2 5 8)-var([3 6 9])) + abs(var([1 4 7])-var([3 6 9])) = 0, but the sum of variance of every group in the above is just 27. The second way is to keep maximum sum of variance of every group. If there are also nine students (with the following status: 1, 2, 3, 4, 5, 6, 7, 8, 9) and classify three students as a team, then the solution of maximum sum of variance of every group would be (1, 4, 9), (2, 5, 8), and (3, 6, 7). The sum of variance of every group in the above is 29.6667, which is great than 27.

Under my consideration, the purpose of team forming is to achieve the maximum performance of all teams in general. So my decision is to apply the concept of maximum sum of variance of every group in the code of simulated annealing K team-forming algorithm for heterogeneous grouping.

Findings

Author has applied this algorithm to cluster 3 (let u=3) students into a team of 9 (let i=9) students (3 teams) and 90 (let i=90) students (30 teams) with characteristics from 1 to n (n=9 and n=90). The Figure 1 showed this algorithm would find pretty well team forming in maximum sum of variance of every group but worse team forming in minimum inter-group variance when n equal to 9. Figure 2 showed this algorithm would also find pretty well team forming in maximum sum of variance of every group when n equal to 90. This algorithm would be used as a team-forming algorithm for heterogeneous grouping and could be reproduced in future experiments.

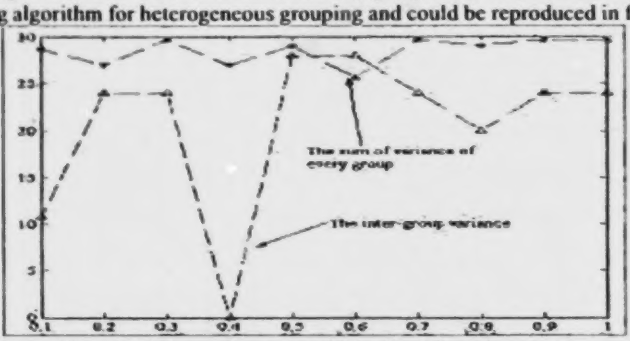


Figure 1: The performance of this algorithm when n = 9

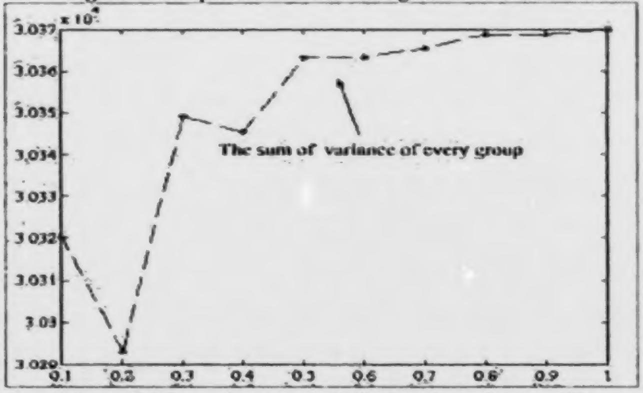


Figure 2: The performance of this algorithm when n = 90

Acknowledgments

The author would like to thank the National Science Council of the Republic of China for financially supporting this research under Contract Nos. NSC 90-2520-S-009-002 and NSC90-2520-S-009-003.

References

Kaufman, L., & Rousseeuw, P. J. (1990). *Finding groups in data: An introduction to cluster analysis*. A Wiley-Interscience Publication, John Wiley & Son, Inc, New York.

Liu, E. Z. F., Lin, S. S. J., & Yuan, S. M. (2002a). To provide a baseline algorithm for team forming: K team-forming algorithm. *Submitted to ICCE*, 2002, New Zealand: Auckland.

Liu, E. Z. F., Lin, S. S. J., & Yuan, S. M. (2002b). To improve a baseline algorithm for team forming: Simulated annealing K team-forming algorithm for homogeneous grouping. *To be appear in GCCCE*, 2002, China: Beijing.

BEST COPY AVAILABLE

Designing Digital Data-Gathering Techniques in a Busy Hospital Environment

Chris Livermore, O.P.E.N. The University of Melbourne, Australia. chrisliv@unimelb.edu.au
Tim Lambert, O.P.E.N. The University of Melbourne, Australia. lambertt@unimelb.edu.au

Abstract: Numerous communication devices flourish on the market but more often fail to meet set objectives due to unforeseen technical issues. More often the mixing and matching of technologies can circumvent these issues whilst appearing to the user as an easy to follow instrument. This article describes a method for more reliable data collection, and the resources necessary to overcome the technical problems in a busy mental health environment. We highlight the authoring and interaction between a personal digital assistant (PDA), a CD-ROM, and an online database to meet set goals.

Introduction

The range of information delivery technologies in the market today creates difficultly when designing an efficient mechanism for data gathering and the provision of associated educational resources. Off-the-shelf technology products rarely cater for all the eventual developmental needs in an evolving project and can be quite costly. This article describes how a Personal Digital Assistant (PDA), a CD-ROM program, and an online database can operate in a streamlined fashion to aid research activities within mental health programs. We highlight the devices, programs and communication pathways developed for use in a mental health research study (Lambert et al. 2002).

The requirements of this study were to:
Identify barriers to the identification of co-morbidity in patients suffering from persistent psychotic illness and; Gather and transfer this information efficiently to the researchers.

The former was addressed by the inclusion of an educational CD-ROM resource rich in digital video training aides (out-of-office training days were not available). Clinicians vary in expertise and experience hence this resource enhanced clinical recognition skills and thus more accurately identified instances of co-morbidity. The latter is plagued by such differing information sources such as questionnaires, cognitive assessments, physical examinations and laboratory screening tests. The paper-based system has proved to be cumbersome due to large patient numbers, multiple clinic locations, and lost or incorrectly submitted data (Chesanow 2000). In addition, a transcription error-prone duplication of data entry must occur to re-input the data into the digital domain. To circumvent this problem the clinician would use a Personal Digital Assistant (PDA) with an authored program to easily convert clinical information into stored data with later transfer to an online database. The PDA, in this case running the PALM ™ OS, is fast becoming a valuable tool for a multitude of medical uses (Duncan et al. 2000, Klainberg et al. 2002) and in addition proving appealing to health professionals (Noble 2000, Rothschild et al. 2002, Washburn 2001). Research also confirms the clinical benefits of PDA programs, CD-ROM education, and online information delivery (Fraser et al. 1997). However, there is a paucity of research proving the combined communicative benefits of these three media elements acting as a single 'flow-through' evaluation mechanism.

Aims

We aim to show that successful development is possible for the budget-tight, mid-sized unit, where development criteria such as cost-effectiveness, ease of use, and program flexibility, are essential. Discussion will include authoring tools used that call for a dedicated hand with multimedia skills without the requirement for a team of individual information technology professionals and programmers.

Usability and a streamlined, intuitive interface across all three media was a critical factor in the implementation of this program.

Goals:

To develop an efficient adaptable hand-held method of data collection for a combination of standardized medical and psychiatric questionnaires, cognitive assessment, physical examination and laboratory screening test information.

To provide computerised education and training (mainly video based) to mental health clinicians and primary care physicians which maximizes the detection and treatment of co-morbidity in patients suffering from persistent psychotic illness.

To create a user-friendly method for online data delivery, data storage, as well as a contact point for program updates/research information.

Discussion

The limitations set on this article has meant the exclusion of a detailed methods section. Collecting clinical information itself is an intensive process and inefficient when the data is incorrect, unreliable or simply missing. The mechanisms mentioned in the full poster/article, combat these difficulties providing the researcher/clinician with on-the-spot evaluation help as well as educational resources if needed. Whilst the technologies discussed are proving successful, it is hoped that they may be used in settings to enhance the accuracy and collection speed of a broad cross-section of data. Eventually, for this study, it may enable the development of screening algorithms for routine clinical use in populations within public mental health facilities.

References

1. Chesanow, N. (2000). Your ticket to fast, flawless prescribing, *Medical Economics*, 77, 93.

2. Duncan, R. & Shabot, M. (2000). Secure remote access to a clinical data repository using a wireless Personal Digital Assistant (PDA), *Proc AMIA Symp*, 210-4.

3. Fraser, H., Kohane, I., & Long, W. (1997). Using the technology of the World Wide Web to manage clinical information, *British Medical Journal*, 7094(314), 1600-4.

4. Klainberg, M. & Giordano, N. (2002). Write in the palm of my hand: The use of Personal Digital Assistants for nurse practitioner practice, *Clinical excellence for nurse practitioners*, 5(5), 21.

5. Lambert, T. & Singh, B. (2000). Clinical psychopharmacology teaching tools for the new millennium. Available online at http://www.psychiatry.unimelb.edu.au/open/new_media_library.html#Anchor-Documents-15996.

6. *Lambert, T., Velakaulis, D., & Alcock, S. (2002). Recovery & community participation of people with prolonged psychotic illness: Developing cost-effective models to translate research into practice. (work in progress).

7. Noble, S. (2000). PDAs and hand-helds: World without wires, *Health Management Technology*, 21, 28.

8. Rothschild, J. et al. (2002). Clinician use of a palmtop drug reference guide. *J Am Med Inform Assoc.* 9(3), 223.

9. Washburn, S. (2001). In the palm of their hands, *Vital Signs*, 11(2), 6-7.

Students Perception on Skills Needed for Successful On-Line Collaborative Projects

Dina Loebl, Ziva Levy, Tel Aviv University, Israel

This study focuses on the skills needed to be an effective learner, in an online collaborative learning environment. Sixty-five graduate students in the school of Health Professions at Tel Aviv University, Israel, participated in this study. All the students took classes that required on-line collaborative projects. In a questioner, students were asked to identify skills and attributes, that they believe, are needed to become an effective participant in an on-line collaborative project. The data was analyzed and a profile of such a team member was compiled.

Protecting The Natural Voice
The Dublin University Voice Care Program

Theresa Logan-Phelan, Center for Learning Technology, Trinity College Dublin, Ireland, tlgnphln@tcd.ie

Pauline Sloane, Clinical Speech & Language Studies, Trinity College Dublin, Ireland, psloane@tcd.ie

Abstract. An audit of all voice-related problems among trainee teachers in the University in Dublin showed an incidence of 52%, indicating that the present curriculum is ineffective in addressing preventative voice care among teachers. Searches further a field showed that no such complete voice-care program exists on the Internet. Here we present a preliminary on-line program of voice care for teachers based on constructivist theory, which has been tested in small samples of trainee teachers reporting voice problems and on control groups including teachers with no voice problems, non teachers, and Speech and Language pathologists.

Introduction

This project arose in the context of teacher education. It was found (Miller and Sloane, 2002) that 52% of those students registered for the higher diploma in education at the University of Dublin, Trinity College, presented with a vocal difficulty at some stage during their periods of teaching practice. The care of the professional voice was taught to postgraduates registered for the higher diploma in education using a traditional discipline based approach with little emphasis on Web-based instruction. Internal review mechanisms and student feedback, plus the high incidence of voice problems mentioned above, highlighted the deficiencies in the traditional course. In view of the need for a widely accessible program for voice care addressed to the teaching profession, and of the absence of such an instrument so far on the Web, The Dublin University Voice Care Programme was developed making such a program available (Logan-Phelan & Sloane, 2002). This paper reports on how the preventive Web-based program for the voice care of the teacher works to provide users with technical knowledge of the *psychophysiology* of the voice to empower personal change.

Methods

The course is designed using the constructivist theory, allowing teachers (the user) using the program to engage in active, intentional and cooperative learning on the care of the professional voice. Learning tools include -

- Self-assessment tools. Students must assess their voice, and decide if they are experiencing vocal problems. *Constructing the solution requires learners continuously articulate what they know about the problem and reflect on its sufficiency for solving the problem* (Jonassen & Peck 1999).
- Audio clips to demonstrate various vocal exercises. *Hearing and seeing tasks embedded in a real-world context makes the tasks more understandable* (Jonassen & Peck 1999).
- Self-assessment exercises and quizzes are employed to facilitate the users, so they may test their learning on the content. *Students involved in solving complex problems are active learners.* (Jonassen & Peck 1999).
- A discussion board is employed so the users participate in social learning and collaboration. The discussion board may also be used as a support group for those with voice problems. *Learning most naturally occurs, not in isolation, but by teams of people working together to solve problems* (Jonassen 1997).
- Original FLASH animated graphics to explain the bio-mechanics of voice production.

The environment is intended to help users in three areas - -

- Develop self-awareness in recognition of voice problems at an early and preventive stage.
- Feel empowered to make changes in their attitude to voice care.
- Decide on their own solutions and make personal decisions on action they should take to preserve and improve voice care.

Results & Discussion

The Web-based course may be seen at: http://www.webvoice.tcd.ie and results have been obtained by way of written feedback from 20 users belonging to four categories; 1) Teachers reporting work-related voice problems (target group), 2) Teachers not reporting voice problems, 3) Other voice professionals not involved in teaching and 4) Professional Speech and Language Therapists.

All users reported learning something new from the programme, but those professional voice users felt the programme not only offered real learning in the form of content but it also motivated and empowered them to make personal change in the care of the professional voice.

The teachers experiencing voice problems felt the programme was a tool on which they could look for support and guidance on how to deal with their voice problems. The programme had the most impact on those users who were most in need, i.e. teachers with voice problems. The programme offered users who were more vulnerable or more in need, confidence to make personal changes in how they use their voices. With the caveat of the small numbers, consisting of people with different learning styles, we are satisfied that the programme offered users an environment which could give them the amount of depth they required to meet their personal requirements on voice care.

The non-professional voice users shown a polite interest in the programme, they were surprised that voice care was so in-depth. While both groups of teachers were very impressed with how the programme enhanced their self-awareness on voice care, teachers not experiencing vocal problems, stated they would work on using the programme as a preventive instrument.

The results show that the care of the voice for teachers is indeed a topical subject. There are a large number of teachers and other voice professionals aware that they are experiencing voice problems, but they are not aware that such disorders can be prevented if they take proper preventive measures. Professional voice users should take a holistic approach to voice care, coordination of breathing, posture, relaxation, voice are required to ensure a voice in harmony with the emotions and the communication. Most people are not aware of what voice care entails, while they realize voice care entails some voice exercises, they do not realize that breathing, posture and relaxation play a major role in ensuring a healthy voice.

References.

Miller, M. Sloane,P, (2002). The Prevalance & Effects Of Voice Disorders In Student Teachers.

Logan-Phelan, T. Sloane,P. (2002). Protecting The Natural Voice - The Dublin University Voice Care Programme.

Jonassen, David,H. Peck, Kyle,L. Wilson, Brent,G. (1999). Learning with technology. A Constructivist Perspective.

Jonassen,David,H. Pennsylvania State University, USA. (1997). Constructivist Learning Environment on the Web: Engaging Students in Meaningful Learning.

Title: Depressed? Go online! (or: how to get counseling via the internet)

1. Introduction

In the fast-changing world of the internet, an exciting new feature towards helping people with psychological and general counseling problems are being developed. There are several advantages to such a kind of help for counselees and all the possibilities of the internet should be fully explored, even advantages that have not been researched or thought about. As the way of "doing counseling" develops, new avenues will be opened and may be new problems encountered. However, this should not inhibit the researcher and internet-user to fully utilise this possibility.

The paper will be divided in three parts: how the first stage of this development is handled, what the advantages and/or shortcomings are of such a system and finally: what new possibilities may arise and what future development may happen.

2. How this evaluation works

Any person experiencing a psychological/life problem, can get access free of charge to an interactive questionnaire of 25 questions about "quality of life" on a website developed especially for such a purpose, e.g. www.drhansdreyer.co.za . After answering the questionnaire online, the preliminary "diagnosis" is shown and the user go to a next level where a comprehensive analysis is given of the suspected problem; eg. phobia, depression, post-traumatic stress etc. A short definition is given as well as a medical, psychological and theological description of the problem. At this point a list of participating counselors, like psychologists, pastoral counselors, social workers and psychiatrists and where they can be reached, is communicated to the user, who can register online by paying a fee and get access to one of the professionals mentioned above. When the person gets in touch with the therapist, the data is already available and it can give the therapist a quick preview of what might appear to be the problem of the counselee. Counseling can now start either by way of e-mail, phone, videophone, chat rooms or via the internet itself.

3. Advantages/disadvantages

There are many advantages in doing counseling via the internet. For the purposes of this paper, this focus will mainly fall on e-mail communication. Although some of the advantages may also be applicable to other forms of internet counseling. The advantages and disadvantages are shortly mentioned. Note that they are not extensive and are not necessarily in opposition to each other.

Advantages	Disadvantages
• Immediacy	• No interpersonal interaction (body language etc)
• Anonymity	• "Disqualification" (stop writing, delay answering)
• Accessibility	• Less time as issues and demands grow
• Speed	• Hide behind the internet
• Cure against loneliness	• No "personal actions" like card, visit
• Not limited to locality and time	• Easy to dodge negative issues
• Record of what has been written is kept	• Can become addictive (daily routine)
• Reference easily made to other internet help	• Ethical issues (child molesting should be reported)
• Time for reflection/thought before answering	• Payment of therapist
• Attractive to individualistic approach	• Control over therapist?
• Data available which might not be personal available	• Therapist cannot evaluate reaction on counseling
• Time-saving, evaluations already done	• Possibility of extra-marital and other unhealthy relationships

4. New possibilities

As mentioned in the introduction, there are many exciting new developments in the field of counseling w via the internet that might be pursued, some of which might not even be contemplated.

4.1 The chat room

Counselees with different kinds of problems, like *inter alia* phobias, addictions etc. may use chat rooms to communicate their frustrations, progress in therapy or even share helpful hints regarding their common problem. All the advantages mentioned in 3 above will also be applicable here. Organizations like AA (Alcoholics anonymous) and GA (Gamblers anonymous) have had great success in providing a *support group* for the person with a problem. The chat room can provide for such a need, without the element of "personal shame" or shyness.

4.2 Direct communication between the counselor and counselee via computer links

This might be helpful for a one-on-one contact where with a camera the one can see the other (sometimes the counselee prefer to see the counselor but not be seen him/herself). This gives the opportunity to *hear* from someone's voice certain halo data which are absent in e-mailing. Since the counselor may be abroad and never see the counselee again, brings an openness which might not happen in the usual counseling where there may be other contact in society as such. (In the South Afican situation where many young people work abroad and sometimes have great stress, this is a very usefull way of counseling, especially in one's own langauge!) This is of course a more personal approach that e-mail only. Tapes of the camera may be kept for later reference for either the counselor or counselee.

4.3 Video phones

The researcher suggests that video phones of all could be used as a viable option which may be similar to 4.2 although a computer may not be necessary. Again, seeing each other may be more personal, but not as exposing than ordinary counseling in a counselor's office.

4.4 Other applications

Although the researcher is not aware of any other ways of evaluating and doing counseling via the internet, other possibilities may be developed, like switching into support groups world wide, listening to them and participating in their discussions, going into databases of people with similar problems and be able to communicate with them in the various ways described above. Technology may develop to the point where blood pressure or heart beat might be taken via the internet or other medical procedures and tests which are unthinkable at this point.

5. Conclusion

This paper suggests that there are already very practical and user-friendly ways in which psychological evaluation and counseling can be done via the internet and different applications thereof. The advantages and disadvantages of this method is discussed and finally new, exciting ways in which the internet can be used in the future with regards to counseling are also mentioned.

EduKBr Portal: an Environment Concerned with Quality of Information in the Brazilian World-Wide Web

Marisa Lucena
KBr Project, Padre Leonel Franca Foundation
Pontifícia Universidade Católica do Rio de Janeiro
Brazil
mwlucena@kidlink.fplf.org.br

Valmir Soares Azevedo
KBr Project, Padre Leonel Franca Foundation
Pontifícia Universidade Católica do Rio de Janeiro
Brazil
valmir@kidlink.fplf.org.br

Abstract: This paper presents EduKBr Portal, an educational, thematic portal on the Brazilian World-Wide Web. EduKBr Portal is segmented in sites that present projects, activities and services based on users day-by-day lives, multicultural aspects, and different school subjects. This educational portal is structured in order to achieve quality educational activities and content, to facilitate the access to and use of technology, to provide a democratic access to documents and contents, and maintain a motivating, attractive, ludic and safe place on the Brazilian Web.

Introduction

It is notorious that the Internet offers mechanisms that facilitate communication, cooperation and access to information. It has, therefore, become an indispensable tool for a conscient education, which takes into consideration social changes and the acquisition of new knowledge through collaborative instruction. Considering that cooperative learning depends on the motivation and on interactions obtained, there are many websites on the Brazilian Web that aim at this objective, for example, Kidlink in Brazil (http://venus.rdc.puc-rio.br/kids/kidlink), Doce de Letra (http://docedeletra.com.br), among others under the category "Education" or "Infantile Education".

However, we have noticed that, in general, there is difficulty in interaction regarding an effective and regular participation by adults and youngsters, and, also, regarding the quality of the contributions made by them (Lucena 1997). We believe that some users (specially teachers) either (a) have not developed the skills and the mentality necessary for the efficient use of Internet resources, (b) still are in an initial-to-intermediate level in relation to the use of Internet resources (e.g. exchange of information by e-mail), (c) do not have access to adequate equipment, or (d) still need to participate in activities and projects that are designed in a traditional way in order to become more confident and be part of the Dynamic Learning Community on the World-Wide Web (Win, 1993).

Therefore, participation and navigation on the Internet may foment incidental learning, which is very profitable. But, as field studies have showed (Wilson 1996), it is necessary to offer a structured environment in which the learning process is not submited to random happenings, and offer an environment that facilitates participation of schools and the majority of Brazilian users, who still are in an initial and exploratory phase in relation to the use of resources offered by the Technological Education area.

The EduKBr Portal Environment

The EduKBr Educational Portal (http://www.edukbr.com.br) is a specialized, thematic portal which is maintened and implemented by the interdisciplinary and organizational partinership between the KBr Project team and EduWeb, a company specialized in development of material and environments for distant-learning/formation.

Whereas KBr Project participates in this partnership with its team of experienced consultants and specialists from Pedagogy, Psychology, Logopedia, Biblioteconomy and Arts to specify, develop and maintain the contents of the environment, EduWeb contributes with its professionals specialized in WebSolution/Design, Economy, Administration, Law, and Marketing. These professionals are responsible for the general administration, law-related issues, and the publicity of the portal. In this case, the main objective is to search for resources in order to assure the autonomy and continuity of the project. This partnership between KBr Project and EduWeb is also supported by professionals from LES (Sofware Engineering Laboratory) from Pontifícia Universidade Católica do Rio de Janeiro (PUC-Rio).

The thematic spaces/sites of EduKBr Portal relate: (a) teaching and learning process, (b) distant courses planning, (c) Human Resources fomation, and (d) establishment of a Learning Dynamic Community on the WWW *with* (a) day-by-day lives of adults and youngsters (e.g. entertainment, culture, etc.), (b) some multicultural aspects, such as Information Society, globalization, Distant-Learning/Teaching, and (c) subjects suggested in MultiEducação Curricular Guide (Lucena & Soldon 1998).

At first, the development team from EduKBr Portal chose, implemented and launched those which are the first thematic environments. Nevertheless, there was the necessity to open the portal to the submission of new sites and new innovative ideas from the community. In order to be integrated to the portal, these sites and/or ideas must go through a qualitative evaluation of content and interface performed by and editorial board constituted by professionals from Education, Psychology, and Web Design. The Law Team is responsible for copyright issues and for the inter-relation between proponents and participants of the portal. The principal commitment of EduKBr Educational Portal is with quality of information and quality of the services offered in its environments.

EduKBr Portal uses an integration tool that is a relational and referencial search engine, called Estúdio System (Salvador 1988). This tool simplifies navigation through the thematic spaces within the portal, which, in spite of having autonomy in content, visual identity, technological development, information, activities and services, allow: (a) an effective inter-relation between and query to the resources and data distributed in each of the sites of the environment, and (b) navigation and democratic access to the Internet. In this case, for example, users can retrieve and use a piece of information or application that is located in a determined thematic space without the necessity of leaving the place where they are or leaving the portal itself. Therefore, this mechanism guarantees security and interactivity issues inside the portal.

BEST COPY AVAILABLE

The Thematic Websites of the Portal

EstúdioWeb
A cooperative environment idealized and maintained by the KBr Project Team. The website offers both a search engine that supports web-based educational practices and great virtual repository of websites selected and analysed qualitatively.

Celeiro de Projetos
Celeiro de Projetos' objective is to develop the Portuguese language and be a point of reference regarding the use of the Internet. It presents cooperative projects based on the indication of a website that is previously selected by the team.

Arte Manhas
This site aims at the appreciation and production of various artistic languages through processes of experience, reflection and comparison. The activities proposed start from a personal cultural and historic context to reach a greater sensibility regarding interaction and multiplicity of manifestations existent in the world of arts.

Leitura&Escrita
Leitura&Escrita dynamizes reading and wrinting and uses technological tools, specially web resources, for this purpose. It is more than a repository of links or a digitalized version of a library; it intends to transform authors, readers, writers and illustrators into a dynamic community that privileges the joyful and creative contact with texts, images and the infinite literary universe.

Mochila nas Costas
This site's themes are the study of geography and ecology focusing on the notion of natural space and dynamic relations established so that individuals become constructor and preserver agents of the habitat and of the quality of life on Earth.

Profs Online
This service aims at helping students develop procedures necessary for the clarification of their doubts. Profs Online does not offer answers, but leads students to think about how they could solve problems.

Colunas do Portal
In partnership with PUC-Rio's Central Coordination of Distant Education, Colunas do Portal offers recent and original articles on various themes from education professionals formation and the process of teaching and learning to Dynamic Learning Communities interaction.

Oficina de Aprendizagem
This site is a virtual classroom specially designed for teachers and students. In this classroom, considered a learning workshop, online courses and workshops complement the curricular grid of the Elementary and High curricula. Oficina de Aprendizagem aims at motivating teachers to create their own online courses using AulaNet.

Expected Results

Great is the number of portals in the web. They are characterized by the power of collecting pieces of information of various types and cataloguing them to make possible for users to find them easily. However, many of these portals treat education as one of their virtual stores, i.e, they are horizontal portals.

EduKBr Educational Portal's pioneerism is due to: a) the verticality of its design, b) its commitment with Information Technologies applied to the formation of Dynamic Learning Communities on the web, and c) the use of resources in Educational Technology for a quality Distant Education.

EduKBr Portal intends to present and apply activities and solutions for problems in our socio-cultural-economic reality and in our educational system. These problems were cited in an ethnographic research developed in a doctorate thesis (Lucena 1997), and they can be exemplified as folloing: a) cultural diversity, b) socio-economic unequality, c) difficulties of communication in foreing languages, d) late schools computarization, e) necessity of pedagogical support in specific content, and e) motivation for participation.

In the long term, EduKBr Portal should achieve and/or maintain the following essential goals: a) to offer Brazilian schools a space of educational possibilities and activities, b) to simplify the use of technological resources in order to facilitate access, interaction, and tools integration (e.g. search systems, video conference, etc.), c) to provide a democractic means of access to documents, d) to maintain a motivating, attractive, ludic, and safe place, and e) to combine curricular and extra-curricular items compatible with the socio-cultural profile of the country.

References

Lucena, M. (1997). *Um modelo de escola aberta na Internet*. Rio de Janeiro: Editora Brasport.

Lucena, M & Salvador, V. L. G. (1999). *Learn@Web: Um ambiente integrado para aprendizagem cooperativa*. Rio de Janeiro.

Win, W. (1993). *Instructional Design and Situated Learning: Paradox or partnership?*

Wilson, B. (1996). *Dynamic Learning Communities: An alternative to design instructional systems* University of Colorado, Denver.

Lucena, C. A. & Soldon, L. (1998). *EduWeb: Termo de adesão*. InfoGene.

Salvador, V. L. G. (1998). Educação com o apoio da Internet: A importância da qualidade da informação. In Revista Praxis Online.

Ierusalimschy, R. et al. (1996). Lua – An extensible language.

Lucena, M. (1997). Projeto Kidlink no Brasil: Um modelo de escola aberta na Internet. COPPE/UFRJ.

BEST COPY AVAILABLE

Applying qualitative research in e-learning. Discussion and findings from three case studies. Setting the base for a knowledge management oriented metadata schema.

Mr. Miltiadis D. Lytras
Athens University of Economics and Business,
Greece
Email: mdl@aueb.gr

Abstract

The case of learning in digital economy 's era is a fascinating phenomenon. The complexity of learning integrated with the diversification of new technologies set a dynamic landscape where the performance seems to be the overall objective of combined efforts. Our approach tries to investigate the phenomenon from a "myopic" point of view. The starting point of our research effort is the acceptance for the existence of a direct relation that brings togethe learning, new technologies, pedagogy and knowledge management. In this paper we present the initial findings from the application of qualitative research methodology. More specifically we discuss three case studies (multiple case strategy) concerning e learning systems implementation and we discuss the way that knowledge management theory can support in practical ways the performance of e-learning systems.

1. Introduction

A common practice in academic institutions or business units is the employment of new learning technologies in order to support the human resources management. In most of cases the adoption of several Learning Management Systems, provides a context for exploitation but unfortunately the achieved learning performance is rather inadequate (Lytras and Pouloudi 2001) (Lytras and Pouloudi 2001), (Lytras, Pouloudi et al. 2002). The enormous efforts that have to be paid in order to develop e-courses have risen a critical questioning on whether the invested money and the employed human capital are utilized.

After the critical reviewing of e-learning literature and the analysis of several cases presented on conferences and described in journal articles, we decide to put the emphasis of our research on parameters that could provide empowerment in e-learning. Additionally the participation of our research team called ELTRUN (http://www.eltrun.aueb.gr) in Athens University of Economics and Business in projects concerning Knowledge Management gave as a hint that these two areas could be integrated. Several conflicting opinions about the convergence of knowledge management and e-learning realized a dialectic context of reasoning and justification (Allee 2000), (Hodgins 2000), (Hong and Kuo 1999), (John Garrick 2000), (K.-D. Altho, F. Bomarius et al. 2000).

The fact that knowledge management concentrates on knowledge processes and knowledge artifacts (Mentzas, Apostolou et al. 2001) promoted the initial step in our approach. The underlying logic is extremely clear. If in an e-learning environment we can justify several knowledge processes that construct a kind of knowledge artifact that is finally diffused to learners then the information technology can analyze the technical standards and the required applications for the support of our conceptualization.

This challenging situation sets a context that promotes the research in reusability of knowledge resources. A realization of reusability can be based on semantics that enrich general knowledge resources (e.g. an article, a journal paper, a PowerPoint presentation, etc.). The ultimate objective is to expand the customisation capabilities of learning environments and knowledge management seem to be a well justified mean for the achievement of such a goal (Lytras and Pouloudi 2001), (Lytras, Pouloudi et al. 2002).

2. Conclusions

In the next section in which we will provide a very brief tabular presentation of the convergence of theoretical findings and empirical result that jointly provide some conclusions.

Key themes	Theoretical findings	Empirical results	Conclusions
E-LEARNING CONTENT DEVELOPMENT AS A CONSTRUCTIVE KNOWLEDGE MANAGEMENT PROCESS	(Mentzas, Apostolou et al. 2001) claim that knowledge processes is a value carrier. This theoretical abstraction utilized the propositions of other researchers (Hahn and Subramani 2000), (Nissen, Kamel et al. 2000) who provided several life cycle descriptive models for KM	All 3 cases provided information that justifies e-learning as a KM process. Specific phases usually informal provide a context for the diffusion of learning content to users. Several problems unfortunately and limited management mechanisms decrease the performance	The conclusion is that the knowledge process concerning e-learning realization range to a wide spectrum that incorporates two general pillars: General knowledge management processes and process for the adoption of knowledge to learning objects.
LEARNING OBJECT AS A KNOWLEDGE ARTIFACT	(Mentzas, Apostolou et al. 2001) claim that knowledge artifact is a way for realizing the knowledge management. Several researchers (Nonaka and Takeuchi 1995), (Heldund and Nonaka 1993), (Boisot 1987)	In all cases it was recognized that learning content was not knowledge in its true sense since there was an absence of metadata or semantics that would enrich the semantic density of learning material. But it was also stated that	The development of learning content requires the attachment of metadata in order to become a qualitative transformation of information to knowledge. This requires excess effort from educators. The overview of several metadata schemas (LOM,

	where a questioning concerning what is knowledge is provided. The justification of learning object as a knowledge artifact drive an excessive analysis	codification and diffusion is of critical importance for the learning objects. Additionally a number of other value ingredients of the learning product were described from interviewees. Their realization in e-learning settings requires more sophisticated techniques	GEM, Ariadne, IEEE LOM, IMS, DC) seem to bee inadequate to support the learning dimension of e-learning
METADATA JUSTIFICATION ANDE-LEARNING PEDAGOGY SUPPORT	(Shuell, 1992) & (Bloom and Krathwohl 1984) provide a context for providing different learning value. Learning processes or learning objectives are the value drivers.	Unfortunately the learning performance of three cases was based on static learning scenarios. It was evident that this dimension of e-learning implementations was to weak and needed support.	The detailed analysis of learning processes can cause a significant contribution specifying metadata elements for specific learning processes. This secures and the dynamic nature of e-learning since its learners could get a different value selecting different learning processes.

This approach is not ending here. A systematic modeling of metadata for learning processes has already finished. A prototype of a tool called **Semantics for Learning™** is already developed. This interoperates with a prototype of the **Dynamic Elearning Case Builder™**. We believe that very soon we will be able to launch a new platform based on the abstractions that mainly enrich information resources in order to build re-usable learning content. Our research unit (www.eltrun.aueb.gr) welcomes any comment or contribution concerning the key ideas presented in this article.

6. REFERENCES

Binney, D. (2001). "The knowledge management spectrum - understanding the KM landscape." Journal of Knowledge Management **Vol. 5**(1): pp. 33-42.

Bloom and Krathwohl (1984). Taxonomy of Educational Objectives, Handbook I: Cognitive Domain. New York, Addison-Wesley and Co.

Eisenhardt, K. M. (1989). "Building theories from case study research." Academy of Management Review **Vol. 14**(No. 4): pp. 532-550.

Hahn, J. and M. Subramani (2000). A Framework of Knowledge Management Systems: Issues and Challenges for Theory and Practice. 21st International Conference on Information Systems (ICIS 2000), Brisbane, Australia.

Heldund and Nonaka (1993). Models of KM in the West and Japan. Implementing Strategic Processes Change, Learning and Cooperation. in, B. Lorence, B. Charkavarthy, Roos, J. and H. Van de Ven, Mackmillan, London: pp. 117-144.

Hoepfl, M. (1997). "Choosing Qualitative Research: a primer for Technology Education Researchers." Journal of Technology Education **Vol. 9**(1).

Hong, J.-C. and C.-L. Kuo (1999). "Knowledge management in the learning organization." Leadership and Organization Development Journal **Vol. 20**(4): pp. 207-215.

John Garrick, S. C. (2000). "Knowledge work and the new demands of learning." Journal of Knowledge Management 4(4): 279-286.

K.-D. Altho, F. Bomarius, et al. (2000). "Knowledge management for building learning software organizations." Information Systems Frontiers, **Vol. 2**(3/4): pp. 349-367.

Klein, H. K. and M. D. Myers (1999). "A Set of Principles for Conducting and Evaluating Interpretive Field Studies in Information Systems." MIS Quarterly **Vol. 23**(1): pp. 67-94.

Lytras, M. D. and A. Pouloudi (2001). E-learning: Just a Waste of Time. In Strong, D., Straub, D. & DeGross, J.I. (Eds) Proceedings of the Seventh Americas Conference on Informaton Systems (AMCIS), Boston, Massachusetts, pp. 216-222.

Lytras, M. D. and A. Pouloudi (2001). IT Skills Utilization: From Rhetorical Verbalism to Applied Knowledge Management. In Strong, D., Straub, D. & DeGross, J.I. (Eds) Proceedings of the Seventh Americas Conference on Informaton Systems (AMCIS), Boston, Massachusetts, pp. 1957-1962.

Lytras, M. D. and N. Pouloudi (2001). "Expanding e-learning effectiveness. The shift from content orientation to knowledge management utilization". Word Conference on Educational Multimedia, Hypermedia and Telecommunications (ED-MEDIA 2001), June 25-30, 2001, Tampere, Finland (CD Proceedings).

Lytras, M. D., N. Pouloudi, et al. (2002). "Implementing knowledge management in learning: an advanced framework for technology and learning convergence in work environments." Journal of International Forum of Educational Technology & Society and IEEE Learning Technology Task Force, (accepted for publication in the special issue of April 2002).

Lytras, M. D., N. Pouloudi, et al. (2002). "Knowledge Management Convergence: Expanding Learning Frontiers. Journal of Knowledge Management,." Journal of Knowledge Management **Vol. 6**(1): 40-51.

McAdam, R. and S. McCreedy (1999). "A critical review of knowledge management models." The Learning Organization **6**(3): 91-101.

Mentzas, G., D. Apostolou, et al. (2001). "Knowledge networking: a holistic solution for leveraging corporate knowledge." Journal of Knowledge Management **Vol. 5**(1): pp. 94-107.

Myers, M. D. (1997). "Qualitative Research in Information Systems." MIS Quarterly **Vol. 22**(2): pp 241-242. MISQ Discovery, archival version, June 1997, http://www.misq.org/misqd961/isworld/. MISQ Discovery, updated version, last modified: December 24,2001, http://www.auckland.ac.nz/msis/isworld/.

Orlikowski, W. J. and J. J. Baroudi (1991). "Studying Information Technology in Organization: Research Approaches and Assumptions." Information Systems Research **Vol. 2**(2): pp. 143-67.

Walsham, G. (1995). "Interpretive Case Studies in IS Research: Nature and Method." European Journal of Information Systems **Vol. 4**: pp. 74-81.

E-Learn is about business:
A business model for the digital economy.

Miltiadis D. Lytras
Athens University of Economics and Business
Department of Management Science and Technology,
Greece
Email:mdl@aueb.gr

Abstract

From time to time, the e-commerce landscape is enriched with several business models that promote new value propositions to a number of stakeholders. The attractiveness of e-, in any business, rises a questioning concerning the viability of the justified business model. The phenomenon of the digital economy in our paper is investigated from a knowledge-based perspective. The digital economy is the economy that exploits knowledge and our business model facilitates the exploitation of knowledge in business and academic environment: E-learn business model is a combination of strategy and conceptual abstraction with a clear market orientation.

1. Introduction

Considering the phenomenon of digital economy numerous approaches try to explain the self-evident: That digital economy is more demanding in requirements, is more competitive and its value proposition can be evaluated more rigidly from the various target groups. According to (Allee 1999) "this new economic era has been referred to by various authors as: the Intangibles Economy, the Knowledge Economy, the Experience Economy, and the Idea Economy. Whatever name it goes by, it is rewriting the rules of business and forcing a radical rethinking of corporate value and business models". (Lytras and Pouloudi 2001) after a critical reviewing of several implementations of e-learning systems concluded that e-learning is providing limited value especially in the cases of simple adoption of e-learning platforms. Successful implementation of e-learning requires the same management commitment as other mission-critical organization-wide initiatives. Most of all e-learning needs to be compelling to the audience it targets, offering the learner a resource that is seen as appealing, valuable and productive to their goals and aspirations".2. E-learning marketplace characteristics. (Ruttenberg, Spickler et al. 2000) uses three key variables in order to provide a description of the e-learning market. These variables are:

- **Markets Served:** Academic, corporate & consumer, **Revenue model:** Contracts, pay per use and ads/sponsors, **Core Offerings:** Contents, services & technology, **Types of Content:** ?? , business skills, life style, academic, custom, **Types of Services:** Content distribution, consulting, implementation, eCommerce and community portals, **Types of Technology:** Learning Management Tool, content creation tool, delivery platform, collaboration tool.

One of the major observed problems in e-learning is the absence of standards capable to justify e-learning as a value-adding proposition. After many years of research in our research unit ELTRUN (http://www.eltrun.aueb.gr) in Athens University of Economics and Business we tried to justify the convergence of e-learning and knowledge management using an approach derived from e-commerce.

2. Value proposition – The underpinnings of E- 4. E-learn business specification

The E-learn business model is not a simple abstraction or a common organization of thought. The complexity of learning as a cognitive process, the technology imperatum, and the special features of Internet as a learning medium make the success of such a model a difficult goal. The desired unique proposition that this business model promotes requires an extensive analysis of several aspects. In the limited space of this article we are summarizing the main aspects of this model:

a. **Market Focus**: Academic Institutions & Business Executives Training
b. **Products:** A new metadata knowledge management oriented schema. A new Tool called Semantics for Learning ™, capable to catalogue information resources with the proposed semantics model (A set of metadata that focus on learning. This focus differentiates the proposed metadata schema from all the other standards such as IMS, DC, SCORM, LOM). An integrated E-learning platform called Multidimensional Dynamic Learning Case Builder ™ that packages the learning content using learning processes and not learning modules. Each learning scenario is a combination of learning processes.

c. **Innovation – Unique Proposition:**
The organization of knowledge in distinct objects, small structural components, is the basis of reuse. In the case of customized learning the same learning content can be used in many ways due to its integration with other knowledge objects. Our approach is based on two clear assumptions that initiate the whole research: A learning object is a synthesis of knowledge and metadata that expand further the learning effect of knowledge. From this perspective an e-learning environment has to utilize a learning objects base. A critical question is which metadata can we use in order to increase the

learning effectiveness. A learning process is an abstraction of a logical sequence of learning activities or tasks. The conceptualization of learning processes determines an interface in which the components of a learning object can be realized. This layout is a value container, which is utilized by the embodiment of learning object. The critical question is which learning processes can we use? And is there any hierarchy of learning processes that determine different value layers. The underlying issue behind the packaging of knowledge is the reveal of a key idea that will support the accomplishment of a metadata scheme. Our proposition that has been developed after many implementations of e-learning projects in our research unit, ELTRUN. (www.eltrun.aueb.gr) is that the convergence of knowledge management and e-learning is realized through an integrated life cycle model. Each step in this model that represents a value adding process. Each step sets a context for questioning about the required metadata that have to be attached to a generic knowledge source in order to formulate learning object. The first cycle summarizes a general Knowledge management framework where 6 processes / activities (Relate / Value, Acquire, Organize, Enable Reuse, Transfer, Use) make possible the management of knowledge object. The second cycle stands due to the assumptions that learning requires a further adoption of general knowledge sources. The six processes of the second cycle in figure two justify a learning orienting enrichment. The engagement of learners with the e-learning environment is becoming true through the employment of a number of learning processes.

d. **Strategy:** Differentiation. The proposed products of the model are differentiated from all the available in the relevant markets. Metadata industry is rather inadequate to support dynamic learning since it is focus on cataloguing purposes. LMS platforms are not really learning oriented in the sense of realized pedagogy.

e. **Technology Focus:** XML but based on concrete conceptualizations concerning e-learning scenarios, learning processes modeling and knowledge management.

f. **Pricing policy:** Mixed. Extensive promotion in the first two years.

3. Conclusions

The overall approach described in the limited space of this paper provides a context for exploitation focusing on learning. E-learning is a huge market with billions of dollars spent its year. The refinement of this model and the development of products that where describe will penetrate the market just because the e-learning market is not as mature as it would be assumed according to the overall size in terms of learners and invested money. Knowledge economy forces everybody to construct value through learning. So the value is not an abstraction. Is the cumulative and incremental ability of everybody mind to exploit the knowledge wealth and to prepare its cognition for new ideas and constructive thinking. E-learn intends to be the business model that proves that information technology is good not only for selling products on the net but mainly to support sophisticated mechanisms that support knowledge workers to manage effectively their most valuable asset: The knowledge. Is it imagination more important than knowledge? Yes, but only in the cases that creates knowledge.

References

Allee, V. (1999). "New tools for new economy." Perspectives on Business and Global Change, World Business Academy **Vol. 13**(No. 4).

Fry, K. (2001). "E-learning markets and providers: some issues and prospects." Education + Training **Vol. 43**(4,5): 233-239.

Henry, P. (2001). "E-learning technology, content and services." Education + Training**43**(4,5): pp. 249-255.

Kim, C., R. Mauborgne, et al. (1997). "Fair process: Managing in the knowledge economy." Harvard Business Review **75**(4): 65-75.

Lytras, M. D. and G. I. Doukidis (2000). 'E-learning evaluation criticism, The Multidimensional Dynamic e-Learning Model'. The Fourth IASTED International Conference on Internet and Multimedia Systems and Applications (IMSA 2000) [CD Proceedings], ,November , 20-23, 2000, Las Vegas, Nevada, USA, pp. 368-373.

Lytras, M. D. and A. Pouloudi (2001). E-learning: Just a Waste of Time. In Strong, D., Straub, D. & DeGross, J.I. (Eds) Proceedings of the Seventh Americas Conference on Informaton Systems (AMCIS), Boston, Massachusetts, pp. 216-222.

Lytras, M. D. and A. Pouloudi (2001). IT Skills Utilization: From Rhetorical Verbalism to Applied Knowledge Management. In Strong, D., Straub, D. & DeGross, J.I. (Eds) Proceedings of the Seventh Americas Conference on Informaton Systems (AMCIS), Boston, Massachusetts, pp. 1957-1962.

Lytras, M. D. and N. Pouloudi (2001). "Expanding e-learning effectiveness. The shift from content orientation to knowledge management utilization". Word Conference on Educational Multimedia, Hypermedia and Telecommunications (ED-MEDIA 2001), June 25-30, 2001, Tampere, Finland (CD Proceedings).

Lytras, M. D., N. Pouloudi, et al. (2002). "Implementing knowledge management in learning: an advanced framework for technology and learning convergence in work environments." Journal of International Forum of Educational Technology & Society and IEEE Learning Technology Task Force, (accepted for publication in the special issue of April 2002).

Ruttenberg, B., G. Spickler, et al. (2000). E-learning: The engine of the knowledge economy, MORGAN KEEGAN, http://www.internettime.com/itimegroup/morgankeegan.pdf.

Timmers, P. "Business Models for Electronic Markets." In: Gadient, Yves; Schmid, Beat F.; Selz, Dorian: EM - Electronic Commerce in Europe. EM - Electronic Markets. **Vol. 8**(2).

Developing community in on online or web-enhanced course

It is our belief that for an online or web-enhanced course to truly be of benefit to students, a community has to be developed and the students have to believe they are part of the community and are taking an active role in that community.

To this end a unique online interface was designed that could be implemented for any Course or community. Every time a participant accesses the website they are given the realization that they are part of a group. The participant is given ownership over information on the system and is given the oppurtunity to contribute to the course/community.

The system includes a complete online grading program, database baqckend and several collaboration tools. It emphasizes ease of use for both participant and facilitator and is participant-centric.

Parallel Computing Performance Monitoring Tool for a Cluster of Computers

Authors: M. Madani (Student Author) x1aut@unb.ca
J. Light jlight@unbsj.ca
R. E. Shaw reshaw@unbsj.ca
Applied Statistics & Computer Science
UNB Saint John, Canada

Abstract: Clustering has always offered significant price/performance advantages to many high-performance workloads. The efficient use of both CPU and memory within each node of a cluster of computers is of center importance to cluster computing. This paper investigates the design of a CPU usage monitoring system for a cluster of eight nodes. Real time simulation has been used to introduce the contribution of each node to solving a parallel program. The tool developed allows a cluster of Linux systems to be managed from a single point of control.

Introduction

A cluster is a type of parallel or distributed processing system, which consists of a collection of interconnected stand alone computers (nodes) working together as a single integrated computing resource.

A node can be a single or multiprocessor system (PC, workstation, or SMP) with memory, I/O facilities, and an operating system. A cluster generally refers to two or more nodes connected together. The nodes can exist in a single cabinet or be physically separated and connected via a LAN. An interconnect (LAN based) cluster of computers can appear as a single system to users and applications.

Communication software offers a means of fast and reliable data communication among cluster nodes. Clusters with a special network switch use communication protocols such as active messages for best communication among the nodes. They bypass the operating system and thus remove the critical communication overhead, providing direct user level access to the network interface. This approach maximizes the range of options that provides mechanisms for evaluating alternatives and thus reduces the cost of backtracking from wrong choices.

The four distinct stages are: partitions, communications, agglomerations and mappings. Partitioning is decomposing the task (computational activities and the data it operates on) into several smaller tasks. The communication aspect focuses on the flow of information and co-ordination among the tasks that are created during the partitioning stage. In the agglomerations, the tasks and communication structures defined in the first two stages are evaluated in terms of performance requirements and implementation costs. Finally, the mapping is concerned with assigning each task to a processor such that it maximizes utilization of system resources (such as CPU) while minimizing the communication costs. These decisions can be made statically or dynamically at run time. The tool developed here will be used in the agglomeration stage.

Objectives

Predicting how well hardware works while solving a parallel algorithm and how it performs on different types of workloads is not possible. The goal is to develop system-monitoring software, which represents the CPU and memory utilization and the degree of contribution of each node to different types of workloads in the system. The existence of such a system is crucial to resource optimization in a cluster of computers.

Methodology

A dynamic table is created on the master node of the cluster, which keeps track of CPU utilization and memory cycles available in all the nodes of the cluster. This data can be retrieved through a sophisticated shell program or with the help of sockets. The table can be accessed via a well-interfaced program, which visualizes this trend with the help of graphical user interface.

The existence of a text file consisting of desired data from the nodes was assumed in the simulation process. This text file can be created by real time values obtained from the nodes of the cluster in future work.

Figure 1.1 gives the simulation results of a master-slave cluster consisting of eight nodes, while solving a parallel program. Figure 1.2 represents the overall resource allocation in a cluster of computers as a unified computing resource.

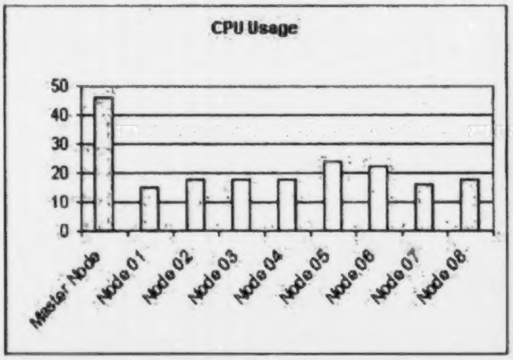


Figure 1.1

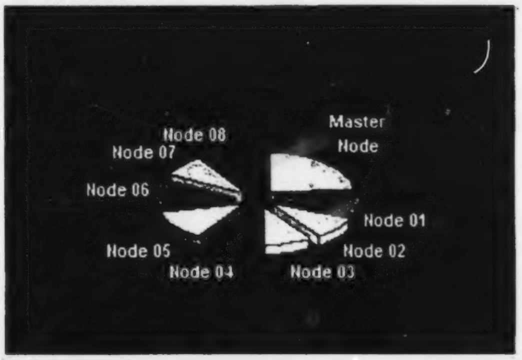


Figure 1.2

The performance monitor software is compatible with Windows based applications and can be easily updated in order to respond to future needs of the system.

Conclusions

We have established and evaluated the performance-monitoring tool, which represents the amount of workload and the degree of contribution of each node of the cluster of computers to solving a parallel algorithm. The performance evaluation of our approach leads us toward developing web management software to accompany the performance monitoring tool in order to achieve real time performance information in future work.

Acknowledgement

This research work was supported by CRA-W, NSERC grant # RGP 170170, and Dean of the Faculty of Science, Applied Science & Engineering at UNB Saint John.

References

[1] Hong Chen, Brett Tjaden, Lonnie Welch, Carl Bruggeman, and Lu Tong. 'Monitoring Network QoS in a Dynamic Real-Time System' in Proceedings of 16th International Parallel & Distributed Processing Symposium, April 2002.

[2] Scalable Computing Lab, SCL Cluster Cookbook, 1998. http://www.scl.ameslab.gov/Projects/ClusterCookbook

[3] Alex Vasilesco. Forecasting CPU Utilization: a Simple Saturation Model in a UNIX Web Applications Server Environment. http://www.geocities.com/SiliconValley/Garage/5347/satur-mdl.html

AN INTRODUCTION TO THE TEXT-TO-SPEECH XML-DRIVEN E-LECTURE DELIVERY SYSTEM

Wai Keong, Mak, Ngee Ann Polytechnic, makwk@singnet.com.sg

Abstract

One of this innovative implementation in education is Lecture on Demand (LoD) which integrates digitized and interactive video segment with purposeful learning activities so that students remained engaged during the session; students may access the LoD anytime, anywhere and any number of times they require. A XML-driven system, with in mind the issue of bandwidth constraints, and the surge in the use of e-Learning for education, is created to provide an easy-to-use web application that creates an e-Lecture with the use of MSAgents, and utilizing the Text-to-Speech engine to recite the salient information which would otherwise be text that the users read.

Introduction

The use of computers to provide an integrated environment for teaching a variety of disciplines has received much attention in recent years. Many frameworks have been developed for such purposes. The material provided by such courseware varies greatly from the provision of lecture notes and lecture support material to integrated and interactive tutorial packages. Until recently courseware has existed as standalone packages. However, with the advent of the World Wide Web (WWW) on the Internet and accompanying WWW (hypertext) browsers, such as Netscape and Internet Explorer, the provision of courseware has taken on a whole new dimension. In the last couple of years, we have created a global electronic library of unprecedented scope and value.

Researchers are posting new ways of looking at learning that promote:

- engaged, meaningful learning and collaboration involving challenging and real-life tasks; and
- technology as a tool for learning, communication, and collaboration.

As such, there is an increase in the use of the Internet as a platform for educational purpose. One of this innovative implementation is Lecture on Demand (LoD) which integrates digitized and interactive video segment with purposeful learning activities so that students remained engaged during the session; students may access the LoD anytime, anywhere and any number of times they require.

Many institutions are engaging streaming media as a mode of lecture delivery. Streaming media is real time delivery of audio and video over the Internet. The disadvantage of using such media is cited as unreliability of network, poor video quality and the lack of resources to connect to the service, and the lack of facilities such video streaming facility and large bandwidth for comfortable access.

An online system, with the following characteristics has been created:

a) use of XML files to drive the e-Learning: developers need only to modify the XML files to create the e-Lecture via a provided interface;
b) Use of text-to-speech engine to remove the bandwidth barrier (via MSAgent technology);

Feature of the System

Basically, the developer can create e-Lectures and updates the system, via an easy-to-use interface in the system. It includes:

- Title of the lecture

- Headings for individual section of the e-Lecture;
- The text to be read out for each section;
- Any stipulated action for the animated character (e.g. waving, winking, moving within the screen, etc.)
- A link to the slide / URL (if necessary)

Advantage of the system:

- Low bandwidth will still work: In essence, only text data are sent across the Internet to the recipients, as oppose to continuous streaming bits of video or audio packages which could choke the network and slowdown the whole system; users with a 56.6 kbps modem will still enjoy the lecture as those using broadband access;

- Use of XML to drive such system makes the integration with existing system plausible;

Implementation and Development

The author is moving the system into ASP.NET platform, which would allow seamless server-out of the e-Lecture to users using mobile computing devices like hand-held PCs, palm and even WAP devices.

In addition, surveys on its usage are being carried out on users of the system which will help to improve on the system.

In the implementation of such online learning lecture, it is proposed that:

- the learning segment has to be short (not more than 15 minutes)
- the segment has to peppered with purposeful synchronous /asynchronous learning activities:- This is manifested in the use of case studies that students must read and discussed before proceeding to the Analysis segment of the e-Lecture.

Conclusion

A trend is underway to more effectively blend e-Learning technologies with traditional learning approaches to create hybrid solutions. Doing so can create more powerful learning experiences by drawing on the strengths of the different mediums, while at the same time, helping people work through their apprehension with new technologies. Lecturers will be able to use this system as a supplement to their weekly routine lecture, to touch on rudimentary topics and areas, leaving more time for discussion and interaction during the face-to-face sessions.

As students have access to the materials via the computers, the instructors will be able to work individually with students as there is now less drudgery and repetition in their work and they would have access to more accurate appraisal and documentation of the student's progress (Kulik, Bangert & Williams, 1983).

This system is made, with in mind the issue of bandwidth constraints, and the surge in the use of e-Learning for education, to provide an easy, XML-driven web application to create an e-Lecture with the use of MSAgents.

References

Kulik, J.A, Bangert, R.L. & Williams, G.W. (1983), Effects of Computer-based Teaching on Secondary School Students, Journal of Educational Psychology (75), pg. 19-26.

The Assesment in "an on line Learning Model of Marketing" in a University.

Ma. Magdalena Maldonado Avalos
Instituto Tecnológico y de Estudios Superiores de Monterrey (ITESM)
Campus Estado de México
Mexico
mmaldona@campus.cem.itesm.mx

Abstract: At ITESM we are using the concept of "redesign", and this implies the use of a technological support called Lotus Notes-Learning Space. This concept implies a new role for students, the must have a more active role in learning. One of the advantages of Lotus Notes-Learning space is the "Assessment Center", it help the teacher for different activities: a) designing. applying and grading exams; b) To grade and return grades to the students in different activities like reports, task, etc.. and c) To audit the implementation of the course for different teachers in the same period.

The Assesment in "an on line Learning Model of Marketing".

At Instituto Tecnológico y de Estudios Superiores de Monterrey (ITESM), we are working in a new model called "Rediseño" (redesign). This means that we are working not only in the academic topics, we are considering also abilities, attitudes and worths. This model implies the use of a technological support called Lotus Notes - Learning Space. (LN-LS). One big change is the new role that a student has, he or she need to learn to learn, their role in more active than in the traditional educational models in the past.
In order to teach a class in this model required that all the design and the material that will be used during the period of classes be in the (LN-LS). Before to teach a class in this model a teacher must work in the design of the class. The LN-LS works using the following 5 database: 1) Schedule: Here we can find the programming of all kind of activities divided per week. (Our courses have 16 weeks); 2) MediaCenter: here we can find all the material that supports the course: Videos, abstracts, presentations, printed advertising, etc.; 3) CourseRoom: this is the space designed for make and send the homework (assignments) and the discussions, and also through this database the teacher can graded the tasks; 4) Profile: here we have all the information about the participants of a course (instructors and students). And also here the students can know their grades and the annotations that the teacher made related to their work.; 5) Assessment: This space permits to create different types of evaluation like : quiz, exams, survey, self-Asses. I will explain later about how we use the Assessment Center.
Each course is created in a server at each campus. Then each student needs to replicate the course in his or her Laptop through the use of the WEB or the Intranet. So all the activities that a course implies are in the (LN-LS). Actually I teach Basic marketing, and I designed the course in (LN-LS). In this model I scheduled all the activities, so the student can know in the beginning what he or she has to do during all the semester. The student can know what are the objective of the class, what the teacher expects the student has to do. Also he or she can know what is the homework (assignment), when is the deadline. Also the student can find examples of diverse products that are sell in Mexico. In each theme the student can find an Internet address of Mexican products, so he or she can visit it and he can learn a little bit more about how this companies use the Internet as a part of their marketing effort. This is a particular aspect of how Internet can improve the way of teaching Marketing. The students can see in a dynamic and actual way what is happening in the world. In the past, before the Internet and (LN-LS) we depend on what the companies want to publish in books, articles, magazines or journal.. Here are some examples:
http://www.profeco.gob.mx, http://www.ticketmaster.com.mx, http://www.jumex.com.mx
Another activity that is in the Marketing course is the use of the "Digital Library". Through the server the students at ITESM can access a lot of publications for example: Journal of Marketing, Journal of Marketing Research, Journal of European Marketing, etc. During the semester each student must read al least 3 articles of Marketing. The student makes an abstract and comments about what he or she read. Instead of going to a library they have access form any part. They only need a computer and connect to the ITESM through Intratec, and they can enter to the Digital Library. This is another benefit of the technology. Another important use of Internet and Intratec, is the possibility of put relevant information in the MediaCenter. We use a printed advertising of Mexican products or products that come form other countries but they need to be "tropicalized". The student can see the advertising and answer the different questions related to the topic of the week. They send the assignment through the CourseRoom.

THE ASSESMENT CENTER.

We use the Assessment Center for the following activities: First, a teacher can grade the activities that the student do in the CourseRoom, and we have the possibility to return the grade to the student by (LN-LS) with the comments *related to how the student did the task, or to suggest what the student need to study.* Second, here it is possible to create a bank of questions, in order to create exams. The program has the option to randomize the questions, so the exams are different for the students. There is four type of questions: true-false questions, multiple choice questions with a single answer, multiple choice questions with multiple choice, and the open questions. In the first 3 options it is possible that the program graded the questions. One of the objectives that we are working on is to increase the bank of questions with the participation of different teachers. We increase questions each semester. One advantage of using the exams in the Assessment Center is that it doesn't matter who is the teacher, the students have the same kind of exams, so there is a big possibility that the students learn the topics that were designed. Third, through the Assessment Center we have the option of Audit how the different courses are been given for different teachers. We have 12 groups of the same subject (marketing) in each semester so we have 5 or 6 teachers, with different styles. So I work in the project of following the implementation and an evaluation of the course of Marketing in Lotus Notes –Learning Space (LN-LS). This project began in the semester August-December 2000, and in the semester January-May 2001. As I am the designer (author) of the course of Marketing, I have access to all the database generated in our server for the different groups. First I built a matrix like the following:

TEACHER	**Status**	**Groups**	**Students number**	**Time using the course**

The expectations was that an experienced teacher has less problems in the use of the course in learning space. Second I built another Matrix with the following elements:

Activity	**Group 01**	**Group 02**	**Group 03**	**Group 04**	**Etc.**	**Etc,.**
AdvertisingTopic 1						
Ethical dilemma Topic 1						
EXAM Topic 1						
Advertising Topic 2						
Ethical DilemmaTopic 2						
etcetera						

Third, so in the Assessment Center I found the report of how many of the different activities were graded, and I filled the matrix with the number. After that I compared the number of students with the number of activities grades, and I found the deviation. If the difference is low, it is possible that some students didn't do the activities, this is acceptable. But if we found that the difference is big, so we have a problem. And we suggest actions to do with the teacher that have problems. If the problem is lack of abilities to work with learning space we suggest taking a course in the use of learning space. We make a following for the next semester, so we expect that the differences will be lower each time the teacher use the LN-LS course. Of course we understand that learning is difficult to standardize, but we also think we can offer a better service (education) using the advantages of on-line courses.

Conclusions

The use of the Assessment Center is very useful as an active and quickest way of receive and grade the activities the student make. And also we can control the performance from different teachers in our model called "redesign".

The WWW, ADDIE, and the ADL Guidelines

Patricia McGee
Department of Interdisciplinary Studies and Curriculum & Instruction
The University of Texas at San Antonio
pmcgee@utsa.edu

Leah Wickersham
Texas A&M University at Commerce
Department of Secondary and Higher Education
Leah_Wickersham@tamu-commerce.edu

Abstract

The proliferation on online learning requires that instructional designers know and apply sound instructional design. How and where they locate guidelines for ready reference has been addressed by the Joint ADL Co-Lab that provides *Design Guidelines for the Development and Evaluation of Effective Web-based Instruction.* To provide appropriate illustrations of the guidelines and ready access to them, the authors have created a Web site that illustrates the ADDIE model of instructional system design along with a repository of guideline examples.

The increasing development of Web-based learning necessitates careful and well-designed learning environments. The proliferation of organizations and institutions offering and often requiring online learning (Aldrich, 2001; NCES, 1999; Salopek, 1998; Fjortoft, 1995) means instructional designers must not only understand effective site design but also design that supports instructional interactivity. In response to the need for principles that inform designers, the Joint Advanced Distributed Learning (ADL) Co-lab in conjunction with the Institute of Simulation Training in Orlando, Florida researched effective practices and created the *Design Guidelines for the Development and Evaluation of Effective Web-based Instruction*. The ADL Initiative "is a collaborative effort between government, industry and academia to establish a new distributed learning environment that permits the interoperability of learning tools and course content on a global scale. ADL's vision is to provide access to the highest quality education and training, tailored to individual needs, delivered cost-effectively anywhere, anytime" (Joint ADL Co-Lab, 2002).

The Joint ADL Co-Lab envisions the guidelines as part of a dynamic and evolving resource to which instructional designers, researchers, theorists, and students may contribute. The current guidelines were completed in 2001 and made available to the public as a downloadable document, available from http://www.adlnet.org/ADLDOCS/Document/guidelines.doc. The design guidelines are organized into the following topics.

- Instructional Content Design
- Multimedia Design
- Web Site Design
- Graphic Design
- Web Page Style
- Web Page Layout
- Web Usability

There has been a concern within the ADL community that instructional designers may not reference the ADL guidelines (Hall, 1997) throughout the development process of Web-based learning. While the guidelines are comprehensive (over 80 pages) illustrations are limited and few. Additionally, there are concerns that designers may rely more on fast-prototyping rather than follow an instructional systems design approach (ISD), such as ADDIE, to material development. There is also a question as to how the ADL guidelines fit into the ISD process.

In response to these concerns, the authors proposed and developed a Web site for instructional designers of Web-based learning tools or environments that serves two functions:

> (a) provide a general overview of the ADDIE model of Instructional Systems Design (ISD) and
> (b) allow instructional designers to locate design strategies that will improve the educational functions of Re-useable Learning Objects (RLOs).

The site provides an overview of the ADDIE model of instructional design. Users can review the model and find general tips by stage or they can search a database to identify specific, research-based applications of effective design. For example, if a user wanted to find some different ways to provide interface interactivity, he or she could search the database and view examples of specific applications.

Due to the depth and breadth of the existing guidelines, the site designers reviewed and re-organized the guidelines based on the input of experts. The site design initially came from feedback from the same experts who felt that instructional designers had preferences in how the guidelines should be presented. There are two paths in the site. The first allows the user to review the ADDIE model and, from some sub-tasks, provides links to examples of a step. The second path leads to the ADL guidelines which are organized into four categories: Re-useable Learning Objects, Instructional Design, Multimedia Design, and Web Site Design. Each category lists sub-categories through which visitors can view sequentially or randomly. Each category and sub-category are designed to show an example that illustrates a specific guideline. Not all guidelines have an associated illustration. Visitors will be able to submit an example (either as a hyperlink or an asset) which will be reviewed for suitability. If accepted the example will be posted to the repository with credit cited. Several institutions will require graduate students in instructional technology to submit either objects or new guidelines. It is the intention of the site owners to update and revise the ADL guidelines as they become obsolete or irrelevant as new technologies and methods of instruction.evolve.

The site has been designed to supplement formal university courses, training, or self-study. Students or professionals may have been trained in instructional design but they may not have seen examples of good practice. This site is not a tutorial but rather a device that will allow learners and practioners at various stages of understanding and experience to find illustrations of basic principles, tips for completion of each step, and practical applications that can be used immediately. Although the site is designed for those interested developing Web-based learning contents, the principles and concepts represented here provide a basic introduction for any ISD project.

References

Aldrich, C. (2001). Strategic e-learning: Trends and observations. (In K. Mantyla, and J. Woods (eds.) *The 2001/2002 ASTD Distance Learning yearbook*, pp. 3-29. New York: McGraw Hill.

Fjortoft, N. F. (1995). *Predicting persistence in distance learning programs.* (ERIC Document Reproduction Service No. ED 387 620).

Hall, B. (1997). *Web-based training cookbook*. New York, NY: John Wiley & Sons, Inc.

Joint ADL Co-Lab (2002). http://www.adlnet.org/index.cfm

Joint ADL Co-Lab .(2001). *Design Guidelines for the Development and Evaluation of Effective Web-based Instruction*. Retrieved on July 17, 2002 from http://www.adlnet.org/index.cfm?fuseaction=rcdetails&libid=38.

National Center for Education Statistics. (1999). Digest of Education Statisics, 1999. Retrieved June 16, 2001 from http://nces.ed.gov/pubs2000/digest99/

Salopek, J. J. (199). Workstation meets playstation. *Training & Development, 52* (8), 26-35.

E-Learning: Courseware Development Among University Students

Sharihan bt Md. Khalid
Multimedia Technology and E-Commerce Research Group
Labuan School of Informatics Science
Universiti Malaysia Sabah
Labuan International Campus
87015 W.P Labuan FT
Malaysia
e-mail: sharihan@ums.edu.my ;Telephone: 6-087-460484 / 460445; Fax: 6-087-465155

Abstract: This paper explores the approach used by university students from one of the local University in Malaysia in designing and developing courseware (online or CD-ROM) for teaching and learning purposes. Exploratory studies from the final year students project documentation were carried out to examine the main courseware development technique process used among the university students. Findings indicate that majority of the university students comply with all the main courseware development techniques process requirements such as feasibilities studies, designing phase, implementation phase and testing phase except on the milestones, users manual, system manual, operational and maintenance manuals of their system. To produce a marketable courseware product for teaching and learning, it is very important that a developer should fulfill all the standards in designing and developing a new courseware besides satisfying the users' needs.

Introduction

In general, according to Learning Circuits (2002), "e-learning" "covers a wide set of applications and processes such as Web-base learning, computer-based training, virtual classrooms, and digital collaboration. It includes the delivery of content via Internet, intranet/extranet (LAN/WAN), audio and videotape, satellite broadcast, interactive TV, and CD-ROM". As "e-learning" is crucial to the development of Malaysian society; its potential can only be realized if high quality content is readily available at the right place, the right time and the right price. To fulfill such needs and high quality standards, most government-backed institutes of higher learning (IPTA) in Malaysia are encouraging their students in the field of Multimedia Technology to create quality "e-learning" courseware that can fulfill the needs of their target groups. The main purpose here is to expand local expertise in "e-learning" (users, designer and developers) in line with the new NITC strategic plan (NITC, 2001) to develop the relatively new spheres of 'E-Community', 'E-Public Services', 'E-Learning', 'E-Economy' and 'E-Sovereignty'. Therefore, a case study were carried out to investigate the strategy employed by university students from Multimedia Technology program in one of the local university in Malaysia in developing courseware on-line or CD-ROM. This paper will focus on the process and strategy used among the students in designing and developing new courseware that comprises multimedia components (text, graphics, animation, simulation, audio and video) – (Learnframe, 2001). The courseware developed can then be accessed through the Internet, Intranet or CD-ROM.

The Study

Exploratory study from the final year project documentation, only 18 out of 60 (almost one third) final year students chose to design and develop a new courseware as their final year project to be used by target groups such as school children, members of the public or other university students. However, only 5 out of 18 students choose to develop both on-line courseware through the Internet and CD-ROMs, while others preferred using CD-ROMs. This is due to the fact that CD-ROM can accommodate more and bigger multimedia files, thus adding to its interactive value as well as its attractiveness. Besides, CD-ROMs are portable and do not require connection to the Internet therefore allowing for a faster response compared to on-line access to learning materials where too many multimedia elements will slow down the on-line courseware downloading time.

BEST COPY AVAILABLE

Findings

From the case study, the standard methods used by the students are:

- Feasibilities studies on gathering user requirement through data collection (questionnaires, interviews, observations and other sources), technical, economic and operational aspects in developing the new courseware;
- Designing phase: structure chart which consists of system flow chart or pseudo-code, hierarchical chart or sequential chart and storyboard; and System User Interface
- Implementation phase: Creating the Tables / Databases needs (normally for on-line courseware for user login); creating the system user interface; and creating the coding (will need to include security and system coding for on-line "e-learning").
- Testing phase – executing a program with the intent of finding an error and verifying that the system meets all the requirements as set in the system design specification. The four types of testing are: unit testing, integration testing, validation testing (Alpha testing and Beta testing) and system testing.

In this case study, of all eighteen (18) projects documentations by the final year students, only three (3) students fulfilled all the development process requirements, while others are unable to finished the Beta testing and System testing phase. Only 13 students describe the functional components of their system in detailed. By comparing the student development process as to the software engineering process stated by Sommerville (2000), it was found that, all students does not include milestones, users manual, system manual, operational and maintenance manuals of their system.

Conclusions

From the exploratory study of the final year project (project documentation and courseware produce), majority of the university students comply with all the main courseware development techniques process requirements such as feasibilities studies, designing phase, implementation phase and testing phase except on the milestones, users manual, system manual, operational and maintenance manuals of their system. As maintenance phase is very crucial, therefore all university students should be alerted with the importance of milestones, users manual, system manual, operational and maintenance manuals in their system. Besides, as a developer, the students should also be sensitive to their users' needs rather than basing courseware content needs on their own preconceived notions (David, 2002; Anne, 2002).

In conclusion, a student will be able to produce a marketable new courseware (on-line or CD-ROM) if that courseware had been developed according to the standards in the courseware development processes as well as satisfying the users' needs. As a result, the courseware will easily allow for 'mastery of content' as well as 'mastery of learning'.

References

'National Information Technology Council, NITC'. (2001). Citing Internet Sources URL: http://www.nitc.org/nita/index.html [2001,Jun 30].

'Learning Circuits'. (2002). Citing Internet Sources URL: http://www.leaningcircuits.org [2002, April 2].

'Learnframe'.(2001).Citing Internet Sources URL: http://www.elearningshowcase.com/eleamfaq [2002,April 1].

David, R., & Anne, M. (2002). *The Future id in the Margins: The Role of Technology And Disability In Educational Reform.* Citing Internet Sources URL: http://www.air-dc.org/forum/AbRose_Meyer.htm [2002, March 23].

Sommerville, I. (2000). *Software Engineering.* Addison Wesley.

Proposal Summary of "Shaping the Delivery of Middle School Mathematics Curriculum through Production of Original Video"

1. Overview - Objectives

Participants will:

- Walk through the process experienced by an expert panel of Texas Middle School Teachers that was used to create real world scenarios that are mathematically rich and used as the basis of creating PBS-quality video
- receive information on a proven process that has been successful for districts receiving millions in technology awards; used by a consortium of 6 school districts to build a technology rich middle school mathematics curriculum that is standards based;
- articulate the process of consortium building and developmental stages of "break-through thinking" in designing a customized multi-media, Internet delivered curriculum for diverse student populations for middle school mathematics
- have information as how to access the eMath Project with 30 math modules as funded by a $1.8 million TIE Grant from the Texas Education Agency; how to participate in on-going research of the impact of emerging technology in mathematics education
- view and interact with Professional Development module and experience one student module with its interactive, video, gaming components
- experience one teacher's journey in break-through thinking on developing the mathematics modules for grades 6-8

2. Outline of Presentation
   - Review 3 years of planning, goal setting, defining needs by 6 school districts
   - Discussion of teacher input, curriculum design, break-through thinking in process of designing the curriculum;
   - Outline of the design of the web-based content to support the original video clips used in the modules with a thematic and problems based approach
   - Experience sequences of the video that are teen-interest based on problems that both this age group and society must use mathematics

   Audience will experience photos of teachers in the development process, see examples of modules that teachers have developed, view a video clips of administrators discussing the support given to the project; experience a module (as though they are students) to solve the posed problem and work toward solutions with web-based and video sequences.

3. Research Based — Because this project is cutting edge of emerging technology curriculum development, an Expert Panel of nationally known math professors was engaged through TEXAS A&M University to write a 'White Paper" on best practices in middle school technology initiatives in mathematics. The research is embedded in a staff development module.

4. Presenter Qualifications—In past 9 years has received funds for nearly $22 million for technology initiatives for consortiums of Texas schools, all the while serving as assistant superintendent for curriculum or acting as project director. Served on the 1999-01 Texas Education Agency Educational Technology Advisory Committee.

    - Workshop appropriate because it represents a major effort to integrate emerging technologies including a major use of original video into the middle school math program; uses teacher expertise in designing the content and delivery system
    - Major Presenter has given presentations to local, state, national, international audiences on technology, school reform, staff development for past 15 years

The Development of a Web-based Teaching System for Traffic Engineering Education

Leonimer Flávio de Melo and Luís Geraldo P. Meloni
Faculdade de Engenharia Elétrica e de Computação
Universidade Estadual de Campinas
Brazil
{leonimer, meloni}@decom.fee.unicamp.br

Abstract: This paper presents a teaching and learning environment for use in telephony courses in Electrical Engineering, where computers and Internet are meant to be used as facilitating tools for distance learning and attendance classes. The system uses client-server architecture, integrated with the Matlab software, allowing the conception of simulators, which offer high interactivity for the students. The simulators show the numerical results by means of graphics and tables. The system may also be used by professionals of traffic engineering.

Introduction

The teaching and learning of traffic engineering are in many aspects a hard task, as it involves topics with quite complex statistical computations. Besides the conventional methods for Internet courses based on HTML pages, the developed system is strongly supported by simulators, bringing to the students a high level of interactivity. The input pages for the simulators are called by hyperlinks strategically positioned inside the topics of study. These simulation pages may also be called in exercise resolutions, representing a very helpful tool for the students. For implementation of the simulators, the Matlab server was integrated by associating the computation power of this software with the high accessibility of the Internet. Matlab is well known by the academic community, offering a great number of mathematical functions, area-specific toolboxes and an ease programming language. In this Web course, we have developed a simulator for the classical traffic engineering equations. The interactive visual environment makes available a large variety of possible results for the students, illustrative graphics and tables. The system, accessible by the Web, can be used in distance learning classes, as well as in attendance classes. The software may also be used in professional traffic engineering computations, replacing with advantages the use of graphics and tables in the paper form.

System structure

The system uses the client-server architecture, rendering availability to the course pages and the simulator calculations over the Internet. The input-data pages, programmed in HTML, are loaded in the user's browser. The data are submitted to HTTP server, using the CGI (*Common Gateway Interface*) standard, allowing the received data to be processed by Matlab. The Matlab in response generates the numeric results, tables and graphics. These data are structured and sent back to client as an HTML page format, as shown in Figure 1. By the use of TCP/IP protocol, the system may also be accessed in a private network (Intranet) or the Internet. The Matlab Web is a multithreaded server, managing the communication between the Web application and the Matlab itself and also controlling the user accesses to the system.

Functions and visual interface

The traffic engineering Web-based teaching system covers loss systems and delay systems modeling. The course was developed with emphasis in the pedagogical aspects, emphasizing more the easier

BEST COPY AVAILABLE

understanding of the subject than the rigorous mathematical treatment. It provides demonstration of the most used equations in traffic analysis, explains in details the theory and also proposes several exercises that the student may solve by the use of the simulator.

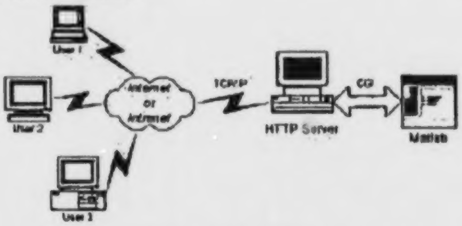


Figure 1: System structure

The main routines of the traffic-equation simulator are the Erlang B formula, for loss or blocking systems, and the Erlang C formula, for delay systems. Figure 2 illustrates a returned page for loss systems. The student defines two among three possible variables: number of channels, traffic intensity and blocking probability; he must also define the desired output. The simulator returns the numerical results, in this case the blocking probability, as well as graphics for the traffic intensity and for the blocking probability. These graphics displays several curves around the desired output. This is a very useful visual feedback for the students. The simulator also generates a table showing the traffic intensity versus the blocking probability and the number of channels. For the professional applications in traffic computations, the system is very attractive allowing the search of the desired results in an easier way than the traditional method of table consulting.

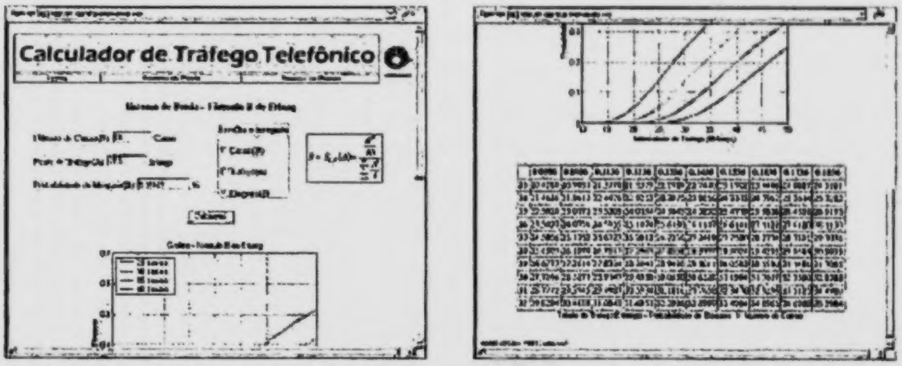


Figure 2: Final page for loss systems

Conclusion

The development of a system using Internet access associated with a powerful mathematical software, such as Matlab, brings a nice solution for telephony traffic teaching and learning, well adapted to distance education systems. The system may also be used as support tool in attendance classes or even in the corporative environment for traffic engineering analysis. It is important to emphasize that with a simple HTML programming, the system may be easily adapted to other content courses using simulations in the Matlab. The use of the simulators offers to the student a high level of interactivity, more attractive than the traditional reference books on the subject of traffic engineering.

References

www.decom.fee.unicamp.br/~meloni/educat/telephony.htm
Bellamy, J., (2000). *Digital Telephony*. New York, NY: John Wiley & Sons, Inc.
Dunlop, J., Smith, D. G. (1989). *Telecommunications Engineering*, London, UK: Van Nostrand Reinhold.

BEST COPY AVAILABLE

Tennessee Board of Regents
Regents Online Degree Programs

Tennessee Board of Regents' colleges, universities, and technology centers joined in Fall 2001, to offer the **Regents Online Degree Programs (RODP)**. All the institutions are fully accredited. All thirteen TBR two-year colleges deliver and award the noted associate degrees, while all six TBR universities deliver and award the noted bachelor degrees. Courses completed in the Regents Online Degree Programs are entirely online and transferable among all the participating institutions. Students are able to choose the college or university (home school) for their admission, registration, and the award of their degree.
The degrees offered are:

- Associate of Applied Science in Professional Studies: Concentration in Information Technology
- Associate of Arts in General Studies (University Parallel)
- Associate of Science in General Studies (University Parallel)
- Bachelor of Professional Studies with concentrations in Information Technology or Organizational Leadership
- Bachelor of Interdisciplinary Studies (General Studies/Liberal Studies/University Studies)
- Masters in Education (in development for Fall 2002)
- Certificate in Computers Operations Technology (TN. Technology Centers Fall 2002)

The Regents Online Faculty and Staff have been highly trained in teaching, learning, and assessing the needs of online students. The Regents Online Courses are designed for a 12 week semester–in an interactive, asynchronous (accessing courses at your convenience) format. These courses contain the same content and rigor as courses on campus. Student Services such as advising, library services, student support, and other forms of student assistance are offered for online delivery. Technical support for accessing course lessons and assignments are available 24 hours 7 days per week.

> Vision: "A better life for Tennesseans through education"
>
> Mission: "The Regents Online Degree Programs, using technology, will improve access to high quality, affordable, student-centered learning opportunities through cooperation among TBR institutions."

Goals:
To increase access to higher education for adult Tennesseans, especially those with some college experience. Census data document that Tennesseans lag behind both the national and regional averages of educational attainment. Further, attainment is uneven across the state, with rural areas lagging far behind urban areas. Economic development of the state depends on increasing the skill levels of the population.

To maximize the effective use of technology for delivery of college-level instruction. Distance delivery through the use of technology will increase access to higher education, especially in remote areas of the state and for adult learners for whom time flexibility is a critical resource.

To provide student access to web-based courses and degree programs. Web-based courses will reach populations not currently enrolled in higher education, and will also permit students who are currently enrolled in on-campus courses to take additional courses, thus completing their programs sooner.

Partnership with Eduprise E-learning Corporation

Eduprise, the leading provider of enterprise e-Learning services for education institutions and businesses, partnered with Eduprise to provide strategic planning, infrastructure hosting support and instructional development services. Eduprise established a major role in TBR's bold initiative by providing the infrastructure support services to underpin the strategic plan for the Regents' web-based degrees. These services include a hosted WebCT course management system, 24x7 technical help desk for students and instructors, WebCT software training for instructors, instructional design assistance.

Current Success

It was projected that the Fall 2001 enrollment would total to 300. However, the final enrollment number was 1,954 with a withdrawal rate of less than 12% and a dropout rate of less than 20% compared to the national average of 42%. The student and faculty surveys indicated an overall satisfaction rate of 79%. The Spring 2002 registration ended at 3,663 enrollments, far exceeding, the Fall 2001 numbers and an increase of over 80%.

If this proposal is accepted, the participants will receive data regarding the program, student, and faculty evaluations, retention rates, and program evaluation which indicates a 84% student satisfaction rate.

The Use of Relational Blocks Demonstrated

Linda L. Merillat
Department of Education
Washburn University
Topeka, KS
United States
lindam@inf-o.com

Dr. Anne Daugherty
Baker University
Baldwin City, KS
United States
adaugherty@bakeru.edu

Abstract: This demonstration will give conference participants an opportunity to see, work with and experience these newly designed manipulative tools, or relational blocks. A quasi-experimental study explored the effects of using these relational blocks to better teach pre-certification teachers basic relational database concepts. The three-week study was conducted with two classes and included a total of 37 students. One class used relational blocks while the other class used note cards. The remaining database concept material was the same for the two different classes. Class A, the control group, had an average pre-test score of 9.9 out of 50 and a post-test score of 27.7. Class B, the experimental group, had an average pre-test score of 16.4 and a post-test score of 34.3. Using ANCOVA, an F value of 28.7 was obtained which is significant at the .01 level.

Introduction

Beginning as young children, human beings strive to put order into their chaotic existence by continually organizing, generalizing, sorting, and categorizing the things in their world. Mathematics is one tool we use to help organize this information. With technology, databases are another practical tool we use to help maintain this same order. The underlying principles of a relational database are very abstract, mathematical constructs.

In many cases, children begin to use mathematical concepts intuitively. "They can generalize by touch and physical perception long before they know the words for the generalizations they form." (Rudolph, 1984) A child understands "round" versus "triangle" versus "square" before they can name those shapes. The benefit of using manipulative objects in teaching abstract mathematical concepts has been documented for several years. Cuisinaire rods, and other manipulative tools, are very popular in many school districts and are included in many of those district's educational standards. (JCPS, 2002; GASD, 2002; SCCROE) The use of manipulative tools is not limited to just pre-literate students, either. The standards that use Cuisinaire rods in these school districts cover a range of age groups from kindergarten through elementary school. Would introducing the abstract concepts of relational databases to children or individuals at this same level allow for the student to develop or form intuitive understandings of these abstract mathematical concepts at a non-verbal level? In doing so, would the student be better able to apply these concepts in practical ways? Relational blocks provide a visual, concrete way for students to access these abstract concepts.

The Study

A quasi-experimental study was conducted to test the usefulness of relational blocks. The basis for evaluation for the students in the study was a pre-test and a post-test and included three weeks of instruction on basic concepts of relational databases. The tests covered the essential concepts presented on relational databases. The test was developed by the researcher for this study and can be accessed on-line at http://www.inf-o.com/ RelationalBlocks.

The key operational variable is the use of relational blocks. Relational blocks are specially designed blocks that can be manually manipulated by a student or groups of students. The relational blocks provide tactile representations to the abstract database concepts of a database table, a row, an attribute, and the relationships between these objects.

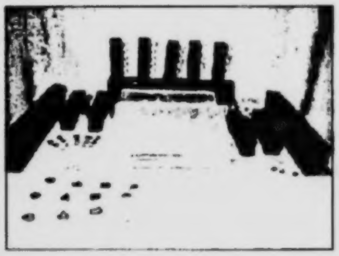


Figure 1 - Relational Blocks Materials

A database table is represented by a rectangular shaped open box. Each row within a table is represented by a block that is stood upright within the table, or box. The boxes and blocks, or tables and rows, and color coded. Each block or row has several hooks attached to it. These hooks represent attributes or columns within the row. The table and each row are identified with a label that fits within slots on the front of the box. The attributes or columns within a row are identified with additional labels that are affixed to the block with a rubber band.

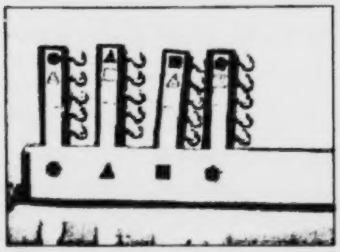


Figure 2 - Blocks for Tables and Rows

Relationships between the data within the tables and rows are illustrated by connecting the hook from one data value to the corresponding data value in another table by using a plastic string with two washers attached to the ends.

The use of relational blocks consists of performing a series of exercises designed to show how data in a relational database is stored and manipulated. During the initial introductory class, the experimental group completed three exercises using the relational blocks. The first one was a simple, abstract exercise; the second one was a conceptual exercise, and the third one was a technically complete exercise. The exercises used can be accessed at http://www.inf-o.com/RelationalBlocks.

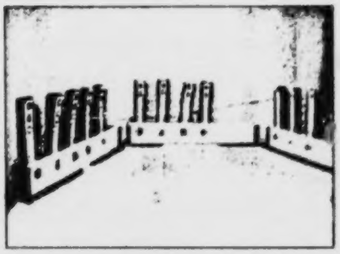


Figure 3 - Visualization of Relationships

Findings

An analysis of the pre-test and the post-test scores revealed these results:

Source	SSadj	df	Msadj	F
Adj	183.0	1	183.026	28.7
Adj Within	351	27	6.4	
Total	534.2			

The obtained F value of 28.7 exceeds 7.72; consequently, we can conclude that the post-test score results were significant at the .01 level.

Conclusions

In summary, the results of the study were encouraging. The results of the post-test were significant and simple observation would indicate that using the relational blocks were beneficial in laying a conceptual framework for the students before introducing the abstract concepts of relational databases. However, because of the small sample size, and because of the vastly different temperaments of the two class sections, more research is needed before firmly establishing the benefit of using relational blocks in teaching the concepts of relational databases.

References

Galena, Alaska School District (GASD). Terra Nova Performance Standards. http://www.galenaalaska.org/idea/terra_nova_perf_standards/TN_perf_standards_M2.htm. March, 2002.

Jefferson County, Colorado, Public Schools (JCPS). Math Staff Development—Materials & Technology, Types of Manipulatives. http://204.98.1.2/online/mathsd/materials/uses.htm. March, 2002.

Rudolph, Margerita and Cohen, Dorothy H. Kindergarten and Early Schooling (2^{nd} Ed.). Englewood Cliffs, New Jersey: Prentice-Hall, Inc., 1984.

St. Clair County, Illinois, Regional Office of Education. (SCCROE) "Education Standards—Goal 6, Standard A, Level 2." http://ww2.stclair.k12.il.us/ March, 2002.

Creating Virtual Experiments within a Web-based Adventure Game

Leslie M. Miller,
Rice University
Center for Technology in Teaching and Learning
United States
lmm@rice.edu

Abstract: Can students learn the process of experimentation and scientific method though virtual experiments within a game environment? This was a central goal of a web adventure series, The Reconstructors™. Using Macromedia's Flash 5.0 and an engaging narrative, the web adventure was tested in middle school classrooms.

The web site (http://reconstructors.rice.edu) is part of a project funded by the National Institute on Drug Abuse. The content focus of this effort is the history and biological impact of a class of drugs known as opioids. The benefits and challenges of using this type of approach for teaching sophisticated science concepts to middle school students is described in this pap er.

Pedagogical Foundations

The Internet's unique capabilities offer a certain seductive aspect that engages people of all ages. Not all of the Internet's applications could be said to have high educational value. Yet, from our own research on adolescents' media habits and preference, we find that "playing games" is high on the priority list of how they use computers (Miller, Schweingruber & Brandenburg, 2001). On the educational side of the equation, however, the Internet provides support for new instructional approaches, such as cooperative learning with other learners at a distance, demonstrations, online references, powerful simulations, tips, tutorials, and wizards (Carliner, 1998). Our efforts are directed toward blending the excitement of games with compelling science content to "create interesting, realistic contexts that encourage the active construction of knowledge by learners" (CTGV, 1993, p. 52). The work of John Bransford and the Cognition & Technology Group at Vanderbilt (CTGV) pioneered the way for exploiting the power of technology to achieve serious instructional goals.

The pedagogical strategies of situated learning (Brown, Collins and Duguid, 1989) or anchored instruction (CTVG, 1993) can provide the prerequisite framework on which to build multimedia environments that have significant learning outcomes. The task of blending best practice in education with the bells and whistles of multimedia is challenging. Perhaps that is why it is more common to find multimedia, particularly on the web that is rich in technique, but shallow in content. The use of technology for technology's sake rather than wrapping technology around tried and true learning principles is a common pitfall.

Specific Example

In the specific project that was designed and field tested, a student enters a futuristic world in which he or she assumes the role of a "Reconstructor" charged with re-discovering medical knowledge from the past. The five episodes – Plaguing Problem, Ancient Alarm, Analgesic Anxiety, Mystery of Morpheus, and Alpha and Omega – carry the concepts and narrative forward. Over the course of the episodes, players "solve the problem" while learning about concepts such as neurotransmission, the neurobiology and history underlying drug addiction, pain management, and analgesia.

Sample segments of the game with virtual experimentation will be presented at the poster session. For example, a major focus of one of the Episodes is to lead players through the same reasoning and experimentation that was performed by Otto Loewi to discover the chemical transmission of nerve impulses. He won the Novel Prize for Medicine in 1936 for this groundbreaking work. His experiment used frog hearts. The same experiment is repeated by the player within the story line of the game and he/she is asked to draw conclusions.

This, along with other examples of experiments which students would never be able to conduct in classrooms, is possible via Flash and the web. The comments received from end-users suggest that the web site has drawn the attention of students of all ages to investigate topics that may not normally be tremendous attention grabbers. Yet, crafted within the game environment and built around solid educational strategies, the site has proven efficacious in both gaining screen time and teaching difficult topics. Another paper presents the results of pre and posttest field test results with middle school students. Significant gains were made in specific knowledge concepts for students of all socio-economic status groups and for both genders. (Miller, Schweingruber, Oliver, Mayes and Smith, 2002).

Summary

Bruner's (1996) advocacy of narrative as an effective pedagogical approach in science education coupled with the "problem-solving" characteristics of CTVG early work in multimedia were used to produce a web adventure series with substantive science content within an engaging computer world. This process and the inclusion of virtual experiments helped to generate an adventure series that has been commended by several educational organizations.

Development of XML-Based Chinese-Multilingual Two-Way Dictionary for Electronic Textbook

Ming Yin, Shinichi Fujita, Satoshi Kasihara, Hiroaki Hasiguti, Seinosuke Narita
Narita Laboratory, Graduate School of Science and Engineering of Waseda University, Japan
yin@narita.elec.waseda.ac.jp

Abstract: This paper discussed how to design a comprehensive and intuitive Chinese-multilingual two-way electronic dictionary for an electronic textbook. The bi-directional electronic dictionary has made the definition search between Chinese and other language words easier. An XML document is created to store the multilingual resources under the support of Unicode. This paper has realized the display of multilingual characters in one homepage. The pinyin of Chinese characters can be shown correctly. The proposed method may not only regard Chinese dictionary, but may be useful for other electronic dictionary design.

Introduction

Along with the development of computer technology, the various electronic dictionaries are developed and put into the actual application such as English-Chinese dictionary. But when a web-based Chinese dictionary is designed, it must be considered that the learners may come from different countries. For a Japanese, Japanese will be displayed but for an American, English will be displayed in same web page besides Chinese characters. Therefore in some Chinese textbooks, multilingual explanation of Chinese is provided such as English, Japanese. But it is impossible to enumerate all languages for the limit of textbook. The electronic dictionary may achieve to add a new language or add a new word anytime. So it is necessary for a web-based Chinese dictionary to support multilingual display.

Choosing Character Encoding

For a web site of Chinese-multilingual dictionary, it will display two languages characters on a web page. A single language cannot simply be declared on the whole page, for instance, if Chinese is declared, then the Japanese text will be misinterpreted. So this paper declared UTF-8 which supports many languages as character encoding to format all pages. UTF-8 is a subset of Unicode and is a commonly used code page on the Web. In UTF-8, each 16-bit Unicode character is encoded as a sequence of one, two, or three 8-bit bytes, depending on the value of the character. When the web server retrieves data from XML documnet, the data can be written out to the browser as UTF-8 and displayed correctly.

Display pinyin of Chinese characters

Because the pinyin of Chinese characters has unusual appearance, it is unable to replace with the characters in windows, therefore this paper uses images to display pinyin correctly. Every character in pinyin with only one index value corresponds to an image which express the appearance of the character. The pinyin will be displayed as images by transforming a series of index value to its corresponding images. For example, the pinyin of Chinese character "语言" (meaning language) is , among them, the and can not be expressed by any characters in windows. When using images to express pinyin, the index value of is y0u1y0a1n0, here y0 corresponds one image whose content is y,u1 corresponds another image whose content is u, and is same to a1 and n0. Through the index value y0u1y0a1n0, the correspondent images can be found. The pinyin can be expressed by those images.

Index value	Image
y0	y
a1	ā
u1	ū

Format of XML Document in Dictionary

This paper uses XML(eXtensible Markup Language) document to store datum of the dictionary. XML can be encoded using almost any character set including UTF-8(Unicode). In order to support multilingual characters, this paper selects UTF-8 as character encoding. XML documents can be edited using any text editor such as notepad. It is also possible to create XML document by program. The <dictionary> is set as root element and the main tag is <word>. The tag <chinese> holds Chinese word. The <mean_language> is a tag to hold the explanation of the Chinese word in a language here language expresses the actual language name such as English or Japanese for example the tag < mean_Japanese> holds the meaning of Chinese word in Japanese. The tag <pinyin> holds the pinyin characters which are consisted of image's index value. The XML document is shown as follows.

Add elements to XML Document

For a new Chinese word, it must be inserted to the XML document including the character, meaning of every languages and the index value of pinyin. But when adding the explanation of a new language to existed Chinese word, the tag of correspondent language and text will be inserted. In both two situations above, one way is editing the XML document directly using text editor, the other is editing the XML document through program. Because XML is very simple, it is not difficult to edit XML document directly.

Retrieval of Dictionary

Retrieval Using Chinese Characters

This retrieval way will search the Chinese characters in XML document which the learner inputs. According to the learner's preferred language of browser, the retrieval result will return the describes of Chinese character meaning in correspondent language and display them in web page.

Fuzzy Retrieval Using Pinyin

When the learner can not input the Chinese characters correctly, it is possible to retrieve the characters using pinyin. This time the pinyin which input by the learner does not contain the corresponding four tones of Chinese characters, the retrieval way is called fuzzy retrieval. For example, the yuyan can be input for retrieving the characters. But the retrieval result will return all the Chinese characters which hold the same pinyin as yuyan(not include tones) in XML document. The learner can find the characters in the result list.

Reverse Retrieval

When the learner does not know the Chinese characters, it is impossible to input the Chinese characters or pinyin. Under this situation, the learner can input the meaning of the Chinese characters in his own language.

Pronunciation Based on TTS(Text-to-Speech)

TTS is the ability of the operating system to play back printed text as spoken words. This paper selects the Microsoft's Speech API(SAPI) to convert the Chinese characters into speech. This enables learners to know the pronunciation of the Chinese characters.

Discussion

Realization of multi-languages support has more other factors to be considered. When an electronic dictionary is designed, it is very important that good design is useful both for the user and the developer.

Reference

[1] Microsoft Active Server Pages: Frequently Asked Questions, Microsoft Corporation, September 1997

[2] Laura Menke, An XSLT style sheet and an XML dictionary approach to internationalization, Technical Coordinator, IBM WebSphere Developer Domain, April 2001

[3] Ming Yin, Seinosuke Narita, A Design Method for Multi-Language Support Web-Based Chinese Learning System Using ASP, Ed-Media, June 2002

[4] Ken Cox, Multilingual Web Pages with ASP and XML, Developer Exchange, Jan. 2001

[5] XML-Based Content Object Reference Builder

Distance Education as a Discursive Practice: Voice, Discourse and Pedagogy

Ananda Mitra, Ph.D.
Wake Forest University
Department of Communication
Winston-Salem, NC 27109
ananda@wfu.edu

Abstract: Distance education has taken on a new shape with the introduction of new digital technologies that have made the process of interaction between the teacher and student a far more vibrant process. Using the construct of "voice" this paper argues that the role of the teacher and the student is constantly changing as multiple voices can be heard in the discursive pedagogic space of distance education.

Introduction

The idea of voice, when applied to the process of technology-assisted distance education, begs the question of whose voices can be heard in this space? For an institution to be able to claim successful networking, it must allow the free flow of communication between the various elements that are networked (Sproull & Kiesler, 1992). The new climate of distance education provides such a networked environment where the players can claim to operate within a networked education organization. Robust and efficient technological opportunities make it possible to create a unique pedagogic discourse, and a teaching discursive space, where the teachers and students can take up roles that are different from traditional classroom roles.

Implications of thinking of Voice

Research on interpersonal communication, communication apprehension, and the opportunities provided by digital communication has demonstrated that, first, more voices can be heard on synchronous (and asynchronous) educational communication tools such as teaching chat rooms (Walther, 1996). Thus, in answer to the question of whose voices can be heard, it is safe to suggest that the students' voices are the ones that are most conspicuous when technology is applied to the distance-learning (or even traditional learning) scenario. This tendency can also be traced in the case of asynchronous communication tools with potential distance-learning applications. Using a tool such as e-mail to communicate with the instructor is often accompanied by an increasing burden on the teacher to respond to all the electronic letters that arrive with missives and voices of the students who are often the quiet ones in the classroom. The reason for this phenomenon can be traced within the literature on communication apprehension, but the consequences of this phenomenon within the context of digital learning with enhanced technology is the focus of attention in this paper.

To start with, the possibility offered by the new technologies can lead to a condition where many of the participants in the pedagogic arena are able to speak together. For instance, in a chat room class the students and the teachers are all able to speak together and can engage in a discussion around an issue that might have been treated as "lecture" material in the traditional classroom either in the face-to-face situation or in a video-enhanced distance-learning environment. The digital option, however, offers the opportunity to all participants to interact in real time. Since this technology often helps to overcome communication anxieties, it is also often the case that, independent of location, more people can actually participate in the discussions. To be sure, such a phenomenon can lead to conditions where the discussion can become unwieldy, given the fact that many more people participate in the discussion. Most research on chat room environments indicates that the lurking habit is insignificant in the synchronous chat room as compared to the asynchronous list services and Usenet bulletin boards. Consequently, a Babel of voices can be heard in the chat room. Yet such a collection of voices demonstrates that more agents are using the opportunity provided by the technology to utter their point of view using their own voice instead of either being silent or having some one else speak for them. In this new pedagogic space, the very act of utterance becomes a determinate moment, since it demonstrates that anyone has the right and ability to speak in this geographically distributed classroom and that location and status could disappear in the nonhierarchical teaching situation (Mitra, Chesner, Burg, and Ferebee, 2000).

Indeed, the shift from being spoken for by a class representative or even by the teacher could disappear in the technology-enhanced distance-learning environment where traditional determinants of speaking capital are removed. In the past, with video technology, the teacher would have a group of students in a face-to-face classroom and a different set of students in the distant classroom. Often the physical proximity to the teacher and the easier interactivity offered in the face-to-face classroom gave those students a certain advantage in gaining the teacher's attention. However, the digital classroom removes such biases, since in cyberspace the teacher and all the students are equidistant from one another, and no particular voice has any advantage based on geographic placement. This is true both for synchronous and asynchronous distance-learning technologies. It can be argued that in the asynchronous technologies that use electronic mail or Web-based tools, every voice is equitably placed in terms of distance. Indeed, the classroom in such cases becomes "ageographic," since the presence of the other students and teachers are felt in the voices and texts that appear on the ubiquitous computer screen of the student and the teacher. Here, momentarily, the technology of the computer erases the traditional relationships between voice and physical location, giving each player an equal voice.

This egalitarianism is also related to the way in which the teacher can exercise control in allowing or disallowing certain voices to be heard. As suggested earlier, the power attached to the teacher has often been the result of the physical structure of the classroom. In the case of distance-learning environments, where teachers would be teaching before a video camera and the students would be watching a television monitor, the teacher takes on the role of the narrator and the teacher's voice necessarily becomes more powerful. The teacher becomes the authoritative voice that is broadcast over closed-circuit television or by videotapes sent to students. However, in the digital situation, such technological and spatial advantages do not exist and the teacher often has fewer tools available to control the flow of the discourse. The natural advantage attached to spatial arrangement is lost, but the teacher and the students are required to mobilize their discursive strategies to assure their voices are heard. Indeed, within a distance- learning scenario where the teacher does not occupy a predefined position of power, it is possible that, instead of being a teacher, the person has to become a moderator to control the flow of the discourse rather than supervise who has a voice in that discourse. When considering the pedagogic condition from the perspective of voice, it becomes clear that the role of the teacher in the discursive environment changes, since it is the voice that becomes more important than a presence that is dependent on pre-existing power vectors. In the electronic distance-learning classroom, the speaking capital determines the teaching process rather than the capital attached to other determinants such as school year, teacher status, or even the physical set up of the classroom.

That voice can be considered central in thinking about the new technology also opens up the opportunity to consider the new pedagogic space primarily as a discursive space where the centrality of discourse and dialog is emphasized. As mentioned earlier, the teaching process is more acutely a discursive act in contemporary distance education. The distance-learning classroom now becomes a discursive space and the way in which the space is constructed is dependent on the way the discourse is created and managed. With the disappearance of the traditional relations of power, the eloquence of the voices of the discursive space of the distance classroom could determine who actually "teaches." A teacher who is not eloquent could easily see his or her "authoritative voice" being usurped by a more eloquent student.

References

Mitra, A., Chesner, C., Burg, J., & Ferebee, M. (2000). Computer-mediated communication and face-to-face instruction: An integrative perspective for a changing society using a case study approach. In D. G. Brown (Ed.), Teaching with technology (pp. 220-224). Bolton, MA: Anker.

Sproull, L., & Kiesler, S. (1992). Connections: New ways of working in the networked organization. Cambridge, MA: MIT Press.

Walther, J. B. (1996). Computer-mediated communication: Impersonal, interpersonal and hyperpersonal interaction. Communication Research, 23, 3-43.

Creating a Distributed Learning Network: Forging Partnerships, Forging Ahead

James M. Monaghan
California State University, San Bernardino

In 1999, our institution was awarded a $ 2 Million, 5-year grant under the Title V program, Hispanic Serving Institutions, of the U.S. Department of Education. This grant's purpose was to improve the infrastructure of the university to allow it to better serve the 27,000 square mile region in Southern California. The intent was to create a distributed learning network, linking CSUSB to regional community colleges. Factors associated with the creation and implementation of the network have included: development of a distance learning strategic plan, development and campus approval of a distance learning policy, development of procedures for online, videoconference, and blended/hybrid course development, formation of agreements with community colleges, academic program development, assessment, authentication, student services, marketing, funding, and other administrative issues.

Key components of the grant, written by Interim Director of Distributed Learning, Susan Cooper and College of Education professor Judy Rymer, included: partnerships with ten community colleges that would offer CSUSB courses, development of multimedia resources for use in courses, and improved accessibility of the university through online web resources.

In the first two years of the grant, due to staff turnover and delays in initial startup, we rolled over a significant amount of money. In the middle of the second year, there was a one-month vacancy in the project director position (which also was the Director of Distributed Learning position). Following this time, I accepted the position as director.

With the assistance of the office of the Provost and Vice Provost and the staff of the Office of Distributed Learning, notably Dr. Rosa Gonzalez, Assistant Director, and Bill Gray, Site Coordinator, we developed a renewed plan for implementing the vision of the grant.

Due in part to limited enrollment in CSUSB courses offered at a site 200 miles from campus, we realized that it was essential to not only forge partnerships with regional community colleges that served students in far-flung locations in our service area, but to actively develop a high demand academic program that could be offered in collaboration with community college partners.

Thus, in the summer of 2001, heeding recommendations from needs assessments, we embarked on a concerted development effort to produce coursework that would lead to a Bachelor's degree in liberal studies, a degree most often pursued by prospective elementary school teachers in California. This development effort involves coordination of diverse interests in our university. Some areas of cooperation include coordination between the Academic Colleges (housed in Academic Affairs), the Office of Distributed Learning (housed in Academic Affairs), the Teaching Resource Center (housed in Academic Affairs), Academic Computing and Media (housed in Information Resources and Technology), Telecommunications and Network Services (housed in Information Resources and Technology).

Other components of the model included making registration services, academic forms, grade reporting, and other student services available through the Internet. We also stepped up our advising for potential transfer students from community colleges. Additionally, as an institution we developed dual admission agreements and agreements to offer CSUSB courses through community colleges (videoconference, live, online, blended).

With a concerted emphasis on program development, it was essential to get the campus to agree to policies and procedures for implementation of online, blended, and videoconference courses. During the spring of

2001, extensive free response surveys were conducted of key internal stakeholders on issues salient to distance learning. These surveys were then collated into categories and analyzed in summer 2001 by members of a faculty senate task force on distance learning. Members of the committee included the chair of the senate curriculum committee, the chair of the Intellectual Property Committee, the Director of Distributed Learning, the chair of the Educational Policy and Research Committee and the director of the National Center for Excellence in Distance Learning. During extensive meetings in the summer of 2001, this committee drafted a campus policy on distance learning. This policy was approved, with limited revision, by upper administration and became binding in December 2001.

Given approval of the policy, after extensive airing of the proposed policy through open forums, we were poised to accelerate development and deployment of courses. This required us to better coordinate existing offices. Thus, roles for online course development were refined between the Teaching Resource Center, Academic Computing and Media, and the Office of Distributed Learning.

In our implementation of the distributed learning network, it was essential to connect with our partner community college schools and offer a blend of coursework: online, face-to-face, hybrid, and videoconference. We also are working closely with these colleges on formal advising procedures in which community college students are encouraged to continue their education and pursue a baccalaureate degree. By working with students at a location in which they are familiar, we anticipated convincing many first generation college students that they could attain a baccalaureate degree.

To date, we have had difficulty convincing large numbers of community college partners to promote online or videoconference courses. It has been our experience that community colleges appear to desire a physical presence of the 4-year university on their campuses. Nevertheless, we have successfully conducted agreements with three new community colleges since the inception of the program.

Additionally, the campus is now actively engaged in a concerted development effort that would have been unheard of on our campus three years ago. There is a clear shift in the willingness of faculty, departments, and administration to embrace distance learning.
A new faculty senate committee is charged with continuing evaluation of courses; this will build on efforts conducted by the Teaching Resource Center and the Office of Distributed Learning.

We are currently expanding our efforts in the student services area. We are exploring remote access to personal advising, to complement a host of student services that have been implemented as a result of the grant.

We are expanding our computer network infrastructure and our videoconference infrastructure. Video streaming is an important component of our current emphasis. Over three hundred campus courses have used course management systems (usually Blackboard) for partial delivery of course materials. The campus is currently developing a technology strategic plan in which distance learning figures prominently.

Through a contract with the Navy, Dr. Ken Lane and the National Center for Excellence in Distance Learning are developing MBA prerequisite courses, with development of an MBA scheduled in the next two years.

Our campus is experiencing a rapid shift to earnest distributed learning. Where previously we served occasional courses to a single remote satellite campus, we are now actively developing online courses, hybrid and videoconference courses that lead directly to a degree. The next two years will reveal whether the emerging internal and external partnerships will solidify or melt away amidst the turmoil of new ways of serving our regional academic needs. In this paper, I hope to illuminate many of the issues involved in such a rapid shift at our campus, and offer ideas on how our successes and failures may assist others.

"CNCplus telelearning" - A cooperative distant learning approach integrating University and Production with IT-technologies

Klaus Müller, Klaus Henning, Achim Streit

Centre for Learning and Knowledge Management and Department of Computer Science in Mechanical
Engineering (ZLW/IMA), University of Technology (RWTH Aachen), Germany,
KlausH.Mueller@de.bosch.com, henning@zlw-ima.rwth-aachen.de, streit@zlw-ima.rwth-aachen.de

Abstract: Co-operation between teams in different countries in research, construction and production as an important part of today's work should be a main component of university education. The project is based on a co-operation across the borders of three European Countries. The Project CNCplus telelearning is a sub-project of ELECTRA and aimed to promote collaboration between different groups of students from 3 European countries, and skilled operators of CNC production systems at distant working places. The collaboration is to be developed through approaches of experience-based learning.

Keywords: CNC, Information technologies, work organisation, production processes

1. Introduction

Current goals in educational research are the integration of telematic services in teaching and learning, focussing specifically on the impact and contribution of telematics for self-directed and collaborative learning. Co-operation between teams in different countries in research, construction and production as an important part of today's work should be a main component of university education. This challenge has been the reason for the ALMA-universities Aachen (Germany), Liège (Belgium) and Maastricht (The Netherlands) to start the project ELECTRA (Electronic Learning Environment for Continual Training and Research in ALMA). The project is based on a co-operation across the borders of three European Countries.

2. The CNCplus telelearning project

Presently the main task of a student of mechanical engineering or computer science is to learn the contents of well-defined subjects and to pass exams. The contents of the studies are defined by the faculties of the universities. Many other tasks relevant for the work in industry are not part of university education. Students of mechanical engineering have to master tasks in mechanical drawing, construction, calculation, material science and informatics etc. Missing tasks are group work, co-operative problem solving and getting a deeper understanding of socio-technical systems e.g. enterprises as a whole.

There are naturally differences between studying at Maastricht, Aachen and Liège. The main differences in the lectures are the numbers of students per lecture, the numbers of hours per subject and the contents of the subject even if they have the same name. Tasks comprising group work and problem-based learning are not part of the courses especially in Aachen and Liège. They are the way of teaching in the third and fourth year of studies in Maastricht. Direct contact with industrial production processes is rarely part of university studies.

On this background, the project CNCplus telelearning has been defined to take into account the demands on professional engineers in Europe today and tomorrow. Thus, the new course comprises the following tasks:

- Distant and co-operative working and learning via technological means
- Group work of peers as well as across peer groups (students and workers)
- Communication in English across European boundaries

- Understanding CNC-turning as a production process
- Learning to use the CAMplus software as an example of professional industrial control software.

The main objective of the project is to integrate experience-based learning in teams with the concept of distance learning. Students get exposed to the real production process beyond the computer simulation by linking simulation and production. They learn collaboration within and between groups at distant working places. The product to be made is a workpiece comprising three different components. The components are developed on a computer which is identical with a CNC system of a real manufacturing process.

Each of the three student groups works on one component of the final product, each group at another university. The three universities are located in Belgium, Germany, the Netherlands with three different languages spoken (French, German, Dutch). English is chosen as the co-operation language. It is a foreign language for all members of the project. The production site of this "enterprise" is a real production site, located at a fourth site in Germany.

The design and production can be simulated with the CAMplus system. A workplan of the CNC turning process is set up, simulated and controlled by each student working group in order to develop the best production process. The task of the production team on the production site is to collaborate with the student working groups in order to produce the workpiece according to the workplan. Skilled workers receive the CNC-production data and produce the components of the workpiece after some feedback and communication with the student teams . In CNCplus telelearning the individual students face three kinds of dialogues and means of co-operation:

- The dialog with the group members
- The dialog between the groups
- The dialog between the individual in a group and the system

The collaboration of the teams can be supported with different technical media. Within this CSCW (Computer Supported Co-operative Work) environment, communication between groups is supported by video-/audioconferencing, electronic mail, electronic whiteboard, file/datatransfer, shared window and telephone.

Thus, the CSCW environment enables the groups to work collaboratively on the internet. The student groups communicate mainly by email, audio or video conferencing. Construction and production data are sent through internet as well. The configurations change dynamically by the use of both real time and asynchronous communication. The different use of tools in the group and the requirements given by the production process play also an important role. The time synchronisation ofthe working processes in the four working places has to be dealt with. The interactive multimedia and telematic services integrate the industrial production in a collaborative learning process at universities.

According to the project aims and concept, test runs were made to record first experiences of students co-operating via these media. The first test run was made with groups who did not know each other before. They had different education and different knowledge. It caused misunderstandings and it led to limitations of the communication within and between the groups. A second and third test run showed better results in co-operation and communication about working processes in the groups. The students got to know each other and at the beginning of the test run they had more of a similar education than in the first test run. The main result was that similar background knowledge facilitates co-operation but it still does not help in communicating effectively in all phases of a co-operation process.

3. Conclusions

The test runs of this specific project have shown that the unique set-up of the project is a strong stimulus for engineering students to develop their intrinsic drive for international communication and co-operation. The different technologies and media used in parallel still cause substantial difficulties for the students as well as for the supporting technical staff. The computer networks still do not fit perfectly together across national borders and between the departments of different universities; the students reject the notion to learn in a cumbersome way to make efficient use of some of the technical means of transmitting drawings; the phone is still experienced as the easiest and most efficient means of communication. These difficulties need much more attention in developing new information technology and networks as is given to them today.

Considering Technology Use in Education: A Pre-service Education Course Model

Sharon Murray, Associate professor
St Thomas University
Fredericton, NB
E3B 5G3
Canada
Voice: 506-452-0473 Fax: 506-452-0611
email: murray@stthomasu.ca

Abstract:

A face-to-face and web-based course model is used to support a community of learners (pre-service teachers). This model seeks to create an environment that supports learners thinking about technology use in education rather than regurgitating an instructor's view. The students consider their readings and the perspectives of their classmates and create a digital portfolio that reflects their experiences and thought development. The course work also includes learning from experience and collaborating as a team to design instructional packages for K-12 educators.

Submission Category: Full Paper

The simulation program and chat in the e-Learning course in physics (mechanics)

Yasushi Nakajima

Abstract

To find the keys to make the effective e-Learning Introduction course in physics, this exploratory study were performed. E-Learning materials including a simulation program were made for the Introduction course in mechanics. The materials consist of 7 parts (vectors and their scalar product and mechanics, cross product of vectors and mechanics, differentiation of vectors and mechanics, Newton's laws and equations of motion, Taylor series and mechanics, computer simulation of circular motion, moving coordinate system and circular motion). In the course, there were two forms to participate. Students individually participated in one form, while they collaborated in the other form. In two forms, the interactions among contents, students and the instructor were observed. The observations suggested that the inter-relay chat and simulation program and easy questions that needs reflection of physical concepts are important.

Introduction

Although distance learning that utilize WWW (World Wide Web) and other telecommunication technology, e-Learning, have become popular in many countries, it is not established how to learn, instruct and collaborate in e-Learning, yet. Although there are some e-Learning schools, which prepare their students for entrance and qualifying examinations, in Japan, most of e-learning courses in the schools consist of electronic multiple-choice exercises and self-instructional text and don't have effective systems that help their students to obtain characteristic and difficult thought process in specific academic field. While it is established in the traditional classroom how to obtain characteristic thought process in special academic field, such as experiment and its report in the physics, it is not established in e-Leaning course. If methods to help students obtain thought patterns and process of various academic field in e-Learning course is developed, e-Learning course is able to be utilized as not assistant but principal and independent course and the methods seemed to result very large economical and educational profits.

This exploratory study attempted to find the key to help students to construct physical concepts in e-learning introduction course of mechanics. Electronic materials were made for Introduction course of mechanics. In the course, students read materials, did simulated-experiments using a given simulation program and submitted assignments and reports via the WWW. The course has two forms to participate. In one form (Individualistic form), students were individually able to submit questions to the instructor and were not forced to collaborate with other students. In the other form (Cooperative form), students were divided into groups, had to collaborate with other members in the same group to submit works. Relationships were discussed among the percentage of works, which students accomplished, instruction and collaboration in the two forms.

Course and the Learning Materials

This Introduction Course of mechanics was a part of preparation curriculum for the students to enter to School of Science and Technology of WASEDA University. The term of the course was 5 weeks in individualistic form and 3 weeks in cooperative form. This course was elective and the students that took the course weren't obliged to complete all works of the course. The Learning materials consist of the following 7 parts.

1) Vectors and their scalar product and mechanics
2) Cross product of vectors and mechanics
3) Differentiation of vectors and mechanics
4) Newton's laws and equations of motion
5) Taylor series and mechanics
6) Computer simulation of circular motion
7) Moving coordinate system and circular motion

Each part has works (assignments or reports) that students do and submit via the WWW.

Students

Students that took this course were 17-19 years. Although all of them have a lot of learning experience of mathematics, their learning experience of physics was variant. Some students took the 3 years advanced course in physics in high school; another student took only 1-year elementary science there. At the beginning of the course, an examination of basic physics (pre-test) was performed and students are divided to individualistic form and cooperative form, as distribution of the marks in the individualistic form is similar to that in the cooperative form. They lived in various parts in Japan and didn't know each other.

Individualistic Form

21 students individualistically participated in the course. The students read the content, did works, submitted works and questions using electronic mail (e-mail). Although the most of their questions were light, the instructors felt that a little of questions had included physical thinking. The results of the observation are the followings.

1) Students that submitted many questions completed many works using e-mail.

2) While only 1 student submitted physically important questions in 15 students that completed below 60 % of all works, 5 students did in 6 students that completed above 60% of all works.

Cooperative Form

19 students cooperatively participated in the course and were divided into 5 groups that consist of 3-4 students. The difference the average of the pre-test among 5 Groups is below 5 percent. In the group, students discussed in the inter-relay chat and electronic bulletin board system, understood the contents and made a work together. Each student was assigned a specific role such as 1) recording of discussion, 2) promoting to participate, 3) dividing a work into small parts and assigning the parts into all students 4) checking their work.

The results of observations are the followings.

1) One group (the best group) completed all works, while other four groups completed 43% of all works.
2) The best group was chatting about works and physical concepts during 11 hours, while the other groups were doing during 6 hours or less.
3) The number of submission in the bulletin board system in the best group is 147, while that in the other group is 74 or less.

Discussion

Important discussion is the followings.

1) In individualistic form, students that could complete many works seemed to think the essence of physics hard and submitted many questions. This suggests that the excellent individualistic e-Learning course in physics should have e-Learning contents that have many students to think the concept and essence in physics.
2) To have students understand moving coordinates, contents including simulation program of circular motion (the 6th part) were made. 5 students performed the simulations and probed the acceleration of the circular motion. The results of analysis of the simulations helped them to understand moving coordinates very much. This suggested suitable contents including computer simulation is effective in e-Learning of physics.
3) In cooperative form, the group whose students discussed each other using inter-relay chat during the longest time could complete all works. The chat records in the group indicate that students had gradually obtained correct physical concepts in the process of discussion without the instructor's advice. In this case the inter-relay chat was very effective to construct the students' physical concepts.

Conclusion

This exploratory study suggests the followings.

1) Utilization of simulation programs and inter-relay chat seems to be important for the effective e-Learning course in physics
2) Instead that teacher's real explanation on physical concepts with discussion in classroom, solving easy questions that needs reflection of physical concepts seems to be effective in e-Learning course in physics.

Systems

1) Server: Microsoft Windows 2000 Server, Microsoft Exchange 2000 Server, Microsoft SQL Server 2000
2) ELearning software: dotCampus (Interlect Co. Ltd.2-2-8 higashi, shibuya-ku, Tokyo 150-0011, JAPAN)

Acknowledgements

I acknowledge Prof. Toshio Oshima (Dean of School of Science and Technology of Waseda University), Prof. Kazunori Ban (Principal of Waseda Senior High School), Prof. Shuuji Owada and Ph.D. Yoshiya Yamanaka in financial support and Ph.D. Takahiro Tachibana and M.S. Masaru Yaoko in helpful advice.

A Multimedia Storyboard Tool

Helmut M. Niegemann
Institute for Media and Communication Studies
Technische Universitaet Ilmenau, 98684 Ilmenau, Germany
helmut.niegemann@tu-ilmenau.de

Abstract: Up to now storyboards for multimedia learning environments consist mostly of copyed templates filled in by hand. The poster presents a software tool to generate storyboards using MS Powerpoint. Advantages of the tool are: ease of use, prototype-like presentation, inclusion of a data-base for the assets, revisability and recording of revisions.

A common way of communicating the design of an e-learning site to clients and programmers is through the use of storyboards. Although storyboards are used by people with (for the most part) a high level of computer literacy, there are almost no computer-based tools available. Typically, a design and development team decides for a photocopied template representing place for a sketch of the screen design and slots for information such as the name of the program, number of the screen, author, date, and directions for color, links, interaction, audio and video files to be integrated, etc. (e.g. Alessi & Trollip, 2001; p. 514 f.). These templates are normally filled in by hand.

The disadvantages of this procedure are obvious. Templates filled in by hand often require additional explanation for clients and other target groups, and cannot be easily presented to a group of people, e.g. using a beamer. Pictures, videos, and other assets cannot be integrated, and must be presented sepaately. Thus, there is an obvious demand for a computer-based tool for creating multimedia storyboards, similar to the well-proven tools for film scripts. Important criteria for the development of such a tool include:

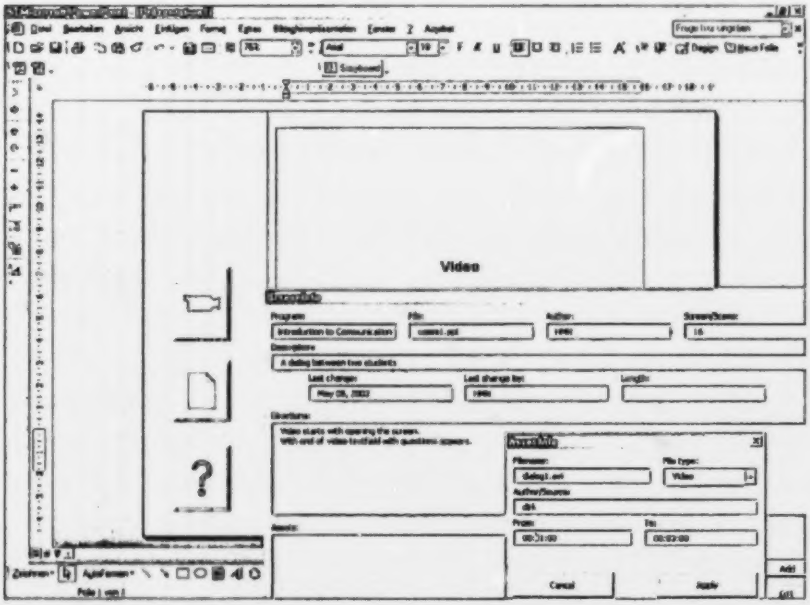


Figure 1: Mask to assess information

BEST COPY AVAILABLE

- ease of use
- possibility of presenting the storyboard both digitally and on paper (printout)
- prototype-like presentation
- inclusion of a database for the assets
- revisability
- recording of revisions (date, time)

Instead of programming new software, we discovered some of the features already realized in a common software product, Microsoft's PowerPoint. We therefore decided to use the features already available and supplement them by programming an add-in using VBA for PowerPoint. The main idea is to use the PowerPoint screens for sketching the web pages, and the notes fields to assess and represent all information and directions for the programmers.

To assess this information, we programmed a mask to be filled in for every slide (Figure 1). The content of these masks is automatically copied into the notes field. In this way, any printout of the slides with the notes fields represents one page of a storyboard, consisting of the screen on the upper half of the page and the necessary information below (Figure 2).

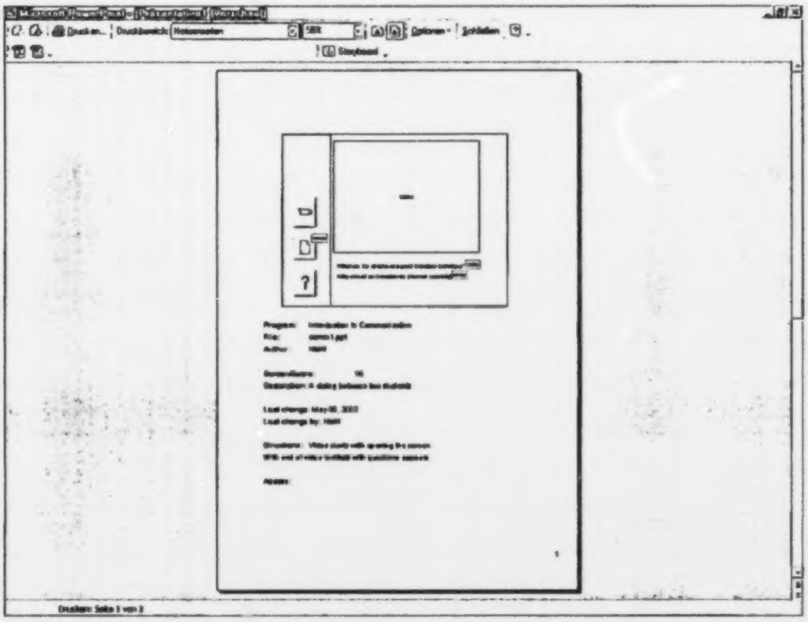


Figure 2: Printout of a page of the storyboard (A4 format)

Furthermore, we recommend the use of the yellow comment fields in the screen sketch. They are especially useful for conveying directions concerning the color of objects, branching information, etc.

The storyboard tool has been in use for several months now, in the context of two projects involving the development of multimedia learning environments for higher education in the fields of communication studies, electrical engineering, and medical informatics.

References

Alessi, S. M., & Trollip, S. R. (2001). Multimedia for Learning. Methods and Development. Boston: Allyn & Bacon.

BEST COPY AVAILABLE

Emerging Perspectives on Learning, Teaching and Technology

By
Michael Orey

In this session I will demonstrate an evolving ebook that I created in collaboration with a group of doctoral students for use in a Masters level class on learning theories and instructional models. Since it is an ebook it, can be regularly updated, it can include interactivity and animations, it can be regularly added to, it can have contributors from around the field, and anyone can use it without charge for their classes. The obvious negative issue is what this would mean for book publishers?

In the Spring of 2001, I helped to create an ebook entitled "Emerging Perspectives on Teaching, Learning and Technology" with a group of doctoral students (http://itstudio.coe.uga.edu/ebook/). The purpose of this book was to provide masters students in the program with a text for a class that has the same name as the title of the book. The class is split between a survey of the most popular learning and cognitive theories (information processing, Piaget, Vygotsky, motivation, social constructivism, learning communities, and situated cognition) and a more in depth analysis of popular instructional models (cognitive apprenticeships, problem-based learning [including anchored instruction and webquests], constructionism [including project-based learning and learning-by-design], Six C's of Motivation, and conceptual change. In the past, I taught this class with a collection of papers and book chapters. I considered books such as Gredler (2001), Joyce, Weil, and Calhoun (2000) and Driscoll (2000), but none of these matched exactly with what I wanted to do in this class. I then proposed to a group of students the idea of creating a book for this class and I was able to get a group of eight doctoral students to volunteer. The creation of this book in the Spring of 2001 was just a beginning.

Unfortunately, because of a variety of factors, I was unable to teach the masters level class until the Spring of 2002 which I just finished at the time of the writing of this proposal. Part of the requirements in this class is to make a contribution to the book and I have given the students (34 of them) some latitude in defining what that contribution might be. One of the contributions has been to do some copy editing. Because we have not used a publisher, we have no resources for copy editing and so the burden is placed back on the students . Another contribution has been to create some sort of animation or interaction to help explain a complex construct in one of the theories in the book. Interactive animations that have been added now help explain Vygotsky's Zone of Proximal Development, Piaget's Equilibration, Assimilation and Accomodation, tracing a stimulus through the information processing system, how scaffolding works, and an animation explaining intersubjectivity.. Another task that some have taken on is to create a piece of web-based instruction that makes use of one of the models of instruction. One such effort was done to help children change their concept of history from one of memorizing facts to interpretation and sense making from various artifacts available to shed light on an historical event. Finally, some students elect to make a contribution to the book. This semester one student wrote a short chapter on the educational applications of behaviorism and another added Piaget's stage theory to that chapter. Every student must create either a high-level design document or a lesson plan that uses one of the instructional models. These examples are then placed into the ebook for later reference by future students.

Having run once through using this book for a semester, I have found that contributions were a little uneven. As a consequence, I plan on assigning teams to chapters who will then be responsible for a chapter. Chapter responsibility includes making sure that there are no spelling or grammar errors. Also, they must verify that all links are working and also generate any additional links that might be needed. Finally, they must examine the chapter for concepts that are particularly difficult or important to understand and design and develop interactive components to help others understand the concepts.

A number of years ago Broderbund started a series of CD-ROMs that were called, "Living Books." These books were designed for children and usually were based on an existing paper book such as Mercer Mayer's "Just Grandma and Me." Within these programs, children could click on various things that would react to being clicked with clever animations and sounds. The ebook described here is what I would also like to call a "Living Book," but in this case it is a living book in that as students use this book, they transform their book by contributing to it. In every other book that they have ever used in a class, at best they are transformed by it, with this book, the book and they can transform together. Further, I would like to invite all members of this academic community to use and participate in this book. In this way, the book is continually evolving as the thinking within the "community of practice" defined as our field evolves. There have been several e-journals to emerge in the past few years. I would like to see the emergence of this new kind of book with contributions being made by everyone whether it is animations, interactions, updates, edits, or creations of whole new chapters. I would also invite other members of the community to make comparable books covering other theories and perspectives in the field.

I make this recommendation while also thinking about a recent exchange on the ITFORUM listserv. I do not in anyway want to devalue the contributions that publishers in our area make to the field. I think they have an important role. If what I propose here is adopted far and wide, it would likely put some of these companies out of business. I try to balance the interest I have in supporting these publishers and the needs of my students who are asked to pay $60-$75 for any of the three books that I mentioned above (I just checked prices at Amazon on 5/6/02). I also balance that with the incredibly slow turn around for print-based publications. Finally, I want to consider the fact that the material that my students are reading is transforming them and they are transforming it. I would like to present the book in the form that it is in next fall and to discuss these issues in my session. There are an additional 40 students who will be using the book in the fall.

The book will shown at the conference on my notebook computer. I will have all the files on my machine, so that internet access will not be an issue. I may bring a projector to enlarge the computer screen. A plain wall or perhaps the availability of a screen would be required.

Building a Model of Collaborative Learning Environment

Thereza Patricia Pereira Padilha
Laboratory of Computational Intelligence
Luteran University of Brazil
Brazil
thereza@ulbra-to.br

João Bosco da Mota Alves
Federal University of Santa Catarina
Brazil
jbosco@inf.ufsc.br

Abstract: This paper reports the development of a collaborative learning environment model, named RESOLVE, that contains the resolution of problems like learning methodology. Thus, making possible geographically away-scattered groups solve problems by using communication tools: chat, text editor and vote, provided by environment. Here are also presented the elements that give shape to the environment.

Introduction

The advent of the communication and information technologies has been building a track to certain changes in the educational system affecting especially the means of teaching and learning. Facing that, schools and universities that used to offer traditional schemes of long-distance education using cassette tapes and mail service, for example, had to reestablish it's educational broaches to include the Internet and it's communication and information technologies. As Ragoonaden and Bordeleau say, the students that learn by the Internet develop cognitive skills to the point of making themselves able to search, analyse, identify and summarize new information to conceive his/her own basis of knowledge (Ragoonaden & Bordeleau, 2000). Therefore, this paper stands to present a collaborative learning environment for a long-distance education, named RESOLVE, that has as apprentice methodology five stags of problems resolution. This environment was projected in a multi-agent architecture to support teachers and students in the teaching-learning process.

Computer Supported Collaborative Learning (CSCL)

The CSCL can be defined as an educational strategy in which two or more students build their knowledge through discussion, thinking over and decision taking, using the computer tools as mediators for the teaching-learning process (Ribeiro, 2000). The researchers of CSCL, for a long time, have been concerned about: interactivity, group size, joiness time and especially the learning methodology. Among the existent methodologies, the group problems resolution, is becoming the most popular in this environment, because learning occurring as a side effect expected is, interceded by the aquireness of new knowledge or by the improvement in performaning problems resolution (Rosatelli, 1999). The use of Artificial Intelligence techniques, mainly intelligence agent, is a new tendency to the CSCL development and, has been bringing good results like, for example, the MEMOLAB that is an experiment in which intelligent agents cooperate with students and teachers as co-pilots in the navigation through the Internet (Dillenbourg et al., 1996).

RESOLVE Collaborative Learning Environment

The RESOLVE collaborative learning environment goal is provide critic thinking development in a group of students, by using the five steps of the problem-based methodology. Here they are: a) reality observation: global view of the subject taken, identifying a problem to study; b) main-topics: identification of the main topics related to the problem; c) theory building: theoric explanation of each main-topic identified through the reading and researching; d) hypothesis elaboration: identification of possible hypothesis to solve the exposed problem(s); e) reality fitting: election and settlement of the most suitable solution. From this steps onwards was projected the RESOLVE environment architecture, as shown Figure 1.

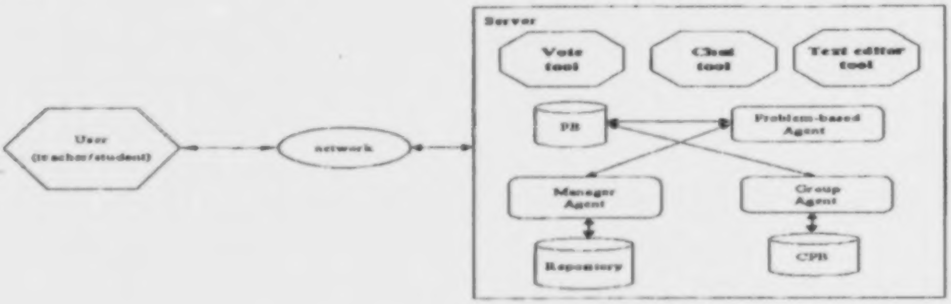


Figure 1 – RESOLVE Environment Architecture.

- Problem-based agent: restore and analyse the deposit's information to determine the group's ability to solve problems, thus, leads the groups to the direction of possible resolution(s). For that, this agent uses the problem base (PB) that has got the knowledge acquired by preview problem's resolutions;
- Group agent: supervises and shapes the group members' interactions, storing them into the collaborative profile base (CPB);
- Manager agent: run the environment's working as a whole managed;
- Repository: stores the documents which the groups produced;
- Chat tool: allow group members to discuss about certain topics in an informal way;
- Text editor tool: enable the group members to compose texts jointly;
- Vote tool: allow the members to decide about the away they may follow or even get to a common agreement.

The embodyness of the intelligent agents to the RESOLVE environment has as it's main goal assist teacher and students in the problem's resolution dealings and not replace the teachers themselves in the process of analysis and accompaniment of groups of students. The implement of this environment is being made with the help of the programming language JAVA 2.

Conclusions

In the proposed model of methodology, the teacher retires the centralizer role (the same one we have being having for years in standard classrooms) to assume the easiness maker, encourager and collaborator role. On the other hand, the student will participate more vigorously of the set up of his/her own knowledge, researching and collaborating to the solution of a certain problems. The usage of intelligent agents in the RESOLVE environment has a positive impact in the problem's resolution process, in the direction of providing and stimulating the mutual collaboration among the group members. The next step oh this work is use validation of the model proposed, in long-distance courses.

References

Dillenbourg, P., Baker, M., Blaye, A. & O'Malley, C. (1996). The evolution of research on collaborative learning. In E. Spada & P. Reiman (Eds) *Learning in Humans and Machine: Towards an interdisciplinary learning science*. (pp. 189-211). Oxford: Elsevier.

Ragoonaden, K. & Bordeleau, P. (2000). Collaborative Learning via the Internet. In Proc: *Educational Technology & Society* (pp. 361-372).

Ribeiro, G. S. N. (2000). Pedagogia de Projeto: Integrando a Tecnologia no Currículo. In: *XI Simpósio Brasileiro de Informática na Educação* (pp. 244-250). Maceió: Alagoas.

Rosatelli, M. C. (1999). *Um Ambiente Inteligente para Aprendizado Colaborativo no Ensino a Distância Utilizando o Método de Casos*. Florianópolis, Santa Catarina: Universidade Federal de Santa Catarina.

BEST COPY AVAILABLE

Management of the Educational Process

Ciro Martins, Paulo Ribeiro, Pedro Paraíso
Campus Beiras - Portuguese Catholic University
Estrada da Circunvalação – 3504-505 Viseu – Portugal
{ciro.martins,pribeiro,pparaiso}@crb.ucp.pt

Abstract: The ability to teach and learn in a heterogeneous environment, subject to a fast renovation of contents and practices, leaves little room and time for the accessory. Nevertheless, and especially nowadays, we are aware that ephemeral and accessory elements are those, which increasingly provide strong appeals and calls. This constraint leads to a new and each time stronger concern about efficiency and effectiveness in the orientation and usage of the available formative resources.

Educare ... Educere

Without retaining ourselves in the socio-political implications of the concept of education, and if we just consider the phenomenology of the process itself, we are "compelled" to realize that we live in a time in which the definition of a new paradigm in education occurs, which in itself creates new constraints and opportunities. This scenario submits all actors of the educational process to a greater focus on the objectives and methodologies to use. Today, more than ever, it is a true priority that a correct balance is achieved between instruction and construction activities. On the other hand, and under the point of view of the pedagogical relationship, which is hereby established, the ability of knowing how to find a point of balance in the continuum between Authoritarism and Permisivity is a real critical factor.

A pedagogical system marked by authority-based relationships seeks to maximize the monolithic component of the instruction structure, leaving little autonomy, or even none at all, and little room for criticism, by valuing the ability to absorb, to conform to the norm and to obey. However, if authoritarism silences, permissivity isolates and empties, defrauding all expectations of the actors of the teaching/learning process. It allows no instruction, because it empties, it discourages all construction in that it isolates. Among other related phenomena, establishing the balance we mentioned above means, in Torrado's[1] words, to fight against a form of "an indisposition of 'modernity', which is characterized by individualism, primacy of the instrumental reason and loss of freedom".

In the society of knowledge and learning there is each time more room for the educational process to be placed within the angle of shared responsibilities. Shared by those who "teach" and by those who "learn", leaving both enough room for freedom and creativity.

Only in an adequate environment can the psychological mechanisms be created and stimulated, which are favourable to a fast adaptation and change, against the traditional resistance to the latter. The same environment encourages an ability to resist to the stress created by the constant lifewide and lifelong need to learn. To create spaces of freedom and responsibility for the process of Educare (to mould) and Educere (to give birth) to prevail and to affirm itself as the daily praxis of the universal citizen of the new millennium, is a challenge posed to all those who share responsibilities in this field.

It is a challenge posed to all methodologies and teaching/learning techniques but particularly to those, which, due to their intrinsic nature, are best suited at present times.

---

[1] - Torrado, Sánchez (1998). "Ciudadanía sin fronteras – Cómo pensar y aplicar una educación com valores. Bilbao. Ed. Desclée de Brouwer.

Methodologies and technologies of the new teaching paradigm

The creation and implementation of a new paradigm in teaching methodology is nowadays a high potential area, in which new practices and new relationships are defined and related to the traditional teaching and learning processes. The interest raised within the different teaching and training institutions for this new approach is promoting a fast expansion of teaching/learning techniques and methodologies. However, these methodologies cannot be seen as mere processes, in which flexible and expanded means for the divulgation and distribution of didactical contents is promoted. These new methodologies must be viewed as generator means of the dynamic relationship between the different intervenient parties of the educational process – institutions, tutors and learners. They will allow the reformulation of the present processes of teaching, learning and interacting.

The tutor's role acquires therefore a new relevance, in that it faces a whole set of new and important challenges. Tutorship is a teaching support methodology, which despite being suitable from the most classical to the most modern teaching models, is particularly assertive within the constructivist approach. Thus the tutor should have a profile and a set of competences, among which we find the need to explore and take the best advantage of the new teaching technologies at his/her disposal. The new roles and skills a tutor is required to have should be understood and defined within a specific context, according to the technical and pedagogical restrictions of the learning environment, the characteristics of the target public and the pedagogical model in effect.

If, on the one hand, in a perspective of face-to-face or classroom teaching the tutor gets a reduced feedback from the participating elements, in an ICT supported learning situation, on the other hand, the direct relationship between learners and tutor facilitates the fast and efficient perception of the problems and concerns of the former. However, in a classical situation, the tutor can obtain verbal or non-verbal feedback, which is sometimes impossible in a teaching typology connected to the new paradigm. In this area, the asynchronous interaction "tools", which are normally used as support ad complement to the learning activities, do not provide an effective support to the resolution of this kind of interaction needs. Here, the synchronous interaction "tools" assume a particular relevance, covering the gaps left by the former.

Applying the approach

HEINET (Human Education Interactive NETwork) is therefore an essential "tool" for the implementation of this kind of methodological approaches within the new teaching paradigm. By including technologies, which as a whole allow a synchronous interaction, it enables all intervenient elements in the educational process to communicate in real time: the participants interact together and simultaneously, thus stressing one of its basic assumptions – the equity in the educational process. By operating in a synchronous environment, the tutor can add a nearer and more immediate presence to the educational process, which beyond the intrinsic motivational character also allows a more effective socialization of the tutor-learner relationship.

Another aspect of particular importance in new teaching methodologies is the system's capacity to allow the tutor a fast and effective evaluation of the teaching process. If in a classical presence-based methodology the tutor has at his/her disposal a set of pointers, which allow him/her to actively evaluate the level of progression of the educational session, in an approach where technologies allow the real distancing of the participants, such pointers are often disregarded or inexistent. Therefore, the use of such "tools" is essential, where beyond interactivity, eventually spoken or written, a "visual interactivity" is also provided, in such a way that it allows both intervenient parties to identify and acquire the different educational perspectives. However, these synchronous communication tools are as more relevant and acceptable, as greater the flexibility they provide to those who make use of them.

The correct use of information and communication technologies as a support to the new teaching paradigm encourages the training processes to develop with great independence towards space and time. To communicate and to evaluate simultaneously, without temporal or spatial restrictions – to be there, without actually being there. The "BeThere" tool we use is a further example of this kind of methodology, where we aim at applying the new teaching paradigm, strengthening the philosophy of flexible learning.

Designing for a moving target: design and development of content for delivery in a wireless environment

Beverly L. Pasian
Bodec Corporation
Canada
bpasian@bodec.com

In the fall, 2001, a content development team (including project management, instructional designers (IDs), subject-matter experts (SMEs), and technologists) was formed with representatives from McGraw-Hill Ryerson (MHR), Seneca College and the Northern Alberta Institute of Technology (NAIT). The challenge for this group was to develop content that could be accessed on a PDA in a wireless environment and, potentially, enhance student success in a first-year college accounting course at the 2 partner colleges. They had 10 months to meet this challenge as the project consortium prepared for the delivery of the mlearning pilot project in September '02.

This presentation will describe the unique experiences of this group, including challenges they encountered and the strategies they used to overcome them, as they collaborated to explore the potential of mobile technology and develop compelling 'mcontent'.

Developing the mcontent

Agreeing to an instructional design model for this project was not difficult: it was decided to adopt an outcome-oriented, learner-centric approach currently in use by both colleges. The real challenge lay in deciding how to create enriching content for a device never before used by the SMEs or IDs.

Several issues affected our design and development efforts. Some of these included:

- Constantly changing PDA devices meant that the potential of the technology was largely unknown and enormously difficult to design for. Early on a critical question emerged: what criteria would we use to determine what could make *effective* mcontent?
- Faculty and instructional designers were largely unfamiliar with the device, so time and resources had to be allocated for training and orientation. Jumping from the technological learning curve to the creation of compelling content for that device was a challenge.
- Uncertainties surrounding the type(s) of content that may or may not work on the market-ready PDAs influenced the choices available to the SMEs. Involvement of our IT colleagues was critical and influential.
- While the demand for learner and faculty support was unchanged, it became apparent that the complexities of the support resources could increase dramatically.
- And, of course, for many pilot exercises, unforeseen costs and resource-demands emerged. Unlike in an elearning environment, however, where experience could allow us to anticipate what these costs might be, mlearning design, development and production requirements were more difficult to anticipate. Flexibility on the part of all project partners was the order of the day.

What were the results of our efforts?

Based on initial assessments of and orientation to the PDA—along with our reliance on our 'elearning experiences—an initial wish list of content objects was made. Among the many items included on the list were: Learner and faculty manuals, Online learner support, Audio and video clips, Access to accounting software, more Excel templates, Dynamic financial statements, Access to 3rd party Web sites, Practice quizzes, Games, contests, eBook, Online assessments, Generic/daily news questions, Animation of some textbook problems, Course calendar, and collaborative learning opportunities.

Once testing occurred, however, many of these content types were removed from further consideration and would not be included in the September '02 Pilot. The methods used to make these decisions, along with some qualitative feedback, will be shared in greater detail in the presentation.

Conclusions / observations

This project is still in its implementation phase (the Pilot will be running until December '02), making firm conclusions inappropriate at this early stage. It is reasonable to note, however, at least 2 key observations from the initial design stages of the content development effort.

Partnerships between academe, content providers (eg, publishers) and technology suppliers are becoming increasingly important, as technology delivery options become more complex or "bleeding edge." When a radically new technology is being introduced that could have such a drastic effect on the learners' success, the involvement of various partners to the team is critical. There needs to be an ongoing, open and frank dialogue that is devoted to exploring the potential and limitations of the technology and how it will affect the accessibility of content and the learning and teaching experiences. As always, the bottom line (or question) has to be: can this content delivered via this technology enhance student success?

The role of the academic technology support centers is becoming critical. There are new offices emerging in higher education where instructional design and technology specialists work: the difference is that in this new environment, the awareness and appreciation of each other's role has never been greater. Instructional design, content development and production has, at least in this project, benefited enormously from the participation of professionals who are bilingual—they can speak the languages of instructional design and technology, fully aware of the impact each will have on the learning experience.

eInstruction: A Gateway to Effective eLearn

The whole world is being kept on changing in very short span due to the uninterrupted resource are made available from the world of new vision, technology. Education is not an exception. Educational Technology and Instructional Technology has revolutionised the classroom pedagogy. The uses of modern amenities within the classroom environment are easily accepted by the teachers and learners but media and multimedia is still away and their use is being observed restricted in the classroom pedagogy. This is one of the barriers and one should think of why the teachers or the people employing their efforts are not able to get their endeavours visible in the classroom environment. The prime concern of this paper will be the 'Instruction' and eLearn. It will be discussed in the light of Educational Technology and Instructional Technology. Following will be the key area of eLearning.

1. Instructional Design for eLearn. -eInstruction
2. Learning environment in Learning and eLearning. eLearn Environment.
3. Classroom Pedagogy. -ePedagogy
4. Developing Software (Course Content) - Need of Pedagogical Approach. -eCourse Content.
5. Integrating Conventional Teaching-Learning Process and eLearn. eTeaching-Learning.

The world of education cannot be replaced by the another system, one is to think of introducing the modern trends to the system to enable it to accept the change as such changes are being observed in the habits of the common people. It is called the life, the technology is the part of the life and one cannot separate it but one can make it more accurate or inaccurate. The question is: Do we really find the ET or IT in the lives of teachers teaching in the educational institutes? This answer can be wisely put forward disguised but the fact is very different. The reason is the chasm between the people who are teaching (not only teachers, all those who are backbone of the teaching community) and the people who are engaged in developing any kind of software (Video, audio, multimedia, etc.). To look into the world of education and technology needs a very different eye, a balanced eye that can look into the problems faced by both communities. As learning can be eLearn, why Instruction can not be eInstruction.

The teachers, the policymakers, the teacher educators, educational Researchers have to deviate from the conventional strategy to emerging scenario of the world of teaching and learning. eLearn is introduced at the level of technocrats, not edu-technocrates, for that we need an extra force to make all our endeavours be real not superfluous.

In the paper all the points will be discussed in the terms of developing course content to enhance eInstruction for better eLearning. The fundamentals will be derived from the Educational Technology, Instructional Technology, Educational Psychology, Pedagogy, IT, Role of Media in effective curricula transaction, use of Media technology, Developing Multimedia Software, Asynchronous and synchronous modes of Instruction, etc.

Blended WBI: A Meteorology Mixture

Any mixture requires consideration of the appropriate mix of ingredients. With blended WBI, it is more than a question of how much face-to-face vs. web components. It is also a question of the characteristics of the web components. The prototype web-facilitated Meteorology I course at Embry Riddle Aeronautical University might be thought of as a "double blended" course. Not only does it blend web components with face-to-face instruction, but it also blends various types of web components. The results from this study are informative as to the ingredients and the proper mixture of those ingredients to enhance learning and reduce costs.

Project Description

The Online Course Development Project at Embry Riddle Aeronautical University was designed to document and study the development and implementation of several different types of web based instruction. The prototypes ranged from highly engaging, totally web-based content to simply posting supplementary lecture materials on the web. The web-facilitated weather course used a mid range development model that utilized the web for guiding student use of existing content and participation in learning activities created specifically for the course. The web components were utilized to reduce class meetings. Students attended lectures on Tuesdays, but completed web activities in lieu of attendance on Thursdays.

Web Components

The web facilitation approach blended four inherent web capabilities into the course.

1. The web can be used to present information that introduces and focuses attention on key concepts in existing content such as the textbook and CD-ROM for the course.
2. The web provides a rich resource of information that can be incorporated through appropriate web research learning activities.
3. The web provides communication tools for collaborative learning activities.
4. Web pages can be programmed to respond to learner input.

For the web-facilitated weather course, those capabilities resulted in ten components for each week of the course. The introduction for each week contained an introduction to the content for the week, a list of required activities for the week, a list of outcomes for the week, and foundational information such as key terms, formulas, and tables. The components for each week also included an introduction to the textbook reading assignments, a web research activity, a collaboration activity, and a CD-ROM activity. The summary for each week presented diagrams and illustrations as interactive manipulatives that focused on key concepts. A self-assessment of randomly generated multiple-choice questions with feedback was also available for repeated attempts each week.

Face-to-Face Components

For the web facilitated weather course, students met in a face-to-face lecture setting on Tuesdays and were encouraged to attend tutorial sessions on Thursdays. Since lecture time was decreased by half, the instructor used the web to help her identity the topics to focus on during the lecture. Students were required to post topics they wanted addressed during the Tuesday lectures by noon on Fridays. The instructor used that input to determine not only the topics, but the level of importance for each topic to adapt the focus of the lectures.

Results

An end of course survey obtained data on student demographics, perceptions of the value and usefulness of the web components, and satisfaction with the blended approach. In general about two-thirds of the students indicated a positive response to questions related to satisfaction with the course and its effectiveness. They found most of the web components to be useful and appreciated the variety of learning opportunities. They appreciated the flexibility of completing activities at their convenience. Grades for the course were comparable to those in traditional courses. However, there was some negative feedback suggesting some students preferred the traditional class structure over self-directed activity.

The usage data from the survey indicated the most high ly used and helpful components included the activities list, introduction to the reading assignment, web research activity, collaboration activity, and summaries. It should be noted that the web research and collaboration activities were graded, which likely was a contributing factor that they were highly used and valued. While the introduction and the CD ROM activity were rated as highly used, they were not rated as highly helpful. It is conjectured that the introduction was used more than valued because it was the first screen of weekly activities, and that the CD ROM was used more than valued because it contained engaging content of a supplementary nature. The online self-tests were rated as only moderately helpful with a corresponding lack of use. That perception may have been because graded unit tests were short answer rather than multiple-choice questions. The foundations and outcomes components were perceived as not helpful and were not used.

These results confirm that students value and use components that help them know what to do, focus on important content, or are graded assignments. The results also imply that engaging activities are likely to be used, but there also needs to be instructional value if they are to be perceived as helpful as indicated by a comparison of the summary and CD ROM activities. Both activities engaged students through interaction with the computer, but the content in the summaries was more directly related to the core content of the course, and therefore, perceived as more valuable. From a development perspective, creating the foundation and outcome components may have been wasted effort since they were not valued or used by students. However, from an instructional design perspective, it was critical to define outcomes to insure alignment between expectations, instructional elements, and assessment, and little extra effort was required to post them as a web component.

For the best return on resource investment, development should be targeted toward helping students focus on the important content for the course and guiding their activities. Development of those types of components requires relatively little content development and only low-end development skills. However, design that communicates directions and expectations clearly is essential and must be completed carefully. From this study, it is recommended that user testing be incorporated into the design process early and frequently to identify and correct misconceptions.

While this study indicates that creating web pages with programmed interactions engages the students and are highly valued if they provide appropriate instruction, resources for creating those components are relatively costly. In this prototype, the animated diagrams and programmed interactions were representations of information in the book and were created using Flash. While the content design was minimal, the Flash design and development was resource intensive. Because of their perceived value, such components should be included, but incorporated judiciously due to the resource cost required.

From the instructor's perspective, the blended course required more preparation time to adapt lectures and monitor student participation. It also required more communication with students outside of class time since they had increased electronic access. The return on those investments was more student participation and interest in the course content.

Implications

The results from this study indicate that blended courses that use a variety of web components to reduce class-meeting times have the potential to enhance learning while reducing costs.

The variety of web activities in the course provided a range of learning opportunities to better meet individual student needs. The collaboration activities provided learning opportunities for those who learn best with social interaction. The web research and textbook reading activities provided opportunities for individual learning. The interactive maniuplatives provided 'hands on" exploration. Adding a variety of web activities to the traditional classroom lecture provided additional avenues for individual students to interact with content in ways meaningful to them. While there was not a significant improvement in performance by the participants in this study, there was a high level of satisfaction with the variety and flexibility of learning activities. None the less, there were a few students who indicated they preferred the passive lecture environment to self-directed participation.

Web facilitated courses offer resource utilization efficiencies by reducing development costs and optimizing classroom facilities. The development time to contact time ratio for the web facilitated weather course was approximately 30 development hours for each instructional contact hour as compared to 100 - 400 to 1 for totally online course content. By utilizing existing content such as the textbook and maintaining some face-to-face contact, development time is reduced significantly. Face-to-face time also reduced the electronic communication time experienced in many totally online courses. Using the blended approach also cut classroom usage by half which represents a huge savings potential for capital and maintenance costs.

While this study indicates that blended courses may represent a significant potential for enhancing learning while containing costs, a note of caution should be sounded. Feedback from some students indicates that the transition to blended courses may encounter resistance. The negative feedback seemed to stem from engrained expectations that teaching means instructors lecture while students listen. Implementing blended instruction will require a student mindset shift that they need to become actively involved in their own learning.

Summary

This study indicates that blended courses have potential for enhancing learning and reducing costs. Further study needs to be done to determine the best use of web components in a course and the best way to blend them with face-to-face instruction. Student expectations will also need to be addressed, but it seems likely that blended courses can be used to reduce class meetings while maintaining learning effectiveness.

Digital and Educational Empowerment in Urban Teacher Education Environments

Joyce Pittman, Ph.D.
Teachers College of Education
University of Cincinnati
USA
joyce.pittman@uc.edu

Abstract: This paper describes research findings from the transition of two teacher education courses, a distance learning and instructional technology course in transition from a traditional learning environment to an e-learning web-based system in teacher education. There is an enduring and growing interest and investment in digital and Internet technologies as the new model for education reform for the 21st century. This shift has forced attention on complex issues that have emerged as education moves swiftly into the world of cyber learning and teaching. Perhaps the most pressing and complex issues in public education are those of digital equity and empowerment of people of color and other traditionally underserved populations in urban and rural communities through the use of new educational, digital, and Internet technologies (Pittman, 1999; 2000). Findings from the study provide profound implications for infusing technology into teacher education programs in urban universities.

Introduction

Aspects of the digital divide addressed in this paper include two broad goals. The major goal is to provide information on strategies helping online communities emerge in urban communities. Strategies to connect the principle of digital equity to the empowerment of people and humanism in e-learning environments will be demonstrated. The examples will communicate the idea of cultural sensitivity, new literacies, computers, telecommunications, and digital technology as valid tools to increase people performance, change the nature of living, learning and teaching.

Virtual Learning and Technology

Technology can exacerbate the problems in the world or redefine achievement by providing technology and Internet access to information to all people to communicate effectively in a global world. This session describes a digital learning portal designed to connect home, school, community and teacher education field-based experiences. Digital empowerment includes ideas, systems, and practices that build and restore confidence in all people and their ability to think, to want, to know, and to produce in the technological arena along with the mainstream population (Freire, 1997).

Social, Economic, and Digital Education Crisis

Education in America is facing a social, educational, and digital technology crisis in urban schools that serve large traditionally, underserved populations, and especially African Americans. We need to openly examine the portable characteristics of virtual professional development, learning, and teaching models in urban and mainstream environments at local levels. What does the concept of "empowerment" mean for online teaching and learning in traditionally underserved teacher education programs that outreach to schools in urban communities?

Defining Empowerment

In an attempt to further refine the definition of empowerment in this paper, we will attempt to do so by analyzing two models that best represent suitable access to computers and the Internet. Therefore, the cases featured in this poster presentation will move beyond projects and the idea of simply making the technology available to in schools. The criteria will include essential information that encourages participants to consider access and outcomes in a variety of ways.

References

Freire, P. (1997). Pedagogy of the oppressed. New York, NY: The Continuum Publishing Company.

Pittman, J. (2000). Community access to technology study. Cincinnati Youth Collaborative. Cincinnati, OH 45221. Unpublished Report.

Pittman, J. (1999). A study of professional development, research, practices, and policies to prepare inservice teachers in new technologies: Implications for training standards in new technologies. A published dissertation. Iowa State University. Ames, IA.

Region-based Image Retrieval System using Color Spatial Relationship

Nucharee Premchaiswadi*, Wichian Premchaiswadi**, Surangkana Rawongyot**,
Wichai Premchaiswadi***, Worapot Kreesuradet**, Seinosuke Narita****
*Faculty of Information Technology, Dhurakijpundit University, Bangkok, 10210, Thailand
**Faculty of Information Technology, King Mongkut's Institute of Technology Ladkrabang,
Bangkok, 10520, Thailand
***Faculty of Engineering, Khon Kaen University, Khon Kaen, Thailand
***School of Science and Engineering, Waseda University, Tokyo, Japan

Abstract: This paper proposes a method for color indexing and similarity image retrieval with single and multi color region, that employs 2D+ String for represent spatial relationships. This method consists of 2 steps: database construction and image retrieval. In database construction process, the color regions of each image in database are extracted. An image is represented by a set of color regions, corresponding to minimum bounding rectangle (MBR). These features are used for creating index for each image in database. In the image retrieval process, a target region with size, color and spatial relationship of each region are specified via a user interface tool. This allows very fast indexing of image collection by color contents of image. Furthermore, information about the identified region, such as color, size and location, enables a rich variety of queries that specify both color content and spatial relations of region.

Introduction

In the past few years, there has been a growth of media-rich digital data such as images, video and audio. This trend has motivated research in rich effective store and retrieve of large image database. The best known image database system is IBM's query by image content (QBIC) (Faloutsos, et al. 1993, Flickner, et al 1995), which allows an operator to specify various properties as image content of a desired image. This method specifies a query by drawing rectangles with the desired colors, shapes and sizes. Moreover, users do not need to paint the entire color layout of the query, the unpainted area will be treated as "don't care". The locations, size, shape and color features of rectangles are used in computing the similarity measure, but the spatial relationships among rectangles are not used. This paper proposes a scheme for image indexing and retrieval system by using color spatial relationship. The scheme enables a rich variety of queries that users can specify both color content and spatial relations of region. The 2D+ String (Bowon, et al 199) technique is employed for representing spatial relationships among each color region.

The Proposed Scheme

The proposed scheme consists of two main steps namely: color region extraction and comparison of image similarity.

1. Color Region Extraction

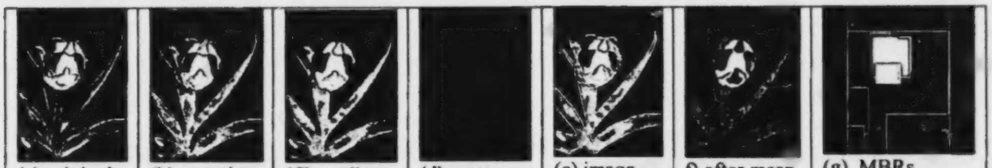
In this process, RGB color space of each image is transformed into HSV color space. The image is then transformed into the image representation by using the perceptual color model. Next, the HSV is quantized into color space with 18 hues, 2 saturations and 2 brightness values. The process quantizes color into 76 colors. Images may be corrupted with noise during quantization process, so noise is removed by using a color median filter. Then, color index for each region of an image is calculated by using Eq. 1, then image are transformed to 76 gray levels with color index component for image labeling process.

$$\text{Color Index} = \{\, i \mid ((\min(|H_i - H_j|, 180 - |H_i - H_j|) + |S_1 - S_j| + |V_i - V_j|))\,\} \qquad (1)$$

Then each image is scaled into the size of 200 x 200 pixels. as shown in Figure1. Finally HSV value, color index and MBR coordinate of each region in each image are stored in database.

2. Comparison of Image Similarity.

This process is used to compare the similarity between the query and images in the database. The comparison is depended on the given query that can be divided into cases: query with single region and query with multiple regions.



(a) original (b) quantize 76 (C) median filter (d) gray scale 76 (e) image labeling f) after mean color) (g) MBRs

Figure 1. Color extraction.

a) Query with Single Region.

The similarity measure is defined as the similarity between color index of segmented image and the query image, that overlap together as describe at Eq. 2.

$$\text{Area}_i = \{r_i \in R \mid R = R_i \cap R_q\} \qquad (2)$$

Where Area_i is a color region I of image in image database that have the same color index and area with query area. R_q is a query region. R_i is a image region in image database.

Images that satisfied the condition are retrieved. Then the rank of similarity is arranged. Many parameters are used for the purpose namely: color dissimilarity distance (CDD), Location Dissimilarity Distance (LDD), Size Dissimilarity Distance (SDD), and Area Dissimilarity Distance (ADD).

b) Query with Multiple Regions.

The calculations are the same as that of single region but the location of all regions are used to compare the similarity by using 2D+String (Bowon, et al 199). Then the images are ranked by using Eq. 3.

$$MD_i = W_c CDD_{i,q} + W_s SDD_{i,q} + W_A ADD_{i,q} \qquad (3)$$

Experimental results

The scheme is tested with a database that contains 2001 pictures, which stored in JPEG format with size 250x170 or 170x250. First, properties of each region in the image are extracted. The color index, color value, area and MBR coordinates of each color region are stored in the image database. Then users can draw rectangles with desired colors to specify a query picture on left-lower frame. After query comparison completes, the rank of each image is displayed on the other interface in ascending order. For single region retrieval process, query images are created various size, position and color 50 experiments. The values of CDD, ADD, LDD and SDD are set to 60, 90, 90 and 80, respectively. The weight of color (W_c), area (W_A), location(W_l) and size(W_s) are set to 40, 30, 10 and 20, respectively. The average of precisions with in 50 queries is 0.97 and average of time for have relevant image is about 1.7 seconds. Another experiment, that don't have relevant image used average time for retrieve about 1.687 seconds. Recall was not calculated because the database is large and it is difficult to estimate the total number of image in one category, even approximately. Multi regions retrieval process, the values of CDD, ADD and SDD are set to 60, 90 and 80 respectively. The average of precisions with is 0.91 and average of time for retrieval is about 16.63 seconds form 30 queries on a personal computer with AMD thunderbird CPU and 128 MB RAM.

References

Faloutsos C., M. Flickner, W. Niblack, D. Petkovic, W. Equitz, and R. Barber (1993). Efficient and effective querying by image content. Research Report, No. 9453, IBM Almaden Research Center.

Flickner M., H.S. Sawhney, J. Ashley, Q. Huang, B. Dom, M.Gorkani, J. Hafner, D. Lee, D. Petkovic, D. Steele, and P. Tanker (1995). Query by image and video content: the QBIC system. IEEE computers, Vol. 28, No.9, pp.23-32.

Bowon Kim and Kyhyun Um (1999). 2D+ string: A Spatial Metadata to Reason Topological and Directional Relationships, pp.112-121.

Text-to-Speech in Learning Thai Language for Foreigners

Wichian Premchaiswadi*, Nucharee Premchaiswadi**, Wadida Chawangwongsanugul*,
Wichai Premchaiswadi***, Prachuab Vanitchatchavan*, Seinosuke Narita****
*Faculty of Information Technology, King Mongkut's Institute of Technology Ladkrabang,
Bangkok, 10520, Thailand
**Faculty of Information Technology, Dhurakijpundit University, Bangkok, 10210, Thailand
***Faculty of Engineering, Khon Kaen University, Khon Kaen, Thailand
****School of Science and Engineering, Waseda University, Tokyo, Japan

Abstract: Text-to-Speech synthesis can be coupled with computer aided learning system and provide a helpful tool to learn a new language. The conversation dialogs are one of the important materials for practical used of each language. In the past, the learner could learn the correct pronunciation from tapes that come with the books. However, the learners could learn to pronounce only in the limited words in the book. When they find new words that do not have in the book, they must guess what is the correct one. In case of Thai language, the pronunciation of each word becomes more difficult because the Thai language is a tone language. This means that pitches are meaningful. A word pronounced with different pitches carry different meanings. This paper presents the work in progress on Thai text-to-speech for helping foreigners in learning Thai language. The aim is to build a system that could generate sound from the input Thai sentences.

Introduction

It is hard to learn a new language without adequate support. Now a day, computer becomes cheaper and more powerful. Therefore, it is used in many applications including language teaching. Text-to-Speech synthesis can be coupled with computer aided learning system and provide a helpful tool to learn a new language. The conversation dialogs are one of the important materials for practical used of each language. In the past, the learner could learn the correct pronunciation from tapes that come with the books. However, the learners could learn to pronounce only in the limited words in the book. When they find new words that do not have in the book, they must guess what is the correct one.

In case of Thai language, the pronunciation of each word becomes more difficult because the Thai language is a tone language. This means that pitches are meaningful. A word pronounced with different pitches carry different meanings. There is no spacing between words and no special mark to identify the end of a sentence. The Thai vowel forms do not follow initial consonants; some are placed before the initial consonants, some after the consonants, some above the consonants, and some underneath the consonants. The vowels that are "complex" forms (i.e. composed of more than one part) can be placed around the consonants.

There are 5 distinctive tones (pitches) in Standard Thai. They are

1. mid level tone (here represented with the number 1)
   for example: *khaa1* (to be lodged in)
2. low level tone (represented with the number 2)
   for example: *khaa2* (Galanga, an aromatic root)
3. falling tone (represented with the number 3)
   for example: *khaa3* (I, slave, servant)
4. high level tone (represented with the number 4)
   for example: *khaa4* (to sell)
5. rising tone (represented with the number 5)
   for example: *khaa5* (leg) .

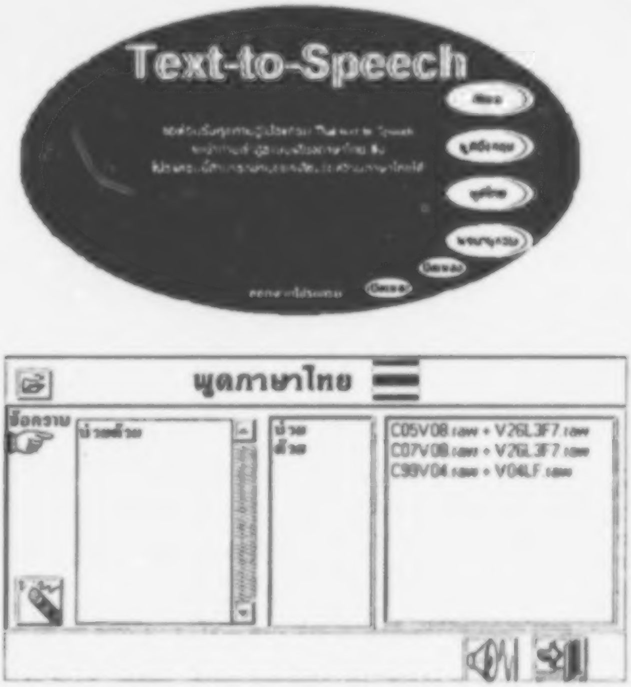
From the example mentioned above, it can be seen that it is very hard to the foreigners to pronounce a Thai word correctly.

The proposed system

This paper presents the work in progress on Thai text-to-speech for helping foreigners in learning Thai language. The aim is to build a system that could generate sound from the input Thai sentences. The synthesis system receives input Thai text and separates it into token according to the grammar of Thai language (Pantumetha, 1998, Dutoit, 1997). The sound of each word is generated.

Experimental Results

At this point of time, the system can generate sound from the variety of user input and shows how to produce sound for each word as shown in Fig. 1. However, some words are still not correctly produced and need to improve in the future.



ช่วยด้วย

ช่วย
ด้วย

```
C05V08.raw + V26L3F7.raw
C07V08.raw + V26L3F7.raw
C99V04.raw + V04LF.raw
```

Figure 1. The proposed Thai text to speech system.

References

Pantumetha K. (1998). Thai Language Characteristics. Ramkamhaeng University.

Dutoit T. (1997). An Introduction to Text-to-Speech Synthesis, Dordrecht: Kluwer.

BEST COPY AVAILABLE

CyberTutor, A Socratic Electronic Homework Tutor at MIT

David E. Pritchard, Elsa-Sofia Morote, and David Kokorowski
Research Laboratory of Electronics
Massachusetts Institute of Technology
United States
dpritch@mit.edu, smorote@mit.edu, davidk@mit.edu

Abstract. CyberTutor is an interactive web-based program that functions as a personal tutor for the student, offering help with the problems when requested or in response to incorrect answers. CyberTutor collects extensive feedback which is processed to inform the teacher about current performance and lack of foundational skills of each student, to identify troublesome problems and concepts for the class, and to inform the problem author about flaws in the problems. CyberTutor contains problems involving Newtonian Mechanics at the freshman college level and at high school AP level, many of which involve conceptual issues as well as quantitative ones.

Introduction

CyberTutor is a platform for delivering homework and illustrative problems via the web, combined with tutorial features that help students work problems through to a correct solution. Like a human tutor might, CyberTutor presents each student with a problem, provides hints or simpler subproblems at the student's request, assesses the student's responses immediately, and gives feedback if the student's answer has particular recognizable deficiencies. CyberTutor strives to equal the range of question types used by a human tutor, and its repertoire includes several free response answer types: symbolic expression, fill in the blank, and mouse-drawn curves. This allows us to de-emphasize multiple choice and which often encourage students to guess, and numerical answer types, which provide the teacher with little basis for determining what the students did wrong.

The CyberTutor problem library includes 500 problems involving Newtonian Mechanics and Electricity and Magnetism at the freshman college level and 100 at high school AP level, many of which involve conceptual issues as well as quantitative ones. CyberTutor has been used by over 1000 students in versions of introductory Newtonian Mechanics at MIT and in several high-school AP physics classes over the past three years. Pre- and post-testing conducted by Prof. Ogilvie in 2000 (Ogilvie, 2000) and by Prof. Pritchard and Dr. Sofia Morote in 2001 (Pritchatd & Morote, 2002a) showed that CyberTutor use correlates over five times more strongly then written homework or class attendance with reduction in the number of errors made on the MIT final exam elative to an MIT final unsuccessfully taken in the preceding term. Moreover, CyberTutor use correlated twice as strongly as written homework with gains on a standard test of conceptual knowledge administered before and after the course. Written surveys indicate that students felt they learned more from using CyberTutor than from graded written homework. In addition, the ratio of students recommending its use next year to those not recommending it has risen to consistently each semester, and it is now 7 to 1 (yes: no) ratio.

Feedback for the Teacher

CyberTutor is a tutor that also works for the teacher. In addition to maintaining a standard gradebook, CyberTutor collects and analyzes detailed data on student performance. For each part of each problem displays statistics on numbers of right and wrong answers, hints and solutions requested, and median time. This information enables the teacher to see where the students are having trouble and what that trouble is in time to correct it during the next lecture. Wrong answers can be displayed in decreasing order of frequency given, and specific responses recorded for future students who give these answers. In this manner, CyberTutor can respond to over 50% of the wrong answers submitted.

Skill Profile

We have recently shown that CyberTutor can assess students with two orders of magnitude less error than a three-hour final examination (Pritchard & Morote, 2002b). This huge improvement arises from a combination of the longer time students use CyberTutor over the term (3 hours a week versus the 3 hour-final) and an almost order of magnitude reduction of error for a given interaction time that is achieved by inclusion of time and wrong answers per problem data in the assessment algorithm. We are now working to calculate and display a comprehensive current assessment of each student's skill level. Using all available information submitted by each student for every CyberTutor problem attempted, we shall update each student's current skill rating on each of 100 topics in the syllabus, about 25 percent of which are foundational skills. CyberTutor's assessment algorithms should enable the assessment of each topic at the same reliability level as the overall grade on a well-designed three-hour examination. This assessment will be called a skill profile.

In addition to providing detailed information about the progress of the class and the students, the skill profile has two impacts. The growing number of college students in introductory courses who have serious deficiencies in foundational skills is a serious problem - perhaps due to the educational diversity of today's freshmen. The skill profile will allow the identification and remediation of such deficiencies before the student becomes discouraged and "drops out." It has another revolutionary implication: if used for the homework grade, it would reward the student for learning instead of penalizing him/her for wrong answers. This can change his basic strategy from avoiding lost points to learning the most per unit time.

Because we hope that CyberTutor will eventually be used by thousands of students, it is worth the effort to make and improve a library of excellent problems. We have a group led by experienced teacher-tutors who propose, select, write, and review problems. The detailed data collected by CyberTutor allows the author(s) to improve the educational effectiveness of each homework problem. The author (or teacher) can make specific comments to students who give specific wrong answers. The time spent on each problem and subpart, which hints and subparts were needed to enable students to proceed to the solution, the number of wrong answers preceding the correct response, and the students' opinion of the effectiveness of the problem provide a guide for improving individual problems and problem parts. Confusing questions (questions that elicit consistent wrong answers or comments), overly time-consuming problems, and problems that the students judge educationally ineffective can be improved or eliminated. The hint structure can be extended so that students rarely run out of hints and subparts. We are working toward determining the educational efficiency of each problem, allowing optimization of the homework in order to provide more learning per unit time.

Education Research

CyberTutor is a powerful tool for education research (see our latest findings at URL: http://torrseal.mit.edu/effedtech.) Its built-in statistical capabilities allow every teacher to analyze the data for his/her own class easily and quickly – something that, in the past, was logistically impossible. Such data give immediate feedback that allows the teacher to redirect a portion of the next class to correct misperceptions, add a particular insight, etc. while the topic is still being studied.

References

Ogilvie, C. (2001) Determining the Effectiveness of Different Course Components in Driving Gains in Conceptual Understanding. On-line: URL: http://torrseal.mit.edu/effedtech/

Pritchard, D & Morote, E. (2002a) *"What Course Elements Correlate with Improvement on Tests in Introductory Newtonian Mechanics?*. The National Association for Research in Science Teaching Annual Meeting, Louisiana, April 7-12, 2002

Pritchard, D. & Morote, E. (2002b). *Reliable Assessment with CyberTutor, a Web-Based Homework Tutor*. World Conference on Elearning in Corporate, Government, HealthCare, & Higher Education, ELearn 2002, Montreal, Canada, October 15-19, 2002.

Technology Driven Course Redesign in the Humanities

Poster Session

Florida Gulf Coast University was founded in 1997. Since it's inception FGCU has been a pioneer in developing and applying distance learning principles and practices. In 2000 FGCU Instructional Technology staff and faculty from the Division of Humanities and Arts began the year-long application process in seeking a grant from The Pew Grant Program in Course Redesign sponsored by the Center for Academic Transformation at Rensselaer Polytechnic Institute.

The grant program required a challenging three round application process. Over almost a year 10 higher education institutions were selected as grant recipients out of over 400 applicants. Each institution was awarded $200,000 to redesign a course with national significance with an eye toward improving student learning, solving an inherent problem in current course delivery, and reducing course costs. Understanding Visual and Performing Arts (HUM 2510) was the course selected for revision by the FGCU redesign team. The poster session will present the results of this redesigned course and demonstrate the instructional innovations that have been incorporated in the current Understanding Visual and Performing Arts course.

Course Drift: The Problem

Because of the nature of humanities courses, they are often taught in large lecture sections or in small classes that emphasize face-to-face interaction. Faculty in the humanities have been reluctant to incorporate technology into these courses because of their perception that technology might eliminate active engagement with issues and activities that are central to humanities courses. As a result of growing enrollments and the lack of belief in the efficacy of technology based learning FGCU has been forced to add multiple sections while hiring a growing number of adjuncts to teach HUM 2510. At FGCU the number of Understanding the Visual and Performing Arts sections has grown from 7 sections with 180 students in 1997-98 to 30 sections with 800 students in the 2001-2002 academic year.

Like other undergraduate institutions and community colleges, we face two critical problems in providing our required humanities to our students: we do not have the necessary resources to offer increasing sections of the course and we have experience course drift because of the large numbers of adjuncts that we have employed to teach the same course.

Course Redesign: A Technology Based Solution

The solution to our problem at FGCU involved a redesign of HUM 2510 with these goals in mind:

1. Improved course quality by controlling course drift
2. Improve student learning
3. Improve course cost per student ratio; i.e., decrease cost
4. Introduce a scalable staffing model
5. Utilize technology to achieve new course goals

We are in the midst of the course redesign process for HUM 2510. The entire project spans five semesters and is proceeding as seen below:

- Summer 2001: Team building and Assignment of Redesign Tasks
- Fall 2001: Development of Infrastructure and Course Materials
- Spring 2002: Pilot Redesigned Course
- Summer 2002: Refine and Finalize Redesigned Course
- Fall 2002: Full Implementation of Redesigned Course

The key to this project has been the integration of instructional technology in the course redesign. Projected outcomes of the course redesign project highlight improved student learning, course stability, and a cost savings of $331,000 over the next five years.

Why is The Project Significant?

Technological innovation is one of the key aspects of the course redesign project. Of particular importance is the use of technology to enhance student interaction, rehearse writing skills, and learn content via practice examinations. These tools have permitted a realignment of teaching strategies and supervision. Students *are* engage in a student-centered learning experience that is accessible on and off campus and is available when they are best ready to learn. The application of WebCT as a course management tool permits large numbers of students to access consistent course content while being engaged in small group discussions as well as individual and collaborative writing assignments.

Perhaps the most important element of the course redesign that has been the writing intensive nature of the learning. Key to this process has been the introduction of an online essay grading technology known as the Intelligent Essay Assessor (IEA) from Knowledge Analysis Technologies. The IEA is a unique program that grades essay questions according to the meaning of terms and phrases as opposed to just the presence of key words or phrases. The content meaning relationships of student essays are compared to the content meaning relationships of course materials through a program that creates "semantic space" for the course. The strength of this program is that the scoring ability of the computer program approaches that of human scorers. This permits a significant offloading of work from instructors to a computer without sacrificing quality. In a practical sense it saves instructors from having to read and grade up to 2400 essays per year for the course. This saves significant time, frees personnel resources, and introduces scoring consistency across course sections.

Testing the IEA is a key component of the redesign project. If the IEA proves successful it opens tremendous opportunities to redesign other courses that require writing intensive learning. Application of this tool is not limited to the humanities.

What Will Attendees See

This Poster Session will provide an updated presentation on the Pew Grant Program in Course Redesign project at Florida Gulf Coast University. Included in the presentation will be results of project cost savings, student learning, and results of the IEA testing. The course staffing model will be presented along with the impact of the project on instructional programs at FGCU.

One of the requirements of the Pew Grant Program in Course Redesign is that institutions receiving grants actively share what we have learned. Conference attendees will be some of the first to see the HUM 2510 redesign project results. In addition, attendees will be able to view the final version of the Understanding the Visual and Performing Arts course via a short multimedia presentation. A limited number of CD's containing the project presentation will be available for interested viewers.

Please send questions to:
Dr. Craig Rademacher
Director, Course and Faculty Development
Florida Gulf Coast University
BB #10
10501 FGCU Boulevard South
Fort Myers, FL 33965
941-590-7085
crademac@fgcu.edu

USING WEBQUEST IN PROJECT-BASED LEARNING

Jorge Joel Reyes-Méndez, Health Care Department, Universidad Autónoma Metropolitana Xochimilco, México,
joelr@cueyatl.uam.mx

Abstract: Many institutions are moving towards project-based learning as a solution to producing graduates who are creative, can think critically and analytically, and are able to solve problems. We focus on using WebQuest model as an innovative teaching and learning strategy in a project-based learning environment by giving the students a framework to train them in this skill set. The purpose was to access the students' skills in framing and solving problems using the Internet. They worked in groups and each group had to pick a topic for their project, develop, design and present it in a Web format. Students were very positive toward the project, enjoyed teamwork, able to think critically and became active participants in their learning process. WebQuest can be used as an innovative and effective tool for the acquisition of problem-solving skills.

Introduction

The Metropolitan Autonomuos University campus Xochimilco was born with the Modular System, wich involve project-based learning as a solution to producing graduates who are creative and can think critically, analytically, and solve problems. Since knowledge is no longer an end but a means to creating better problem solvers and encourage lifelong learning, project-based learning is becoming increasingly popular in educational institutions as a tool to address the inadequacies of traditional teaching. Since these traditional approaches "do not encourage students to question what they have learnt or to associate with previously acquired knowledge" (Teo & Wong 2000), project-based learning is seen as an innovative measure to encourage students to *learn how to learn* via *real-life* problems (Boud & Feletti 1999).

Project-based learning

Whether you call it problem-based learning, project-based learning, engaged learning or constructivist learning, our students will only come to thrive in this new information landscape if we engage them frequently in challenges calling for fresh thought. The focus is moving from content towards problems to provide a more realistic approach to learning and to create an educational methodology which "emphasises real world challenges, higher order thinking skills, multi-disciplinary learning, independent learning, teamwork and communication skills" via a problem-based learning environment (Tan 2000). However, this model can be further strengthened with the inclusion of Internet into this project-based learning environment to enhance the students' learning experience.

We extended this contention further by using Bernie Dodge's model, WebQuest to create a Web-oriented project. By doing so, we hope to further develop the students' ability to become creative and critical thinkers and analysers, as well as problem-solvers, within this Web-mediated environment. This learning mode is constructivist in approach whereby the students participate actively in their own learning process and construct their own knowledge (Jonassen et al. 1999).

The WebQuest Model

WebQuests allow students to complete authentic projects and use technology to find and present information and, at the same time, alleviate some of the barriers teachers may find in their attempt to work in the confines of project-based learning. In planning for such learning, we should always start with the end in mind. A WebQuest can provide the educator with the project for a unit of study. After reading through a specific WebQuest, the teacher can then begin to select the standards to be mastered. An alternative way to start would be to select the standards, and then find a WebQuest that would help master those standards. Subsequently, the teacher can decide which enabling activities need to be taught. Every WebQuest has an Introduction, a Task, Resources, a Process, Evaluation (with a Rubric), and a Conclusion.

As students locate expert level technical information to bring to bear on the problems they are investigating during intense, authentic study, they frequently end up with a tremendous amount of information and little if any way to construct meaning from that information. In order to make good use of the wealth of information available on the Internet and truly enable students and non-expert teachers to engage in in-depth, authentic inquiry, WebQuest should provide frameworks for analyzing and using complex data sets. Such explanatory features will help demystify information and consequently increase its utility for non-experts.

Some of these tools will scale data to help eliminate variables that create noise but not relevant information. In other cases, examples of expert applications of information will provide enough context to assist novice users in making their own interpretations. These tools will help students select meaningful data sets for interpretation and evaluation, explore and identify significant parameters and variables, and perform analytical operations on subsets of data.

Environments for WebQuest will help develop and distribute unique models, simulations, and tools that will augment understanding and enable sophisticated analyses and solutions. In addition to providing information, the WWW is unique as an educative medium that allows the communication and publishing of new knowledge to both selected and broad audiences. The WWW is at once a place to gather information and a place to publish one's findings, thus allowing users to contribute to the learning community's growing resource base. WebQuest should include technologies for direct and moderated communications and publishing for additional sharing of resources and development of a science learning community. Students enjoy WebQuests because they are given the opportunity to use the Internet to find and apply information.

Conclusion

This paper presents and discusses the use of WebQuest in a project-based learning environment to equip students with high-order thinking and problem-solving skills and to enable them to experience an IT-oriented learning situation. From the results, we are able to conclude that by integrating Internet into the teaching and learning process, the conventional project-based curriculum model is reinforced and strengthened. The Web project in this course enabled the students to exercise their creative and critical thinking skills in solving their design and development problems, work collaboratively to gain team-based experience, and to face the real-life situation of problem-solving. This is a student-centered learning approach which allows them to construct their own knowledge and understanding, and determine their own learning goals. The role of the teacher, on the other hand, changes from the *sage on the stage* to a *guide on the side*, assisting the students in the construction of their knowledge.

As such, the use of Web project are an innovative and effective teaching and learning strategy because they motivate the students in their learning process and help them to acquire good problem-solving skills. As evidenced by this project, students became very active participants in their learning process instead being passive learners, and were able to use various digital media elements to accomplish their project. These findings are significant in that: by using a Web project, we can move towards the constructivist learning mode, which is student-centric. In this context, the students had to utilise their prior knowledge in other disciplines to breakdown the problem into component parts, and then synthesize and re-construct a possible solution. This experience is invaluable in creating a new generation of effective problem-solvers for the current professional needs. We successfully integrated Internet into the classroom, instilling effective *learning how to learn* and lifelong learning attitudes into the students, and they are in line with the Tapscott's (1998) proposition that today's generation is IT-savvy and look to digital media for learning and they expect universities to provide IT-oriented programmes in their curriculum as well as in teaching and learning methodologies. As such, Web-oriented model serves as a strong framework for teaching and learning in this respect. WebQuest like many other learning solutions, can be appropriately used as an innovative and effective tool in a project-based learning environment for the acquisition of problem-solving skills.

References

Jonassen, D. H., Peck, K. L., and Wilson, B. G. (1999). *Learning With Technology: A Constructivist Perspective*. NJ: Merrill/ Prentice Hall.

Tan, O. S. (2000). Thinking Skills, Creativity and Problem-Based Learning. *Paper presented at the 2^{nd} Asia Pacific Conference on Problem - Based Learning: Education Across Disciplines*, December 4-7, 2000, Singapore.

Tapscott, D. (1998). *Growing Up Digital: The Rise of the Net Generation*, NY: McGraw-Hill.

Teo, R. & Wong, A. (2000). Does Problem Based Learning Create A Better Student: A Refelection? *Paper presented at the 2^{nd} Asia Pacific Conference on Problem –Based Learning: Education Across Disciplines*, December 4-7, 2000, Singapore.

Issues in the development of online teacher education

George Gadanidis, Sharon Rich
Faculty of Education, University of Western Ontario, Canada
ggadanid@uwo.ca, srich@uwo.ca

Abstract: This paper discusses issues related to the implementation of an online content and discussion component to replace large group lectures in a pre-service teacher education setting. A large number of post-secondary institutions and school districts are considering how to create or expand online teacher education programs (and education programs in general) – and there seems to be a hurry to put *something* online. Our experience and research in this area should offer some guidance for other institutions interested in online teacher education.

Task forces involving leaders from government, business, and education (Ontario Ministry of Education/Ontario Ministry of Training, Colleges and Universities, 2000, June; Web-based Education Commission, 2000) envision a comprehensive e-learning enterprise with full courses being delivered online. In this context, we consider issues in the development of online teacher education based on our experiences in replacing large group lectures with online modules and discussion.

Prior to 2001-2002, elementary pre-servive teachers at our Faculty of Education received 18 hours of small group instruction (25-30 students per class) and 9 hours of large group lectures (200 to over 400 students per lecture) in the areas of mathematics and language arts. In 2001-2002, in an effort to improve pre-service teacher learning in the areas of language arts and mathematics, we replaced the 9 large group lectures with 9 online content modules and online discussion conferences. The goal was to move from the simple transmission of information through face-to-face lectures toward online interaction through online modules that offer content, links to web-based resources, video, and web-based interactive activities, as well as online discussion conferences. This new and innovative direction for pre-service teacher education builds on existing expertise and capacity in our Faculty of Education to offer online courses through its Continuing Teacher Education program.

Our shift from large group lectures to online content and discussion is an attempt to better align the pedagogical content we teach with our teaching processes. The online component allows for students to interact with ideas represented through various media, including web-based simulations, and supports the online sharing and discussing of ideas and issues. We strongly value the *process* of coming to know as we see knowledge as something that students build from the inside out rather than something that is passed on to them ready-made. Our teaching philosophy is of heightened importance in a faculty of education setting, as it both process and content in the courses we teach. We are sensitive to situations where we may use learning processes that are not aligned with the pedagogical directions we promote for our students. For example, when giving large group lectures, we sense contradictions between promoting a learning environment where students actively participate and collaborate and delivering this message in a lecture hall with 200-450 students.

In the proposal stage of the project, we experienced both resistance and support. Concerns were raised about student access. How do we know that the over 400 students affected will have access to the Internet? If they all depend on our computer labs for access won't this make access impractical? Concerns were also raised about notification of program change to students. Application forms were processed and acceptance letters were sent out to students prior to the proposal for this project. Should prospective students have been told ahead of time that part of their program was online? Support came in the form of a recent external review of the Faculty of Education that suggested consideration of incorporating online technology into the pre-service through the instructional methods developed and used successfully in the Continuing Teacher Education. Also, with increasing enrollment over the last 3 years, physical space in the Faculty is at a premium. For example, in 2000-2001, the mathematics lectures were scheduled at 8 am on Monday morning, which increased both tardiness and absenteeism. Support for the initiative also came from the mathematics and language arts instructors, who felt that the lecture format did not provide optimal effectiveness. The shift from large group lectures to online content and discussion tried to better align the pedagogical content with the teaching processes. The online component allows for students to interact with ideas represented through various media, allows interaction with web-based simulations, and supports the online sharing and discussing of ideas and issues in each of the 9 modules. After discussion of the issues, it was agreed that the initiative should proceed for the 2001-2002 year as a pilot project that would be assessed through surveys of the pre-service teachers and instructors.

Interestingly, when students were asked at the general orientation presentation in September 2001 whether they had regular access to the Internet outside of the Faculty of Education, over 90% indicated with a show of hands that they did. Only approximately 50% of the students answered positively when a similar question was asked at the September 2000 orientation. The anticipated problem with access did not appear to be an issue for students in their online participation in 2001-2002. Though the general format of online content and discussion conferences was used in both language arts and mathematics, there were differences in implementation. For example, in language arts, each workshop instructor was responsible for monitoring, facilitating and assessing student performance in the online component of the course. In contrast, in mathematics only one instructor was responsible for the online component. Workshop instructors indicated that compared to the large lecture format of previous years they have noticed a significant improvement in terms of pre-service teachers' completion of readings prior to attending the workshops. Instructors also saw a benefit in reading pre-service teachers' ideas and issues online and incorporating these in workshop activities and discussions. Issues of workload arose, as there were obvious differences in workload between presenting a lecture and facilitating and assessing online participation and discussion.

What made the implementation of the proposal possible in a short time (proposed in the spring 2001 and implemented in the fall of 2001) was the existing capacity to offer online content and discussion in our Continuing Teacher Education program. What is unique about the course delivery experiences in the Continuing Teacher Education program of the Faculty of Education is that rather than simply accepting technology as a given, members of the distance education team with pedagogical experience have worked with the web designer and other technology staff to develop and integrated system that places the needs of learners and instructors first. Early recognition that the technology needed to be almost invisible to the end user meant that all team members had to think about and learn how to write content for the web and facilitate assessment practices appropriate to the learner and the medium. The program of online delivery of instruction developed by the Continuing Teacher Education program of the Faculty of Education includes a process to facilitate the effective management of students and course conferences and a set of course management tools that enable efficient registration, records administration and student evaluation. In 2001-2002, these processes and tools were adapted and used in the language arts and mathematics component of pre-service teacher education. First drafts of online content for each of the modules were authored by team leaders in language arts and mathematics in the spring and summer of 2001. The pre-service teacher candidates were informed of the new direction of their program through a letter sent to them in the summer of 2001. The online technology was demonstrated to students at a general orientation presentation in September 2001. The online component will be part of the elementary mathematics and language arts teacher education programs in 2002-2003.

References

Gadanidis, G., Graham, L., McDougall, D., Roulet, J. (2002). *Mathematics online: Visions and opportunities, issues and challenges, and recommendations (A White Paper).* Toronto, ON: The Fields Institute for Research in Mathematical Sciences.

Gadanidis, G. & Hoogland, C. (June 2002). Mathematics teacher education online. Proceedings of the World Conference on Educational Multimedia, Hypermedia and Telecommunications, Denver.

Ontario Council for University Lifelong learning [OCULL]. (January, 2001). Distance education opportunities at Ontario universities. Toronto: OCULL. Available: http://www.ocull.ca/courses/index.html

Ontario Ministry of Education/Ontario Ministry of Training, Colleges and Universities. (2000, June). Plugged into learning, plugged into tomorrow. Paper prepared for the Ontario Knowledge Network for Learning Symposium, Toronto.

Rich, S. (2001). On-line Teaching: What do instructors need? *Proceedings of the 17th International conference on distance education*. Madison: University of Wisconsin Press.

Rich, S. (1995). Teacher support groups: Contexts for learning. *Education Canada*, *35*(3), 15-21.

Rich, Sharon and Woolfe, Adele (2001). Creating learning communities. *Proceedings of the Eighth International Literacy and Education Research Network Conference on Learning.* Melbourne: common Ground Publishing.

Rich, S. and Woolfe, A. (2001). From a distance: Creating virtual learning communities. *Proceedings of the Eighth International Literacy and Education Research Network Conference on Learning.* Melbourne: The University Press.

Creating an Effective Training Model: One Size Does Not Fit All

Finding an effective faculty training model for online and web-enhanced courses has been an on-going challenge in the Center for Teaching and Learning at Wright State University. On one hand, there is the question of how to best train the faculty to effectively use the course management system for the university, WebCT. The other major consideration is how to help faculty make the transition from teaching in a traditional classroom to a virtual one. Finding a model to meet both needs has been an evolving process, but one that I believe has been as instructional for the trainers as it has been for the trainees.

We began using WebCT two years ago, and the initial training sessions followed the company's suggested two-day fare, which, we quickly discovered, turned out to be very unpopular and quite ineffective. True, after two full days of training the faculty had a good fundamental understanding of the tools in WebCT, but the benefits of this type of training were short lived. If the faculty did not continue to use WebCT immediately after the training, and many did not, then what they learned was quickly lost. When the faculty did find time to work in WebCT, they were quickly overwhelmed and consequently frustrated. To compound the problem even further, the version of WebCT we were using at the time, 2.x, was not user friendly. There were too many clicks to achieve any results, and the path leading to the right combination of clicks was not very intuitive. Some changes definitely had to occur.

The next logical step was to tailor the training to fit Wright State's own particular needs. We cut the two day session down to a one day fundamentals training, with two hour supplemental training sessions held at later times. The hope was that the faculty could be introduced to WebCT's functionality, but when the training began to fade then the two-hour sessions would provide the needed refreshers. These sessions were focused on specific aspects of WebCT, such as course management or quizzing, so that faculty could choose whichever sessions they needed to brush up on. Another need we realized was to allow faculty time to work with their own materials in a workshop atmosphere. We setup developmental sessions where faculty brought their own materials on with them to the sessions (typically they were stored on a shared drive that they could access from the training lab) and they were able to get more productive time. So instead of spending two hours in a session and then going back to their offices to apply what they learned, faculty brought their own materials and not only received training but got real work done as well. The sessions were limited to a few participants and the method worked out extremely well.

To complement our WebCT training sessions, we created an online course that every faculty member was enrolled in. The course contained step-by-step instructions on many WebCT tools and functions as well as instructions on typical course management issues (requesting courses, adding students, resetting courses, etc.). The third area in the course housed materials for instructional design and course planning.

Basic concepts of instructional design had always been part of our course management system training; it simply made it easier to approach the majority of faculty about their teaching and learning practices in the context of discussing the applicable tools in WebCT. However, there was also a need for a more detailed and more formalized approach to designing courses for online delivery. To accomplish this, faculty would meet individually with the CTL's instructional designer to start the course design and planning process. After the initial design processes for the course are completed and an outline is produced, the next steps in the process are to establish a work schedule with the faculty member and to get the other members of the Distance Learning/Multimedia team involved. Of course the faculty member will be responsible for providing the learning content, but depending on the learning activities and the learner profiles the presentation of the material will change. Our goal is to assist the faculty member as best we can so that her technical sophistication, while enhanced, is not crucial in delivering the course. The faculty member is seen as the content expert and we support him or her as best we can.

This model worked well for a limited amount of faculty. Some faculty went through the entire design process and completed their courses in a 15 to 20 week time period. In addition, they also completed training in WebCT so that they could use the course management system. For many, this entailed around fifteen hours of training in WebCT and endless hours of development time in creating the course materials. The results for these faculty members were outstanding. Their courses were well thought out and well designed for an online learning environment. In addition, the faculty members had some confidence in using the course management system and so were able to progress independently, just as they would in a traditional classroom.

However, last year the Provost announced that there would be an online section of every general education offering at the university. Suddenly our existing training model was being stretched dangerously thin; we needed a training component that would ensure quality course design as well as a clear understanding of WebCT but at the same time not deplete our limited staff and resources. So, the idea was to develop a five week, mixed mode training course that would combine the two main initiatives: quality course design and detailed technology training. We wanted the participants to finish the five weeks with an online course well underway, including a completed design layout and several weeks of materials ready to go. We also wanted them to have a thorough knowledge of WebCT.

In summary, our training model in The Center for Teaching and Learning at Wright State University continues to evolve as we try to remain flexible enough to effectively meet the faculty needs. The five week training seminar was developed to fit an emerging need, but of course it's not for everyone. There is a tremendous time commitment, and for those faculty interested in web enhancing their courses it is generally viewed as too much. So we continue to offer the other trainings and services as well, hopefully meeting the needs of all our constituents.

Using Knowledge Levels with AHA! for Discovering Interesting Relationships

Cristóbal Romero[1], Paul De Bra[2], Sebastián Ventura[1], Carlos de Castro[1]

[1]Departament of Computer Science and Numerical
Analysis, University of Cordoba
14071 Campus de Rabanales, Cordoba, España
cromero@uco.es, sventura@uco.es, cdecastro@uco.es

[2]Department of Computer Science,
Eindhoven University of Technology (TU/e)
PO Box 513, Eindhoven, The Netherlands
debra@win.tue.nl

Abstract: In this paper we show how the AHA! system was (modified and) used to create an adaptive course in which the course material is presented in three levels of difficulty. The aim of the experiment is to perform data mining in order to find good candidates for meaningful relations between reading times, difficulty levels and test results. We want to discover information between all the stored evaluation data and show a selection to the teacher so that he can carry out appropriated modifications in order to improve the course.

Introduction

In the past years, we have seen an exponential growth in the use of web-based technology in distance learning systems. At the same time, more and more artificial intelligence techniques have been applied to these systems to improve students' learning, named as Intelligent Tutoring Systems. The union of web-based learning with Intelligent Tutors has given place to the current Web-based Hypermedia Adaptive Systems that allow adapting the teaching to each individual student through Internet. But the methodology used for its construction is static. Once the construction of a course is concluded and it is published in the Web for its use, the system starts logging information about the users' interaction with the course. However, teachers only use this information for student evaluation. We propose a dynamic construction methodology that uses the system usage information to discover some information that will allow the teacher to improve the course. We will use association rule mining to obtain useful information that helps the teacher to modify the course in order to improve student performance, thus making it educationally more effective (Zaïene, 2001). In order to prove our methodology we have developed some web-based hypermedia adaptive courses using the AHA! system (De Bra & Calvi, 1998). We have chosen AHA! because it is a simple general-purpose hypermedia adaptive system, it has a high degree of adaptation and it's available in source code. We have modified AHA! in order to make it use different knowledge levels. In this way the AHA! engine can adapt the content and navigation of the course to the specific knowledge level of each student. Another advantage of AHA! is that it automatically stores usage information in logs files. We converted these files to a database in order to do association rule mining.

AHA! with knowledge levels

AHA! is a general architecture for building adaptive hypermedia applications. We have modified it in order to be able to control the adaptation depending on the student's knowledge level. To do it, we have modified: the user model, the domain model and the adaptation engine, see [Figure 1].

- Domain Model. One course consists of several chapters with several concepts, but the concepts and the questions related with these concepts are divided in three levels of difficulty (high, medium or low).
- User Model. The student's knowledge for each concept, initial test or final test can be only one of these values: 0 (not yet read), 10 (low), 50 (medium) and 100 (high).
- Adaptation engine. Before studying a new chapter the students have to do an initial adaptive test to discover their initial knowledge level. The system then presents them only the concepts with this level. Each concept has an activity to evaluate the student's knowledge about this specific concept. When the students have visited all the concepts they have to do a final (multiple-choice) test to evaluate the their knowledge about the chapter at this level. If they obtain a medium or high level in the final test they can go to a higher level. If they are in the highest level already they can go to the next chapter. In each chapter everything starts again: initial test, studying pages and doing activities and then the final test.

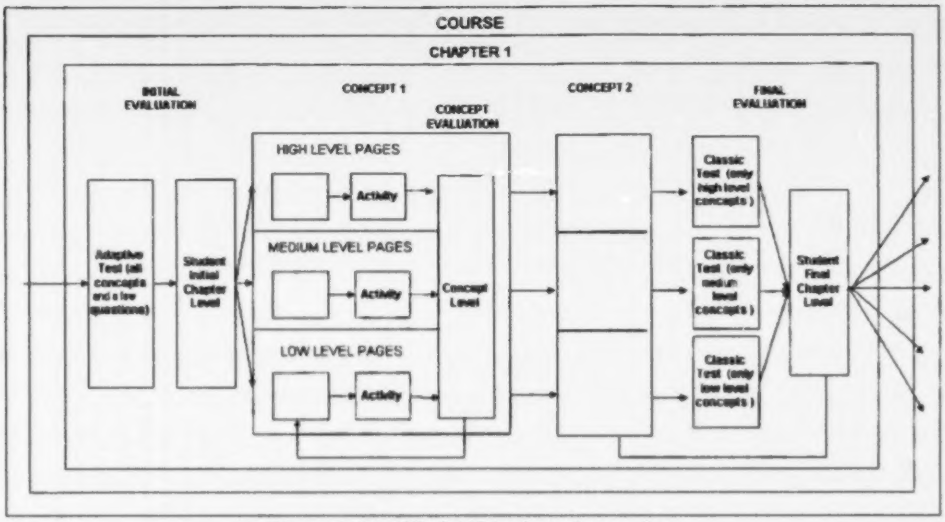

COURSE
CHAPTER 1
INITIAL EVALUATION
CONCEPT 1
CONCEPT EVALUATION
CONCEPT 2
FINAL EVALUATION
HIGH LEVEL PAGES
MEDIUM LEVEL PAGES
LOW LEVEL PAGES
Adaptive Test (all concepts and a few questions)
Student Initial Chapter Level
Activity
Activity
Activity
Concept Level
Classic Test (only high level concepts)
Classic Test (only medium level concepts)
Classic Test (only low level concepts)
Student Final Chapter Level

Figure 1: Modified AHA adaptation engine.

Discovering association rules and Conclusions

We are using a genetic algorithm to obtain association rules (Romero et al., 2002) from the user evaluation data. The association rules relate variable values. Genetic algorithms are a paradigm based on the Darwin evolution process, where each individual codifies a solution and evolves to a better individual by means of genetic operators (mutation and crossover). In general the main motivation for using genetic algorithms for rule discovery is that they perform a global search and cope better with attribute interaction than greedy rule algorithms often used in data mining. The format of the rules we want to discover is:

```
IF Variable1 = Value1 (AND Variable2 = Value2 …) THEN VariableX =ValueX
```

Where:

- Variable1, Variable2, VariableX are the database's field names (times, levels and scores).
- Value1, Value2, ValueX are the values of the corresponding database fields.

We want to discover relations between knowledge levels, times and scores that help the teacher modify the course's original structure (joining concepts, changing concepts from level or chapter, etc.) and content (eliminating or improving bad questions, bad pages, etc.). We have developed a course on Linux with the modified AHA! and we are now obtaining usage information about different types of students with different initial knowledge about Linux. We expect to have enough usage information in a few months to apply association rule mining and see how useful the discovered relations are. We have tested our genetic algorithms with the data obtained from the evaluation of a Web-based Hypermedia Course on the subject of Rheumatology (Romero et al., 2002) and we showed that they can produce potentially useful results. We are also developing a more sophisticated evolutionary algorithm to obtain more comprehensible and interesting rules.

References

De Bra, P. and Calvi, L. (1998). *AHA! An open Adaptive Hypermedia Architecture*, The New Review of Hypermedia and Multimedia, vol. 4, pp. 115-139, Taylor Graham Publishers.

Romero, C., De Castro, C., Ventura, S. (2002). *Using Genetic Algorithms for Data Mining in Web-based Educational Hypermedia System.* Workshop on Adaptive Systems for Web-based Education. Málaga, Spain.

Osmar R. Zaïene. (2001). Web Usage Mining for a Better Web-Based Learning Environment. Proc. of Conference on Advanced Technology for Education. Alberta, Canada.

Essential Elements: Prepare, Design & Teach Your Online Course

Raymond M. Rose, Concord Consortium, United States of America, ray@concord.org

Alese Smith, United States of America, alese@concord.org

Abstract. Essential Elements is the latest publication written by staff at one of the Internationally renown eLearning organizations. It builds on over six years of work in online education and from our experience helping to develop hundreds of online courses. We show you how to create and teach a successful online course. There are just seventeen "basic, indispensable, necessary" parts that make up a successful high-quality online course. Include them all in yours and you are nearly guaranteed success.

Essential Elements is the latest publication written by staff at one of the Internationally renown eLearning organizations. It builds on over six years of work in online education. Chris Dede, from Harvard University says about EE; "Its model will aid instructors in reconceptualizing their teaching to take full advantage of the new interactive media." And Zahrl Schoeney, from Curry School, University of Virginia proclaims; This book gives you the closest thing to a surefire formula for creating successful online courses..."

This book, with our *Essential Elements* gleaned from our experience helping to develop hundreds of online courses, reveals just what that difference is. We show you how to create and teach a successful online course.

There are just seventeen "basic, indispensable, necessary" parts that make up a successful high-quality online course. Include them all in yours and you are nearly guaranteed success. Is that all there is to it? Yes, it is that simple. Of course, making sense of and implementing the seventeen *Essential Elements* may take some work—but that is what this book is all about.

We describe these *Essential Elements*, and show you how to implement them in a truly high-quality learning environment for your students. With tips addressing everything from technology to student assessments, from community building online to collaborative teaming, and from pacing issues to the "chunking" of course activities and materials, we have the virtual classroom covered. In addition, we illustrate the tips with practical examples from our experiences.

To fully explain our method for creating successful online courses, we have developed The Concord Consortium e-Learning Model. The following nine key characteristics define The Concord Consortium's approach to delivering quality e-Learning.

1. **Asynchronous collaboration.** Participants don't have to be logged on to the course simultaneously; they work in an asynchronous environment in which text-based, threaded discussion and collaborative problem solving form the core learning strategy.
2. **Explicit schedules.** Instructors of online courses that rely on collaborative discussions schedule lessons within a specific timeframe so participants can share similar experiences and insights.

3. **Expert facilitation.** Online courses are led by a qualified person specifically trained in online facilitation.

4. **Inquiry pedagogy.** Designers create effective online courses -- with many specific elements that contribute to sound pedagogy for inquiry learning.

5. **Community building.** Course designers and instructors are proactive in designing and nurturing a community culture in which participants are supportive, honest, and willing to take intellectual risks.

6. **Limited enrollment.** There are between 12 and 25 participants in a class to keep collaborative learning manageable.

7. **High-quality materials.** Course designers include the widest feasible range of media and activities to appeal to different styles of learning.

8. **Purposeful virtual spaces.** Online, course designers create explicit structures so the community gets what it needs without interrupting the flow of content-based discussions. Typically included are a "Student Lounge," a "Questions about Assignments," a "Technical Questions," and a "Class Meeting" discussion space for debriefing course experiences.

9. **Ongoing assessment.** Online assessment is a continuous, ongoing process. Instructors find evidence of achievement in participants' daily contributions to online discussions. They learn each student's unique voice and approach to solving problems through their postings.

The type of online course that we will help you develop is one in which you will have clearly written assignments that engage your students in active learning with each other, and in which you, as the instructor, play an integral role as a facilitator of that learning. You will use the Internet both as a resource and as a means for connecting yourself and your students based on your mutual interest in the content—regardless of your individual schedules, geographic location, or physical ability to come to class. You'll choose a courseware package (such as Blackboard, Lotus LearningSpace, WebCT, to name just a few) to display the course assignments and reference materials as text, with graphics, colors, and multimedia to enhance the presentation, along with a discussion area that allows for student-to-student and student-to-instructor interaction.

The type of online course we hope to help you create is one in which you and your students will communicate and collaborate on a regular basis. Within the course, students will assess their own growth and learning through group discussion and reflection, peer review, instructor feedback, and self-evaluation. The richness of these interactions will translate into positive and meaningful learning experiences for your students that will carry over into their face-to-face lives.

Online Education for Adults: An Andragogic Approach

Ryan, Mark
National University
USA
mryan@nu.edu

Serdyukov, Peter
National University
USA
pserdyuk@nu.edu

Abstract: Online education may have to undergo curricular and methodological transformations to best serve the growing population of working adult learners. It would seem that a fundamental understanding of adult learning theory in an online environment is imperative in order to adequately meet the needs of this distinct population.

Andragogy is a specific learner centered theory geared toward teaching adults. As a methodological approach, andragogy understands that the adult learner has had different life experiences as compared to a pre-adult - and so adult teaching and learning methods are geared to the "different" kind of student (Knowles, 1991). This may have profound implications on the instruction and scholarship of the working adult learners (WAL), especially in online education.

The goals and curriculum of an online course from an accredited university should, undoubtedly, be the same as of the onsite, campus-based one. Nevertheless, the difference between a higher education course given online as opposed to one taking place in a classroom, is in the unique methodological approach. Accordingly, there is a need to articulate a particular educational philosophy (i.e. andragogy - learner-centered adult education) when developing an online course, training an online professor or orienting an online student. An appropriate philosophy informs a coherent methodological approach so that a course will be designed to supply the appropriate curriculum, a professor will be prepared for distinctive techniques, and the WAL will be assured that he or she will receive the most enriched learning experience in an online format. Therefore, an important relationship exists between adult learning and online education based on the andragogical notion that adults are self-directed learners.

Here are six assumptions about the adult learner. The WAL:

- is likely to be self-directed;
- has a life experience that can serve as a unique learning resource;
- is usually a goal-oriented learner, not a curriculum oriented learner;
- is more likely to initiate and sustain learning due to genuine motivation rather than external incentive;
- demands an explicit initial framework of study, and then the freedom to pursue knowledge within those borders;
- hates to waste time.

Following andragogical tenets in implementing online education for the adult student, it should display a distinct power sharing collaborative course design. Correspondingly, facilitators and learners become participants in an educational process that is both active and reflective. The key responsibility for leadership in the creation and maintenance of an online course clearly rests with the trained instructor. Ultimately the curricular and methodological success of an online course is revealed by the educator's rapport with his or her adult students. Online instructors need to be both competent and caring facilitators aware of cognitive psychology (how we learn affects what we learn) as well as the affective psychology involved in making a student feel welcomed, supported, and able to achieve.

Collaboration is *modus vivendi* of online education. Collaborative learning is based on the andragogical assumption that adults are self-directed learners who are shaped by the accumulation of authentic personal experience. Moreover, their desire to learn grows out of a need to confront an ever-changing reality. Given their goal-oriented approach to learning and an ever more crowded personal calendar (adults hate to waste time!), a self-paced asynchronous design has proven to be a most effective instructional online approach.

Thus, the logical extension of these assumptions for an online class is a collaborative asynchronous learning format. Such a learner-centered format calls for both direction and support. The key factors in providing a foundation for a partnership among facilitators and learners is to provide both direction and support for all. It is usually up to the facilitator to determine direction (i.e. how to carry out the learning process) and support (the learner's competence to take part in that process) although students familiar with this paradigm can also partake in a shared decision making process. Support for the online adult learner is provided through a learning environment that meets both the adults' cognitive and affective needs. An academic atmosphere in which all participants have a sense of well-being is an essential element in a collaborative partnership among facilitators and students.

Considering the WAL's idiosyncratic lifestyle, we realize that along with the course outcomes, the most essential feature of online instruction is convenience - convenience of schedule, of course structure, assignments and interaction with the instructor. Convenience, in our view, is another iteration of customized learning. Nowadays customized goods and services tend to become more prevalent. The rigid traditional onsite format of higher education cannot provide this individualized instruction by definition. In fact, certain adult learners have not been able to access higher education due to the simple factors, such as inflexible scheduling and traveling distance from campus. This is why online students appreciate the new dimensions of time and distance presented in asynchronous online education. This does not mean online education is a simplified version of the traditional onsite experience. We are convinced online and onsite rigor and outcomes must be equivalent. Nevertheless, a comfort zone for the WAL can be provided in the course format through planning and organization that relies on adult learning theory specific to an online environment. For instance, convenience of schedule in online education is apparent in its flexibility (students work at their own pace at a time of their choice). Convenience in content delivery is provided by the availability of reliable and quality online learning resources with the professor acting as a gatekeeper (to assure an accurate and scholarly information base) for a variety of Internet resources. Another manifestation of convenience is the presentation of online course on the students' computers. The instructional process, assignments and evaluation should be very unambiguous. Complexity of learning should be not on the screen but in the communication between a student and the instructor (Ryan, 2001).

The ongoing transformation of online education in terms of the professor, learner, curriculum and specific methodological approach is appropriately enhanced by adult learning theory. In a sense, online education presents an exceptional laboratory experience that can produce a collaborative effort to construct a model that meets the particular needs of the adult learner. Rapport between the instructor, enlightened by adult learning theory, and the WAL is paramount to a successful online learning experience. Broadening access to online education opens up new horizons of opportunity for greater number of diverse adult learners than ever before.

References

Knowles, Malcolm (1991). Adult Education: Evaluation and Achievements in a Developing Field of Study. John M. Peters, ed. San Francisco: Jossey-Bass.

Ryan, M. (2001) *Ask the Teacher: A Practitioner's Guide to Teaching and Learning in the Diverse Classroom*. New York, New York: McGraw-Hill Companies Inc.

STRATEGIC FOCUS / BLENDED LEARNING

Corporate Education – A new vision of training and development.

The current competitive scenario shows us a radical reduction in knowledge life-time, and companies perceived that they cannot depend anymore only on the traditional schools and programs to develop their employees.

In this way, some enterprises have chosen to improve their own educational areas, looking for a closer follow-up of the training processes, focusing on the company's necessities specifically. It is believed that the key for success is to provide to the employees a better access to the information, improving their knowledge and skills, giving the companies a real competitive advantage. All of this should be accomplished through results evidence.

In Brazil, companies need to establish a main unit responsible for sharing their vision, corporate strategies and for the management of the acquired knowledge. In the same way, there is also a pressure to focus training and development on the companies core business, as well as to demonstrate their return on investment.

However, there is no value for the best training program if the managers were not concerned about retaining this knowledge in the enterprise. Training people for the opponent is a very close possibility in the competitive world nowadays. So, Corporate Universities take place as an internal organization with the mission of developing people in the long term, attracting and retaining the best professionals, and also accelerating the internal knowledge flow.

Concerned about the same problem, Brasil Telecom has decided to use a blended corporate education model as the formula to focus all the development efforts, straight to the company's strategic objectives.

The targets for Brasil Telecom Corporate Education are all the business units, developing their leaders on the following subjects:

- Leadership;
- People management;
- Financial management;
- Marketing management;
- Telecommunication management.

To develop its activities, Brasil Telecom's Corporate Education uses both internal and external instructors. The partnership with external schools aims to establish contact with the best management technologies, as well as the best practices in the industry. On the other hand, the internal instructors will teach how the company works, spreading out their know-how.

At the same time, complementing all the courses, Brasil Telecom's Corporate Education uses also on-line distance learning tools, proportioning video-on-demand, web based training courses, on-line library, synchronous meetings, among others. The use of distance learning allows specific advantages, such as:

- offering training in a large scale, reaching all the value chain (customers, partners, suppliers);
- choosing the place and schedule for training sections - students have they own rythm;
- accelerating the knowledge acquisition and update;
- offering just-in-time training;
- offering a simple interface;
- offering a better control of the training process.

Concerning return on investment, Brasil Telecom's Corporate Education students, once selected, have the commitment of improving their areas results and optimizing the use of their resources.

The competencies developed by Brasil Telecom's Corporate Education are:

- *customer focus* (identify and preview what the customer needs and value);
- *leadership* (focus the strategies, the activities and the resources);
- *teamwork* (work as a team, considering the organizational goals);
- *continuous development* (create an environment for a continuous learning);
- *coaching* (motivate and influence people for a high performance).

Finally, Brasil Telecom's Corporate Education allows the company to centralize learning solutions, supplying the traditional education gaps, sharing the internal know-how, defining training standards and decreasing costs through the scale of contracting.

Authors:

Last name: SABRITO
First name: Carlos Eduardo
Affiliation: Brasil Telecom
Department: Corporate Education
Address: Rua Cel. Genuíno, 421 – 13° andar – Centro – Porto Alegre (RS)
Zip Code: 90010-350
Country: Brasil
Phone: +55 51 3229-1537
Fax: +55 51 3229-1244
E-mail: csabrito@crt.net.br
Last name: CORREA
First name: Juarez Sagebin
Affiliation: Brasil Telecom
Department: Educação Corporativa
Address: Rua Cel. Genuino, 421 – 13° andar – Centro – Porto Alegre (RS)
Zip Code: 90010-350
Country: Brasil
Phone: +55 51 3229-1537
Fax: +55 51 3229-1244
E-mail: jsagebin@crt.net.br

STUDENT PERFORMANCE ANALYSIS USING BIVARIATE CORRELATION FOR HIGHER ACADEMIC SUCCESS IN ELECTRONICS ENGINEERING PROGRAM

Gulden KOKTURK
Dept. of Electrical&Electronics Eng., University of Dokuz Eylul, Izmir, TURKEY
gulden.kokturk@deu.edu.tr

Guven SAGDIC
Dept. of Electrical&Electronics Eng., University of Dokuz Eylul, Izmir, TURKEY

Abstract: In this work, we established a statically connection between age, college entrance score and student performance, and between basic science courses of first year like physics, calculus etc. and student performance. We calculated this relationship using bivariate correlation analysis. For all data, score transformation was computed with linear transformation method. Data was extracted from undergrade classes in Electronics Engineering program. We investigated the student performance for all and classifying data with correlation analysis.

Introduction

Researchers and educators have been interested in determining factors related to student academic success. Student performance analysis has historically been used as predictors of school success by establishing correlation method in which to compare school achievement with similar schools.

The purpose of this work was to determine the effect of student age, college entrance score with relationship between them and average scales on student achievement courses. The courses examined in this work were as follows; physics I (first year, first semester course), physics II (first year, second semester course), calculus I (first year, first semester course), calculus II (first year, second semester course), chemistry (first year, first or second semester course), first year-first semester average scale and fist year-second semester average scale. The study question, therefore, addresses to what extent these student enrollment status are related to student grades in courses.

Bivariate correlation was used to analyze the relationship between the student enrollment status and last semester average scale, and between lecture grades and semesters average scales. This analysis examines the correlations between these items to determine the prediction of factors that best predict student scores.

There are several researches on correlation. Patrica Plympton et al. (2000) have recently proposed effects of daylighting on student performance. Sherry and Jesse (2001) were investigated student solving talent with correlation. Another research (Tinto, 1995) has been studied on overall degree progression of the students.

Bivariate Correlation

In this study, bivariate correlation analysis was conducted on several variables related to college student's demographic and enrollment status and their student grade performance. All data consisted of all students grades in courses, were extracted from the University's student record system. Specifically, as you known that status variables included age (in years), college entrance score, and grades in courses. Grades were obtained on a 4 point-to-point average scale. After data was analyzed, they were classified as first, second, third and last grades. Then correlation coefficients calculated for all and classified data.

As a simple fact that the correlation is association between two quantative variables (Borden, 1998). In this project, we used correlation for our maximum likelihood estimator (Mendenhall et al., 1990). It was seen that the correlation among some variables in the study is large in age than in the school entrance score. However, correlation between age and last semester average scale is small. Because of the positivity in it, age has smallest correlation with last semester scale. Calculus II score had the largest correlation with last scale. The positive correlation indicating that students had attained a math grades in their high school class tent to attain higher college grades. It is noted that first year-first semester and first year-second semester average scale is highly related with last average scale. This is indicated that first year-first and second semester courses are the most important in student achievement. For each class, correlation is presented for some courses in this work. It is shown the correlation of the basic courses grades with last average scale for each class. All correlation coefficients are positive. In this situation, the largest correlation is in physics course. When it is calculated the relation between age and entrance score with last average scale for class-to-class, age to last scale in first and second years of University life is negatively related with each other. This means that younger students tented to lower average scale.

Conclusion

Bivariate correlations demonstrated that variables; age, school entrance score, first and second semester basic courses, first year-first semester average scale and first year-second semester average scale were the most highly correlated with last average scale and all positive correlates. However, the two predictors which age and entrance score are negatively correlated in some classes suggesting that their impact on last average scale might be mitigated.

The statistical relationship uncovered in this analysis, is qualified by the very large sample size. That is the large size makes it possible to uncover very weak associations.

References

Borden, V. (1998). Correlates of Student Performance. *imir.iupi.edu/imi/vborden.html.*

Mendenhall, W., et al. (1990). *Mathematical Statistics with Applications*. PWS-KENT Publishing Company, Boston.

Plympton, P., et al. (2000). Daylighting in Schools: Improving Student Performance and Health at a Price Schools can Efford. *American Solar Energy Society Conference*, Madison, Wisconsin.

Sherry, L., & Jesse, D. (2001). The Impact of Technology on Student Achievement. *Texas Study of Secondary Education*, X (2), pp.15-17.

Tinto V. (1995). *Keynote address to the Inaugural Pan Pasific First Year Experience Conference*, Brisbane, Australia.

The Use of The Internet in High School and University

Nicoletta Sala
Academy of Architecture - University of Italian Switzerland
CH 6850 Mendrisio – Switzerland –
nsala @ arch.unisi.ch

Abstract The aim of this paper is to present two different experiences which involve the Internet in educational paths in high school and university. In first experience, named Web Learning Environment (WLE), we have studied the use of the WEB and its resources to develop a new learning environment. We have involved a classroom (sixteen students, aged 16-17) of a technical institute in Italy. The project has been divided in six different phases: the knowledge of the Internet, the research in the Internet, the access to the FTP, the didactics with the Internet, the communication using the "Net", and the creation of a cooperative hypertext dedicated to the Bonaventura Cavalieri (an Italian mathematician). Our second experience, named "Cybermath", is an attempt to build some hypermedia modules to introduce the fundamental of Mathematics in a undergraduate course. It has been developed at the Academy of Architecture of Mendrisio (University of Italian Switzerland), Switzerland.

First Experience: Web Learning Environment (WLE) Project

The computer technology and the Internet have become important parts of education across the curriculum and will likely be more so in the future. Innovative use of technology combines telecommunications (e-mail, online resources, Internet navigators), multimedia authoring (home page editors), user-friendly convenient applications software are modifying respectively the role of the teachers and of the students in the didactic environment (Sala, 1999; Sala, 2000). The role of the classroom teacher is evolving from that of a giver of information to that of a facilitator of student learning. The role of the students is more active than the last years. Our first educational project is an attempt to build in a high school an active learning environment using the Internet and the Web technologies. It has been divided in six parts:

1. the knowledge of the Internet (the students, organised in eight groups each composed by two persons, have learnt the Internet directly in the Web using some special interactive lessons, developed by the "Polo Didattico e di Ricerca di Crema" Italy, available at the Internet address: http://weblab. crema.unimi.it/ internetcourse/),
2. the research in the Internet (the students have learnt to use the search engines, for example: Altavista, Yahoo, Google, Vivisimo, comparing their performances using the same keywords),
3. the access to the FTP (the students have analysed the capability to download, to install and to use some shareware and freeware software dedicated to the mathematics, geometry, Italian literature, and information technology),
4. the didactics with the Internet (the students have used some educational Internet sites dedicated to the Italian literature, to the physics, and to the mathematics),
5. the creation of a cooperative hypertext dedicated to the Italian mathematic ian Bonaventura Cavalieri (our approach is also a "Learning by Doing", in fact the students have also learnt the history of mathematics during the hypertext development),
6. the communication using the "Net" (where a disabled student of our classroom has communicated with other European students using the e-mail).

Second Experience: "Cybermath" Project

Second experience involves the use of the Internet and its resource to build a hypermedia course of Mathematics in university (Sala, 2001). This course, named "Cybermath", intends to develop a propaedeutic course of Mathematics to introduce some particular subjects. This project intends to create an effective-based learning environment that provides synchronous and asynchronous education to learners who are physically remote. The aim of this project is to develop a distance learning model to introduce the fundamental of Mathematics, to permit to the students:

- to overcome the problems of the different background before the beginning of the academic year;

- to help them to reach a good grounding in Mathematics
- to overcome the strong dislike for this subject using a medium, the computer, which has a good communicative impact.

The environment provides: the user registration; the hypermedia lessons; the course materials; the tests online; some active links to other Internet sites dedicated to the mathematics. The hypermedia modules have been written using the DHTML (Dynamic Hypertext Markup Language) with the aid of Java Applet and JavaScript procedures to introduce multimedia codes (e.g. video clips, audio comments). We have also used Virtual Reality Language Modelling (VRLM) to create the virtual worlds and the virtual object (e.g. virtual polyhedra). Virtual Reality (VR) is a good medium, in distance learning, for making abstract concepts concrete, for example to touch or to manipulate virtual geometric objects and to observe their symmetries (Sala, 2002). Virtual reality can also help constructivist learning and this is an important aspect of distance learning (Winn, 1993).

Conclusions

The Internet provides a perfect environment for the learner to have access to many resources, to choose the exercises, to offer an almost similar educational connection with reality, to encourage learning and to create a constructivist approach in the learning (Postema et al, 2001; Sala, 1999; Sala, 2000). The Web is viewed as a solution for the global access of information (Collis, 1998). Our projects demonstrate that the Internet and the new technologies offer significant benefits in educational process, and they show that there are clear educational advantages to be derived from cooperative student activities. Inside our WLE and Cybermath projects, the role of the teacher is evolving from that of a giver of information to that of a facilitator of student learning. We have also noted that the students exhibited strong motivation in the hypertext development, and this is encouraging for the future application of the Internet and its resources in the educational process.

References

Collis, B. (1998). New didactics for university instruction: why and how? *Computer & Education*, 31, (4), Elsier Science Ltd, 373 – 393.

Postema, M., Sheard, J. & Markham, S. (2001). Understanding Web Support for education within a Diffusion Context. *Proceedings International Conference on Computers in Education 2001 (ICCE)*, Seoul, Korea, 383 – 390.

Sala, N. (1999). Surfing in the Web: An Experience of the Use of Internet in Educational Process. *Proceedings World Conference on WWW and Internet WEBNET 99*, Honolulu, Hawaii, USA, 1411 – 1412.

Sala, N. (2000). Web Learning Environment (WLE): An Example of the Use of The Internet in Educational Process . *IEEE Learning Technology Task Force (LTTF)*, Volume 2 Issue 4 (ISSN 1438-0625). Available at: http://lttf.ieee.org/learn_tech/

Sala, N. (2001). Cybermath - The Future of Learning of Mathematics: A Case of Study. *Electronic Proceedings of World Conference on Open Learning and Distance Education ICDE 2001*, Dusseldorf, Germany.

Sala, N. (2002). Virtual Reality as an Educational Tool. *Proceedings International Conference on Computers and Advanced Technology Education 2002 (CATE)*, Cancun, Messico, 415 – 420.

Winn, W. (1993). *A conceptual basis for educational applications of virtual reality*. (HITL Technical Report No. TR-93- 9). Seattle, WA: Human Interface Technology Laboratory. (Available as online HTML document: http://www.hitl.washington.edu/publications/r-93-9)

Using CMC to Build Middle School Communities Among Peers with Mild/Moderate Disabilities

"Email has swept the world during the last decade..." (Bikson & Panis, 1997, p. 1). Recent surveys indicate that middle school age children are its most prolific users (Quinn, 1998). Ditlea (1999) reports that net surfing adolescents are virtually "flocking to cyberspace" (p. 1), and apparently, "what they mostly want is to read each others' words" (Ditlea, 1999, p. 1).

This revolution emerged against the backdrop of a" proliferation of education reform efforts" ushered into American schools since the release of A Nation At Risk (Means, Blando, Olson, Middleton, SRI International, Morocco, Remz, Zorfass, Education Development Corporation, 1993, p. 1). Pundits of American schools, fueled by warnings in the report that the Nation's future and people were threatened by an erosion of educational standards, and, having witnessed the manner in which technology had transformed the workplace, advocated for the use of technology to support the kind of structural reforms in schools they believed necessary to improve the dire state of education as outlined in the report (Means, et al. 1993). In response, two trends developed that greatly impacted public schools today: (a) a proliferation of computer/technologies in schools, and related challenges to determine the best ways to utilize this technology; and, pressures for improving academic outcomes (i.e., statewide performance testing/CMT's, advanced academic courses). Recent events in schools across the nation (e.g., shootings of students and teachers, charges of harassment and an increasingly diverse school population-including students with disabilities) have also increased pressures to specifically improve social outcomes within school environments for all students.

The purpose of this paper is to explore the potential interface of these trends in the emerging phenomenon of computer-mediated communication. Computer-mediated communications, "(CMC) is a method of communication that uses a computer as a transfer medium permitting individuals to communicate without geographical or time restrictions" (Holden & Wedman, 1993, p. 5). Although computer-mediated communications exists in many forms, this review concentrates on two text-based CMC systems that have achieved ubiquitous acceptance: email and the World Wide Web [WWW] (Haythornthwaite, Wellman, & Garton, 1998), and evidence of its use in mediating social interactions among preadolescent middle school youth with and without disabilities. These students are faced with unique challenges in an increasingly dynamic and diverse school environment, hence exploring the potential use of CMC, particularly email as an intervention to establish and maintain positive social relations between them is important.

Technology, Teachers, and PT3

A progress report on a Department of Education PT3 (Preparing Tomorrow's Teachers to Use Technology) grant

Seeing is not necessarily understanding, when it comes to online lessons. In this seminar, real examples of actual online lessons are highlighted. The presenters demonstrate how PT3 faculty and support personnel did what they did – from incorporating text to Java applets and more.

In our PT3 project, we consider technologies (e.g., email, word processing, web course building, streaming audio/video, java applets, ePortfolios) based upon a number of factors, including ease of integration, cost, existing campus and departmental support, and potential impact upon teaching and learning. The examples illustrate a range of different types of course content in various disciplines, and demonstrate what is possible in the online environment.

We believe that technology-based interventions should be consistent with what we know about how people learn and what constitutes good teaching practice. Models for infusing technology into teaching can include strategies such as peer coaching, collaboration, mentoring, problem-based learning and modeling. In this presentation, we move from theory to practice, and demonstrate how technology can be implemented within proven teaching and learning models.

Attendees will be provided with a web address that contains the conference presentation as well as additional materials for their exploration when they return home.

Using Speech to Enhance a Math Education Applets

David B. Sher
Mat/Sta/CMP Department
Nassau Community College
1 Education Dr.
Garden City NY 11530
sherd@ncc.edu

This paper discusses a java package, called **talk,** that takes numbers (and in the future expressions) and speaks them out loud. The package is designed to run on a maximal set of browsers and is used by several applets as part of a precalculus education web site (http://www.polar.sunynassau.edu/~sherd/Applets/Calclet or http://www.calclet.com).

The reform approach to mathematics education is to present mathematical ideas with multiple modalities. Speech adds a powerful ability to mathematics education web sites. Speech allows applets to fully implement the rule of four (verbal, numeric, symbolic and graphical modalities) that forms the heart of the reform calculus approach.

I. Talk Package Design

This section discusses how to use the talk package from another java applet.

1.1. Sound Files

The sound files must be in the au format to maximize the set of web browsers that can properly present the sounds. A collection of sound files has been installed in http://www.calclet.com/Sounds/. The package expects sound files in a folder called Sounds in the same folder as the web page. So if the web page containing a talking was at location http://www.somewhere.com/mypage.htm a copy of the sound files would have to be at http://www.somewhere.com/Sounds/.

Sound files have been constructed to say any number in the author's voice. Numbers like fourteen are said by playing the sound file in 4.au to say four and teen.au to say teen. To use the talk package you need to copy all the au files in http://www.calclet.com/Sounds/.

1.2. Package Components

This paragraph describes how to use the components from a Java applet.

1.2.1. Copyright applet

The copyright applet does two things for the package. It says the copyright notice in copyright.au (in the Sounds directory) and will say it when the mouse is clicked on it.

Putting the copyright applet in the initial web page causes the talk package to load as the page loads, so that the other applets that use it can load it from cache rather than waiting for the package to download from the internet.

Its even more useful if other packages are contained in the jar file with the talk package. All of my precalculus teaching packages are stored in a file called everything.jar. By using the copyright applet all of the applets preloads while the users observe the initial page and decides which applet or applets they want to use.

1.2.2. Sayer class

Sayer is a thread that is used to organize and synchronize the words and mostly to prevent them from being said at the same time. Java 1.1's sound methods are rather primitive and if the play method of an audio clip is called when another audio clip is playing both sounds will be overlapped. The Sayer takes an audio clip and a number of milliseconds and waits that number of milliseconds before it plays another one. Each talking number creates a Sayer. You will not need to directly call the methods of this class.

1.2.3. talkingNumber class

This is the central class of the talk package. talkingNumber has methods to play integers, doubles, and strings containing any number. It can only handle numbers up to 999,999,999,999,999. It will ignore any digits beyond that. It can handle numbers in scientific notation and numbers with decimals.

It will also say certain words. It has the word "bleh" built in to indicate an error. It has the copyright message built in. It expects all the sound files to be in a Sounds directory that is under the directory containing the web page containing the applet.

You can change and add to the sounds in the Sounds directory or download them from http://www.calclet.com. You can add new words into this directory and use the talkingNumber's playWord method to play the word using a specified number of milliseconds. playWord("moose",700) will play the audio clip in Sounds/moose.au and give it 700 milliseconds to play. Recently I added audio clips x.au and y.au to help the package give coordinates.

The getDigitTime method returns the number of milliseconds to say a digit (approximately 1 syllable). This is useful for timing other words. You can also speed up or slow down the speech by using the setDigitTime method. Setting too small a digitTime may have unfortunate results.

1.2.4. talkingNumberSource class

A talkingNumberSource is a component that extends TextField and also runs stand alone. Basically any number written into that TextField will be said when an action is sent to that class (which is an action listener). Of course it also has all the methods that a TextField ordinarily have so you can put text in and either allow or prevent the user from entering text. This is an easy way to introduce talking into your applets and applications.

2. *Talk Package Use*

This section discusses how the talk package is used in the games package of http://www.calclet.com. From this other users can see how it can be used in their packages. Since this package was developed using support from the Department of Education and Nassau Community College, users of the package are requested to email sherd@ncc.edu so the dissemination of the package can be documented. The components of this package are copyrighted, but they are free for educational use. Anyone who wishes to use them for profit making software is requested to contact David B. Sher, the author.

2.1. Copyright

The copyright applet serves to download the jar file necessary to run these tools and to speak the copyright notice. Failure of this applet indicates some problem with the web site or browser (or maybe the operating system). When the applet runs it will display a copyright symbol, as shown in the red box in the figure below. Thus it is apparent, even on a muted computer, whether the jar files loaded.

Copyright © David B. Sher 2002

Copyright Applet running in web page

The main point of this applet is to download the jar file and the sound files into the cache before while the user is selecting which applet to run. http://www.calclet.com uses the applet for this purpose in the frame http://www.calclet.com/precalculus_games.htm.

2.2. Games and Drills

Many of the games and drills in http://www.calclet.com use the talkingNumber class to state the problem. If a game has a "Do Talk" button, pressing the button starts the applet talking. Usually there will be no speech until the game is started though. You can turn on or turn off speech during a game by pressing this button.

The default for the applets is no speech because speech slows down the applets. Computers better suited to multimodal processing may not experience this problem, which does occur on Pentium 200 with 64Mbyte RAMs.

Usually these applets refer to points in a coordinate system and the applet states the x coordinate and y coordinate of each of the points. Thus the problem is prompted verbally. Also verbal negative feedback is used when the user presents incorrect answers. In the future positive feedback will be added (and maybe some kind of encouragement for close answers also).

2.3. Modeling

In the economy modeler (and soon in the stock modeler) applets the talk package is used to present the difference between the modeling function and the data being modeled. Checking the talk check box, toggles speech. The applet won't say anything till a data set is selected and a modeling function is entered.

When the user enters a new modeling function the error of this function is presented verbally as well as in a TextField. Since the user is seeking to minimize the error this will focus attention on it. This focus is important for a complex applet with a lot of textual and graphical information presented.

In the future we will consider adding the ability the present the user's modeling function expression verbally too. This will avoid surprises, for example, parts of the function lying outside the visual area of the text field.

3. *Conclusion*

This paper presents a package used for adding speech to mathematics teaching applets and other applets with significant mathematical content. It has been successfully used in a package documented in http://www.calclet.com.

4. *Acknowledgement*

The work in this paper was sponsored by the MSEIP program of the Department of Education, in a grant #P120A010031 entitled *Four Colleges: Calculus + Enhancements*.

BEST COPY AVAILABLE

Development of Computer-Based Instructional System on Introductory Statistics

Minsuk K. Shim
University of Rhode Island
19 Upper College Road, Kingston, RI 02881

Sunguk M. Shim
South Kingstown High School
215 Columbia Street, Wakefield, RI 02879

Abstract

This paper describes the motivation and usage of interactive instruction developed for basic statistics education. It was developed to help students in introductory statistics courses better understand some of the more difficult concepts that they encounter. When students use spreadsheets to experiment and illustrate their problems, they can better visualize the problems and more easily see what happens. Interactive instruction with thirteen lessons may be found at http://www.soe.uri.edu/mshim/StatProject/.

Introduction

Students frequently view statistics as the worst course taken in college (Hogg, 1991) and a reform of introductory statistics classes has been advocated by many statisticians. Some believe that the goals of an introductory statistics course should be redirected from mathematical technique to data analysis (Cobb, 1991). Others advocate changes in pedagogy, replacing passively received lectures with hands-on activities (Bradstreet, 1996; Smith, 1998).

Functional skills in statistics are a basic requirement when students analyze data. Often those skills can be more efficiently learned by applying statistical concepts through statistical programs (Malthy, 2001). Familiarity with statistical programs provides students a chance to see how statistical concepts can be applied to understand and analyze real-life problems. The author has found that many students do not have easy access to statistical software at home. Many of them, however, have computers at home with spreadsheet software such as Microsoft Excel. This research first began with wondering whether students could use the spreadsheet software for statistical analysis, as they are more accessible and easier to use than conventional statistical software. The idea was then expanded to the development of a computer-aided, self-paced instructional system on statistics using Excel as it can give students more freedom to work when and where it would be most convenient for them.

Spreadsheets for Teaching Introductory Statistics

SAS (Statistical Analysis System) and SPSS (Statistical Program for Social Science) are the two most widely used statistical programs and the ones that are available on computer labs around campus. Although they are much more powerful in complex, high-level statistical analyses, they are often difficult to learn and expensive to buy for personal use. Spreadsheet software is easier to use, widely used, and now includes extensive statistical functionality (Nash & Quon, 1996).

Research also suggests that students studying functions using spreadsheets and graphing tools understand functions better than those studying functions in a more traditional manner (Dugdale, 1990; Magidson, 1992; Schwarz, Dreyfus, and Bruckheimer, 1990 [cited in Fyfe, 1995]; Zucker & Huntley, 2001).

Many states require students to begin using spreadsheets as early as grade 5. In Virginia, for example, students are required to obtain the minimum skills of creating simple databases and spreadsheets to manage information and create reports by the end of grade 5, and communicating spreadsheets by entering data and setting up formulas, analyzing data, and creating graphs or charts to visually represent data by the end of grade 8 (Virginia Department of Education, 1995).

Activities

Basic descriptive and inferential statistics are covered (descriptive statistics: mean, median, mode, variance, standard deviation, frequency, and reliability; inferential statistics: *t*-tests, analysis of variance, regression analysis, and Chi-square test). Thirteen topics that were relevant to the course were selected and multimedia self-exploratory lesson is being developed for each topic. Each lesson takes approximately 30 minutes. It explains how to manipulate the data set and use Excel functions for statistical analysis, and provides hands-on activities using sample data. Once it is fully developed, it can be used for many courses where statistical knowledge is needed. The detailed activities include:

- Creating the sample data sets for the basic descriptive and inferential statistics defined above,
- Creating the course modules using the sample data sets,
- Converting the course modules into user-friendly on-line learning format,
- Developing a web site to maintain and distribute the system, and
- Customizing the system according the users' needs.

Conclusions and Discussions

This research shows how the spreadsheet and multimedia tools (Macromedia Director and Flash) can be used in aiding the understanding of introductory statistics. After the relevant concept has been introduced and discussed in class, the tutorial is demonstrated and its pertinence to the concept is explained. Students are then asked to investigate the interactive lessons further on their own time and to analyze the sample data sets designed to guide their exploration of the concept.

On the whole, this computer-aided, self-paced learning tutorial was a success. It provided the students with the ability to complete data analysis with all the benefits of spreadsheet, without accessing the commercial statistical software. The students enjoyed using it and would like to see other topics covered in a similar manner. Most students became involved in the system and tried to analyze data with the spreadsheet. Although students' attitudes and responses toward this computer-based instruction haven't been surveyed yet, they seem to be very supportive to it. To take advantage of the full capabilities of this system, the next steps would be collecting students' feedback, adding more multimedia-rich instruction such as audio, and creating tutorial CDs as stand-alone executables.

A BLENDED LEARNING APPROACH to FACULTY DEVELOPMENT: USING the OR-CAT MODEL for the I3 TRAINING SERIES

Bernadette Sibuma, Mathematics, Science, & Technology Department, Teachers College, Columbia University,
New York, New York, United States. E-mail: bes2004@columbia.edu.

Due to the shift to economies of knowledge, universities face the challenge of rapidly creating distance learning programs while staying true to the values of higher education. At the heart of the university's transformation lies the relationship between the institution and its faculty. Faculty participation in distance learning initiatives, such as e-learning, is crucial to the long-term success of the program at the university. However, at present, there are mixed responses from faculty at many campuses about the development of distance learning initiatives. Debates focus on the traditional faculty-university relationship and seek to resolve how that relationship may be changed or maintained with the advent of distance learning programs. This project addressed the need to find successful strategies to foster faculty participation and commitment to distance learning initiatives at higher education institutions.

The majority of the project presents the OR-CAT instructional design framework and the Internet Infused Instruction (I3) series – a blended implementation method. To begin the project, the general development of e-learning as a distance learning technology was reviewed. Then the contextual issues surrounding elearning in higher education were researched, particularly the need for faculty participation in the university's integration of distance learning. Finally, a strategy was proposed to increase faculty participation by providing training and support in teaching with new instructional technologies. The elements of the OR-CAT instructional design model are: 1) Observe: A learner observes a simulated event or phenomena; 2) Read: A learner reads background materials and other resources about the event or phenomena; 3) Reflect: A learner reflects and communicates about what she has observed and read, connecting it to her own context or past experiences; 4) Construct: A learner creates a publicly viewable demonstration of her understanding; 5) Argue/discuss: A learner views others' reflections or constructions and "argues" with other participants about any differences in understanding; 6) Adapt: A learner revises her construction, based on the previous step; and 7) Transfer: A learner problem-solves a new situation in which the knowledge or skill can be applied. Based on the OR-CAT model, the proposed I3 training series incorporates recent information from the learning industry about elements found in successful blended learning programs as well as constructivist instructional design principles. In addition, Chickering & Ehrmann's (1996) work is highlighted as guiding principles for instructional technology integration at the university level.

Experts indicate that long-term committed involvement by the faculty in distance learning initiatives requires a coherent institutional strategy that shows genuine concern for faculty interests and development. One already identified area where the university may fall short is in faculty training and support in using learning technologies in their courses. By offering technology training such as the Internet-Infused Instruction (I3) series, the administration moves towards sustained support for distance learning initiatives from faculty as well as signifies the importance of the faculty-university relationship during a time of institutional transformation.

References

Altschuler, G., & McClure, P. (2002 Jan 18). "… And colleges must create technology plans", *Chronicle of Higher Education*, 48 (19), pp. B16-B17.

Anderson, J. R. (2000). *Cognitive psychology and its implications* (5th ed.), pp. 170-250. New York: Worth Publishers.

Black, J. B., & McClintock, R. O. (1996). "An interpretation construction approach to constructivist design." In B. G. Wilson (Ed.), *Constructivist learning environments: case studies in instructional design*, pp. 25-31. Englewood Cliffs, New Jersey: Educational Technology Publications.

Carnevale, D. (2000 May 12). "A college's detailed policy on distance education", *Chronicle of Higher Education*, 46 (36), p. A49.

Carnevale, D. (2000 Aug 4). "Turning traditional courses into distance education", *Chronicle of Higher Education*, 46 (48), pp. A37-A38.

Carr, S. (2000 Jun 9). "Faculty members are wary of distance education ventures", *Chronicle of Higher Education*, 46 (40), pp. A41-A42.

Chickering, A. W., & Ehrmann, S. C. (1996 Oct). "Implementing the seven principles: technology as lever", *AAHE Bulletin*, pp. 3-6.

Dunlap, J. C., & Grabinger, R. S. (1996). "Rich environments for active learning in the higher education classroom." In B. G. Wilson (Ed.), *Constructivist learning environments: case studies in instructional design*, pp. 65-82. Englewood Cliffs, New Jersey: Educational Technology Publications.

Ellin, A. (2000 Aug 6). "The battle in cyberspace", *New York Times*, p. 4A15.

Gilbert, S.W. (2002 Mar). "A portfolio of strategies for collaborative change." http://www.tltgroup.org/gilbert/strategiesbase.htm. Retrieved from source, 29 Apr 02.

Munitz, B. (2000 Jan/Feb). "Changing landscape: from cottage monopoly to competitive industry", *Educause Review*, 35 (1), pp. 12-18.

Newman, F. (2000 Jun). "Keeping faculty members involved in new online programs", *Chronicle of Higher Education*, 46(43), p. B13.

Papert, S., & Harel, I. (1991). Situating constructionism.
http://www.papert.org/articles/SituatingConstructionism.html. Retrieved from source, 4 Nov. 01.

Peterman, T. (2000). "Elements of success at a traditional/virtual university: lessons learned from three years growth in cyberspace", *Journal of Academic Librarianship*, 26(1), pp. 27-32.

Rayburn, W. E. & Ramaprasad, A. (2000). "Three strategies for the use of distance learning technology in higher education". In L. Lau (Ed.), *Distance learning technologies: issues, trends, and opportunities*, pp. 52-68. Hershey, PA: Idea Group Publishing.

Savery, J. R., & Duffy, T. M. (1996). "Problem based learning: an instructional model and its constructivist framework." In B. G. Wilson (Ed.), *Constructivist learning environments: case studies in instructional design*, pp. 135-148. Englewood Cliffs, New Jersey: Educational Technology Publications.

Shea, T., Motiwalla, L., & Lewis, D. (2001 Nov/Dec). "Internet-based distance education – the administrator's perspective", *Journal of Education for Business*, 77(2), pp. 112-117.

Slaughter, S. (2001 Spr). "Technology, markets, and the new political economy of higher education", *Liberal Education*, 87 (2), pp. 6-17.

Werry, C. (2001 May). "The work of education in the age of e-college," *First Monday*, 6 (5). http://firstmonday.org/issues/issue6_5/werry/index.html. Retrieved from source, 27 Apr 02.

Zenger, J., & Uehlein, C. (2001 Aug). "Why blended will win", *T + D, 55* (8), 54-60.

Acknowledgements

I wish to thank Loretta Donovan for her careful review and helpful suggestions in reviewing a longer version of this paper; and Howard Budin and Robert McClintock for their helpful presence during different stages of my work on this project.

MathThread: Math and Distance Learning threaded discussions

Glenn Gordon Smith
Janice Grackin
David Ferguson
State University of New at Stony Brook
United States

Abstract: Distance learning web-environments do not provide the most basic communication tools for discussion of math problem solving vital to math courses. A needs assessment indicates that online instructors and students need to be able to view, edit, and post diagrams and formulas directly in online postings, without going through laborious intermediary stages. MathThread, an NSF-funded project, is dedicated to providing these tools to online instructors and students, supporting instructors in adapting their classes to use these tools and researching the effects of more natural math-oriented threaded discussion tools on mathematics learning. After reviewing the existing possible tools, we have formed a partnership with NetTutor who makes the Whiteboard math discussion tools. We have conducted a pilot study evaluating undergraduate students' ease of using the Whiteboard for calculus discussion. We found that most participants had little trouble understanding and using the tools.

Need

Current distance learning web-environments emphasize the written word and threaded discussions, but do not provide the most basic communication tools for discussion of math problem solving vital to math courses. In face-to-face math classes, instructors work problems, write formulas and draw diagrams on the chalkboard while students ask questions, providing a feedback communication loop. When students hand in homework, instructors and TA's can cross things out and write other formulas. This ability to demonstrate problem solving, represent problems through diagrams, and provide a communication feedback loop are fundamental to math learning, yet are awkward in web-based distance learning environments. Currently math notation, as well as diagrams, can not be directly included in online distance ed. documents. Because math notation and diagrams are NOT integral with the online distance education environments, instructors laboriously go through several steps to attach an image file with formulas and diagrams. Since students can not respond by writing math notation, this disrupts the communication loop. In a Sept. 2000 needs assessment of 40 web-based math instructors in N.Y. State using a dominant web-based environment, instructors declared, *"It has been extremely frustrating teaching math online..."*, and *"Your project sounds very timely and useful ."* Instructors consistently wished they could put equations, math notation, conceptual diagrams and graphs directly into online postings (i.e., a math notation editor, a drawing tool for creating conceptual sketches, and a graphing calculator).

Major goals, approaches, past and current work

In response to these goals, the MathThread group at Stony Brook University seeks to:

1) Provide distance ed. math instructors with basic math communication tools to fluently teach math, including direct inclusion of math notation, conceptual drawings and graphs into distance ed. postings by both instructors and students. Instructors will directly put math symbols into distance ed. documents, without converting documents into unmodifiable formats (such as image files, gif's, LaTex etc.) and adding them as attachments. Our goal is to have modifiable math notation in distance ed. documents, so instructors can easily copy, modify and annotate students' work and thereby achieve fluent of two-way math communication. *Achieve by:* Unite an existing distance ed. Environment with a math-friendly interface, NetTutor's Whiteboard, which creates, views and edits math notation and diagrams. 2) Adapt existing web-based and face-to-face college math courses to include these basic communication tools for math. *Achieve by:* Through the SUNY Learning

Network, a non-profit infrastructure for distance ed. at the State Universities of New York, redesign/deliver two Intro. Calculus and two Pre-Calculus courses using the math friendly communications tools. 3) Provide faculty development/support for instructors to re-design their math courses. *Achieve by:* During redesign of adapted courses, instructors meet with the project personnel and receive feedback on designing online math classes from other instructors at SLN, through online threaded discussion. 4) Research the impact of more natural math and diagrammatic communication on math learning. *Achieve by:* Once adapted courses are running in the SLN environment, research students' use of different modalities (e.g., diagrams, graphs, formulas) in their learning, for example, the correlation between diagrams use and comprehension/achievement, particularly for developmental students. 5) Facilitate the quick spread of basic math distance ed. communication tools to other math instructors a) in the Dept. of Applied Math & Statistics at STONY BROOK, b) within SLN through-out the state of New York and c) nationally. *Achieve by:* During redesign of adapted math courses, approach other math instructors at SLN for suggestions. Offer on-campus workshops through the Center for Excellence in Learning and Teaching (CELT) at STONY BROOK. Provide other math instructors with a simulation of a distance ed. math course using easy creation/viewing/editing of math notation, diagrams and graphs within assignments and discussions. During teaching of adapted courses, allow other math instructors to unobtrusively observe. Suggest that other math instructors use MathThread in one experimental unit. Present at the yearly SUNY Conference on Instructional Technology (CIT). Approach other distance ed. providers about using the basic math communication tools. Write papers for peer-reviewed journals and present workshops and papers at national conferences.

MathThread has adopted what is probably the best and most complete communication infrastructure solution for college math e-learning, the Whiteboard by NetTutor (www.nettutor.com). Whiteboard can also be used in asynchronous mode for math oriented threaded discussions. So far Whiteboard is the only working tool that allows users to put *directly* into asynchronous threaded discussions the most vital elements of math communication: formulas, graphs, and diagrams. There are no intermediary stages, just an interface that allows users to view, edit and post discussions with these elements. The NetTutor/Whiteboard could use some improvements on its interface. Since Whiteboard is the only reasonably complete and working product supplying the needs of math asynchronous threaded discussion, we have chosen Whiteboard as the tool we will use and they have agreed to a partnership with us.

The Math Thread project has recently been funded by the National Science Foundation, through the program Course, Curriculum, and Laboratory Improvement - Adaptation and Implementation (NSF CCLI A&I). The funding started January 2002 and runs for three years.

Prior to introducing the Net Tutor software into experimental classroom settings it is important to identify human and other factors (such interface design and technical usability) that might influence how well the software would function as part of a course. Early identification of such factors provides opportunities to modify or eliminate them prior to actual implementation, or to control for the identified factors in the experimental setting and account for them in subsequent project assessment.

A series of six pilot sessions were completed. Students who had taken or were currently taking pre-calculus or calculus were recruited to participate in single sessions to evaluate the use of the Net Tutor software in a naturalistic setting. Sessions were held in a computer lab, and students received course credit for their participation.

In general, responses to Net Tutor were relatively positive. Most, though not all, participants had little or no difficulty understanding how to use the tools ("It wasn't hard at all."), found most of them easy to work with, felt they had the right tools to do what they wanted to do, and felt there were enough tools provided. There also appeared to be a consensus that there was a certain awkwardness and tediousness to using Net Tutor, and participants suggested that they would feel more positive about the software if it functioned in simpler and more familiar ways. Most participants indicated that they believed they could become comfortable and proficient with the tools as part of a class in a fairly short time. The people at NetTutor have agreed to immediately address issues brought up in the pilot study. We feel that when these problems are fixed, NetTutor's Whiteboard will be a very serviceable tool for mathematics-oriented asynchronous threaded discussion.

The next phase in our project is to train and support several online mathematics instructors to incorporate the Whiteboard tools into their existing courses. We have made a partnership with a community college Long Island New York to convert a pre-calculus and a calculus class to take full advantage of the Whiteboard tools. The adapted courses will be offered Fall of 2002.

Automated Study Questions for Medical Students Using the Web

P.R. Smith and Virginia H. Black
Department of Cell Biology
NYU School of Medicine
550 First Avenue
New York, NY 10016, USA.
e-mail: smithp01@med.nyu.edu, blackv01@med.nyu.edu

Abstract: Study questions challenge a student's knowledge of a topic. They reinforce the knowledge s/he has of the topic and guide him/her to identify and fill in those areas where knowledge is weak. They provide a very effective tool for learning, but are "expensive" in time for the student to answer and for the faculty to respond to. To meet these issues we have developed a software framework to administer study questions using the web. Student responses sent to the server by a web form are analyzed according to script on the server and appropriate answers returned. An anonymous log is kept of each student response so that the analysis script can be debugged and refined. Our preliminary experience with a pilot program as part of the first year medical school course "Cell Biology of Tissues and Organs" (Histology) is described here.

Introduction

Study questions are an effective way for the student to test his/her current level of knowledge. In the past, we have given the students a set of questions for each unit in the syllabus for the course "Cell Biology of Tissues and Organs" (Histology) (Black, 2002). Students referred to lecture notes and to the textbook in order to answer the question and then went to members of the faculty to get a critique of their response. While effective, with increased pressures from the curriculum, this approach may not be the most efficient use of student and faculty time. We therefore looked to see if a useful part of the study question paradigm could be delivered via a web-based tool.

Software was developed that provides a very general framework for the administration of questions to students in a study (rather than an examination) setting where the identity of the individual student is not an issue. We expected that automation would be well received by the students since most have had previous experience with computers and all are required to own one.

Software Implementation

The aim of the software development was to develop a tool that was simple to use, fast in execution and highly flexible. One of the criteria was that the software should be able to analyze free-text responses from the students, and be able to work with questions created with check-boxes, radio buttons, etc, which are used as common components of web forms.

We chose to build the tool, which is called KEYSEARCH, as a traditional cgi program activated by the standard web forms interface (HTML Forms, 2002). In operation KEYSEARCH is activated to accept the data posted from the student's web browser by way of a response to the study question. KEYSEARCH then reads a file containing the specific script that directs the processing of these data. The computed answer is returned to the browser and a log of the transaction is written to an HTML (HyperText Markup Language) file to be reviewed by the faculty member responsible for the particular question to which the student had responded.

The author of a study question has three tasks: first, the web page has to be prepared by defining the form that solicits and then posts the student answer to the server. Second, the "Response Logic File" (RLF) that directs data processing must be created. Finally, the log of student responses must be reviewed continually so that any scripting errors in the RLF can be found and corrected and the analysis of student responses refined.

The core of KEYSEARCH is the RLF that contains four types of control lines; these are Logic lines, aRithmetic lines, Answer lines and administration lines that customize output and define processing controls.

Logic lines define logical variables (L1, L2, ..., Ln) that store the result of a keyword search of the response the student has provided. An example of a L-line might look like this:

```
L1: 2; endomysium; perimysium; epimysium;
```

In this case, the variable L1 would be true if any two terms in the list were found in the student response.

aRithmetic lines evaluate logical expressions written in "Reverse Polish Notation" (RPN) (Ralston & Reilly, 1993) and are used with Answer lines which specify part of the answer to be returned to the student's web browser. An example of a pair of R- and A-lines might look like this:

```
R1: L1, L2, A
A1: Excellent! You identified connective tissue sheaths in muscle.
```

In this case if the logical variables L1 and L2 were both true then R1 would be evaluated as true ("A" is the **AND** operator) and the A-line paired with the R-line would be sent as part of the answer to the student. Complex expressions involving many L- and R-lines can be built to provide the resources to generate a nuanced answer, sensitive to the student response, and more valuable to the student than bald "true" / "false" statements.

The manual for KEYSEARCH, providing the full details of its implementation, is available on-line (Smith, 2002).

Preliminary Results

To test the potential value of KEYSEARCH the faculty of the Histology course committed to provide at least two study questions suitable for programming for KEYSEARCH in each of twelve topic areas. By the end of the course nearly 100 questions had been prepared, either as modifications of existing questions or as new questions. The types of questions were predominantly those that required free text input with the remainder (15-20%) being based on check-box or radio button selections similar to the multiple choice exam questions they would face.

The results for the course overall were very encouraging. KEYSEARCH logs appeared to show that for several topic areas over one third of the class (of 160 students) attempted to answer the on-line questions. The sets of questions used most frequently were in those topics that had most questions available and included questions that queried areas emphasized in lecture. Even the least-accessed questions were used by 15% of the class. It was interesting that for most study questions, students were willing to work at submitting a response that would cause the program to give the faculty answer.

The outcome of the test was judged a success. A range of question formats was prepared at a reasonable level of sophistication, sometimes driving improvements to the software. Conversations with students indicated that if they tried the questions they liked them: they worked differently from other on-line teaching materials and they enjoyed that.

Discussion

KEYSEARCH has two novel features: the ability to automate study questions where the student provides a free-text response, and a powerful logical expression analysis engine to power the creation of responses specifically targeted to the details provided in the student's answer.

The experience of the faculty with free text responses to study questions has always been that such questions require more thinking on the student's part and therefore work best as study materials. This anecdotal observation is supported by studies that have shown that multiple choice answer components may act as cues to the student elevating their performance (Newble et al., 1979).

The experience gained through the past year's course indicates that the "logic engine" provides a valuable tool to prepare study questions and that the students like the result. The KEYSEARCH logs verify that in many cases students think hard and work to improve initially unproductive answers to the study questions. This is exactly what was wanted: learning is an active process occurring inside the student's head, not inside the computer.

References

Black, V.H., editor (2002) *Cell Biology of Tissues and Organs, Syllabus 01-02.* New York, NY: New York University.

HTML Forms. Retrieved May 29, 2002, from http://www.w3.org/TR/html401/interact/forms.html

Newble D.I., Baxter A., Elmslie R.G. (1979). A comparison of multiple-choice tests and free-response tests in examinations of clinical competence. *Med Educ.* 13(4), 263-268.

Ralston A., Reilly E.D., editors. (1993) *Encyclopedia of Computer Science*, 3rd edition. New York, NY: Van Norstrand Reinhold, p. 1065.

Smith, P.R., (2002) *KEYSEARCH.* Retrieved July 15, 2002, from the NYU School of Medicine Erhman Library web site: http://library.med.nyu.edu/epub_support/keysearch-manual.html

THE LINKS PROJECT:
DEVELOPMENT, IMPLEMENTATION, AND INSTITUTIONALIZATION

Sharla L. Snider, Ph.D.
Department of Family Sciences
Texas Woman's University
USA
ssnider@twu.edu

The purpose of this poster presentation is to provide an overview of the Learning and Integrating New Knowledge and Skills (LINKS) technology project and related research findings. This initiative was designed to integrate established and emerging technologies into the teacher preparation program at Texas Woman's University (TWU) and is supported by a U.S. Department of Education, Preparing Tomorrow's Teachers to Use Technology (PT3) grant. The LINKS project encouraged institutionalized efforts by prompting change in university faculty involvement and roles; technology curriculum content and delivery, and preservice teachers' performance and responsibilities in field-based locations.

Over three years, approximately 300 future teachers each semester have progressed through university coursework, technology seminars (now incorporated as coursework requirements), documentation of proficiencies in a Technology Passport, and field-based placements. Implementation and outcome data for events involving preservice teachers have been collected. As Intern Is and Intern IIs, the preservice teacher cohort participated in technology seminars, bi-weekly conferencing groups, and completed the Technology Passport. During Residency, preservice teachers began their student teaching and attended technology seminars on campus. Preservice teachers completed pre- and posttests each semester to assess changes in technological proficiency and use, as well as attitudes and concerns. Parametric paired-samples t-tests and effect sizes have been utilized for analyses of quantitative data for students with complete data sets. In addition, preservice teachers completed evaluations at the end of each semester to assess the utility and quality of their experience.

Each year, a volunteer sample of university instructors participated in professional development sessions primarily focused on an orientation to LINKS resources, technology expectations for preservice teachers, and the preparation of web-based course delivery via the university's web-based course delivery template. Overall, more than 75 university instructors from various disciplines have participated in LINKS activities. For year 3, data were collected on 23 instructors' stages of concern, levels of use, and perceptions of the utility and quality of training. In addition, a representative sample of faculty (7 instructors and 1 dean) participated in interviews to give feedback on LINKS involvement, technology proficiency and use, and the impact of LINKS on the institutionalization of technology at TWU.

Results and Conclusions

In fall 2001, 64 Residents completed the LINKS curriculum sequence. This cohort will be the last group finishing the teacher education sequence under the old certification plan. Overall, results reveal that Residents consider themselves more technologically proficient after experiencing LINKS activities, with statistically significant pre- and posttest differences for all domains of the Basic Computer Use and Internet Use, and on 2 out of 7 domains on Advanced

Computer Use. Preservice teachers moved toward higher impact concerns and relatively low self-concerns as measured by the SoCQ. Qualitative analyses revealed generally positive acceptance of and comfort with technology, as well as confidence in curricular integration of technology.

In year 3, LINKS preservice teacher activities have been redesigned as courses that are university teacher education requirements. This revised format involves interdisciplinary collaboration for the education of preservice teaches. New certification plans that include a technology component have been implemented in fall 2001. LINKS preservice teacher activities were redesigned as university teacher education course requirements. Prerequisite technology proficiency standards have also been established. This revised technology-driven format involves interdisciplinary collaboration and institutionalizes the integration of technology proficiencies for preservice teachers.

A growing cadre of university instructors have been oriented to the technology needs of preservice teachers and introduced to online course delivery via LINKS training and activities. More than 75 instructors have either participated or received support from the LINKS center. In May 2001, additional activities were implemented for faculty beyond the PT^3 proposed grant to institutionalize LINKS activities. Faculty were given training through an INTEL grant—Teach to the Future. Participating faculty then redelivered training to Residents and their supervising teachers in fall 2001. This enabled LINKS to systematically integrate the Intel curriculum into teacher preparation. In addition, in summer 2001, LINKS collaborated with TWU to provide summer training institutes for 12 faculty in online course development. LINKS activities have also been extended to the post-baccalaureate teacher preparation program. Through a unique mentoring approach, 5 experienced faculty (with extensive LINKS training) functioned as mentors and expert facilitators for 5 university instructors developing post-baccalaureate courses. Additionally, the LINKS faculty training and support was redesigned in year 3 to encompass a series of 17 training sessions across the academic year. The 23 participating faculty received support from the LINKS team either individually or online.

Preliminary findings point to factors contributing to institutionalization, including the integration of LINKS resources with other university initiatives, the inclusion of diverse disciplines in LINKS activities, ongoing communication between LINKS staff and university administrators, the exceptional quality of LINKS activities and products, and a constant focus on sustainability of grant efforts.

Educational Importance

Findings regarding the implementation and effectiveness of LINKS project have implications in at least three specific areas. First, results will demonstrate how technology proficiencies of entry-level teachers can be increased to address state and national expectations. Next, findings will also show how university professors can be supported as effective models of technology use in web-based course delivery and electronic communications with students. Finally, the LINKS experience provides a model for universities undertaking similar changes in teacher preparation programs. The LINKS web site provides a number of project-related resources, such as the Technology Passport, that are available for use by other institutions. Documentation of learner-centered standards for preservice teachers through the Technology Passport provides a much-needed accountability model for monitoring and assessing changes in preservice teachers' technological proficiencies in relation to established standards.

DEVELOPING AND VALIDATING COMPETENCIES FOR CLASSROOM AND ONLINE TEACHERS

J. Michael Spector, email: spector@syr.edu
Syracuse University, Syracuse, NY USA

James D. Klein, email: james.klein@asu.edu
Arizona State University, Tempe, AZ USA

Dennis Fields, email: dennisf@stcloudstate.edu
St. Cloud State University, MN USA

Ileana de la Teja, email: idelatej@licef.teluq.uquebec.ca
LICEF Research Center, Télé-université, Montréal, CANADA

Barbara Grabowski, email: bgrabowski@psu.edu
Pennsylvania State University, University Park, PA USA

Roderick C. Sims, email: rsims@deakin.edu.au
Deakin University, Geelong, AUSTRALIA

Jan Visser, email: jvisser@learndev.org
Learning Development Institute, FRANCE

Abstract: The International Board of Standards for Training, Performance and Instruction is completing a three-year effort to develop and validate competencies for classroom and online teachers. This effort is partly an update to the previous set of standards for classroom instructors, but is aimed specifically at exploring new competencies that are required in technology enhanced settings. The focus of this presentation is the relationship of skills and knowledge for online instructors (broadly interpreted to include web-delivered as well as hybrid settings) vis a vis those required in a traditional classroom. Data were collected from approximately 1,000 respondents worldwide representing a variety of contexts and settings. Several expert panels were held in addition to the survey. Problems in conducting such a large online survey will also be discussed.

Introduction

The mission of the International Board of Standards for Training, Performance and Instruction (***ibstpi***) is to improve individual and organizational learning and performance, and in doing so to promote the quality and integrity of professional practice. Among the activities of the Board have been the development, validation and revision of sets of competencies pertaining to the performance technology community, including competencies for instructors, instructional designers, and training managers.

The Board has been engaged in a three-year effort to update its instructor competencies. Associated with this project was an effort to develop an accompanying elaboration of competencies for those who conduct training in online and hybrid settings that mix some classroom instruction with online and other forms of technology -enhanced learning and support. The Board's process for competency development begins with an extensive review of current literature and practice and expert panel meetings (Collison et al., 2001; Cyrs, 1997; Goodyear et al., 2001; Kearsley, 2000; Pea, 2000; Salmon, 2000; Spector & Anderson, 2000; Thatch & Murphy, 1995). From these data, the Board drafts an initial set of competencies and then elaborates associated performance statements that serve as indicators that a person has or lacks a particular competence. The draft set of competencies is then submitted to a large international audience for review and comments.

BEST COPY AVAILABLE

Development and Validation of the Competencies

In the development and validation of competencies for classroom and online teachers, the process was significantly more complex and challenging. Lengthy discussions, debates and forums addressed the issue of how classroom and online instruction were related. The Board's initial position was that practice of instruction in classroom and online settings were sufficiently different to warrant separate sets of competencies. As the Board's empirical work evolved, it became evident that there was much overlap at one level of abstraction while specific ways that competency might be demonstrated still differed in classroom and online settings. Moreover, the emergence of blended instruction - a kind of technology integration that makes use of hybrid delivery means to achieve various instructional objectives - underlined the need to explore the extent and nature of the relationships between classroom and online instruction (Spector & de la Teja, 2001).

The Board drafted competencies in five areas: Professional Foundations, Planning and Preparation, Instructional Methods and Strategies, Assessment and Evaluation, and Management. Associated with 21 competency statements in the initial draft were 126 performance statements. To validate the competencies, a web-based survey was created to assess the respondents' level of agreement with each of the competency and performance statements in face-to-face, online and blended learning environments. A paper-based version was also available for those without Internet access. Extensive demographic data were also collected to determine the respondents' workplace, teaching background, educational level, area of the world so that detailed analysis could be conducted. The survey was then sent to training institutions, professional organizations, and worldwide contacts in training and teaching, distance education institutions.

This presentation will highlight the use of MOT, a knowledge modeling tool developed at LICEF research center in Montreal, allowing the graphic representation of the relationship between competencies in online and classroom settings. In addition, this presentation will focus on the empirical findings and an initial analysis of an extensive international survey. Finally, several issues will be discussed, including the need to address competencies for learners in both classroom and online settings, and worldwide cultural differences found.

References:

Collison, G., Elbaum, B., Haavind, S., & Tinker, R. (2000). *Facilitating online learning: Effective strategies for moderators*. Madison, WI: Atwood Publishing.

Cyrs, T. (1997). Competence in teaching at a distance. *New Directions for Teaching and Learning, 71*, 15-18.

Goodyear, P., Salmon, G., Spector, M., Steeples, C., & Tickner, S. (2001) Competencies for online teaching. *Educational Technology Research & Development 49* (1), 65-72.

Jones, C., Asensio, M., & Goodyear, P. (2000). Networked learning in higher education: practitioner perspectives. *Journal of the Association for Learning Technology, 8*(2).
Kearsley, G. (2000). *Online education: Learning and teaching in cyberspace*. Belmont, CA: Wadsworth.

Pea, R. (Ed.) (2000). *The Jossey-Bass reader on technology and learning*. San Francisco: Jossey-Bass.

Salmon, G. (2000). *E-moderating: the key to teaching and learning online*. London: Kogan Page.

Spector, J. M., & Anderson, T. M. (Eds.) (2000). *Integrated and holistic perspectives on learning, instruction and technology: Understanding complexity*. Dordrecht: Kluwer.

Spector, J. M., & de la Teja, I. (2001, December). Competencies for online teaching. *ERIC Digest*, December 2001.

Thatch, E., & Murphy, K. (1995). Competencies for distance education professionals. *Educational Technology Research and Development, 43*(1), 57-79.

The Konstanz Internet Solar Cell Experiment

Martin Stachel, Department of Physics, University of Konstanz, Germany, email : ms@lockin.de

Abstract : Due to the strong interest in the physics and technology of modern solar cells, even outside of universities and research labs, the Advanced Physics Lab of the University of Konstanz, Germany, is making efforts to make accessible its Solar Cell Experiment to an interested and qualified public over the internet.

Basic Ideas

In view of the augmenting hazards of power generation from fossile combustibles, electric power generation from regenerative energy ressources, especially from solar radiation, by semiconducting solar cells, becomes increasingly important. The investigation of new light sensitive materials and improving the quantum efficiency of known solar sensitive material, like Si, is a challenge for physicists and engineers worldwide.

In order to familiarize our physics students with this topic, we have built up a Solar Cell Experiment at our Advanced Physics Lab, in close co-operation with the renowned Materials Research Lab at the University of Konstanz. In this experiment, the students have to investigate the important parameters of differently manufactured and contacted Si solar cells : their dark and bright I(U) characteristics, respectively, as well as the quantum efficiencies as a function of the energy of the incident light.

Due to the general interest in solar cell physics and technology, not only with our students but also with "external" people and even with the upper classes of high schools, considerations were made how to open this experiment to an interested and qualified public. Since our Advanced Lab was among the first labs to offer, and to work with Virtual Internet Experiments worldwide (Stachel 98), and for reasons of our experience from this work, making the experiment, or parts of it, accessible over the Internet was suggesting.

Here, in contrast to the above mentioned "virtual" experiment, work and interaction of the user with remote real physical devices and instruments "anywhere in the world" is necessary. This interaction, as well as a mediation of the "look and feel" of the experiment, has to be performed over the Internet, a new challenge for people involved in teaching experimental experience.

Due to our experience with the previous virtual experiment, the programming work was again made in Java, in this case with special use of the Java Native Interface, in order to remotely control measuring instruments, or cameras. In this way, the whole technical task of the interaction between experimenter and remote instrumentation may be performed by means of "pure Java". This procedure has the advantage that no special ("proprietary") equipment on the experimenter's side is needed : a standard "Java 2" enabled Internet browser is sufficient to work with the experiment, a fact to be considered well with regard to the intended audience.

Overview of the Project

The "local" experiment at the Lab is divided in two parts :

1. Measuring and analysing the different I(U) characteristics, as well as calculating the overall efficiency of the cells from these data.

For this purpose, our sun simulator at the moment simply consists of a low voltage halogen lamp. Since the solar spectrum at the surface of the earth has an intensity maximum at about 450 nm, with continuous decrease to larger wavelengths, the red and IR parts of the halogen spectrum are reduced by a KG-3 filter. A substantial improvement of the resultant data is expected from using a metal halide discharge lamp which has a spectrum much closer to the sun's as compared to the "heated filament", resistive halogen lamps.

2. Investigation of the differential quantum efficiency of Si solar cells.

For this part, the equipment consists of a xenon discharge sun, and a prism monochromator for wavelength selection. Since the cells' efficiency is very low below 450 nm and in the vicinity of the Si band gap energy (above 900 nm), to determine the cells' output current, lock-in measuring methods have to be applied. At this point, our Virtual Lock-In Experiment (Stachel 98) is generally of great help for students new to this – commonly used but rather sophisticated, and thence, in general, poorly understood - technique.

Experts will probably agree that this experiment "by itself" is rather complex and demanding, even if carried out locally. To make it accessible over the Internet adds further problems to the system which have to be solved successively.

Status of the Internet Implementation

At the moment of this writing (August 2002), the first part, as described above, may be performed in parts over the net (Stachel 02). Since only one user at one time may be allowed to work with the experiment, "time slots" of about half an hour are allocated in which the experiment can be accessed by a password. This password has to be applied for by means of a registration form on the experiment's home page. If appropriate time slots are at disposal, depending on local or further Internet use of the equipment, the password is issued via email.

After logging in, the experimenter may select one of the solar cells available, set several measuring parameters (voltage span to be covered in the characteristic, number of data points, and the time interval between the measurements), and the "Sun's" condition.

If the dark characteristics are to be taken, the settings are sent to the experiment server over the net, the voltages calculated from these params are applied across the active system (solar cell plus series resistor) by an DA converter, and the corresponding current is measured by a DA converter as a voltage drop across the series resistance. At this point, the Java Native Interface comes into the play.

The complete data set is sent back in list form to the user, and are displayed as a I(U) graph, on-line. In the graph area itself, the students have the possibility to draw the maximum power rectangle necessary to calculate the efficiency of the cell under investigation. The IU data measured may be saved on the experiment's server and be retrieved later by ftp for further analysis or documentation.

If bright characteristics are to be taken, the experiment sun has to be managed, too. In the case of the halogen lamp, its proper function is tested by the resistance, or voltage drop caused by a constant durrent, of a light sensitive resistor. If the sun is ok, the UI data are taken and handled as above. If the sun is "burnt out", a respective message will be displayed on the experimenter's monitor, and the measurement is cancelled.

In the case of metal halide discharge lamps, it takes a little bit of time until a stable light emission is achieved after starting the discharge. This procedure is also monitored by a light sensitive resistor in the experiment. The "ok", or "sun failure" statuses are sent back to the experimenter so that he/she may, or may not, start the mesaurement.

As to the "look and feel" of the experiment, two approaches are being tested :

The user is given the choice to select a "still background scenery" consisting of a set of three large images showing the whole experimental setup in its "fundamental" three states, with normal lab illumination, with the sun on and off, respectively. It is possible for the student to „navigate" around in the images, as with a camera, to zoom in and out, to look at details or to get an overview. The user can identify the instruments and parts used in the experiment and follow the connections between the devices and instruments, and compare his/her observations with the given setup schematic.

The other choice is the use of a webcam controlled over the internet for online visual inspection of the experimental scenery. This may be more appropriate when working with the "discharge sun".

As in our previous virtual experiment, support for the remote student may be obtained via email communication which has proved to be a generally sufficient solution for any experimental, or understanding problem.

Reference : Stachel 98 Interactive Lockin Simulation, ED-Media Proceedings (AACE), Freiburg 1998, and www.lockin.de
Stachel02 fp7.physik.uni-konstanz.de/solarcell/

Web Design Education: An Interdisciplinary Convergence to Optimally Prepare Web Authors and Designers

R. Brian Stone
Department of Industrial, Interior, and Visual Communication Design
The Ohio State University
United States
stone.158@osu.edu

Phillip Diol
Department of Industrial, Interior, and Visual Communication Design
The Ohio State University
United States
diol.16@osu.edu

Abstract: As educators, designers, engineers, and authors, we are all trying to fully understand the nature, potential, and appropriate application of the WWW. There are many different skill sets trying to claim ownership to the medium of web design. To satisfy the technical, functional, cognitive, communicative, and aesthetic demands of web site design, a convergence of our collective expertise will be necessary. A synthesis of principles from the fields of design, human-computer interaction, computer information science, cognitive psychology, engineering, and marketing has merit. We believe that through the understanding and application of these interdisciplinary concepts, designers will consistently deliver sites that are visually appealing, stimulating, easy to learn and understand, easy to use, efficient, useful, and empowering. This paper/poster explores relevant interdisciplinary curricular issues, and how they can be appropriately integrated to teach web design from a holistic viewpoint.

Introduction

Interactivity is the fundamental principle underlying the growth of communication between users and responsive systems delivered via the World Wide Web. Given the constraints of structured curriculum, how then do we appropriately integrate the rapidly emerging field of web design into our teaching? Additionally, how do we fully prepare students for the dynamic nature of this design activity? In order to make optimum use of this medium; one must be grounded in the issues relevant to those concepts that distinguish the medium.

As the bodies of knowledge, and breadth of web applications continue to expand in our various disciplines, how do we appropriately integrate the instruction of web design into current design curriculum? One strategy may be to look to our companion disciplines for structure, and guidance. Web design is an application that crosses several curriculum boundaries. Valuable theoretical principles from design, human-computer interaction, computer information science, cognitive psychology, engineering, and marketing can and should be applied to web design pedagogy. To design web sites from a holistic viewpoint, web design educators must begin to embrace the idea of interdisciplinary methodologies, principles, and concepts. An examination of the relationships between these inter-related disciplines may prove useful in structuring a process for understanding and teaching web design and adequately preparing students.

Presentation

Because web sites are manifested as a visual and interactive medium, its incorporation into visual communication design curriculum is a logical one. In order to design web sites that are optimum for users, one must be grounded in the issues intrinsic to the medium. Furthermore, students who study "web design" in a siloed environment do not always have a core set of skills necessary to be competitive and productive and a highly dynamic field such as this. Those students who are employed find that their education continues when they join the professional ranks. The employers must continue to guide and instruct their designers on issues relating to appropriate visual problem solving for screens, programming language, interaction and interface design, site architecture, usability, and new and developing authoring tools.

Our research has indicated that a synthesis of principles from the fields of design, human-computer interaction, computer information science, cognitive psychology, engineering, and marketing have merit. It is our intent to integrate these concepts into a more formal area of study within the discipline of visual communication design at our institution. We believe that through the understanding and application of these interdisciplinary concepts, designers will consistently deliver web sites that are visually appealing and stimulating, easy to learn and understand, easy to use, efficient, useful, and empowering to users.

By examining the areas that define and distinguish web design, several relevant concepts are realized. Having an understanding of these concepts, and then applying them at appropriate levels of the design process, can begin to yield web applications that truly meet or exceed the expectations of users. The following figure outlines the range of disciplines that we believe makes up the core competencies needed for entry-level web designers and authors.

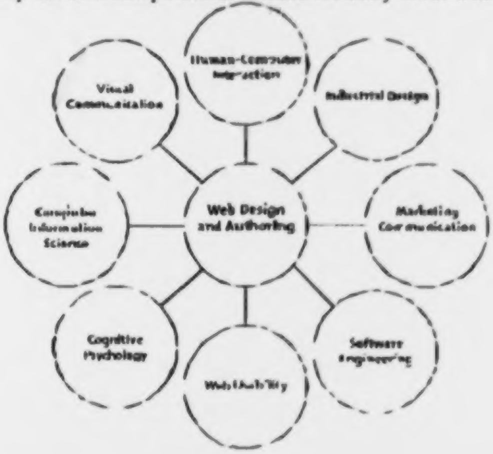


Figure 1: Core competencies for web design and authoring

Once these similarities are recognized and understood, a meaningful design process can be outlined. A typical process model is as follows:

1) Identify the problem / needs
2) Research past and present solutions
3) Planning / concepts
4) Develop prototypes
5) Usability test
6) Choose and refine
7) Acceptance test
8) Refine
9) Implement
10) Evaluate

Conclusions

Our research explores the relationships between these interdisciplinary curricula, and how it can be appropriately integrated to teach web design from a holistic viewpoint. The study looks at the similarities of design process and activity between these interdisciplinary models, and outlines important considerations for teaching web design. Through this research, we proposed a curriculum plan for four-year undergraduate design programs that prepare students with the needed skill set, which in turn, will allow recent graduates to distinguish themselves in the immerging field of web design and authorship

BEST COPY AVAILABLE

E-Learning and International Education:
Fulfilling the Promise of the Virtual Classroom

Introduction

This brief paper will present the history, pedagogy and design of an innovative online course, Qualitative Research in Education, that is currently being offered through the International Education Department and the Distance Learning Project at Teachers College, Columbia University. This exceptional course brings to the forefront the expanded educational opportunities made possible by online learning and the Internet. International learning communities comprised of students and professionals, virtual work and study teams, and the focus on an authentic education project form the basis for the design of this course. Online learning is the mechanism that makes this type of education possible.

History

Each year the course Qualitative Research in Education is taught in the International Education Department at Teachers College, Columbia University. The focus of the course is evaluation of educational projects using qualitative research methods. The course is constructivist in nature. The students evaluate a real education project in collaboration with a participating national or international non-governmental organization (NGO). Past participating organizations include but are not limited to: The International Rescue Committee, New York, The Anti-Defamation League, New York, Teachers Experiencing Antarctica and the Arctic, Mongolian Foundation for Open Society, the U.N. Association of the U.S.A. and the Soros Foundation, Latvia. Two years ago, the professor of the course, Dr. Gita Steiner-Khamsi decided to offer the course online. The online component allows for direct participation of the international NGO partners.

Educational Partnership

In the Spring 2002 semester the course took another innovative step. Prof. Steiner-Khamsi and Mr. Hugh McClean of The Open Society Institute (OSI), Budapest, Hungary developed a plan for an educational partnership between Teachers College and the Open Society Institute network in Eastern Europe and Central Asia. An initiative of the Soros Foundation,

> "The Open Society Institute was established in 1993 to promote the development and maintenance of open societies around the world. OSI does this by supporting an array of activities dealing with educational, social, legal, and health care reform, and by encouraging alternative approaches to complex and controversial issues."[1]

The Open Society Institute has offices throughout the world. The Budapest, Hungary office is the regional headquarters for Eastern European and Central Asian national OSI offices. Mr. McClean had identified two needs in relation to the national OSI offices in his region: 1) the need for effective evaluation of the educational projects being developed and implemented; and 2) the need to develop the local capacity for professional evaluation in these national offices. A huge emphasis in international education is the development of local capacity. In the past, international education specialists have failed to transfer their knowledge to individuals in the local community. As a result, first world funded educational initiatives for the developing world would fail once the educational specialists left the country. Training personnel in the developing host country is key to the success of educational initiatives in these countries.

Recognizing the need to develop professionals with great evaluation skills in the national OSI offices in his region, Mr. McClean and Prof. Steiner-Khamsi created the plan to enroll 16 OSI professional staff members in eight Eastern European and Central Asian countries in the Qualitative Research in Education course. Sixteen matriculated Teachers College students would also be enrolled in the course.

This cohort of 32 students presents a unique opportunity for all involved. The OSI professional staff members are receiving crucial professional development that will strengthen the effectiveness of their respective national education projects. These professionals are also enjoying the experience of taking a course with a well-respected internationally known scholar (Prof. Steiner-Khamsi) at one of the premiere education graduate schools in the United States, Teachers College, Columbia University. The Teachers College students have the opportunity to work in the field with professionals on real education projects. Many of the Teachers College students hope to establish careers in educational evaluation upon graduation. The opportunity to gain hands-on experience in their chosen field is significant. The benefits to students enrolled in the class cannot be overstated; they are not only learning the content material of the course, but also gaining valuable experience in cross-cultural communication and online education.

Instructional Design

The course has a unique organization. In addition to the blend of students, professionals receiving professional development and students developing content area knowledge and receiving hands-on experience, the course utilizes three modes of pedagogical presentation: 1) four face-to-face week-end seminars (two in Eastern Europe and two in New York City); 2) Online course presentation including online lectures, discussion boards, virtual chats, virtual team meetings, videos and tutorials; and 3) A week long onsite visit of the educational project being evaluated. Also, a videoconference session occurred between all participants on April 12th.

---

[1] http://www.soros.org/osi.html - Copy taken from web site on 04/06/02 at 10:33am.

The students work together in virtual teams. There are eight team consisting of four members each, two teachers college students and two OSI professionals from one of each of the eight countries represented. The eight participating OSI national offices are:

- Azerbaijan
- Georgia
- Kazakhstan
- Moldova
- Romania
- Slovakia
- Ukraine
- Yugoslavia

Each team works to evaluate an educational project that the respective OSI team members have selected in their countries. The virtual teams meet two to three times per week in the synchronous chat rooms online to plan the details of the evaluation and to discuss course material and readings presented in the online class. The whole class has a virtual chat once a week and there is also an ongoing discussion in the whole class asynchronous discussion board.

Blackboard was used as the online course platform. The technical affordances of Blackboard were used to the fullest in this class. A second level of navigation was added in the course documents section of the site. This allowed the professor of the course to organize and disseminate the extensive course materials. The lectures were presented in PowerPoint presentations that could be run from the server or downloaded to an individual computer and run from the local drive. Extensive Internet resources were linked throughout the PowerPoint lectures. Students were presented not only with lectures and links, but also given access to specific freeware tools for doing qualitative research. Blackboard's group pages section was used to create special group pages for each of the eight virtual teams to work. Each team had its own discussion board, virtual chat area and file exchange, all of these tools were frequently used. Introductory videos explaining the history of the course as well as the genesis of the project were created and uploaded to the site. Videos covering the unique pedagogical and technical aspects of the class were added, as was a video outlining the professor's expectation of the students.

The onsite visits occurred during the week of March 14-March 21, 2002, spring break for the Teachers College students. The Teachers College students traveled to the host country of their OSI counterparts and together the virtual teams collected qualitative data with which to conduct the evaluation. The cost of the onsite visit was borne by the Soros Foundation.

Another unique aspect of the course was the participation of three instructors. The course was co-taught by Dr. Gita Steiner-Khamsi and Dr. Cathryn Magno, adjunct assistant professor of education at Teachers College. Mr. McClean, participated in the course as a content expert and attended the face-to-face seminars and participated in the online discussions.

Student Satisfaction

Brief interviews undertaken during the semester with a small number of both the OSI cohort and the Teachers College students revealed a deep satisfaction with being part of such an innovative educational experience. According to these students, virtual work team communication is the most challenging aspect of this type of experience. Cross-cultural communication in an online medium logically presents special problems. Prof. Steiner-Khamsi designed the face-to-face seminars and the onsite visits as a means for participants to communicate with one another and to facilitate the creation of a learning community.

EVA_pm: Towards Project-Based e-Learning

Paraskevi Synteta
TECFA – FPSE
University of Geneva
Switzerland
Paraskevi.Synteta@tecfa.unige.ch

Daniel K. Schneider
TECFA – FPSE
University of Geneva
Switzerland
Daniel.Schneider@tecfa.unige.ch

Abstract: EVA_pm, is a method and at the same time a constructivist web-based environment that has as it's main goal to scaffold Project-Based e-Learning in higher education. More precise, it focuses on improving the effectiveness of pedagogical models that are based on projects (usually called Project-Based Learning, project method or project approach). It leverages XML (eXtended Markup Language) and suggests a rich vocabulary (DTD) for the project/research plan as a prompting and reflection tool. Moreover, an online toolset ("commNcontrol") is provided for teamwork, visualization, communication, peer benefits and progress tracking. Finally, a second vocabulary is provided for the final paper on the project and dissemination of the project products is being done through a portal that is called "Virtual Book". This is an ongoing study and current results will be reported here.

Introduction

Project-Based Learning (hereafter PBL) is a constructivist instructional model that organizes learning around projects i.e., complex tasks based on challenging questions, that involve students in design, problem-solving, decision making or investigating activities and give them the opportunity to work autonomously and culminate in realistic results. According to several studies (reviewed in the PhD thesis of Thomas, 2000), organizing learning around projects is considered to be a profitable learning strategy. In higher education, it is very often the case to ask students to conduct projects and almost always studies end with a big project like diploma work, thesis, etc. *Still, its implementation faces several challenges.* Very often, students face difficulties such as initiate inquiry, define the research project, direct investigations, manage time, collaborate and give feedback, and follow-up the project. For all the above reasons, several studies have concluded that the method needs support and that the projects have to be well structured (Guzdial, M., 1998 refers to "scaffolding" and Scardamalia, M., et al., 1999 to "procedural facilitation") and several computer environments were developed to provide that (CAMILE, CSILE, PBLSS, Design diary, Reflective learner, etc.). While most of them were focusing on a specific problem, EVA_pm tries to scaffold PBL through all it's phases. The primary objectives of this study are: a)help students acquire *methodological competence* through support for the research plan, b)support students acquire *professional competence* on the subject of the project, c)help them acquire social competence by teamwork and d)develop *meta-cognitive skills* by reflecting on the work done. At a second stage, it aims also in making *students more efficient* and the method *affordable for tutors*. To do the above, this study uses structured text (in XML format) as a cognitive tool and a web and java based environment as the project's portal; to scaffold students to construct basic knowledge on research design, to get a project done, to reflect on their work, to disseminate results, to facilitate the tutor's role and enjoy the peer benefits.

The EVA_pm Environment

EVA_pm is formed by four components: 1)*EVA_pm ML*; an XML grammar (DTD) for project design that is used as cognitive tool to scaffold students during the projects, 2)*commNcontrol*; a web portal[1] that provides several tools to support the method like awareness tools, versioning system, file transfer tools, discussion tools and tutor evaluation tools, 3)*Virtual Book* ; the web portal[2] that joins the results of the projects (papers) and plays the role of the socio-constructivist "product" element by giving the chance to the students to expose the common result of their work, 4)*EVA_paper ML*; an XML grammar (also a DTD) for the paper that describes the results of the project, serves as cognitive tool and help students reflect on their work. These components are orchestrated in the following way: students have to describe their project (specification and management) by editing an xml file that follows the EVA_pm grammar in several phases; that file should be uploaded and shared online through a versioning system with the other members of each group; viewing and interactions can be done through the "commNcontrol" portal where students and tutors can log in; tutors can scaffold and give regular feedback using the system; the project culminates with students writing a paper that describes the product (also as an xml file) and an online "Virtual Book" is being created with all the papers produced. Development was based on principles of participatory design and specifically of cooperative prototyping. From XML technologies the DTD and XSLT+FO have been used. JAVA servlets technology and Xerces Java parser (SAX and DOM API) from Apache Project was used for scripting and parsing the XML files. EVA_pm is the result of four years work of the authors on this project, and has been initially conceived for the course on "Teaching and learning in Virtual Space" of STAF diploma at TECFA, University of Geneva and it has always been tested with those students. The most complete study (Master thesis of Synteta, 2001) has been done with staf-2001 students (12 students=9 men and 3 women, 8 projects=4 from pairs and 4 from individuals). The course was organised around several phases and was in mixed format (one week in presence and 4 weeks by distance). There are three things that have been evaluated, the learning environment (usefulness and ergonomics), the students learning on research design and the tutor's facilitation.

Conclusions

The initial goal of this research was to develop an environment that would improve PBL efficiency by providing more scaffolding and that would structure carefully all the phases of a project in order to overcome the most common pitfalls. For the *learning environment*, we could say that the grammars are mature and the toolset quite powerful. The interface though could be improved concerning usability and more features could be added to improve interaction. For the *students learning*, and using a qualitative analysis approach (monitoring, evaluation of projects and comparisons with previous years, interviews and a case study), the results of this research show some evidence that there is profit at all stages that were targeted. For the *tutors*, whom their contribution to the success is invaluable, there is evidence that EVA_pm scaffolds their role in PBL and facilitates monitoring, feedback and evaluation tasks. Lack of powerful XML editors is the weak part for the moment of the method, and students need to be trained in order to work with XML grammars. Based on the above preliminary findings, EVA_pm has a lot of potential in it but there is also a lot of research that rests to be done yet. Currently, for this ongoing project, we are working in the design and development of an integrated portal that will include EVA_pm as a module among several other modules that are needed to construct a course that is based on Project-Based Learning.

References

Guzdial, M. (1998). Technological Support for Project-Based Learning. In C. Dede (Ed.) *Learning with Technology*, Alexandria, VA:ASCD. (pp. 47-72).

Scardamalia, M., Bereiter, C., McLearn, R.S., Swallow, J. and Woodruff, E. (1989). Computer supported intentional learning environments. *Journal of Educational Research*. 5. 51-68.

Synteta P. (2001). EVA_pm: Design andDevelopment of a Scaffolding Environment For Students Projects. Master thesis for STAF diploma in Educational technology, TECFA, University of Geneva, Switzerland.

Thomas W. J. (2000). A review of research on project-based learning. PhD thesis retrieved from the web: http://www.autodesk.com/foundation

---

[1] http://tecfa.unige.ch/tecfa/teaching/staf18/files-h/EVA_pm/commNcontrol.html

[2] http://tecfa.unige.ch/staf/staf-e/paraskev/servlet/journal (Virtual Book (2002)

The Memphis Educational Computer Connectivity Alliance (MECCA) Young Scholars Program (MYS): Using e-learning Tools to Export Best Practices of High School Summer Enrichment Programs to Other Institutions

Larry Tague, Department of Physiology, The University of Tennessee Health Science Center, Memphis (UTHSC), TN, United States, ltague@physio1.utmem.edu, contact for correspondence

Arthur Geller, Department of Molecular Sciences, The University of Tennessee Health Science Center, Memphis, TN, United States, ageller@utmem.edu

Ann Lambros, Center of Excellence in Research Teaching and Learning, Wake Forest University School of Medicine (WFUSM), Winston-Salem, NC, United States, alambros@wfubmc.edu

Abstract: MECCA using Blackboard's CourseInfo (Bb) has demonstrated the export of "best practices" and collaborative administration of a summer Science enrichment program for high school students between two institutions of higher education. Accepted Students were paired with faculty mentors to do research, participate in online academic study, and prepare online research posters. Student evaluation demonstrated the strength of using e-learning tools with problem-based learning. F2F content delivery techniques in a virtual classroom were found to be educationally non-stimulating. The integration of problem-based learning with e-learning needs further study. Bb was used for administrative collaboration. Collaborative tools associated with Bb were mapped to administrative purposes, and used effectively.

Background

An important criteria for writing "good" proposals for high school student summer enrichment at research institutions of higher education is the export potential of the program as a model for other institutions to emulate. The MYS program represents our attempt to exchange best practice scenarios between two health science institutions who both have previous experience with summer enrichment programs. The conduit for this exchange was the integration of e-learning and computer/network mediated communication (CMC) tools provided by MECCA and UTHSC. Previous Young Memphis Scholar programs (YMS 1993-1998) at UTHSC provided students with a summer research experience and academic enrichment including a computer/network program provided by MECCA. The goal of the YMS program was designed to encourage predominantly minority students to follow academic career paths in math and science. The 9-12 CERTL (Center of Excellence in Research Teaching and Learning) Research Program at WFUSM was similar to the YMS program, but the academic components were absent. However, the goal of encouraging minority students to follow career paths into math and science was the same. YMS student evaluations showed us that providing a relevant academic experience between grades 9-12 was difficult if the focus was on specific disciplines such as math, chemistry, or biology. What was academically good for 12th graders was not always appropriate for 9th graders and visa versa. However, their MECCA computer experience and their research experience always received a higher evaluation from the students at all levels. Their computer/network experience taught them to use CMC tools and to present their summer research projects using web-based documentation. This was exciting for the students and relevant to their research experience.

Study

The MYS program accommodated up to 30 students/summer (2000 and 2001) split between both institutions. Students applied to this program via web-based forms. The MYS program, different from the previous YMS program, included only science curricula neutral to grade levels. We also eliminated paper-based research presentations (YMS programs) in favor of online web-based presentations. The new academic components of the MYS program were provided by instructional staff from both UTHSC and WFUSM using Bb e-learning tools. Virtual research posters were presented using the web server and other resources from the MECCA "Networking Infrastructure for Education" program. By changing the venue of academic offerings to capitalize on student interest in using network resources and by focusing on their interest in using web tools for their laboratory research presentations, we hoped to effectively join and extend this program into one of added enrichment for the students. Two virtual Bb communities were established for this program, an academic community of students, and an administrative community of program directors. For the first year, Bb classes included the Philosophy of Science presented online by faculty at UTHSC, and Life, the Universe and Everything (Astronomy) provided by faculty at Wake Forest Universities' main campus. For the second year, the Philosophy of Science was retained, but the Astronomy class was replaced with Problem Solving in Science using problem-based learning. Since much of e-learning is about collaboration, tools associated with this medium also provide the necessary components for an administrative collaboration. Therefore, we utilized various parts of the Bb environment to jointly administer the MYS program. At the conclusion of each program year, students were required to provide an online poster of their summer research projects. These virtual posters were evaluated (using International Science Fair guidelines) by members of our joint advisory board. Three students from each location were selected to present their research via teleconference to both groups in distance education classrooms. An MYS program evaluation was presented as a survey in Bb and collected from the students to assess the efficacy of the various parts of this program. The model for this evaluation was provided by CERTL at WFUSM, and it was altered to evaluate specific areas of the MYS program. There were four types of questions asked: 1) the general likes or dislikes the students may have relative to the program as a whole (multiple choice), 2) specific questions about each area of the program relative to the programs stated objectives (multiple choice), 3) general information about the student, and 4) questions requesting the students free comment about the program (short answers). Most of the information was obtained via multiple choice questions giving the students a choice of at least two degrees of positive, two degrees of negative, and one option for a neutral response. To score this information, each positive response was given a positive number starting with the least positive response being "1" and the second or most positive response being "2". The same scaling was true for the negative responses, but they were given negative numbers rather than positive numbers. A neutral response was set to "0". For each possible answer of each question, the percentage of students responding in that manner was reported from the Bb survey. The percent student response for each answer was multiplied by the number assigned to this answer and then multiplied by the number of students responding to the question. This provides a "total" student response to each item of every question. This total response was then divided by the maximum possible response for all the students responding to get a total percent positive or percent negative value for the question. These values were then plotted for each multiple choice question. The minimum and maximum possible response is –100% and +100%. Student evaluation of the general aspects (five questions) of this program was between 80% and 43% (2000), and 62% and 43% (2001). General aspects were related to the interactive nature of this program as a whole. The most significant changes between the first and second year was that the response to the question about how much hands-on activity they participated in went down from 76% to 64%, and the question about how much problem solving activity they participated in went up from 45% (2000) to 69% (2001). Responses to questions concerning specific subject areas of the program indicated that their research experience was 64% (2000) and 58% (2001), their computer experience 31% (2000) and 43% (2001), their Philosophy of Science experience was 30% (2000) and 24% (2001), their Astronomy experience was 29% (2000), and their Problem Solving in Science was 61% (2001). The two subject areas with the highest student ratings were their research experience and their Problem Solving in Science class. The non-traditional nature of the Problem Solving in Science class using the problem-based learning techniques was exciting and challenging to these students. More problem-based learning techniques implemented with e-learning environments may improve student retention and performance in online classes. Additional studies integrating e-learning with problem-based learning is needed. E-learning platforms such as Bb provide excellent collaboration tools that can be effectively used for remote program administration. We have successfully demonstrated that using these network tools make possible the export and administration of exemplary summer enrichment programs between multiple institutions. Sufficient prior instruction for using these tools to collaborate and administer is essential.

Algorithm to Evaluate Educational Effectiveness of Teacher's Advice in Multi-Media Assisted Education System with Individual Advance

Motonori Tamaki, Tsuneo Kuwabara, Kouichi Yamada, and Toshinao Kokubun
Access Service Network Systems Laboratories
Nippon Telegraph and Telephone Corporation
Japan
mtamaki@ansl.ntt.co.jp

Abstract: An algorithm is proposed to evaluate teacher advice messages in the Multi-Media Assisted Education System with Individual Advance (MESIA). MESIA is used in combination with a Computer-Assisted Instruction (CAI) system as a mentoring support system. Using MESIA allows teachers to provide efficacious support to stalled students during learning via CAI in real-time (Tamaki, 1998). The algorithm can evaluate the educational effectiveness of a teacher's advice messages that have been sent to stalled students to help them in their learning experience. The results of this evaluation are given teachers. Because of this feedback, teachers can recognize whether or not their advice was effective. Moreover, teachers can share these results on MESIA, thus enabling effective advice given to stalled students to be utilized by other teachers to derive the same benefit. Furthermore, these results can be used to evaluate a teacher's support skills.

Introduction

We have been developing a computer-based education support system named the Multimedia assisted Education System with Individual student Advance (MESIA), which supports teachers working with Computer-Assisted Instruction (CAI) in real-time (Tamaki et al., 1998). By using MESIA, teachers can observe students' learning progress and the results of examinations or questionnaires, and provide efficacious support to stalled students who are learning with CAI. Although conventional mentoring services in e-learning respond to student's questions within 24 hours, MESIA can not only answer these types of student questions in a few minutes but also send advice message that is actively fitted to a student's current state of learning.

In this paper, we describe the algorithm for evaluating a teacher's advice that is used in MESIA. The algorithm can evaluate the educational effectiveness of a teacher's advice message sent to stalled students. The results of the evaluation are given to teachers so that they can determine whether or not their advice message had been effective, thus, enabling them to easily offer new advice to similarly stalled students by reusing advice message for which the effectiveness has already been determined. Furthermore, teachers can share these results in MESIA, hence, they can learn how to offer better advice from the advice message of other teacher. In addition, these same results can be used to evaluate a teacher's instructional skills.

Algorithm to Evaluate Teacher's Advice

When a student reaches a plateau in MESIA, they are sent many words of advice from their teachers. Although a student can answer test questions correctly after being given advice from their teacher, it cannot be said that this advice was necessarily educationally effective. Since the student may be sent an advice message that is very like the correct answer to advance them from their stalled state, they can easily answer correctly questions related to their course-ware. Therefore, it is difficult to evaluate the educational effectiveness of the advice. In an attempt to tackle this problem, we developed an algorithm to evaluate the effectiveness of advice given by using the final examination to solve the above-mentioned problem of determining the effectiveness of advice offered.

Figure 1 shows the architecture of MESIA that is used to evaluate the educational effectiveness of advice offered to stalled students by their teachers. Students can study at their own pace using the CAI function. The Stalled-Student Identification function (SSI) analyzes the student state of learning, such as the time spent on a study item, answers to questionnaires and student's questions to teachers; and thus identifies the stalled students. This function is a red flag that alerts teachers of those students who require their attention. The final examination assesses the ability of students after they have studied an entire CAI course. Final Examination Score DB is a database to store final examination scores. The above functions, questionnaire content, and a database are used in the current version of MESIA.

Looking at things from the teacher's side, the Support Database (SDB), Relevance Database (RDB), and Advice Evaluation Function were added to evaluate the efficacy of a teacher's advice offered to a student via MESIA. When a teacher has sent an advice message to a stalled student, the advice *A* and the stalled student's leaning state *S*, such as the position of the student's stalled item in the course, answers to questionnaires, and questions submitted to teachers; are stored in the SDB in pairs. If a student has become a plateau and SDB had a same state *S* as his state. MESIA would send advice *A* paired with the state *S* to the student automatically.

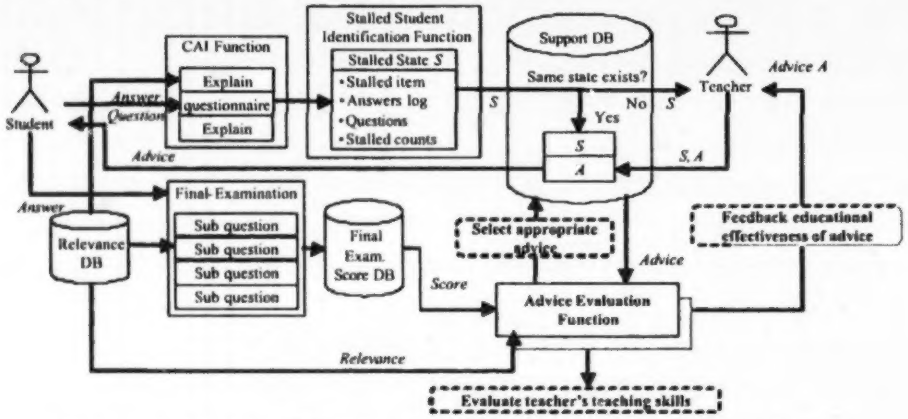

Student
Answer
Question
Advice
Answer
CAI Function
Explain
questionnaire
Explain
Stalled Student Identification Function
Stalled State S
•Stalled item
•Answers log
•Questions
•Stalled counts
S
Support DB
Same state exists?
No
Yes
S
S
A
Teacher
Advice A
S, A
Relevance DB
Final-Examination
Sub question
Sub question
Sub question
Sub question
Final Exam. Score DB
Score
Select appropriate advice
Advice
Feedback educational effectiveness of advice
Advice Evaluation Function
Relevance
Evaluate teacher's teaching skills

Figure 1. Architecture of MESIA to evaluate effectiveness of the teacher's advice

The relevance of study items in-course and final examination's sub-questions are found in advance and are stored in the RDB. When a teacher has sent his advice to a stalled student, the advice and the sub-questions on the final examination pertaining to the stalled student's study item are stored together. Then, the effectiveness y_m of advice m is given by the following equation.

$$y_m = \sum_j \left(\frac{\Re_j}{Y_i \cdot K_j} \right) \qquad (1)$$

Item i is the study item in relation to which advice m was sent, and sub-question j is a sub-question of the final examination. When sub-question j relates to item i and the student answers sub-question j correctly, $\Re_j$ is set to 1. In contrast, $\Re_j$ is set to -1 when a wrong answer is given, and $\Re_j$ is set to 0 when sub-question j does not relate to item i; Y_i is the total number of advice messages sent in relation to item i; and K_j is the total number of items relevant to sub-question j. Equation (1) divides the result of sub-question j by the contribution of advice relevant to sub-question j. Therefore, each effectiveness value regardless of sub-question j is given by divided point $\Re_j$ in relation to item i and sub-question j by the total number Y_i of advice messages for item i and the total number K_j of sub-questions relevant to sub-question j.

Finally, the effectiveness y_m of advice m is calculated by total effectiveness regardless of the number of sub-questions. In practice, advice m is given by averaged y_m by the number of students, etc.

Summary

We proposed an algorithm to evaluate the educational effectiveness of a teacher's advice given to students participating in computer-aided learning. By using this algorithm, teachers can determine the level of effectiveness of their advice to stalled students in a learning program, create advice messages easily by reusing advice messages previously found to be effective, and learn how to develop effective advice messages by using the record of other teacher's advice messages that is kept in a data base. In addition, these the system can be used to evaluate a teacher's instructional skills. MESIA is being used for distance-learning at the central training center of Nippon Telegraph and Telephone East Corporation. Four thousands employees have already received MESIA-based training in the company.

References

M. Tamaki, et al. (1998). Proceedings of 3rd Asia Pacific Conference on Computer Human Interaction, 1998, *Network-based Education System Designed to Allow Individual Student Progress and Improve Teacher Efficiency*, 89-94.

BEST COPY AVAILABLE

Teaching for Social Justice: A Portal for Educators

The aim of this Intercultural and Cross-Cultural Teaching Portal is to establish communities of reflection and practice for diverse educators in P-12 educators who are teaching or preparing to teach in an educational environment. By coming together, we share our commitments and concerns as we review and recapture our experiences in facing challenges of educating everybody's children. We wanted to create spaces specifically where individuals of the same racial/cultural/ethnic backgrounds to communicate with and learn from each other. We also encourage intercultural and cross-cultural communications among teachers of different racial/cultural/ethnic groups. We raise questions such as how our cultures shape our vision of children's teaching and learning in general. More specifically, how our social and cultural identity helps to mold our interactions within the classroom.

The purpose of these forums is to facilitate discussions on multicultural education and social justice issues that may arise in classrooms and school communities. We realize that some groups feel more comfortable sharing with individuals whose worldviews are somewhat similar in nature. Although, we recognize that everyone bring a different set of values, attitudes and beliefs, we believe that some educators will feel more comfortable sharing in their own racial caucus group. Therefore, our position is that we develop racial/ethnic caucus groups so that, for example, Asian American educators who are teaching in intercultural and cross-cultural classroom environments can share their experiences as Asian and Asian Americans. We are interested in hearing from and engaging all educators nationally and internationally who are working in intercultural and cross-cultural school environments.

Our goal is to provide a forum where all educators are heard and their voices are liberated. We provide each forum where each group can share and express concerns within and across racial/ethnic and culture groups, as well as, a general forum for everyone. While anyone can enter any forum, we hold a position that each group be allowed to share comfortably based on their worldviews.

Facilitating Critical Reflection and Discourse in Online Master's Degree Programs

Presenters:

Evie Tindall, Ed.D.
Associate Professor
Regent University
evietin@regent.edu

Deanna Nisbet, ABD
Assistant Professor
Regent University
deannis@regent.edu

Problem Statement

As online degree programs flourish throughout the world, the need for critical reflection and discourse is increasingly evident. Without this type of scholarly engagement, students in online degree programs miss the vital transformational experiences that comprise the essence of teaching and learning.

What We Have Done

To address this problem, the presenters are developing and evaluating an instructional process intentionally designed to foster transformational learning experiences through critical reflection and discourse. The development of the instructional process began with a review of our educational philosophy. Next the key terms were defined, and current theory was examined. From this conceptual framework the instructional process emerged.

The review of our educational philosophy revealed three salient themes related to transformational learning:

- Two ways of knowing: intuitive and cognitive (heart and mind)
- Two dimensions of the learning process: autonomy and interconnectedness
- Multiple ways of constructing knowledge

Key terms were defined as follows:

- Critical Reflection: attentive consideration, meditation, contemplation, evaluation, and appreciation.
- Discourse: mutual interchange of thoughts, ideas, and concepts
- Transformation: substantively altering the present condition, or passing from one state to another.

Examination of the theory base encompassed the areas of critical reflection, discourse, and transformational learning.

The instructional process that emerged is as follows: (a) identification and examination of worldview, (b) critical reflection, (c) discourse, (d) synthesis and evaluation, and (e) extension. This instructional process is being evaluated through student products.

Why the Work is Important

Historically in traditional face-to-face programs, critical reflection and discourse are known as key processes in fostering transformational educational experiences. The challenge of online educational programs is to produce comparable depth and richness in learning in order to equip the great historians, philosophers, novelists, scientists, statesmen, etc. that are needed in our modern world. Our instructional process is an initial attempt to address this challenge. As presenters we look forward to the opportunity to interact with and receive feedback from other distance educators and researchers.

Key Components of the Poster/Demonstration

The poster/demonstration will consist of a display board, handouts and a laptop computer. The display board will be divided into three parts. The conceptual framework (themes, definitions, and theory base) will be displayed in the first section. The problem, instructional process, and accompanying student products will be found in the next section. Implications for practice, in the form of "Seven Tips for Facilitating Transformational Learning in an Online Environment," will be displayed in the third section. Handouts detailing the instructional process will be available. On a laptop screen, participants will be able to review examples of individual applications and group interactions.

Integrating Virtual and Face-to-Face Education in Computer Programming Learning: an Experience Using High Technology Classroom

Romero Tori
Escola Politecnica
Universidade de Sao Paulo
Brazil
tori@acm.org

Alberto Araujo Lopes
Faculdade Sumare
Brazil
aberto@alopes.com

Abstract: This paper reports and discusses an experiment in Computer Programming Learning, based on integrating virtual and face-to-face educational techniques. The main purpose of the experiment was to combine distance education tools and face-to-face education techniques, taking advantages from both kind of education. This experience took place at Sao Paulo, Brazil, within a Computer Science Course held by Sumare College, where classrooms are provided with high technology equipment such as electronic boards for teachers and electronic online desktop for students. The results reported here were focused on how the used techniques improved the student motivation for the course, and how the tools and techniques turned teacher work easier. The data was collect from a one-semester period.

Experiment Environment

Our experiment took place at Sumare High Education Institute, in Sao Paulo, Brazil, where up-to-date technology in classrooms is available, for both teachers and students. Today at Sumare, a typical classroom is equipped with a computer, embedded in the desk, for every student and for the teacher, each of them with Internet access via the Local Area Network (which connects virtually all computers of the institution). The teacher in each dassroom has a set of additional tools for helping him during class time: a multimedia video datashow can project on the whiteboard the actual screen of the teacher computer, allowing him/her to demonstrate, present and interact with digital information. Typical available applications are multimedia presentation software, internet browser and software development tools. The teacher can blank the screen at his/her discretion, switch the image source between computer and VCR, and even use the remote controller as the computer mouse. There is also an "electronic marker", working with a movement capture board attached to the whiteboard, which can be used as the mouse (in a very natural way), and for capturing what is written by the teacher. Finally, there is a webcam and microphone installed in every room, so that there is live video feed to the Internet, which can be viewed by authorized remote students.

On the software side, the following software resources are offered:

- personal network account and storage area for each student and teacher, accessible via Web
- online library resources
- online student services
- online teacher services
- biometric class attendance control system
- online learning tool (WebCT [WEBCT.COM, 2002])

The computer science students also have a webserver and a SQL server available for assignment production.

Observed Facts

After the experience period, the following observation could be collected from participant teachers:

Class Dynamics: teacher was ableto demonstrate the software creation and tool usage techniques, also creating the example files at class time with student interaction and participation, and instantly sharing those files.

Communication: students with low or absent personal communication skills to be able to express themselves more efficiently. Teacher-to-student communication improved, the teacher could be reached more frequently at off-class hours; schedule problems diminished

On-Class Student Behavior: some attention dispersion problems occurred: sometimes, students preferred to access the Internet or other online tools instead of participating in the class if the subject got difficult. The use of online quizzes was also somehow turned not viable because of absence of fraud control schemas;

Motivation: students got consistently more motivated because of the use of electronic tools; use of them were many times asked by them.

Teacher work: digitalization of hardcopy documents involved more class preparation time for the teacher, while creation of new material got faster. The use of e-mail and bulletin board systems required more off-class work by the teacher. That was also the case when using online quiz tools: there were more preparatiown time, but less or no evaluating time (the latter in the case of quizzes composed only by multiple choice questions).

Comments and conclusions

Since in our case we are talking about a young institution, founded in the year 2000, the integration of technology into the curricula is something natural, for the college already brings in its DNA the genetic code of technology, and the projects of its courses were developed under that perspective. In the Computer Science course, in which the experiment reported in this paper was developed, the active and collaborative learning, based on projects, and facilitated by technology, is the basis for its pedagogical project. The teachers who joined our team are all much motivated by the use of technology inside the classroom, as well as by the fact that they count on a support team that, among other activities, offers updating courses to teachers from time to time.

Within the new possibilities of application of technology on learning, we have been searching for solutions for a better learning of computer programming techniques, a topic that reveals itself as one of the biggest barriers to the students at the earlier phases of the undergraduate courses on Computer Science [Mainente, 1999].

The results of the experiment showed that integrating online and face-to-face techniques may be a motivating change for the students, as well as a way for the teacher to use time in a more efficient way.

Several improvements on the tools and techniques will be made for the related environment. There are tools being continuously developed to enhance teacher-student and teacher-course coordinator communication. Also, the Distance Learning group uses the collected experience data to envision new techniques to be proposed for the participant teachers.

References

Mainente, C. (1999) *Aprendizagem Virtual e Interativa de lógica de programação via Web utilizando Animação de Algoritmos com linguagem Java (Master Thesis in portuguese).* Sao Paulo: Mackenzie University.

WebCT.com (2002) *WebCT.com Company website.* http://www.webct.com Visited on Apr 04 2002.

Virtual Spaces of Cooperative Experimentation
Virtual Laboratory of Kinematics

Gonzalo Alberto Torres Samperio & Gustavo Núñez Esquer
Autonomous University of Hidalgo State,Information Technologies and Systems Research Center, México
torres@uaeh.reduaeh.mx gnunez@uaeh.reduaeh.mx

Abstract: This work introduces the concept of Virtual Spaces of Cooperative Experimentation (VSCE) as a generalization of the concept of Virtual Laboratory. A VSCE is a virtual environment that gives Internet oriented experimentation, developed with Virtual Reality techniques, with a Workgroup Model based on Instructional Planned Design. As a study case, there are three experiments developed in a Kinematics' Virtual Laboratory (to carry out the experimental work is required to understand friction or frictionless uniformly accelerated motion) namely: free fall, inclined plane and parabolic shot, with and without friction. The system presented constitutes a platform to solve problems in a cooperative environment which can be improved with new functionalities through the integration of new modules.

Introduction

Virtual reality is one of the most excellent Internet's advances of the last decade. This is in charge of development of three-dimensional computational environments, with interactive modeling techniques interacting one or several people (ISO/IEC 14774-1, 1997), (Burdea, 1994).

Virtual classroom is one of the concepts used when referring to Internet on-line teaching. In first instance, a virtual classroom is a teaching/learning environment supported by computers with a communication system (Adell, 1997). Virtual classrooms, are computer generated spaces that model or reproduce didactic environments of real classrooms, in contexts where is not possible to have participants physically reunited in a teaching/learning process. Laboratories, libraries, corridors, coffee shops and other virtual spaces plow being developed to you simulate yourself personal interaction in those ambient (Adell, 1997), (XML, 1999).

The concept *Virtual Laboratory* is one of the most relevant examples given for educational modality. Virtual Laboratories represent an interesting and revolutionary instrument for Computer Aided Education, since they can construct a whole intellectual exploration system conceived to increase speed of the learning process (Banks & Moon, 1997), (XML). Virtual laboratories can be a complement of conventional laboratory to make experiments which cannot be carried out in other way.

The concept of Virtual Spaces of Cooperative Experimentation (VSCE) introduced in this work, is a generalization of virtual laboratories that considers the use of interactive three-dimensional scenarios developed with virtual reality modeling techniques, where users can carry out planned experimental work in a cooperative environment. The proposal of VSCE is inspired by the concept of Learning Virtual Spaces (EVA) (Guzman, Nuñez, 1998). VSCE is centered in the development of virtual spaces for the experimentation and workgroup given by EVA.

Virtual Spaces of Cooperative Experimentation.

In VSCE, a cooperative experimentation model is developed for interaction among users, and those with professor. The knowledge of the area are ordered based on a Instruccional Planned Design, (Englewood, 1996), (Dick & Carey, 1978) which contemplates the cognitive processes, the learning objectives and the instructional strategies (see figure 1). Communication through Internet, allows collaboration and assistance getting in contact to each user with others in the same level or with professor (Rodriguez, 1999). Distributed experimentation, allows different users to carry out cooperative experimentation in simultaneous way in the same scene. With this outline, users execute cooperative experimentation tasks by manipulation of three-dimensional objects in a virtual space, shared with other users located in different geographical places. However, and although is taken as part of the pattern, the distributed experimentation is not implemented in the current version.

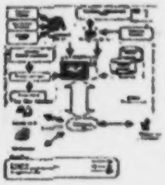


Figure 1: Virtual Spaces of Cooperative Experimentation.

Information about individual and group registration activities, carried out in the system are registered in the database, as well as the specific resources of the applications, such as initial simulations, experimental observations or experimentation activities are registered in the database.

Evaluation is an VSCE's important part, it is taken as a fundamental element to improve the quality of knowledge and

BEST COPY AVAILABLE

considers, in integral form, all tasks the student carries out, such as group work, carried out consults, experimental work, etc.. In this process, all learning elements for student are counting. Evaluation is considered individual because it is focused for each student and it is continuous, because has to be considered in student's record during the whole process. In the current version, individual evaluation is implemented.

Model of Cooperative Experimentation.

The proposed cooperative experimentation model, is looking for problems identification, and their possible solutions, carrying out activities in those that ideas, are expressed freely and summations are gotten by participants discussion or voting [25], (Ellis, Gibss & Rein, 1991).

The workgroup is moderated by a person which proposes a schedule that should be followed during instruction. The same person has the responsibility of meeting administration, specifying strategy to use in each stage assigning tasks and their responsible. On the other hand, participants carry out activities or commended tasks to be evaluated counting participants of the whole group (Hang, Lin, 1987), (McGilly, 1996).

Workgroup is ordered in sequential stages based on the use of strategies for presencial work that allow distributed interaction among users. These strategies (Brainstorm, Cognitive Maps, Quality Circles and Delphi), [25], (McGilly, 1996), (Hang, lin, 1987), (Ellis, Gibss & Rein, 1991), are implemented using available Internet communication basic tools; namely, e-mail, discussion forums, electronic boards and chat. Figure 2, shows the way strategies are integrated to cooperative experimentation.

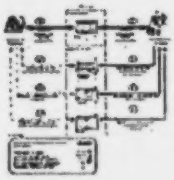


Figure 2: Implementation of workgroup strategies in communication services.

In this work, strategies have not been used just the way they have been described, but rather one of our own one has been generated taking some of the most excellent elements of the mentioned strategies. Proposed strategy is oriented to participants carry out activities and cooperate with each other in a natural way, to solve as better as possible the outlined problems.

Summary (Conclusion).

VSCE's model, defined in this work, incorporates, to Virtual Laboratory concept, the use of three-dimensional scenarios and a instructional planned design in a workgroup model context. Environments as presented in this work are not very common in Internet. With the VSCE concept is possible to develop interactive experiments for workgroups in several fields of knowledge. System developed in this work is a contribution to remote experimental work through Internet.

The cooperative experimental work design developed for VSCE uses workgroup strategies incorporated in experiments' instructional design. The system introduced constitutes a platform which can extend its functionality capacity through new tools, modules and heterogeneous systems integration and can be resized to solve problems in a cooperative environment.

References

Adell, J. (1997), *"Entornos Virtuales de Enseñanza Aprendizaje"*, Nuevas Tecnologías de la Información y la Comunicación para la Educación, Sevilla: Ediciones Alfar, págs. 114-121.

Burdea, G. (1994), *"Virtual Reality Technology"*, John Wiley & Sons.

Dick, W. & Carey, L. (1978), *"Diseño Sistemático de la Instrucción"*, Ed. Voluntad, Bogotá.
DHTML Dynamic Drive, (2001), URL: http://www.dynamicdrive.com

Ellis, C.; Gibbs, S. & Rein, G. (1991), *"Groupware: Some Issues and Experiences."*, Communications of the ACM.

Englewood, C. (1996), *"Case Studies in Instructional Design."*, New York Educational Technology Publications Inc.

Guzmán, A. & Núñez, G. (1998), *"Virtual Learning Spaces in Distance Education: Tools for the Eva Project"*, International Journal Expert Systems with Applications: (Special Issue), Pergamon Press.

Hwang, C. & Lin, M. (1987), *"Group Decision Making Under Multiple Criteria: methods and Applications."*, Springer Verlag.

ISO/IEC 14772-1: (1997), *"Virtual Reality Modeling Language (VRML97)"*, URL: http://vrml.org/specifications/VRML97.

BEST COPY AVAILABLE

Title: Education in an Era of Digital Competition: Gist and boundaries

By: Kiran Trivedi, Lecturer, EC/IT Department, S.S.Engineering College, Bhavnagar, Gujarat, India **Email**: kittuad1@sancharnet.in,

Abstract: *The purpose of this article is to examine the meaning and implications of e-learning and to assist individuals and organizations, whether they be schools or workplaces, with implementing e-learning. The author explains his broad definition of e-learning, discusses pros and cons of e-learning, and elaborates ways to effectively lead e-learning through championing, clear communication and effective project management. The article contains information for leaders in education and training—instructional designers, developers, consultants, instructors and administrators.*

Introduction

As we close the door on the 20th century and uncork the millennium we have entered the e-decade. The worldwide Web has given us e-commerce. A new way to sell services, products—anything. The Web and the Net have also increased opportunities to communicate with a large number of people, quickly and cheaply. There are plenty of e-opportunities—all using new technology to grab a larger market share. Maybe even to produce and distribute goods and services more effectively and efficiently. We can hope!

Hurdles to eLearning that must be overcome!

- Quality and intensity of content
- Availability of content
- Habits, customs, and culture
- Technology delivery -- bandwidth, etc.
- Lack of digital collaboration models
- Research gap

Eight issues with e-learning

All is not rosy on the e-learning front. There are challenges, issues—or optimists might say, opportunities—to address. Issues associated with the use of e-learning are as follows.

1. Students may be required to purchase or rent new computer equipment.
2. Technical difficulties or operator error may hamper students and instructors.
3. Students and instructors may have gaps in their computer knowledge in such areas as Windows, so they will require training in computer basics before they can start the online learning training.
4. Using telephones lines and Internet service providers to access Internet services, when required, leads to high user fees in many parts of the world.
5. Initial costs of developing courses may be considerable, depending on the approach taken.
6. Instructors may need to become familiar with electronic text books; Internet-based

research material, copyright, and other e-learning related topics.
7. Internet bandwidth may not be robust enough to support the desired level of multimedia.
8. People working in the e-learning field at an individual location may be pioneers and not have the support of a network of more experienced colleagues.

Our quick review of two baker's dozen plus pros and eight cons tends to underscore the diversity of e-learning. The challenge one faces as an e-learning leader is to reap the benefits and avoid the pitfalls. What can a leader do to achieve success with e-learning? One of the first steps is to become an effective champion.

Summary

Implementing e-learning is not for the faint of heart. It can be challenging. You could experience setbacks, even failure. To succeed you need to understand the up and down side of e-learning. You need to address the weaknesses—especially the perceptions of weaknesses. Successful champions of e-learning are effective communicators. They explain new words clearly, concretely, in terms that their listeners understand. The essence of championing is clear communication. Decide what you need to say, to whom and how. Plan what you are going to say and follow through on your plan. Effective champions anticipate questions before they are asked, find the answers and deliver them in a convincing manner. Tips, tactics, strategies play a pivotal role in the successful implementation of an e-learning program. Plan the start of the project, concentrate on communicating, manage carefully, identify risks and address them, and most of all lead—inspire the people around you with your support for the e-learning project and your reasoned enthusiasm.

References & Recommended Web Sites

GForce
Internet Time and its e-learning resource
Learnativity
Training Supersite
E-Learning (Technical) Jargon Explained

? Albert S., and C. Thomas, A new approach to computer-aided distance learning: The 'Automated Tutor', Open Learning: The Journal of Open and Distance Learning, 15(2), 1-5, 2000.
? ALN: Asynchronous Learning Networks
? American Journal of Distance Education
? Australian Journal of Educational Technology
? BBC Education Sites
? British Association for Open Learning
? *British Journal of Educational Technology*
? e-learning Hub, The
? elearningpost
? Electronic Publishing

Applications of Reusable Learning Objects and Atoms in e-Learning

Dr. Vladimir Uskov
Department of Computer Science and Information Systems
Bradley University
United States
uskov@bradley.edu

Prof. Maria Uskova
Division of Computer Information Systems
Midstate College
United States
muskova@midstate.edu

Abstract: This research paper attempts conceptually to describe modularity (granularity) of learning content, reusable learning objects and atoms, and reusable information atoms. The premise is that later on those conceptual modular models can be formalized in a form of working models (for example, agent-based models) and be used in e-learning(EL), providing increased effectiveness and efficiency of both EL-related instructional design and teaching and learning processes.

Introduction

Modularity (granularity) is the foundation for a design and development of EL courseware. Using this principle, designers of online degree program will be able easy and quickly to assemble various appropriate curriculum from online courses. Course designers can put together a course by quick integration of existing online classes and lessons using various models of learning sequences and activities. Online lessons can be constructed from a library of standardized learning objects and information objects, such as texts, pictures, images, figures, graphics, tables, essays, video clips, sound recordings, advanced animations, etc.

Hierarchy of Learning Content

We will use the following definitions in this paper: An online course is a sequence of learning experiences enabled by a course designer/instructor and pursued by learners. An online course consists of classes, and each class consists of lessons. Each class and /or lesson is a collection of learning objects and learning activities aimed to accomplish one or several of the sub-goals of the online course. In many ways, an online class is a miniature online course requiring its own objectives, welcomes, introductions, assessments, and feedbacks. Based on given definitions, we will use the following hierarchical structures of *learning content*: 1) Curriculum (Degree Program or Training Program), 2) Courses, 3) Classes, 4) Lessons or *Reusable Learning Objects* (RLOs), and 5) *Reusable Learning Atoms* (RLAs) and *Reusable Information Atoms* (RIAs), and *learning process*: 1) *Learning Sequences* (LSs), 2) *Learning Activities* (LAs), and 3) *Learning Actions.*

Reusable Learning Objects, Atoms, and Information Atoms

RLO's Definition to Be Used In this work, we will use the following working definition of *reusable learning object*: " RLO is any digital resource that can be reused to support Web-based learning". This definition includes anything that can be delivered across the network on demand, be it large or small. Examples of RLOs may include live or prerecorded video or audio, pieces of text, animations, graphics, web-based applications, web pages, and other pieces that are aimed to deliver complete experiences, such as a lesson.

RLO's Structure to Be Used. The proposed RLO's structure is based on the idea that RLO is a collection of Reusable Learning Atoms (RLAs) that are grouped together to teach a common task based on a single learning objective. In order to convert the collection of RLAs into a complete "learning experience" - "a lesson" or RLO, four other Reusable Information Atoms (RIAs), specifically, *Welcome RIA, Overview or Introduction RIA, Summary RIA, and Assessment RIA,* are added to a set of RLAs.

A Reusable Learning Atom is an elementary non-dividable piece of learning that is built upon a single learning objective. Each RLA can be classified as either being a concept, fact, process, or procedure. Each RLA combines three content items, specifically: 1) content items (pieces of learning), 2) practice items (learning activities), and 3) assessment items (tests, quizzes, exams).

A Reusable Information Atom is an elementary non-dividable piece of information that is built upon single information objective. The ***Welcome RIA*** contains only one content item – Greetings. The ***Overview/Introduction*** RIA may contain up to seven different content items, such as: 1) Overview, 2) Introduction, 3) Importance, 4) Objectives, 5) Prerequisites, 6) Scenario, and 7) Outline. The ***Summary RIA*** may contain several content items such as 1) Review, 2) Next Steps, and 3) References/Links/ Additional Knowledge Resources. The ***Assessment RIA*** serves two functions, specifically: 1) *pretest:* tests learners initial knowledge, determines gaps in knowledge and skills prior taking the "lesson", and indicates which RLAs fill those gaps; and 2) *posttest:* ensures the learner has achieved mastery on all objectives for a given "lesson"; determines gaps in knowledge and skills after taking the "lesson" and indicates which RLAs learners should review.

Examples of RLAs and RIAs. Examples of developed types of RLAs and RIAs are given in Table 1.

Table 1.

Type of RLAs	RLA's Description/Function	Type of RIAs	RIA's Description/Function
Knowledge Resources	Provide pointers and hyperlinks to information on the Internet the learner may need before, during and/or after taking the lesson.	Welcome	Greets the learner, tells what the online lesson is about, and makes clear why the learner should take it.
Featured Example, Fact, Concept or Statement	Presents a Web-based description of a single example or case study along with commentary about it (a picture, an image, a concept, a principle, a statement, an event, a phenomenon, a system, etc.).	Overview	Provides hyperlinked general information about RLO's goal, objectives, list of topics, learning procedures/functions/methods to be used, Web-based knowledge resources, and anticipated outcomes.
Code Sample	Demonstrates a self-contained self-executable hyperlinked fragment of a programming or scripting language that can be executed via the Internet (for example, using a sharing application).	Introduction	Establishes the subject and characteristics of the online lesson and prepares the learner to begin the Web-based learning activities.
Event Playback	Lets learners review a previously recorded live event in online mode (for example, video lecture using streaming video and audio technologies, chat session, bulletin board, etc.).	Summary or Conclusion	Recaps the important ideas of the entire online lesson.
Procedure	Provides clear instructions on how to do or execute a given fragment, task, code, etc.	Assessment	A collection of online assessment items.
Feedback	Invites learners to evaluate the effectiveness of the online lesson and to suggest improvements using online evaluation tools.		

RLO's Metadata. In order to compose automatically and dynamically various specific RLOs from a database of RLAs and RLOs, or, more generally, generate a personalized learning sequence of RLOs, the Learning Management System (LMS) must have access to a database with instructional design information to support the decision-making process on "sequencing" the RLOs. As a result, each RLO must be tagged with *metadata* – data about data - that further describes its attributes, functions and associated objects. Usually, metadata include RLO's 1) title, 2) level objective, 3) major topic area, 4) learning objectives, 5) name of designer, 6) name of knowledge source, 7) date of creation, publication date, expiration date, 8) used language (either natural or programming), 9) list of prerequisites, 10) needed technical platform or equipment, etc.

However, in order to increase the reusability of a RLO and make it more efficient and effective, more fundamental RLO's characteristics should be used, for example, 1) ***number of RLAs combined*** – describes the number of individual learning elements (such as video clips, images, etc.) combined in order to make the RLO; 2) ***type of RLAs contained*** – describes the types of RLAs that may be combined to form a RLO; 3) ***reusability of constituent RLAs*** – describes whether or not a RLO's constituent RLAs may be individually accessed and reused in new learning contexts; 4) ***common function*** – describes the manner in which the RLO is generally used; 5) ***external dependence*** – describes whether the RLO needs external information (such as location on the network or Internet) about RLOs other than itself; 6) ***algorithms and procedures*** – describes algorithms and procedures within the RLO; 7) ***contextual reuse*** – describes the number of different learning contexts in which the RLO might be used, that is, the RLO's potential for reuse in different content areas.

Summary of advantages of RLO strategy in e-Learning. In summary, the main advantages of RLO approach to EL include but are not limited to 1) flexibility in RLO's utilization, 2) ease of content updates and searches, 3) adaptation and customization, 4) interoperability, 5) facilitation of a) competency-based, 2) customized, and 3) personalized learning, 6) content management, and 7) increased value of learning content.

National Science Foundation Project on e-Learning in Information Technology

Dr. Vladimir Uskov
Department of Computer Science and Information Systems
Bradley University
United States
Uskov@bradley.edu

Abstract: While the growth in employment of all occupations in the U.S. Information Technology (IT) industry between 1996-2006 is projected at 88.25%, the growth of college/university IT and Computer Science (CS) faculty is only projected at 18.3%. These findings motivated faculty of several U.S. educational institutions to propose the National Science Foundation (NSF) project that is aimed on a design a development of several IT and Computer Science (CS) online degree programs (on both, Associate of Applied Science Degree and Bachelor of Science Degree levels) in the US colleges and universities.

Introduction

Forecasters say that the average worker of the future will have six or seven different careers. Each requires the re-education of a worker who must take new courses and develop new skills, attitudes, and values. Overall, it is estimated that by the end of year 2003, there will be 25 million new learners in the U.S. These learners are more mature and constrained by time and place. Lifelong learners – mature working adults who require continuing education – already comprise 44% of the U.S. student population. On the other hand, traditional undergraduates, those 18- to 22-years-old, attending full time and living in college housing, account for less than 25 percent of all students in U.S. institutions of higher education.

Project Goals and Objectives

Goals. The proposed NSF project on Course, Curriculum and Lab Improvement and Educational Material Development (NSF CCLI-EMD Project) has two goals: 1) accelerating the rate of graduation of Information Engineering Technology students through the active use of innovative online educational materials (OEM) and teaching and learning technology other than Classroom-Based Training (CBT), namely e-learning (EL), and 2) expanding the impact of IT education on various groups of population such as traditional high schools/college/university students and non-traditional students and learners at centers of distance learning, weekend schools, summer institutes, adult vocational centers, career development centers, etc.

Objectives. Given the broad goal of this project, the specific aims of this NSF project are the following ones:

1) Develop online educational materials for twelve (12) IT undergraduate courses, provide wide "beta"-testing of developed OEM, and organize and store IT OEM in form of "IT Courseware Cube".
2) Use actively innovative cost-effective and time-effective Web-based learning and teaching technologies, and "*active learning*" paradigm of education that are ideally match goals and objectives of IT and CS online education of a broad range oftraditional and non-traditional groups of students and learners.
3) Design and develop a specialized "Online IT Courseware" Web server and Web page (available 24/7/365) that will store the developed "Online IT/CS Courseware" Cube of undergraduate OEM and disseminate project-related information nationwide and worldwide.
4) Create a solid foundation for at least two Associate of Applied Science (AAS) and one Bachelor of Science (BS) online degree programs in IT and CS areas.
5) Produce OEM of high quality by using a variety of effective evaluation procedures. Provide various forms of formative and summative discussion and evaluation of all project activities and products.
6) Disseminate project products nationwide by means of various aggressive dissemination procedures with special attention to free distribution of project products to a) historically black and Hispanic educational institutions, b) Tech Prep Consortia in all 50 states, and c) K-16 institutions in rural areas of the U.S.
7) Provide constant active training of faculty and teachers focused on design, development and implementation of OEM, the Web-based innovative teaching and learning technologies and techniques, and state-of-the-art Web-based instructional (WBI) tools.
8) Provide sustainability of project activities by self-sustained distribution of project products by means of 1) production and commercial distribution of CD ROMs with IT OEM, and 2) pre-paid services of the project dedicated Web server.

Project Targeted Audience

Project products are primarily aimed at various groups on students and life-long mature learners in the United States, especially individuals such as:

1) Students of traditional K-16 institutions who find the online learning a convenience.
2) Adult learners who travel a great deal, or have strong commitments for family and/or businesses, and therefore cannot attend weekly on-campus classes,
3) Students who must transfer to another city/state before completing their degree.
4) Adult learners far from U.S. traditional educational institutions.
5) Students in rural areas of the U.S.
6) Disabled students who have no opportunity to attend classes and lab sessions at colleges/universities.
7) Potential international students with Internet connectivity anywhere in the world that are willing to take online courses at US K-16 institutions with no visits or minimal numbers of visits to the U.S.

Project Expected Outcomes

The primary outcomes of the proposed project are expected to be:

1) A set of CD-ROMs that will contain OEM for twelve (12)I ET/CS undergraduate courses.
2) Project's "Online IT Courseware" Cube, project's Web server and Web page.
3) Three (at least) pilot online undergraduate IT/CS programs in participating institutions; several other colleges – project partners, are expected to start their activities on establishment of their own online programs in IT by completion of this project or even before.
4) Project-related articles, papers, presentations, surveys, databases of student FAQ, and evaluation/testing materials.
5) A new mentality of IT faculty nationwide (*"Yes, we can successfully use not only traditional classroom-based IT teaching but also Web-based teaching, and, moreover, various combinations of these two modes in IT teaching"*).
6) A new mentality of IT students and adult learners (*"Yes, we can successfully use a mode of IT education that is the most convenient for me and my family, including CBT, EL, and various combinations of CBT+EL modes of education."*).
7) A designed, developed, and tested "easy-to-replicate" nationwide model of the developed OEM for online undergraduate education in IT.

Particularly, the following undergraduate IT online are planned to be developed.
Online educational materials for **"Software Development and Programming"** IT track:
   1. Web-Based Software Engineering
   2. C++ and C# programming languages
   3. Visual Basic.Net

Online educational materials for **"Networking Systems"** IT track:
   1. Fundamentals of LAN: Hands-on Approach
   2. Fundamentals of WAN: Hands-on Approach
   3. Network Administration

Online educational materials for **"Interactive Multimedia"** IT track:
   1. Web-Based Professional Publications and Presentations
   2. Multimedia Production
   3. Advanced Graphic Design

Online educational materials for **"Information Systems"** IT track:
   1. MS Word, MS, Excel, MS Access applications.: Web-based document and application sharing
   2. Databases and DB Management Systems
   3. Information Systems Analysis and Design

Project Evaluation Procedures

Various formative and summative evaluations will be conducted to assure the quality of project activities and outcomes. Different types of the evaluators will use qualitative and quantitative measures including a) questionnaires, b) interviews, c) observations, d) focus groups, e) instructor and student work samples, f) review of instructor journals, and g) instructor and student assessments. Specific evaluation techniques will include evaluations by students and internal and external experts, peer evaluations by participants at professional meetings, teachers and faculty, attendees of faculty development workshops, and professional journal reviewers.

Engaging Students in Web-Based Self-Development

Diane Wagoner, MS, RD
Instructor
Department of Food and Nutrition
Indiana University of Pennsylvania
dwagoner@iup.edu

Kay Wijekumar, Ph.D.
Assistant Professor
Information Sciences and Technology
The Pennsy lvania State University Beaver
kxw190@psu.edu

Abstract: Nutrition and wellness is fundamental to a healthy life. Fostering the importance of nutrition and wellness across the time and space distance of web-based learning environments can be a challenge. Using the Attention, Relevance, Confidence, Satisfaction ARCS model of Instructional Design, we have developed and offered a course that has received great reviews from the students. The ID model and its implementation are described in this paper.

Introduction

Nutrition and wellness is fundamental to a healthy life and requires very active engagement of learners whether they are in a traditional classroom or a web-based distance learning environment. The course presentation, communication, and assessment techniques available in web-based learning environments adds some challenges but also provides new opportunities to engage learners in this very important learning activity. This paper presents a course to introduce reflection of one's lifestyle and and the implementation of healthy alternative behaviors by using the Attention, Relevance, Confidence, Satisfaction (ARCS) model (Keller, 1983) of instructional design. We begin with a brief description of the ARCS model and continue with example modules applying the model. We conclude with a summary of experiences from the course instructor.

ARCS

ARCS was an instructional design model that is based on a theory of motivation and instruction developed by Keller, 1983. The model emphasizes the interest and relevance of the learning to the learner and emphasizes the confidence gained from being successful at completing a task. Each of these elements is described in detail.

- Attention is accomplished by arousing the curiosity of the learners and maintaining their attention throughout the learning experience. This can be implemented using sensory stimuli, inquiry arousal (thought provoking questions), and variability (varying the activities and presentation modes). Examples include presenting learners with some advertisement that overstates its claims of success to arouse their curiosity, a comparison of calories consumed to calories needed and analyzing their carbohydrate intake.
- Relevance to the learner is fundamental to the learning so that they understand and believe in the merits of the learning for themselves. Examples include the development of activities that require the student to take their pulse after activity and observe the changes.
- Confidence can be gained by the learner understanding the requirements of the learning environment and being able to see that they can be successful. This expectancy for success is implemented by setting goals, and providing feedback. Examples include giving students a schedule of activities and time to complete their lessons.
- Satisfaction in the learning is crucial to the long term use of the learned information. This is described as the learner's intrinsic motivation and response to extrinsic awards "(Mory, 1996). Examples are giving the students rewards in grades for reflecting on their eating habits,.reading food labels, anc calculating protein needs.

In summary, the ARCS model is designed to address the issues that are most relevant to creating a web-based learning environment that engages a learner in reflecting on their lifestyle to improve that quality of life. The next section describes two examples of modules created for a course on nutrition and wellness.

Nutrition and Wellness on the Web Using ARCS

We designed and delivered an introductory nutrition and wellness course on the world-wide-web as a distance learning course. This type of course is a required course for all undergraduates attending a liberal arts public university. The course contained information on lifestyle choices such as nutrition, exercise, substance abuse and many related topics and was offered over a 15 week semester. To design a course that would engage learners at a distance and offer them a long term skill we turned to the ARCS model to frame each module. The course requirements included:

- Completion of orientation to learning including checks on necessary hardware and software as well as concept mapping techniques.
- Completion of 12 modules built around a case/problem that the student had to either solve, reflect or assess.
- Readings from the textbook as well as other references.
- Assessment of learning using self-help quizzes.
- Maintenance of an on-going wellness journal (using a private bulletin board which was only viewable by the instructor and student).
- Posting of reviews and/or critiques to the public bulletin board.

The following section describes two of the modules within the ARCS framework to illustrate how the model was implemented.

Nutritional Supplements

To gain the *attention* of the learners advertisements that made outrageous claims on nutrition and weight loss were scanned and placed within the case study(course content). These were *relevant* to the learner because they were part of the daily life of any person reading the newspaper or watching TV. The students gained *confidence* in reviewing the advertisement by following a prescribed evaluation sheet that they completed for review by the professor. After completing their pre-defined evaluation sheet (which asked questions like the source of the advertisement, the research quoted in it, identifying the specific claims and fine print exclusions) the learners selected an advertisement (Remove they ahd seen?) to review using the same guidelines. These product reviews were then posted on the bulletin board of the course and discussed/shared by the students. The students gained *satisfaction* in this module through the grade they received, and the feedback from their peers and professor.

.

Carbohydrate Intake

Each student maintained a Wellness Journal of their daily eating habits, stress levels, physical and mental activities, and general feelings. We gained their attention by referring the students' to review their journal and identify their carbohydrate intake and giving them guidance on how to measure portions. Since this is part of their daily eating routine the relevance was quite obvious. They gained confidence by reflecting on the food choices they were making and identifying alternatives that were assessed by the professor. The satisfaction in this module was very intrinsic with the student realizing how much control they had over their **dietary** habits.

Reflections of the Professor

As the course evolved from the conception to the design and delivery there were many experiences that are important to note. Four of them are described here. First, preparation time for the design and delivery of the course was significant and took about 5 months of full-time effort to create the course. During the delivery there were daily journal entries to read and grade as well as evaluating the submissions and postings to the bulletin board. Second, comparing this experience to classroom teaching it was clear that students engaged in this course and saw how their choices affected their long-term health and lifestyle. Many students commented on the value of their journal using it to set goals and "contracting with themselves" to modify unhealthy practices. Third, there appeared to be increased participation in this on-line class compared to traditional classroom sections of the same courses. Often times students posted opinions/comments on eachothers findings. Finally, students appeared to be less inhibited about sharing their personal thoughts in this delivery mode compared to the face-to-face classroom environment.

Conclusion

Fostering the importance of nutrition and wellness across the time and space distance of web-based learning environments can be a challenge. Using the Attention, Relevance, Confidence, Satisfaction ARCS model of Instructional Design, we have developed and offered a course that has received great reviews from the students.

References:

Keller, J.M. (1983). Motivational design of instruction. In C.M. Reigeluth, ed. *Instructional-design theories and models: an overview of their current status*, (pp. 383-434). Hillsdale, NJ: Erlbaum.

Keller, J.M. (1987). Developing and use of the ARCS model of instructional design. *Journal of Instructional Development* 10(3), 2-10.

Mory, E.H. (1996). Feedback Research. In D. H. Jonassen (Ed). *Handbook of Research for Educational Communications and Technology*. (pp. 919-956). New York, NY Simon & Shuster MacMillan.

A Blended Learning Approach to Business in Manufacturing

Dr. Michael T. Wood, Chief Academic Officer, Walsh College, USA, mwood@walshcollege.edu

Marie D. Lee, Instructional Designer, Greenfield Coalition, USA, leem@focushope.edu

Abstract: The Internet is fast becoming a source for learning and educational materials, however, the face-to-face benefits of classroom interaction cannot be ignored. By bringing real world situations into the classroom and constructing activities for students to complete with their peers and a set of resources, higher education can respond to the challenges of industry to create skilled and able workers who can communicate and problem solve on the job. An example of this blended classroom experience is a course developed by the Greenfield Coalition (GC) and Walsh College entitled The Manufacturing Organization and Its Environment (MOE).

Blended Classrooms

From our experiences as students and instructors, we know that listening to hours of lectures sitting in a classroom after a long day's work (or other classes) is not ideal for learning. We have also seen the Internet, as a classroom, fall short in supporting the needs of the learner. However, by integrating web-based learning with teacher guidance and hands-on experiential learning, a better learning environment is created. Blended delivery modes produce a pedagogy that accommodates diverse learning styles and capabilities. The world-wide web (WWW) provides the extended learning base for instructional materials, resources, and some activities, the classroom provides face-to-face interaction and peer learning, while hands-on experimentation allows students to directly apply and practice theory and methods in a safe and supervised environment.

Manufacturing Organization and Its Environment Development

A new example of this hybrid blended learning approach is offered in a one-credit course for engineering and engineering technology degree programs called The Manufacturing Organization and Its Environment (MOE). The course is being offered as a foundation for further study in the business aspects of the engineering profession in manufacturing industry. It is part of the Greenfield Coalition (GC) Engineering and Engineering Technology curricula. GC is funded by the National Science Foundation (NSF) and consists of university and industry partners, the Society of Manufacturing Engineers, and Focus:HOPE. The course, developed by Walsh College and GC, incorporates learning via the WWW, classroom sessions, and a common platform of hands-on, experiential learning that pervades all three modules of the course.

GC at Focus:HOPE is charged by the NSF to revolutionize engineering education by using a blended learning approach and by bringing real-world engineering problems into the classroom. The MOE course blends delivery approaches and is designed, as all GC courses, using Gagne's nine external events of instruction. It will first be taught at Focus:HOPE's Center for Advanced Technology (CAT), in Detroit, Michigan. The students, called "candidates," work an eight-hour day in the factory, which is a tier-one supplier to the automotive industry. After work, they spend 2-4 additional hours in the classroom as they work toward associate or bachelor degrees offered by one of the GC's partner universities. The curriculum is designed to take advantage of opportunities available on the shop floor and integrate them with course concepts and activities. Learning activities are reality-based, and often directly related to the day-to-day operations of the manufacturing facility. Work and study opportunities are linked and allow the candidate to learn in class, at work, online and with peers and mentors.

ADVANTIG Simulation

The common hands-on learning platform for the course is comprised of a manufacturing business role-play simulation. The simulation, called the Advanced Manufacturing Technology Implementation Game (ADVANTIG), is used to help participants learn first-hand how organizations work, and how the components of organization, people and technologies interact. The role-play is threaded through three interrelated modules on: manufacturing organization functions and processes, technology in the organization, and trends in manufacturing and business. Participants preview basic knowledge content via the web, come together and "play" two years of company operation, and learn, with the facilitation of an instructor, skills to improve their mock organization. Between physical-meeting sessions, participants receive new information to study and prepare by way of the Internet.

Participants see how the simulation and a typical year operate, then they do it. A full year is equal to 60 or 40 minutes in the classroom. After each "year," they have time for a retreat and related knowledge-building instruction and discussion. Modules include: relations with suppliers and customers; how to value and plan for technology acquisitions; and how to build communication skills to understand and affect others in the organization. The simulation platform allows for "scenario-updating" each year, so new considerations can be introduced as the learners become more proficient.

ADVANTIG Advantage

The online components of the course allow students and instructors to go to specific learning activities, as this format does not dictate linear presentation or navigation. Instructors can provide dynamic links to external resources to assist study and in-class activities. Materials are made available for work or home study via the course web site. Peer learning opportunities occur in chat rooms for synchronous dialog, or via asynchronous threaded online discussions. Electronic peer and mentor notes support activities and provide guidance as students face challenges.

This blended learning experience allows us to adapt the pedagogy to the learning styles, preferences, and capabilities of the learner, without sacrificing faculty-driven quality educational content and assessment. Educational approaches include:

- Collaborative learning -- participants work in small teams and use peer and mentor learning notes;
- Active learning -- candidates engage in role plays, discussion exercises, and hands-on production work;
- Reality-based learning -- participants use simulations and cases drawn from real-world business practice;
- Flexible learning time -- through the Internet, participants utilize the learning material anytime, anywhere;
- Learner-centered focus -- instructors act as guides and mentors, using the model of "guide by the side."

Responding to Education Challenges

With this blended approach to engineering and business education, it is important to ensure common, consistent, high quality throughout each of the components of learning and methods of delivery. Rather than building a multidisciplinary program based on discrete courses from several academic departments, this approach involves designing multidisciplinary courses that thread two disciplines together in integrated units of learning. Thus, the whole learning experience can be truly greater than the sum of its parts. With the transferability afforded by having the learning materials on the Internet, in stand-alone modules, blended e-learning in engineering and business can eventually be available to a wide audience of 21st century learners.

Acknowledgement

The Greenfield Coalition is partially supported by a Grant EEC-9630951 under the Engineering Education Coalitions Program at the National Science Foundation. Focus:HOPE, our industry and academic partners have contributed valuable resources to support the development of Greenfield.

Seeing is Believing! Can Students Learn Culture Using Distance Education?

Jack Fei Yang, MBA, Ed.D (ABD)
The University of South Dakota
fyang@usd.edu

Ching-Mei Hsiao, MBA, Ed.D (ABD)
The University of South Dakota
chsiao@usd.edu

Abstract Can students learn culture using distance education? Emerging technologies have potential to support the use of video to provide live and virtual interaction among diverse cultures. This paper will demonstrate how distance-learning resources in South Dakota can create interactive environments to further East/West cultural understanding. Cultural study through distance education can allow students to experience culture first hand, rather than reading about culture as defined by a textbook. A demonstration will focus on how core values of different cultures can be shown interactively through distance learning.

Introduction

The students of a global society confront daily the question of how the world does things. Many people want to understand cultural differences and similarities and to assimilate new best social behaviors, values, and practices that will make up the concept of "global culture." What are the elements of "culture"? Peterson (1979) stated that culture comprises four elements: norms, values, beliefs, and expressive symbols. "The popular definition of culture has come to refer to the shared values, attitudes, beliefs, behaviors, and language use within a social group" (Talmadge, 1999, p7).

Cultures are a kind of natural system of customs and behaviors that are passed from different generations, races, genders, ages, or groups to the next. The rules for a culture could consist of elements such as language, religion, education, politics, recreation, and family systems that a group of people share together. More complex cultural issues may be related to social behaviors in matters of more difficult matters of sexuality, morality, spirituality, social control, and the search for meaning in life. Among this wide set of topics, how can emerging distance learning resources be a catalyst for learning? How can these sometimes subtle and complex factors of culture be best learned through distance education?

Distance Learning as an Interactive Medium for Global Students of Culture

Chaney and Martin (2000) mentioned culture is learned through perception; the traditional textbook with literature approach was difficult to provide an active-learning and experiential learning environment to students. Language is the most representative element in any culture, but language is not equal to culture, and knowing only language but not culture is dangerous; it causes misunderstandings. The activities to teaching culture could includes all kind of culture topics such as, capsule, cultural consciousness-raising, cultural islands, celebrating festivals, kinesics and body language. The purpose for these activates are to help students to feel smell, touch, and see the culture difference.

Oxford (1994) pointed out in order to teach culture to students, the teaching should be based on a "cultural texture" concept, which includes three different parameters: information sources, activity-types, and selling-points. Current technology provides diverse available information sources; it includes video, CDs, TV, and the Internet. Technology developments can improve teaching resources and create a multimedia-learning environment. Appropriate teaching technology resources can give students a chance to experience interactive learning environments. Current distance teaching methods include correspondence courses, prerecorded media, two-way audio, two-way audio with graphics, one-way live video, two-way audio with one-way video, two-way audio/video, and desktop two-way audio/video (Simonson, Smaldino, Albright & Zvacek 2000). In this paper, researchers will focus on the applications of some of these methods in South Dakota distance learning systems in which distance education can be used to introduce cultural differences and similarities.

South Dakota Distance Learning System Introduction

The Dakota Digital Network (DDN) in South Dakota is a two way audio and video medium; the DDN connections provide Internet access and videoconferencing over a statewide intranet. The DDN connections include about 180 South Dakota K-12 school districts and six South Dakota public universities. Another local area network in South Dakota is the Southeast Interactive Long Distance Learning (SILDL) system. It is also a two way audio and video medium. The SILDL connects to educational institutions pre-K through post secondary and university levels, but in a region of the southeastern part of the state. The SILDL system allows four different classes to operate at the same time even if they are in different locations within a 200-mile radius.

The practical functions in WebCT include chat rooms, message boards, and e-mail to allow instructors to communication actively with students either asynchronously or synchronously. In South Dakota at the university and k-12 school levels, the WebCT product has been used in digital statewide networks to support distance-learning options. The Internet is a most convenient and common learning resource for distance-learning systems, it provide more interaction and more first-hand resources for students. The practical distance teaching techniques with culture will be demonstrated during the presentation.

Conclusion

Distance teaching technologies provide many new methods for creating real and virtual experiences for students. It is possible for emerging multi-media resources to allow a "seeing is believing" environment. Visual and real contact among people of different cultures can contribute to the further development of friendships, safe higher-level learning environments, and development of a global culture. Educational research has long shown that active learning, visual presentation, problem solving, and engagement in learning can be more effective than passive learning alternatives. The challenge to future educational leaders is to use the best of educational technology to bring more active learning to the education of students who will lead the development of the new global society. In a learning environment of trust among people, there are many avenues in which interactive media may encourage discourse among people. Distance education is a potentially powerful concept in this decade. As technological change continues to bring cultures of the world into interaction, there is an increasing need to synthesize norms, values, and social behaviors into a synthesized global society gestalt.

References

Chaney, L. H., Martin S. J. (2000). International business communication. (Sec.Ed.). New Jersey: Prentice-Hall.

Oxford, R. L.(1994). Teaching culture in the language classroom: Towards a new philosophy. In J. Alatis (Ed.), Georgetown University Round Table on Language and Linguistics 1994 (pp. 26-45). Washington DC: Georgetown University Press.

Peterson, R.A. Revitalizing the culture concept. American Review of Sociology ,5, (1979), 137-166.

Simonson, M., Smaldino, S., Albright, M., & Zvacek S. (2000). Teaching and
learning at a distant: Foundations of distance education. New Jersey: Prentice Hall.

Talmadge, C. Guy (1999). Providing culturally relevant adult education: a
challenge for the twenty-first century. In C. G. Talmadge (Ed.), Culture as context for adult education: the need for culturally relevant adult education (p.7). San Francisco: Jossey-Bass.

International issues in using web technologies in higher education.

The purpose of this paper is to indicate the role of international issues in using web technologies in higher education. The main focus is on common uses of web technologies in developing countries and related issues such as accessibility, high price of hardware, software, lack of the knowledge of web technologies, computer phobia and computer illiteracy of students in the higher education of these countries. The second focus of this paper is to identify the role of cultural factors such as language, traditional culture and stereotypical impressions affecting the use of web technologies among students in the universities of developing countries. The educational systems' goals in the primary and secondary schools and the schools' culture and curriculum are also important in the success of using web technologies in the higher education of developing countries. Based upon the results of this study, recommendations will be made for success implementation of web technologies.

Participants were samples of students and professors from different majors of the educational department of Isfahan University. Both graduate and undergraduate students were included in this research. Semi-structured Interviews, questionnaires, observations and archive data were the most important data gathering instruments.

The results of this research (2001-2002) confirm the results of other researchers from various universities of Iran and other developing countries. The results indicate that students in both levels have used a few capabilities of the web technologies. The most important use of web technologies was for doing dissertation and research projects. No courses were presented by web technologies. Both groups were positive toward using computers and they believed that web technologies are useful for communicating and acquiring new information. Access to hardware and software, computer illiteracy, lack of research skills and web technologies knowledge were reported by the participants. Cultural issues related to social attitudes and beliefs were other expressed problems. The results of this study indicate that for using web technologies in developing countries, some consideration in different areas should be taken. These considerations would be discussed in this paper.

Creating Computerized Multimedia Chinese Language Lessons with the KEY 4.0 Timed Reading Module

Sheri Senquan Zhang
Department of Education, University of Ottawa, Canada
senquanzhang@hotmail.com

Abstract: The KEY software from the Canadian developer CJKWARE.COM is a word processing, authoring, learning and teaching system for the Chinese language (Japanese & Korean included). In addition to its existing E-Learn and lesson-authoring features, i.e. (a) automatic generation of Pinyin-with-tone-marks transcription for Chinese-character text, (b) Tool Tip lookup through the Chinese/English dictionary and (c) automatic glossary-building, the new (August 2002) version KEY 4.0 for both PC Windows and Macintosh OS 9.1 / OS X introduces a new E-Learn module for enhancing reading comprehension: Timed Reading. Through the built-in Chinese Text To Speech (TTS) system, the Timed Reading module allows the teacher of Chinese to automatically generate annotated interactive multimedia lessons from any Chinese text in electronic format, e.g., text from the Chinese web. It further enables the learner of Chinese to independently run electronic Chinese text as a computerized multimedia Chinese language lesson.

The Basic E-Learn Components of the Software

Besides being a word processing and desktop publishing system for writing Chinese, Japanese and Korean, KEY / MacKEY in its new version 4.0 (August 2002) includes several innovative authoring, teaching and learning features for the Chinese language. The structural E-Learn components that are integrated in the Timed Reading module are:

- The 240,000-word Chinese/English dictionary using the Tool Tip technique: hovering the mouse pointer on a word in the Chinese character text (without clicking) displays the word's Pinyin-with-tone-marks transcription, its English meaning(s), and further reads the word in its Modern Standard Chinese reading, with a natural human voice;
- The "Hanzi with Pinyin" feature: Chinese character text copied & pasted into the KEY edit screen, is supplemented upon learner request with a second parallel line of its Pinyin-with-tone-marks equivalent, with the correct word boundaries of the imported single-character-based text being automatically reconstructed;
- The bidirectional "Simplified / Traditional Chinese conversion" feature: Chinese Text in Traditional Chinese characters can be converted into Simplified characters. More importantly, Simplified Chinese character text can be correctly converted into its Traditional character equivalent, thus solving the Simplified / Traditional multi-mapping problem. (Explanation: During the language reform that took place in the People's Republic of China around the middle of the twentieth century, two, three or even more different complicated "Traditional" characters were consolidated into one "Simplified" character. Therefore, converting a Simplified character text to its Traditional character equivalent involves ambiguities that have to be resolved through a context-sensitive approach.)
- The Text To Speech module, which reads a marked text passage through the computer's audio system in standard Mandarin, with tone sandhi (change of tone depending on the tone of the following syllable) implemented;
- Automatic glossary-building for a given Chinese text: upon teacher / learner request, the Pinyin-with-tones transcription and the English meaning of words specified in a text are extracted from the dictionary and added to the word list in columnar alignment, resulting in a complete vocabulary glossary;
- The ability to create annotations to a Chinese text, even to multi-part grammatical structures; such teacher / student annotations can be hidden and viewed through the Annotation Tool Tip.

The Timed Reading module consolidates all these components, by allowing the teacher / learner to specify which of the features should be active when the KEY software converts a Chinese text into the E-Learn format of an electronic interactive multimedia lesson.

An Electronic Multimedia Chinese Language Lesson

Besides its interactive, dynamic multimedia capabilities, perhaps the greatest plus of an ad-hoc authoring system like KEY is the up-to-date nature of the resulting lessons. While conventional print-, video- and computer-based E-Learn materials may efficiently teach the basics of a foreign language through a fixed set of predefined lessons, language in truly authentic materials acts as a vehicle to deliver the current social and cultural meaning of the target language to the learners. Authentic materials can be used as a mirror of culture (Zhang, 2002), allowing learners to see how new vocabulary develops along with culture change. The world is changing rapidly in the 21st century, and in many ways is growing more transcultural than ever before (Atkinson, 1999). In other words, truly authentic materials reflect the language use, vocabulary and the culture of the target language community *here and now*, not of ten years ago when a particular text book or video course was created. The gap in authentic, up-do-date learning material is filled by an authoring and learning system capable of creating an ad-hoc reading lesson from *today's* newspaper article, which the learner can study *tomorrow*.

The dynamic ad-hoc authoring capabilities of the KEY 4.0 software are beneficial for teachers and students alike. Teachers can edit and annotate a news passage from the Chinese web and pass the lesson on to their students on diskette, or as an E-mail attachment – the students run the lesson on their multimedia computer. Learners at a more advanced level can independently copy & paste a text passage from the Chinese web onto their computer and instantly run it as a lesson with explanations. In more detail, with KEY 4.0 Multimedia learners of Chinese can

a) Select (=highlight) the Chinese web text displayed in their browser, and "Copy" it on the clipboard;
b) "Paste" the text into the KEY screen;
c) Select (=highlight) the text, and from the KEY Format menu choose "Hanzi with Pinyin". This displays a second line with the Pinyin-with-tone-marks equivalent of the Chinese character text. We can see from the word segmentation of the Pinyin transcription that the word boundaries were automatically reconstructed when the text was copied & pasted into KEY;
d) Use "Text To Speech" to listen to highlighted passages;
e) Use the "Dictionary tool tip" to display the meaning(s) of the Chinese words and their Romanization;
f) Check "Read tool tip with Text To Speech" to hear the Mandarin Chinese reading of the words;
g) Convert the Chinese text into a dynamic, interactive multimedia lesson, by pressing the "TR" (Timed Reading) button on the toolbar, and specifying the various "checks" they want included in the lesson;
h) Run the multimedia lesson in interactive mode;
i) Use the Annotation feature to annotate certain words, grammatical particles, multi-part structures etc.; hide the annotations, and retrieve them with the "Annotation Tool Tip".
j) Automatically build a Chinese/English glossary for the Chinese text, by
    - Copying/pasting the text beneath itself, so that it appears on the screen twice;
    - Using "Return" to segment the second copy of the text into words, one at the beginning of each line;
    - Clicking "Convert to Glossary" (Format menu), which automatically provides the pronunciation and the English meaning for each term, arranged in columns.

In summary, the KEY 4.0 Chinese authoring, teaching and learning software

- Enables learners to analyze and comprehend authentic Chinese web text,
- Allows teachers of Chinese to generate a dynamic multimedia lesson from static Chinese text, such as from the Chinese web.

In the contexts of FLA (Foreign Language Acquisition) and SLA (Second Language Acquisition), this Chinese authoring, teaching and learning system shows a way to complement classroom-based instruction and print-based teaching material with corollary software-based teaching- and learning techniques. Enabling the various features in the checkboxes of the Reading Timer panel allows the learner to thoroughly analyze a Chinese text passage, within the self-imposed time constraints of the Reading Timer. Word boundaries, pronunciation, Pinyin transcription and the English meaning are taught in a dynamic and integrated multimedia lesson. The developer's website is http://www.cjkware.com

References

Atkinson, D. (1999). TESOL and Culture. *TESOL Quarterly*, vol. 33, No. 4, 625-654.

Zhang, S. (2002). Cultural Communication and Miscommunication: Chinese MBA Students in a Canadian Academic and Sociocultural Context. Doctoral dissertation. University of Ottawa.

Mathematics Education Markup Language

Paul S. Wang* Yi Zhou Xiao Zou
Institute for Computational Mathematics
Kent State University
Kent, Ohio 44242-0001, USA

August 18, 2002

Abstract: On-going design of *Mathematics Education Markup Language* (MeML) is presented. MeML is an XML-based language and the key component of Web-based Mathematics Education framework (WME) under investigation. MeML enables authoring of systematic and interoperable mathematics education pages that may contain *active parts* for various mathematics and educational purposes such as example generation, answer validation, difficulty diagnosis, exploration, and plotting of curves and surfaces. A server-side MeML interpreter performs the dynamic computations in an MeML page and generates a regular Web page for delivery to regular Web browsers.

1 Introduction

Web-based learning has anywhere-anytime availability and many distinct advantages. Currently, there are several problems on authoring Web pages for mathematics education: technique obstacles, computation difficulty, time consumption, lack of five ilities (modularity, reusability, exchangeability, adaptability, and machine-understandability). Recent advances in *Internet Accessible Mathematical Computation* (IAMC) and MathML [4] make delivering mathematics education over Web really possible. There are also many Web Sites providing mathematics tools [1]. Efforts have been made by Institute for Computational Mathematics (ICM/Kent) to build a *distributed IAMC framework*[3].

We propose MeML aiming to systematically solve the existing problems for Web-based mathematics education. MeML is a pivotal component in *Web-based Mathematics Education* (WME) [6] framework being investigated by our research group at ICM/Kent.

2 Context of MeML

MeML functions within the WME framework that aims to support easy development and deployment of *mathematics educational content* and *mathematical & other support programming* for the Web. Content pages and support programs can be developed independently and interoperable from anywhere over Web. Figure 1 shows the WME framework architecture.

3 Goals Of MeML

MeML is designed to facilitate authoring, storing, processing, and exchanging learning materials for mathematics education over Web. MeML can represent mathematics domain knowledge, describe the actions during mathematics education (such as exercising, assessing, and etc), and do the computations for mathematics education at high school or college level through back-end computing engines. MeML is designed with following merits:

- *Easiness:* MeML pages can be authored with any text editors or MeML authoring tools without knowledge of HTML, Web programming and etc., which overcomes the technical obstacles for them.

---

* Work reported herein has been supported in part by the National Science Foundation under Grant CCR-0201772 and in part by the Ohio Board of Regents Computer Science Enhancement Funds.

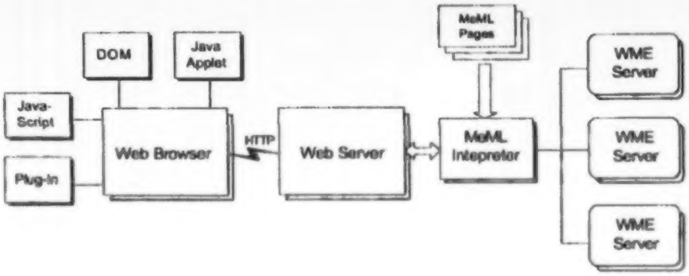


Figure 1: WME Architecture

- *Computation:* MeML provides advanced computation with the MeML back-end support, which dramatically ease authoring tasks.
- *Efficiency:* MeML Authors only need to define *what to be taught in what ways*. How to obtain mathematics teaching stuff is internally done by MeML back-end supports.
- *Modularity & Reusability & Exchangeability:* With MeML structure elements, the content of web pages can be organized into well-defined modules, which provides reusability and exchangeability and makes full use of mathematics education resources over Web.

4 Design of MeML

Mathematics Education Markup Language (MeML)[7] can embed MathML in it and can be embedded in HTML pages. An MeML page can have both fixed and dynamically generated contents. MeML interpreter controls content generation and accesses WME servers for certain requested information. One MeML page can specify all necessary interactions for Web-based Learning. All MeML elements are encapsulated in the `<meml/>` element. MeML has five types of elements: *content elements*, *education elements*, *structure elements*, and *computation elements*.

5 Conclusion and Future Work

MeML enables authoring Web pages for mathematics education easily and efficiently. It shelters authors from the technical complexity. Our solution is implemented on Windows 98/2000/xp with Apache Http server 1.34, and MathLink/Mathematica 4.1. In the future, we will focus on refining the draft of MeML specification, and implementing a full version of MeML context - WME framework.

References

[1] L. Beccerra, O. Sirisaengtaksin, and B. Waller (2000). On Categories of Interactive Computational Web Tools, *ATCM 2000, Proceedings of the Fifth Asian Technologies Conference in Mathematics*, Chiang Mai, Thailand, December 2000.

[2] S. Linton and A. Solomon (1999). GAP, OpenMath, and MCP, *Proceedings, IAMC'99 Workshop*, July 1999.

[3] P. Wang, S. Gray, N. Kajiler, D. Lin, W. Liao, X. Zou (2001). IAMC Architecture and Prototyping: A Progress Report, *Proceedings of ISSAC 2001, International Symposium on Symbolic and Algebraic Computation*, pp. 337-344, July, 2001.

[4] Mathematical Markup Language, `http://www.w3.org/Math/`

[5] MathLink, J/link, `http://www.wolfram.com/solutions/mathlink/`

[6] Paul S. Wang, Norbert Kajler, Yi Zhou, and Xiao Zou (2002).Initial Design of A Web-Based Mathematics Education Framework, *Proceedings Internet Accessible Mathematical Computation 2002 Workshop*, Lille, France. `http://www.symbolicnet.org/conferences/iamc02/wme.pdf`

[7] MeML Document Type Definition. `http://www.mcs.kent.edu/~yizhou/MeMLDTD.pdf`

HAPPENINGS: A FORAY INTO ELEARNING

The purpose of this poster session is to provide an overview of Happenings, a type of e-Learning and to provide a walk-through of three Happenings. The poster will be divided into two segments. The first segment, titled, "About Happenings" provides an overview. The second segment, titled, "Examples of Happenings" will demonstrate three Happenings being developed by Education Development Center, Inc. (EDC).

About Happenings

This component of the poster session will present and describe our definition of a Happening, its purpose, intended audiences, and design principles.

A Happening is an online learning event for educators. The purpose is for classroom teachers, specialists, and administrators to deepen and expand their knowledge on a particular topic. A Happening is similar to an online workshop in that it seeks to promote professional development through a series of interactive activities. But it is characteristically more playful and less structured. Therefore, it serves as an effective foray into e-Learning for teachers who are interested in pursuing new modes of learning, but whom may be new to online learning.

In designing our Happenings, we adhere to the following set of design principles:

- Each Happening focuses on a well-defined topic.
- Happenings are short in duration, often lasting between two and four weeks.
- There is no formal registration process.
- The navigation is easy to understand and intuitive, requiring few directions.
- For some Happenings, participants can choose multiple entry points; a structured order sequence is not important.
- The activities are designed to be engaging, drawing on current research and findings about adult learners.
- There is an expectation that participants will try out ideas from the Happening in their classrooms and then report back the results online.
- The Happenings make liberal use of graphics and photographs.
- Video clips are used to enhance online instruction.
- Participants can easily access additional information by following links to other noteworthy web sites.
- Activities are connected to discussion areas that are facilitated by a qualified facilitator.
- A technical moderator is available to answer questions about the web site, navigation, and discussion software before and during the Happening.
- The "Big Ideas" are summarized and added to the web site at the conclusion of the Happening.

Examples of Happenings

We will present Happenings that are being created for as part of the total professional development program for two projects at EDC: the Literacy Matters Project (funded by the Annenberg Foundation) and the LINK US Project (funded by the U.S. Department of Education).

Literacy Matters

The Literacy Matters Professional Development Program seeks to help teachers and reading specialists improve the reading and writing of all students, and especially students who struggle with literacy development. Literacy Matters offers instructional leaders and teachers a coherent set of activities and resources: face-to-face workshops; access to the Literacy Matters web site; an opportunity to participate in a series of Happenings; video conferences conducted in between the Happenings; a teacher sourcebook containing curriculum materials; and guidelines to support implementation at the local level.

The poster session will present the Happening called, "Literature with Inclusive Themes" Help Me! Find What Works for the Middle Grades." The purpose of this Happening is to help teachers locate and effectively use literature that values diversity.

The Happening, mounted on the Literacy Matters web site, invites teachers to participate in interactive activities such as the following.

- *A Teacher's Dilemma*: Through text, audio, video, and photographs we present a common issue related to the theme as a springboard for teacher discussion.

- *Try It!:* Participants are encouraged to download instructional materials, try them out in their classrooms, and report back what happened.

- *Point/Counterpoint:* Participants debate the pros and cons inherent in two different philosophies about teaching and learning.

- *Read and Discuss*: Participants read and discuss selected online journal articles.

- *Kid's Gallery:* Teachers will invite students to publish their compositions, excerpts from journals, poems, essays, and artwork.

BEST COPY AVAILABLE

- *CyberGoodies:* Participants link to theme-related instructional resources cited on the website and discuss how they used them in their classroom.

- *Links Plus:* Participants access an annotated, hyper-linked bibliography of theme-related materials, most of which are free.

- *Analyzing and Evaluating Student Work:* Teachers post students' compositions and develop a protocol for discussing common characteristics.

LINK•US

The LINK•US Project has developed a comprehensive professional development program called, STAR TECH (Supporting Teachers to Achieve Results by Integrating Technology). The goal of the program is to improve the way in which teachers in urban school districts integrate technology tools into the curriculum to benefit all students with diverse needs and abilities, and especially those students who have disabilities. In the STAR TECH model, teachers meet in small school-based teams to carry out a process that links curriculum, instruction, and assessment to the use of technology. During team meetings, teachers and specialists discuss the abilities and needs of diverse students, clarify curriculum, goals, generate powerful instructional activities that embed technology, and plan assessment. To make the link between instruction and assessment as tight as possible, they follow a protocol to look at student work. In addition to this ongoing face-to-face professional development activity, teachers also have access to Happenings.

We will present two of the LINK•US Happenings. These Happenings were created to provide more structure than the Literacy Matters Happening, whereby teachers to follow a guided, multi-week process.

The first Happening, entitled "E-Team," was designed to serve as an introductory Happening. In this Happening teachers do they following:
- Read a classroom-based problem that is reminiscent of the one teachers pose in face-to-face meetings, and then follow links to additional information
- "Vote" for a solution and discuss their reasons for making that choice
- Engage in online conversations.

In the second Happening, called "STAR Quality Classrooms," teachers become members of a virtual team. This Happening was designed to link teachers across numerous urban school districts, giving them a chance to broaden their collaborative work. Online, participants are able to engage in the same process of discussing student work, curriculum, instruction with technology, and assessment as they do when they are face-to-face.

This Happening runs for four weeks, with each week having a different activity as described below. For each activity, teachers select the grade level that is appropriate for them (K-2, 3-5, 6-8).

- *Week 1: Imagine.* Teachers engage in an activity called "Imagine." Teachers are provided with information about a fictitious student and a particular technology tool (e.g., portable keyboard, Inspiration, sticky notes). The teacher is invited to imagine using the tool and post a description of the activity, along with imagined curriculum goals and assessment strategies. After a week of postings, participants can view a chart that synthesizes all of the ideas.

- *Week 2: Looking at Student Work.* This activity replicates the looking at student work process that occurs within the school-based teams. Teachers are introduced to a fictitious student and provided with the highlights of his strengths and needs, provided with the curriculum goals, given a "problem" posed by the classroom teacher. Teachers then study the student work online and make interpretations. They also offer suggestions for strategies.

- *Week 3: Try It!* During this week, participants have access to varied lesson plans that integrate technology. Teachers are encouraged to find a colleague and try out one of the activities. They then report back by explaining their curriculum goals, what they did to implement the activity, assessment strategies, and what they learned about their students' performance.

- *Week 4: Galaxy of Stars.* The last week is the culminating activity. On screen are photos of teachers superimposed on stars to create a "galaxy." Participants can click on any of the teachers who have tried out activities and taken the time to report results. After clicking on the picture, participants can read about the activities the teachers tried. They can send an email with comments and questions.

The poster session will be lead by Judith Zorfass, lead designer of Literacy Matters and LINK•US and Jen Minotti, web designer and technical consultant. Those attending this poster session will have access to information mounted on the poster board and provided in handouts; will be able to try out the Happenings online; and will be able to ask questions and make comments.

BEST COPY AVAILABLE

The Personalized Courseware Authoring Tool

Yanhua Cao
National Laboratory of Machine Perception and Center for Information Science
Peking University, Beijing 100871, China
Yhcao@cis.pku.edu.cn

Abstract: With the personalized digital service more and more applied in e-commercial, recently, the personalized conception is introduced in the modern distance education. So far, what has been more discussed is to have the platform of the distance education process the personalization, which can deliver an appropriate material to the different learners according to the different learners' behavior, such as accounts of visiting favorite course, frequency of visiting and steps of learning. In this paper, we introduce the personalization into courseware authoring system. The personalized courseware authoring tool is mainly for an instructor to prepare the lessons that can be browsed in a distance learning platform. Using the tool, an instructor can frame the personalized courseware that can provide the special learning material matched to the learner's learning foundation, step, style and impact.

1 Introduction

"Providing special treatment in the form of information and applications matched to a visitor's interests, roles, and needs is known as personalization." With the development of the modern distance education, the personalization in the distance education becomes more and more important. But in the distance education platform, the courseware is "static", i.e. it's invariable at every time when a learner visits the webpage. In our opinion, if a courseware is "dynamic", it can meet the different needs of the different learners. When the learner visits an on-line course in its own styles and steps, the courseware can form the webpage dynamically to fit the learner. We call this dynamic courseware as a personalized courseware. Therefore, we propose a tool that can author the personalized courseware.

The paper contains four sections. In Section 2, we will discuss the personalized thought revealed in courseware authoring tool. In Section 3, we will introduce the structure design of the tool. Finally, the conclusion and the future work will be presented in Section 4.

2 The personalization in the courseware authoring tool

2.1 The personalized teaching pattern

We adopt the multiple-unit model in our authoring tool. The beginning of a course is set according to the individual differences of the different learners, then the best track is chosen according to the learning impact, finally the same academic goal is attained.

2.2 The personalized teaching strategy

We adopt the adaptive diagnostic teaching strategy in our authoring tool. The evaluating system is designed for evaluating the condition of student's knowledge and learning impact before and during the learning progress, to adjust adaptively the teaching strategy via feedback suggestion. Then a series of performance objective is established for the different learners in each learning stage. Finally teaching unit is designed utilizing the different teaching material, medium and learning route according to student's characteristic.

3 The design of the tool

The tool is composed of the four modules: Content-editing, Templet-forming, Learning- strategy, Testing-evaluating. Compared with the conventional courseware producing tool, the following different objects are designed.

- **Instructive object**

The instructive object is a least unit. It is composed of text, hyper text, animation, audio, video and image. It is an independent knowledge point in a teaching material or book. Teaching content is separated into a series of learning object so as to be organized into a flexible course unit.

- **Instructive link**

The instructive link gives the sequence of instructive objects, indicating their correlation and instructive order.

- **Testing object**

The testing object is consisted of testing item and testing value, indicating the degree of obtaining the instructive object and the value of spanning the instructive object.

- **Encapsulation Format**

The encapsulation format defines the present interface and representation form of the instructive object. In the tool, sorts of characteristic templet are offered to be selected.

- **Resource link**

The resource link is the super link to the instructive object's reference information, relevant information and relevant FAQ (Frequency Asking Question).

- **Customer object**
  - The customer mark records the learner's present level of attaining the instructive object, and the sign of spanning the instructive object.
  - The usage range describes the suitable user of instructive object.
  - The time range indicates the maximum and minimum time for learner to obtain the instructive object.

Meanwhile, to match the using of the personalized courseware, the dynamic network service management technology is adopted in the distance education website, so that can dynamically, nonlinearly, stretchable, customized recombine or adjust the network teaching service according to each learner. The instructive courseware is enveloped by XML language, defining the element, attribution, mark, entity and correlation in XML schema, representing the courseware with CSS.

4. Conclusion

Our personalized courseware authoring tool provides a simple and efficient way to edit a courseware that can meet the learner's personal need. In the future, we will perfect our tool and the corresponding tool to build up a whole personalized education system.

Reference

[1] Abidi, S.S.R.; Goh, A. (2001). "A Web-enabled Exam Preparation and Evaluation Service: providing real-time personalized tests for academic enhancement", Advanced Learning Technologies, 2001. Proceedings. IEEE International Conference on, 2001, Page(s): 441 -442.

[2] Koyama, A.; Barolli, L.; Tsuda, A.; Zixue Cheng (2001). "An agent-based personalized distance learning system", Information Networking, 2001. Proceedings. 15th International Conference on, page(s): 895 – 899.

[3] IBM High-Volume Web site team, "Web site personalization", Jan. 2000, http://www-900.ibm.com

Other Papers

Meeting Students Expectations and Realizing Pedagogical Goals within the Development of a Virtual Learning Environment

Christine Frank
Decision Support & OR Lab - University of Paderborn, Warburger Straße 100, D - 33098 Paderborn, Germany
Email: cfrank@notes.upb.de
Phone: +49 5251 602416

Stephan Kassanke
Decision Support & OR Lab - University of Paderborn, Warburger Straße 100, D - 33098 Paderborn, Germany
Email: stephan@kassanke.com
Phone: +49 5251 602416

Leena Suhl
Decision Support & OR Lab - University of Paderborn, Warburger Straße 100, D - 33098 Paderborn, Germany
Email: suhl@upb.de
Phone: +49 5251 605246

Abstract

This paper addresses the importance of assessing and realizing student's needs and expectations while developing a virtual learning environment (VLE). Realizing student's needs in the development of the VLE is one of our key interests out of the pedagogical perspective in the project "Virtual OR/MS" (Vorms). Only if we involve our target group in the design and development process of the learning environment we can ensure that they are going to be satisfied with the product we are developing for them. The thoughtfully defined target group is the basis for developing effective evaluation forms. This paper describes the results of the combination of qualitative and quantitative empirical research and evaluation.

1 Introduction

The project Virtual OR/MS is funded by the BMBF (Federal Ministry of Education and Research) of the German Government. It involves seven German partners from six Universities. The goal of the project supports the four trends as judged by Longworth to be essential in managing the challenges of the 21st century:

1. increased use of educational tools and techniques,
2. greater use of national and international networks,
3. development of co-operative and two-way partnerships, as well as
4. development of learning organizations and individual empowerment

(Longworth 1996).

The close cooperation with the project OR-World (Kassanke 2000, Kassanke 2001), funded by the European Community, enables us to build upon an already existing technological framework. The learning and teaching environment created in OR-World is non-linear and multidimensional allowing cost-effective creation and sharing of materials as well as a personalized mix of contents. Vorms focuses on content generation. Students will be able to visit courses which are based on joint hypermedia environments or explore the hyperspace in a self-study process. Looking upon these goals from a pedagogical point of view, it is very important to design a didactical concept. This concept will integrate the expectations of the target group where possible.

To meet student's expectations in a VLE it is essential to know as much as possible about the target group. In a first step of the realization of our pedagogical goals this was done by the team members of the Vorms project. After outlining for whom the VLE is being developed, the expectations of these persons were evaluated. This was done by conducting a combination of qualitative research, realized as group discussions, and quantitative research, in form of a questionnaire. The evaluation methods, their results, and the conclusions we made for the development of our VLE are the focus of this paper.

2 Target Group

Defining the target group is an essential step in the development of a learning environment (see Euler 1992, p. 85). For the time being Vorms focuses on University students, who specialize in Operations Research (OR). In the future, Vorms also wants to address company employees, who want to extend their knowledge about OR. These two target groups are very homogeneous considering the relevant characteristics for the learning environment, thus it is possible to widen the scope of the target group for the future.

Learners who are interested in the subject OR and have a business background are the target group for Vorms. Their situative, affective and cognitive dispositions can be characterized as follows:

Situative disposition

- Computer-familiarity is rated between high and very high.
- Content-familiarity is rated as low.

Affective disposition

- The acceptance of computer aided instruction is rated as high.
- Learning demands are factual.
- Feedback in the learning process is received as objective, not as personnel feedback.

Cognitive disposition

- An active, intrinsically motivated learning style is assumed.
- The subjective perception is the favorable perceptive faculty.
- Abilities of processing new information are rated as high.

3 Evaluating students expectations

The systematic evaluation was divided into two parts (see Stufflebeam 1985, p. 176; Falk 1995, p. 123). In the first part qualitative, empirical research was done to collect qualitative data. In the second part, the results of the qualitative data were validated, by transferring them into a questionnaire, a quantitative research method, to determine the distribution of the expectations.

3.1 Group Discussion

The group discussion is a qualitative, empirical method and is used to give the interviewees freedom to state what they think, without pressing them into predefined categories (see Kromrey 1998, p. 267; Flick 1996, p. 10). Approximately 120 students were interviewed in groups of about 10 students per group. Techniques such as free associating (see Schnell 1988, p. 391) were used to identify topics of importance to the learners, and other techniques such as focusing (see Koenig 1999, p. 149) were used to explain these topics. After identifying and defining topics of importance, additional key questions were asked, to make out further topics of interest. The results of the group discussion were rated systematically in form of a category system (see Koenig 1999, p.162).

Results of the group discussion

Students expectations regarding VLEs can be grouped into the following categories:

- Installation
- User-orientation / Navigation
- Software-ergonomics
- Content
- Learning Assessment
- Help Functions
- Examples
- Internet Functions.

Installation

If installation is necessary, students expect installation and de-installation to be fast and complete, leaving no debris after de-installation. Students want to be able to decide the installation path themselves, they do not want it to be a default setting. There should be more than one installation version of the program, i.e. a customized version for laptops is rated as important.

User-orientation / Navigation

The main expectation in the category of user-orientation is that the learning environment meets common standards. Students want the navigation to be easy and intuitive to use. Students want to be able to navigate freely to explore the learning environment, as well as being able to use guided tours. They want the possibility to activate a guide, that shows them how the program works. Pages that have been opened before should be marked visited, with the option to clear the mark manually. Many students declare, that they want to be able to use bookmarks, make their own comments on pages or use highlighting pens.

Software-ergonomics

Few students come up with this topic on their own. Once asked by the interviewer many students stated, that the learning environment has to have good software-ergonomics. After inquiring further, the students were not able to describe what they meant with "good", mostly they said they couldn't describe it, they would need to have an example and then they would be able to say this product has good or poor software-ergonomics.

Content

Students expect a VLE to give an overview of all topics covered in the corresponding lecture. Contents of the lecture and the learning environment should be synchronized. One idea to realize this is to offer a guided tour, which is built up in the same structure as the lecture is. The electronic version should extend the contents of the lecture, so if the student is interested in a certain topic, he can get more information to this topic from the learning environment, and he does not have to search in any other information resources. Some students want the VLE to offer complete exam preparation. Several students wanted the VLE to offer different access possibilities to explanations. For example they imagined choosing either textual or mathematical explanations for the exercises. Most students requested the VLE to estimate the time needed to complete a learning sequence.

Learning Assessment

Some kind of learning assessment is requested by almost every learner. Students want the VLE to supply plenty of questions so they can practice very much, not having to repeat the same examples over and over again. They want to choose exercises from a pool of questions with varying difficulty levels. Some students want to choose the difficulty level themselves. Others would prefer for the VLE to keep track of how good they are and ask the next questions according to their skill level. These students would like the VLE to decide in which area they have trouble answering questions correctly, and then ask them questions to these subjects. Several students state that they want some kind of reward for questions they answered correctly. This should not be too time consuming however. Several students proposed integrating a function, which simulates tests. Miscellaneously picking out questions and giving the students only a certain time to answer them – similar to doing a test in class. They are also keen on integrating tests, including their answers, out of the previous semesters into the VLE. It was also proposed to integrate a feature for sending questions to a tutor via email and getting personnel feedback.

Help Functions

Helping functions such as an abbreviation dictionary, an online help, a search function, an English dictionary, a glossary, and an overview of all used symbols are asked for.

Examples

Students want the VLE to offer many examples. They should not only be theoretical ones, but also ones out of real practice. Transfers of theory problems to real life problems should be made. Simulations and animations are also requested by the students to illustrate problems. The speed of animations should be individually settable and an animation must be stoppable at any time. It seems very important to the students to integrate all examples used in the lecture.

Internet Functions

An internet-based learning environment would be favored by some students to enable group work und update functionalities. They would like to be able to learn from anywhere at anytime. Some students proposed implementing discussion databases, but even though they wanted them, they were not sure, if they would use them regularly.

3.2 Questionnaire

The second part of the evaluation uses the questionnaire method to validate the quantitative data collected in the first part. The questionnaire was developed according to the results of the group discussion. The questionnaire was answered by 58 students. 42 male students and 16 female students. This relation of male to female students represents the target group. The gender differences will be pointed out in the evaluation of the questionnaire.

Results of the questionnaire

The results of the questionnaire will be presented in the two categories: Work Independently and Self Assessment. The categories of the group discussion can be divided into two major categories. These are shown below in table 1.

Work Independently	Self Assessment
• Installation	• Learning Control
• User-Orientation / Navigation	• Help Functions
• Software-ergonomics	• Examples
• Content	• Feedback
• Internet functions	

Table 1: Categories of the Group Discussion

Work Independently

69% of the men and 50% of the women want to choose between different installation types. They want to have the possibility to install only parts of the program, for example a laptop version. 67% of the men and 81% of the women want some kind of explanation of how to use the program.

Students want to customize their learning material. They want to use bookmark functionalities and virtual highlighting pens. 52% of the men, and 88% of the women consider it important to post their own comments on a page. 94% of the women, and 88% of the men want to be able to use bookmarks. 93% of the men and 88% of the women want pages they have visited to be marked. A highlighting pen is requested almost equally by 69% of the women, and 62% of the men. 60% of the men and 50% of the women find it necessary to be able to customize their learning material by exporting parts into different programs (for example Power Point).

Students want to be able to use the VLE intuitively. They do not want to spend very much time to get used to the navigation. 88% of the men, and 50% of the women want the layout of the VLE to comply with common standards (for example Windows).

The majority of the students want learning sequences to be between 30-45 minutes. 44% of the women want the VLE to be server-based to enable working in groups. Only 24% of the men find this important. On the contrary, when asking if they want group work, 43% of the men said they did not want to VLE to support group work. Only 12% of the women wanted the VLE not to support group work. 67% of the men want the VLE to be accessible over the internet, 50% of the women thought so, too.

Self Assessment

Students prefer "pull-information" rather than "push information". They want to decide what they want to learn and when they learn it. 67% of the men, and 63% of the women want to be able to choose if explanations to questions are based either on text or on mathematical formulas. 83% of the men and 100% of the women want to choose exercises varying in difficulty levels i.e. beginner, advance and expert. 62% of the women and only 31% of the men want praise from the VLE if they answer a question correctly.

On the one hand students would like to use the VLE on their own, without being dependent on a teacher, but on the other hand, they want the VLE to try to simulate a classroom atmosphere. If the student does not understand an explanation in class he can ask the teacher to explain it in different words, and that's what 88% of the women and 76% of the male students are now asking from the VLE. They would like the VLE to have more than one formulation as an explanation to a problem. Getting personnel feedback is important to the majority of the students. 69% of the men and the women want to be able to send exercises to a personnel tutor who corrects these and then gives them feedback.

4 Conclusions

The wish to work independently expresses itself not only in the evaluated figures, but also in the strong participation in the group discussions and the questionnaire. Our students want us to enable them to work independently. "Today's students, young or old, are leaning towards participatory education and are no longer satisfied to be passive recipients of knowledge" (Erskine 1998, p. 7). We realize this, for example by giving them an approximate timing of lessons to help structure their learning activities according to their needs (see Hill 1997, p.76). We support customization of learning material by integrating common features, e.g. bookmarks, comments, highlighting pen etc. and extending them with a tool still in development called SmartBars. It will enable students to show or hide footmarks, diverse highlighting functions, hints to further going literature, notes from the author, notes from the learner etc. (see Reiners 2002). Intuitive navigation within Vorms will be made possible by offering navigation through hyperbolic trees (see Reiners 2002). The development team of Vorms is convinced that hyperbolic trees are very intuitive to use. What students think about this is going to be evaluated in the future. The implementation depends on the results of this evaluation.

We support the student's wish to work flexibly by giving the synchronization between lecture and VLE a high priority. This way we "…can empower students so learn in new ways and to develop higher-order cognitive skills" (Falk 1995, p. 9).

Our students want to influence the difficulty level of exercises and questions and the way problems and exercises are explained. On the one hand, our students want to learn actively in a constructivist way (see Entwistle 1991, p. 340). On the other hand however, they seem to want programmed instruction (see Criswell 1989, p. 4) because they want the program to make decisions for them, for example giving them a question which has the adequate difficulty level, or telling them in which content areas they still have weaknesses. We are going to continue research in this area, to try to identify the factors that create these different preferences.

The ongoing development of Vorms focuses on those functions, that were evaluated to be of importance to the students. We will transfer the student priorities into the priorities of development. As shown in the questionnaire, there are several differences in the preferences between men and women. The development of Vorms is also going to keeping track of these gender differences.

"In looking at this new learning environment, it is important to remember that the technology does not *cause* the change. Instead, it is probably better to say that the capabilities of the new technologies allow us to facilitate change" (Miller 1996, p. 42). We feel that it is important to integrate those persons into the development process, who are supposed to profit from the new technology. For this reason, we will keep our students integrated in the formative evaluation of the learning environment Vorms.

References

Criswell E.L. (1989). The Design of Computer-Based Instruction. MacMillan, New York.

Entwistle N. & Entwistle A. & Tait H. (1991). Academic Understanding and Contexts to Enhance It: A Perspective from Research on Student Learning. In: Designing Environments for Constructive Learning (Duffy T.M. & Lowyk J. & Jonassen D.H.), NATO ASI Series, Series F: Computer and System Sciences, vol. 105, Springer-Verlag, Berlin, pp. 331-358.

Erskine J. & Leenders M. & Mauffette-Leenders L. (1998). Teaching with cases. Ivey Publishing, London.

Euler E. (1992). Didaktik des computerunterstützten Lernens. BW, Bildung und Wissen, Verl. und Software, Nuernberg.

Falk D. & Carlson H. (1995). Multimedia in Higher Education. Learned Information, Inc., Medford, NJ, USA.

Flick U. (1996). Handbuch Qualitative Sozialforschung. Beltz, Psychologie-Verl.-Union, München.

Hill J. (1997). Distance Learning Environments Via the World Wide Web. In: Web-based Instruction (Khan, B. H.), Educational Technology Publications, Englewood Cliffs, NJ, pp. 75-80.

Kassanke S. & Steinacker A. (2001). Learning Objects Metadata and Tools in the Area of Operations Research, Proceedings of EdMedia 2001, Tampere, Finland, June 2001.

Kassanke S. & Suhl L. (2000). OR-World - Using Learning Objects in a Hypermedia Learning Environment. Proceedings of EdMedia 2000, Montreal, Quebec, Canada, June 2000.

Koenig E. & Volmer G. (1999). Systemische Organisationsberatung. Dt. Studien-Verlag, Weinheim.

Kromrey H. (1998). Empirische Sozialforschung. Leske + Budrich, Opladen.

Longworth N. & Davies W. (1996). Lifelong learning – New vision, new implications, new roles for people, organizations, nations and communities in the 21st century. Kogan Page, London.

Miller G. (1996). Technology, the curriculum and the learner: Opportunities for open and distance education. In: Supporting the Learner in Open and Distance Learning (Mills R.; Tait A.), Routledge, Great Britain, pp. 34-43.

Reiners T. & Reiß D. & Voß S. (2002). Using Hyperbolic Trees and SmartBars within Virtual Learning Environment Concepts. To appear in: Proceedings of the Networked Learning Conference, Berlin, May 2002.

Schnell R. & Hill P. & Esser E. (1988). Methoden der empirischen Sozialforschung. Oldenbourg, München.

Stufflebeam D. & Shinkfield A. (1985). Systematic Evaluation. Kluwer-Nijhoff, Massachusetts.

Visiting heritage landscapes: creating and using an E-media fieldtrip as an educational resource.

D. Craig Whitehead (Planning),
Lesley A. Gardner (Management Science & Information Systems)
& Simon J. Holdaway (Anthropology)
University of Auckland
New Zealand
c.whitehead@auckland.ac.nz
l.gardner@auckland.ac.nz
sj.holdaway@auckland.ac.nz

Abstract: This session describes the educational advantages of and the practical issues in creating a virtual or E-media fieldtrip. The linkages between this educational tool and its further use in heritage management and tourism planning are also explored.

Field trips and site visits are essential components of many academic programmes. These types of activity are incorporated into courses to enable students to experience a location and to encourage a better understanding of an area by observing its characteristics. They are also mechanisms for introducing fieldwork methods and techniques. This teaching method, used in both secondary and tertiary sectors, is well established. It produces positive educational outcomes and is difficult to substitute any other conventional teaching methods to achieve similar results. The choice of location, however, is often an educational compromise, controlled by many factors such as; travel time, cost, amount of suitable accommodation, and effects upon the social and environmental nature of the location.

The material presented does not attempt to suggest that new technologies can adequately replace the field trip or site visit. It does, though, propose using new and evolving technologies as an adjunct support tool or an alternative when an ideal site is inaccessible. Where access to the field site is limited it is often necessary for students to refer to preparatory materials. Restricted access may be due to, danger at the site, remoteness, cost or the physical abilities of a student. Students with restrictions on their ability to reach the location at the specific time of the visit can also be affected, as are those students who are engaged in following a course of study by distance learning.

The educational mixture of the authors involved in this research brings together a number of relatively new and evolving technologies to create a model, or representation, of an island of archaeological and heritage significance which can be used as a "virtual site" for a "virtual fieldtrip".

The virtual reality (VR) environment created integrates visual material within a three dimensional spatial model of a south pacific island, Motukorea in the Hauraki Gulf. The fieldtrip brings together existing technologies for spatial modelling and VR techniques within a hypermedia data structure designed to allow effective and efficient delivery. The presentation includes examples of the Motukorea prototype comprising of panoramic VR with spatial orientation and virtual "fly throughs" of the landscape. The results of this experiment are shown and discussed to illustrate issues of data collection, modelling and display.

This session discusses aspects of technical and pedagogical issues of virtual field trips as educational support tools; it looks at the island, Motukorea (or Brown's Island) as a fully photographed and modelled experiment in VR techniques. Methods are presented which address a number of digital photography and software issues which arose during the project.

The prototype for this virtual fieldtrip can be viewed at:

www.people.auckland.ac.nz/Craig/Motukorea/

Author Index

A.Razak, Aishah ... 2448
Abbitt, Jason ... 53, 1100, 2527
Abel, Marie-Hélène ... 61
Abernethy, Ken ... 2529
Adams, Sterlin ... 2531
Adcock, Phyllis ... 1103
Aerts, Ad ... 240, 1386
Agarwal, Shailesh ... 1035
Aggen, William ... 806
Agostinho, Shirley ... 2609
Aguilar, Marycarmen ... 1521, 1525
Ahmed, Ibrahim ... 2533
Ajhoun, Rachida ... 1183
Akaiwa, Frank ... 1106
Akinyemi, Adekunle ... 1109, 1113, 2535
Akpolat, Hasan ... 2627
Alamaki, Harri ... 67
Alex, Von Eye ... 1655
Ali, Ahmed ... 1116, 2537
Allen, Chris ... 945
Allen, Christopher ... 1590
Allen, W. Clayton ... 1424
Allert, Heidrun ... 75, 1120, 1124, 2086
Alrawahi, Zahra ... 83, 91
Amaral, Telmo ... 1358
Ananny, Mike ... 1128
Anastasiades, Panagiotes ... 2539
Anderson, Tom ... 2623, 2627
Anderton, Betsy ... 1132
Apperley, Mark ... 1866
Appratto, Francesco ... 2579
Aragon, Steven ... 529
Araujo, Carlos ... 1136
Aspden, Liz ... 2043
Astinov, Ilario ... 968
Aufenanger, Stefan ... 1140
Autrey, Kathy ... 1981
Awalt, Carolyn ... 682
Azevedo, Isabel ... 1142, 1859
Bacallao, Aldo ... 1146, 1148
Bacallao, Mary Kay ... 1146, 1148
Bacer, Kathleen ... 1151
Backer, Patricia ... 1155
Bai, Hua ... 2356
Bailin, Alan ... 1159
Bajcsy, Julius ... 1973
Bajnai, Judit ... 2218
Baker, Larry ... 1814
Baniulis, Kazys ... 2542
Baptista Nunes, Miguel ... 98
Barbatsis, Gretchen ... 1655
Barber, Dianne ... 1718
Barber, Sandi ... 2700
Barber, William ... 104, 1163
Barbour, Michael ... 2544
Barnes, Tiffany ... 1167
Batovsky, Julie ... 1171
Batson, Sherry ... 2546
Baudry, Andreas ... 110
Beam, Mary ... 117
Beaudoin, Michael ... 2548
Becker, Darcy ... 1175
Beiersdorfer, Raymond E. ... 2477
Bekiran, Amine ... 1183
Belfer, Karen ... 976
Bélisle, Claire ... 1179
Bell, Mary ... 1163
Bell, Sherry ... 1163
Belqasmi, Youssef ... 1183
Benninger, Mary Lynn ... 1096
Bercu, William ... 1187
Bergin, Rolf ... 2593
Bertie, Ian ... 1191
Biedebach, Anke ... 123
Binfet, Ty ... 1195
Biocca, Frank ... 1655
Bischoff, Michael ... 131
Bitzer, Donald ... 1167
Black, Virginia ... 2743
Blakeslee, Anne ... 1551
Bliesener, Thomas ... 1199
Blum, Timothy ... 2549
Bodvarsson, Mary ... 152
Bohets, Hugo ... 2214
Bohl, Oliver ... 842, 850
Bojkov, Dimitar ... 968
Bolici, Francesco ... 1202
Bolin, Lennart ... 2551
Bollin, Andreas ... 1206
Bomsdorf, Birgit ... 123
Boora, Raj ... 138
Borges Gouveia, Joaquim ... 1210
Borges Gouveia, Luis ... 1210
Bothra, Jashoda ... 1214
Botturi, Luca ... 144, 2475
Boulet, Marie-Michele ... 2553
Bourda, Yolaine ... 1420
Bourdeau, Jacqueline ... 2009
Boutiche, Said ... 2555
Boyd, Gary ... 1218
Boyne, Chris ... 268
Brand, Oliver ... 1222
Brannon, Mary Lynn ... 2557
Braun, Robin ... 1835
Brazile, Robert ... 1226
Brazon, Barbara ... 2557
Breiter, Dr Andreas ... 1230
Brewer, J. Wayne ... 2059
Brinsmead, Anne-Marie ... 2559
Brisebois, Anne ... 759
Brown, Ian ... 1234
Bruen, Catherine ... 1238
Bruning, Roger ... 152
Brunn, Hans Georg ... 1242
Brusilovsky, Peter ... 154
Buehring, Anna ... 901
Bures, Eva ... 1246
Burke, Sandra ... 1250
Burnett, Dale ... 162
Bustos, Alfonso ... 1251
Butler, Jeanne ... 1255
Byers, Celina ... 1258
Cadieux, Cynthia ... 1261
Cakici, Kemal ... 1265
Callaert, Herman ... 2561
Calvino, Francisco ... 1269
Canabal, Maria ... 2142
Canavesi, Brooks ... 2390
Cao, Yanhua ... 2787
Carlson, Patricia ... 1273
Carlson, Randy ... 2080
Carmel, Eric Norman ... 1277
Carter, Bruce ... 1280
Casalino, Nunzio ... 1284
Cassidy, Sheila ... 1069
Cassidy, Sheila ... 1679
Cavanaugh, Cathy ... 168, 1288
Cavanaugh, Terence .. 1288, 1292, 1296
Cavenagh, Robert ... 174
Chalmers, Denise ... 2187
Chan, Chiping ... 1300
Chan, Ivy ... 1304
Chan, Kan Kan ... 1308
Chan, Tak-Wai ... 2431
Chan, Tom ... 1312
Chang, Chi-Cheng ... 181
Chang, Yaowen ... 189
Chao, Christina C. ... 1315
Chao, Tracy ... 1317
Chatton, Dr. Barbara ... 2549
Chawangwongsanugul, Wanida ... 2709
Chen, Wei-Fan ... 1321
Chernish, William ... 1325
Chignell, Mark ... 1327
Childs, Elizabeth ... 1331
Chiles, Michael ... 1803
Chimlek, Sutasinee ... 2047
Chozos, Polyneikis ... 196
Christal, Mark ... 2563
Christie, Brett ... 2565
Chua, Ying Hwee ... 1335
Chuang, Chung-Pei ... 1321
Chun, Seyoung ... 1774
Cissé, Omar ... 61
Clariana, Roy ... 1339
Clark, Heather ... 104
Clementino, Nancy ... 1342
Clemson, Patrice ... 1346
Clifford, Pat ... 2484
Code, Jillianne ... 1063
Coenders, Marc ... 878
Coffey, John ... 1349
Colaric, Susan ... 1071, 1353
Collins, Michael ... 2544
Colwell, Chetz ... 1358
Combs, Leon ... 204
Comeaux, Patricia ... 2567
Conlan, Owen ... 210
Connal, David ... 1356
Contractor, Noshir ... 2474
Contreras-Castillo, Juan ... 218
Cooper, Martyn ... 1358
Copeland, Joel ... 2569
Costa, Evandro ... 1363
Cristea, Alexandra ... 224, 232
Crosby, Martha ... 1652
Crow, Nedra ... 537
Crowther, Karmen ... 2571
Curran-Smith, Janet ... 953

Dabbagh, Nada 1366
Dagger, Declan 210
Dal Farra, Ricardo 1370
Danchak, Michael 2035, 1374
Daniels, Terry 369
Daniels, Terry 1378
Dara-Abrams, Benay 1382
Daughenbaugh, Richard 2572
Daugherty, Anne 2677
Daugherty, James 2573
Davis, John 2527
De Bra, Paul 240, 1386, 2721
De Castro, Antonio 1390, 2575, 2721
De La Teja, Ileana 1392
De Leo, Francesco 1396
De Loght, Toby 2577
De Pietro, Orlando 2579
Dearce, Miguel 2581
Deden, Ann 1400, 1403
Dedic, Helena 1818
Deek, Fadi 1407
Dehler, Christina 247
Delaney, Stephanie 1411
Dempsey, Michael 152
Depryck, Koen 1415
Derrick, Gail 1081
Desrochers, André 1277
Dewar, Tammy 1331
Dhraief, Hadhami 75
Diabaté, Evelyne 2505
Dicks, Dennis 254
Digenarro, Aram 1562
Diggs, Laura 1419, 2384
Diol, Phillip 2583
Doan, Bich-Lien 1420
Dobbs, Rita 1424
Dobill, Dan 2161
Doiron, Gilles 262
Domingos, Jorge 2585
Dominique, Bourgeois 1428
Donnellan, Dave 747
Downs, Elizabeth 2080
Draper, Michael 1432
Dressler, Brenda 1436
Dron, Jon 268
Duckett, Jane 537
Duhamel, Luc 2439
Dunkling, Gregory 2491
Dunlap, Nancy Cassity 2
Eaton, Mark 1439
Economides, Anastasios 1746
Edwards Block, Arthur 218
Eggers, Renee M. 2477
El Saddik, Abdulmotaleb 2587
El-Khouly, Mahmoud 1443
Emmert, Jason 856
Enriquez, Larisa 1447
Erkel, Mary 778
Eseryel, Deniz 275
Eseryel, Ugur Yeliz 2589
Farah, Hanna 1451
Farkas, Daniel 2480
Felberg, Jodi 1265
Ferguson, David 2741
Ferreira, Joao 1455
Ferry, Brian 283
Ferullo, Donna 1459
Fields, Dennis 2747
Finke, Matthias 1462
Fiorello, Phillip 1635
Firdyiwek, Yitna 2481
Fitzgerald, Hirim 1655
Fleitas, Joan 2591
Floto, Christian 2137
Formica, Scott 1517
Fors, Uno 2593
Fortuny, Josep M 1466
Fortuny, Josep Maria 1469
Foti, Sebastian 291
Fowler, Ted 2482
Francis, Dannie 1473
Francis, Tina 1214
Frank, Christine 1242
Franks, Patricia 1477
Fraser, Sally 901
Freeman, Pamela 1884
French, Deanie 1493, 1495
Friesen, Sharon 2484
Frizell, Sherri 298
Frush, Md, Karen 2150
Fuji, Takashi 305
Fujita, Shinichi 2595
Fukuda, Makio 2597
Fumadziev, Ivan 2337
Gabrielle, Donna 1081
Gadanidis, George 1481, 2717
Ganesan, Radha 2637
Garcia, Marilene 2599
Garcia, Penny Ann 1485
Garcia-Ruiz, Miguel 1489
Garcia-Santamarina, Jose 1251
Gardner, Donna 1493, 1495
Garofalakis, John 311
Garrido, Susane 2601
Geier, Constance 1499
Geller, Arthur 2757
Genang, Ralph 1093
Genang, Ralph 1501
Georgi, David 2074
Gharpure, Prachi 706
Giardina-Associate Prof., Max 317
Gibbs, David 1505
Gibson, David 1509, 1513
Giguere, Paul 1517
Gihlstorf, Catherine 1521, 1525
Gil, Ariel 2603
Gilbert, Juan E. 325, 1722, 2059
Gilbert, Richard 647
Giménez, Joaquin 1469
Girona, Cristina 1529
Giroux, Sylvain 331
Gjedde, Lisa 1530
Glassman, Marc 339
Goetz, Susan 1532
Goggin, Nan 1537
Golden, Et. Al., Glenn 2605
Goldfarb, Ilia 343
González, Maríadolores 1541
Goodman, Madeline 349
Gotcher, Nancy 2191, 2745
Grabowski, Barbara 2747
Graesser, Art 778
Graesser, Arthur 353, 471
Graff, Martin 361
Graham, Jason 1100
Graham, Robert 369
Graves, Scott 53
Graviss, Kenton 2607
Gray, Peter 2637
Greenberg, Valerie 1544
Greene, Melanie 375
Greenhalgh, Roy 1096
Griffy-Brown, Charla 388
Grunden, Kerstin 2234
Guardia, Lourdes 1547
Guba, George 1551
Guo, Xiangpei 1552
Guralnick, David 1555
Hagreen, Stacey 2445
Halima, Habieb Mammar 382
Hall, Amelia 2683
Hall, Andrew 1559
Hall, Richard 1562
Hall, Tony 1566
Hamilton, Doug 1331
Hamlin, Michael 388
Han, Chia Y 620
Han, Chialing 2431
Hanlis, Elizabeth 1570
Harding, Wayne 1517
Harper, Barry 2609
Harrison, Laurie 1574
Harvey, Denis 1277
Harvey, Mary 1578
Hasebrook, Joachim 404
Hashiguchi, Hiroaki 2611
Havens, Nicholas 1562
Hayes, Karen 1643
Hedberg, John 2609
Hedestig, Ulf 412
Hedman, Anders 420
Heesch, Daniel 1582
Hegins, Craig 2487
Heines, Jesse M. 9
Heins, Elizabeth 2520
Helic, Denis 426, 1730, 1734
Hemming, Heather 1586
Henik, George 945
Henik, George 1590
Henning, Klaus 2222, 2687
Henri, France 2009
Henry, Paul 433
Heo, Gyeong Mi 1594
Heo, Heeok 1774
Herrera, Miguelangel 1541
Herrington, Anthony 1598
Herrington, Jan 18, 1403, 1598
Hess, Peter 2489
Hetzner, Donald 1602, 1605
Hewling, Anne 1608
Hietala, Pentti 441
Hirashima, Tsukasa 1612
Hishina, Masateru 449
Ho, Curtis 1792
Ho, Dr Yew Kee 2254
Hodges, Andrea 2317
Hoffman, Ellen 1616
Hofmann, Jennifer 2491
Hofmeister, David 2292
Holland, Charlotte 1620
Holmen, Jay 2613

Holstrom, Lisa 2518
Holzman Benshalom, Yona 1624
Hongpaisanwiwat, Cholyeun 2615
Hootstein, Ed 457
Horn, Christy 152
Howard, Richard 1814
Hsiao, Ching-Mei 2778
Hsu, Ti 463, 1628
Hu, Debbie 1632, 1635
Hu, Xiangen 353, 471
Huang, Pei-Wen Nicole 1639
Huber, Richard 2617
Hubscher, Roland 298
Huckstadt, Alicia 1643
Hudson, Ph.D., Cpcm, Shirley A 477
Huk, Thomas 2137
Hunter, William 1645
Hupfer, Matthias 2454
Ibarra, Alma 1648
Iding, Marie 1652
Im, Yeonwook 1774
Inaba, Akiko 2618
Inoue, Hisashi 732
Jackson, Linda 1655
Jackson, Tanner 353
James, Di 1658
Jansen, Bernard 485, 493, 501
Jansson, Eva 509
Jebeile, Sam 1661, 1665
Jennett, Penny 28
Jensen, Jens F. 514
Jenson, Jennifer 1799
Jiman, Juhanita 522
Jimenez, Yolanda 1251
Jitgarun, Kalayanee 1669
Jo, Jun 1673
Johansson, Tor-Björn 2214
Johnson, Maribeth 2620
Johnson, Scott 529
Jolly, Deborah
.... 1069, 1677, 1679, 2500, 2671
Jones, Bob 2317
Jones, Deborah 2171
Jones, Plummer (Al) 1071
Junior, Marcello 1363
Juniper, David 1682
Kadi, Anthony 1835
Kähkönen, Esko 1685
Kailas, Sumant 1029
Kakehi, Naoyuki 916
Kakusho, Koh 1965
Kalamboukis, Theodore 545
Kalia, Suman 1689
Kane, Catherine 1693
Kanfi, Shady 2471
Kaplan, Danielle 2445
Kaptelinin, Victor 412
Kashihara, Satoshi 1697
Katz, Larry 1552
Kaufman, Cathy 1701
Kaur, Abtar 1911
Kayama, Mizue 732
Kazlauskas, Edward 1702
Keefe, David D. 2393
Keenan, Claudine 2622
Keesuradet, Worapot 2707
Kester, Diane 1071
Khadra, Mohamed 1665
Khan, Alim 1706
Kilner, Maj. Peter 2473
Kim, Ph.D., Young H 477
King, Caroline 1710
Kitsantas, Anastasia 1366
Klein, James 2747
Klemm, E. Barbara 1652
Klenner-Moore, Jayne 1714
Klett, Mitchell 53
Klinger, Katie 537
Knapp, Michael 1509
Knight, Cheryl 1718
Kokorowski, David 2711
Kokubun, Toshinao 2759
Kolwalkar, Nupura 1722
Koosha, Homa 2623, 2625, 2627
Korba, Larry 2419
Kostur, Pamela 1726
Koul, Ravinder 2629
Kreipe De Montaño, Marty 2563
Krottmaier, Harald 1730, 1734
Kuehl, Hans 1702
Kunze, Tobias 75
Kura, Tsuneko 916
Kurhila, Jaakko 1738
Kurosu, Masaaki 1742
Kurowski, Brandt 1509
Kuwabara, Tsuneo 2759
Kyriakopoulou, Antonia 545
Labour, Michel 561
Lahire, Nathalie 2630
Lai, Theresa 2195
Lakey, Paul 1085
Lakey, Raye 1085
Lam, Paul 2187
Lamboudis, Dimitris 1746
Lambros, Ann 2757
Lamont, Chris 2522
Landon, Bruce 1750
Langille, Lisa 1586
Larisa, Soldatova 2632
Latva-Karjanmaa, Raija 2634
Lau, Teresa 1754
Lauer, Tobias 553
Lawee, Alan 1758
Lawless, Kimberly 1761
Leacock, Tracey 1766
Leader, Lars 1770
Leavitt, Matthew 2637
Leblanc, Patty 2494, 2520
Lee, Insook 1774, 1778
Lee, Marie 2146
Lee, Marie 2776
Légaré, Geneviève 1780
Leinweber, David 1784, 2639
Leite, Cidorvan 1363
Leleu-Merviel, Sylvie 561
Lenne, Dominique 61
Lennon, Jennifer 567, 573
Leon, Juan 1788
Leong, Peter 1792
Lepkowski, Frank 1796
Lesjak, Dusan 922
Leung, Kit 578
Leung, Mei 1327
Levy, Ziva 2649
Lewis, Brian 1799
Lewis, Michael 2615
Liang, Ting-Wen 2641
Liao, Luby 1803
Liestøl, Gunnar 586
Light, Janet 1807, 2661
Lim, Eric 593
Lin, Huifen 1810
Lin, Janet Mei-Chuen 601
Lindquist, Karen 1706
Lindroth, Tomas 2234
Linser, Roni 606
Lister, Susan 2497
Liu, Eric Zhi-Feng 2643, 2645
Liu, Yu-Hsin 2431
Livermore, Chris 2647
Llanes, Jose 612
Lockhart, Marilyn 1814
Loebl, Dina 2649
Logan-Phelan, Theresa 2581, 2650
Lopes, Alberto Araujo 2764
Lotter, George 2652
Lou, Yiping 1818
Lucena, Marisa 2654
Luczaj, Jerome Eric 620
Lundy, Jo Lynne 1822
Luxenberg, Jared 2055
Luz, Saturnino 1870
Lytras, Miltiadis
.... 627, 1826, 2656, 2658, 196
Mackenzie, Douglas 635
Mackie, Brian 1831, 2660
Madadnia, Jafar 2623, 2625, 2627
Madani, Mahshid 2661
Mahadevan, Venkatesh 1835
Maia, Carmem 1839
Maitland, Murray 1552
Mak, John 1843
Mak, Wai Keong 2663
Maldonado Avalos, Maria Magdalena
.... 1847, 2665
Mallory, James 635
Mardis, Marcia 1616
Marinilli, Mauro 1851
Marriott, Philip 640
Marti, Ramon 1269
Martine, Chomienne 1855
Martins, Ciro 2698
Martins, Constantino 1142, 1859
Marttunen, Miika 1862
Mascazine, John 2341
Masoodian, Masood 1866, 1870
Mathews, Eric 471
Matsuno, Ryoji 647
Matthew, Thomas 2292
Maurer, Hermann 573
Mccauley, Enid 1874
Mcclelland, Robert 655
Mcclelland, Sara 2027
Mcenery, Lillian 1876
Mcewen, Laura April 661, 1880
Mcfrazier, Michael 1884
Mcgee, Patricia 1887, 2667
Mcgreal, Rory 32
Mcintosh, Sandy 1570
Mcintyre, Elaine 104
Mckegney, Thomas 2468

Mclaurin, Sylvia 1891
Mcmanus, Thomas 1895, 1899
Mcmurray, Donald 1903
Mcnierney, Donna 1907, 2477
Mcpherson, Maggie 98
Mcsporran, Mae 669
Md Khalid, Sharihan 2669
Md. Hanafiah, Mustafa 1911
Meathenia, Peggy 1677, 2500, 2671
Medrano, Maria 537
Mehringer, Susan 676
Meisner, Gerald 1915
Melis, Erica 2313
Melo, Leonimer 2673
Meloni, Luis Geraldo 2673
Melton, Robbie 2675
Menchaca, Marylu 682
Mensing Triplett, Dr. Linda 1918
Merillat, Linda 2677
Messier, William 1921
Michailidou, Anna 690
Miettinen, Miikka 1738
Miller, Alton 1925
Miller, Leslie 2679
Ming, Yin 2681
Minoh, Michihiko 1965
Mitchell, Richard 268
Mitra, Ananda 2683
Mittermeir, Roland 1206
Modro, Nilson 1929
Monaghan, James 2685
Monette, Céline 1096
Montgomery Kasik, Maribeth 1933
Monthienvichienchai, Rachada 698
Montoni, Mariella 1936
Moodie, Peter 1940
Moore, William 1944
Morales Salcedo, Raul 1948
Moron-Garcia, Sue 1952
Morote, Elsa-Sofia 785, 2711
Mosher, Michael R. (Mike) 1956
Moulin, Claude 331
Mudur, Sudhir 706
Muehlhaeuser, Max 714
Mueller, Klaus 2687
Muffoletto, Robert 1957
Mulgan, Felicity 1961
Murakami, Masayuki 1965
Murali Manohar, Kantayapalem 1969
Murray, Sharon 2689
Murthy, Narayan 2480
Nachmias, Rafi 722
Nahrstedt, Klara 1973
Nakajima, Yasushi 2690
Narita, Seinosuke 2047, 2707, 2709
Nasah, Angelique 2494
Nash, J C 1977
Nealy, Susan 1981
Nejdl, Wolfgang 75, 1124
Nett, Bernhard 2076
Newby-Fraser, Jenny 1984
Newmarch, Jan 1988
Nguyen, Thanh 1992
Nichols, Paula 2546
Niegemann, Helmut 2692
Nijhavan, Hemanta 154
Nilsson, Stefan 2234
Nisbet, Deanna 2762
Nishigori, Shuichiro 2226
Nokelainen, Petri 1738
Noonan, Coral 1994
Noonan, Melissa 1250
Norman, Alan 2502
Nuñez Esquer, Gustavo 2766
O'connor, Richard 729
Odell, Michael 1100, 2527
O'donoghue, John 1997
Okamoto, Toshio 732
Oliveira, Kathia 1936
Oliveira, Lia 2001
Oliver, Carol 2005
Oliver, Ron 2609
Orey, Michael 2694
Orre, Carl Johan 412
Ortner, Wolfgang 2218
Östlund, Christian 2234
Ottmann, Thomas 553
Oubanaissa, Laila 317
Ozkan, Nadine 2009
Pacifici, Linda 375
Padilha, Thereza 2696
Paes, Rodrigo 1363
Pahl, Claus 740, 747
Palumbo, David 753
Pang, Ka-Man 2013
Paquette, Gilbert 759
Paraíso, Pedro 2698
Parente De Oliveira, Jose M. 2017
Park, Sunghee 2356
Park, Young 2021
Parker, Drew 812
Parker, Heather 1327
Pasian, Beverly 2700
Pathak, Kalpeshkumar 2702
Patterson, Tonya 1163
Paul, John 1803
Payeras, Jessica 2505
Pedersen, David 2703
Pedersen, Joshua T. 1374
Pemberton-Shows, Amy 2546
Peremans, Herbert 2214
Pérez Cereijo, María Victoria 767, 772
Permezel, Pierric 2023
Persky, Hilary 349
Person, Natalie 353, 778
Petrides, Lisa 2027
Picus, Lawrence 1702
Pilling-Cormick, Jane 1081
Pintus, Antonio 331
Piskurich, George 1081
Pittman, Joyce 2705
Plass, Jan 1026
Platt, Jennifer 2031
Polhemus, Linda 2035, 2039
Pouloudi, Nancy 196
Pountney, Richard 2043
Power, Ruaidhri 2581
Premchaiswadi, Nucharee 2047, 2707, 2709
Premchaiswadi, Wichai 2047, 2707, 2709
Premchaiswadi, Wichian 2047, 2707, 2709
Price, Robert 2051
Priest, Curtiss 2055
Pritchard, David 785, 2711
Qi, Haiyu 2059
Qiu, Lin 2063
Rabelo, Lísia 1936
Rabelo Jr., Álvaro 1936
Rademacher, Craig 2713
Rajan, Parvati 706
Rathbone, Carla 2067
Raubenheimer, Jena 2070
Ravenscroft, Andrew 792
Ravindran, J. Anton 2345
Rawongyot, Surangkana 2707
Redeker, Giselher H.J. 798
Redmond, Pamela 2074
Reduan, Noorazah 2637
Reeve, Robert 1661, 1665
Reeves, Thomas 806, 818
Reklaitis, Vytautas 2542
Remmele, Bernd 2076
Repman, Judi 2080
Resta, Paul 682, 1994, 2563
Reyes-Méndez, Jorge Joel 2715
Reynolds, Thomas 2084
Ribeiro, Lígia Maria 1142, 1859
Ribeiro, Paulo 2698
Ricca, Joseph 1562
Rice, Robert 1578
Rich, Sharon 2717
Richard, Philippe R. 1469
Richards, Rhonda 729
Richter, Christoph 75, 1120, 1124, 2086
Riesbeck, Christopher 2063
Rincon, Lilian 812
Ring, Geoff 818
Robert, Robert 2090
Roberts, Chris 2719
Rocha, Ana Regina 824, 1936
Rocha, Catarina 824, 1936
Rochefort, Stephen 830
Rockman, Ilene 2094
Roehr, Frank 2076
Roessler, Peter 2461
Rogers, Bill 1866
Röllinghoff, Andreas 2098
Romero, Cristobal 2721
Ronchetti, Marco 837
Rose, Raymond 1079, 2104, 2508, 2723
Rosenfield, Steven 1818
Rousseau, Brendan 1386
Rousseau, Leona 2107
Roy, Loriene 2563
Rozina, Irina 2111
Rubenfeld, Lester 2035
Rude-Parkins, Carolyn 2115
Ruelland, Diane 759
Ruelland, Diane 1081
Ruhl,, Thomas 1096
Ruiz, Connie 2546
Runyon, Linda 2119
Ruppenthal, Leonardo 1327
Ruttner, John 2122
Ryan, Mark 2725
Sabo, George 2165
Sabrito, Carlos Eduardo 2727

Sagdic, Guven 2729
Sagebin Correa, Juarez 2727
Sakkopoulos, Evangelos 311
Sala, Nicoletta 2125, 2731
Salcedo, Pedro 2129
Salomone, Danielle 2133
Saltsman, George 1085
Salvador, Beatriz 1936
Sander, Uwe 2137
Sanders, Salvatore A. 2477
Sangra, Albert 1547
Sani, Sharin Bin Mohamad 2258
Sanna, Raffaella 331
Santema, Sicco 1093
Saromines-Ganne, Barbara 1792
Sasse, M. Angela 698
Satterfield, Richard 945
Sauve', Louise 1218
Sax, Selma 1069, 1679
Schellhase, Jörg 842, 850
Scheuermann, Michael 2140
Schinzel, Britta 2076
Schlageter, Gunter 123
Schmidt, Klaus 2142
Schneider, Daniel 2755
Schneider, Werner 2698
Schoeny, Zahrl 1079
Schuch-Miller, Diane 2146
Schuh, Michael 2218
Sclater, Jennifer 661
Seelinger, Mha, Terry 2150
Seinosuke, Narita 2681
Sellers, Hannah 2733
Semich, George 2119
Seppala, Pauliina 67
Serdyukov, Peter 2084, 2725
Sfondilias, John 2734
Sharif, Naubahar 1304
Shaw, Ruth 2661
Shaw, Steven 1246
Shaw, Steven 2154
Shelton, Kaye 1085
Sher, David 2158, 2735
Sheu, Yung-Hoh 1639
Shidhani, Saleh 91
Shih, Ching-Chun 2161
Shim, Minsuk 2737
Shim, Sunguk 2737
Shortridge, Ann 856, 2165
Siburna, Bernadette 2739
Siedlaczek, Kathy 2700
Sierra, Christina 2364
Simon, Arne 2222
Sims, Rod 2171, 2747
Simsek, Aytac 1392
Singh, Mukhbir 864
Singleton, Bryan 2175
Sirmakessis, Spiros 311
Sivakumaran, Thilla 2178
Skelton, Stephen 2180
Skiera, Paul 2522
Sloane, Pauline 2650
Slotte, Virpi 870
Smith, Alese 1079, 2723
Smith, Deborah 2184
Smith, Glenn 2741
Smith, Gordon 2094
Smith, John 878, 2465
Smith, Richard 1799
Smith, Ronald 2187
Smith, Ross 2743
Smits, David 240
Snider, Sharla 2191, 2745
Sniderman, Sarah 2154
Snis, Ulrika 2234
So, Simon 2013, 2195, 2199
Sogabe, Yuki 2203
Sombunsukho, Suwanna 2207
Song, Melvyn 2258
Soreanu, Peter 2210
Sorensen, Carsten 2234
Sorókina, Tatiana 1541
Soudan, Karel 2214
Souza, Marcus Vinicius 1936
Sparks, Nathan 886
Specht, Marcus 2510
Spector, J. Michael 2368, 2637, 2747
Springer, Julie 16
Squier, Joseph 1537
Staab, Steffen 909
Stachel, Martin 2749
Stahley, Mern 2031
Stahl-Falck, Pia 2234
Stash, Natalia 240
Steinberger, Claudia 2218
Steinweg, Sue 1071
Stewart, Dr. Jeff 891
Stingl, Benjamin 2076
Stirling, Deborah 2522
Stone, R. Brian 2751
Stowers, Gwen 537
Streit, Achim 2222, 2687
Strohecker, Carol 1128
Strother, Judith 895
Stuckey, Bronwyn 901, 2465
Studer, Rudi 909
Stumme, Gerd 909
Stumme, Gerd 909
Suganuma, Akira 2226
Sugiyama, Takeshi 916
Sulcic, Viktorija 922
Sullivan, Florence 2753
Suman, Yogesh 2230
Susarla, Suresh 471
Svensson, Lars 2234
Swan, Karen 2035, 2039
Swarbrick, Andy 2474
Sword, Wendy 2317
Syed Ahmad, Sharifah Nuranthasha 2238
Symons, Sonya 1586
Synteta, Paraskevi 2755
Szabo, Michael 929, 2242
Szulik, Matthew 1089
Taghaboni-Dutta, Fataneh 2246
Tague, Larry 2757
Taibo, Kathy 1163
Takahashi, Tokiichiro 916
Tamaki, Motonori 2759
Tamura, Toshitaka 2250
Tan, Ivy 2254, 2258
Tane, Julien 909
Tang, Kuo-Hao 2261
Tanigawa, Takeshi 305
Tappert, Charles 937
Tarcy, David 945
Tashner, John H. 375
Taylor, Stephen Gilbert 2265
Taylor, Terry 2457
Tchoumatchenko, Vassiliy 2268
Tenev, Dimitar 2268
Tenku Shariman, Tenku Norishah 2272
Teo, Sarah 2276
Terrell, Elaine 948
Terrill, Thane 2280, 2282
Tettegah, Sharon 2513, 2761
Thomas, Cate 2285
Thomas, Jennifer 2288
Thomas, Kelli 2292
Thompson, Ann 2161
Thorne, Dafydd 2296
Tian, Zhi Yun 2414
Tichon, Jennifer 2299
Tindall, Evie 2762
Tirri, Henry 1738
Tori, Romero 2764
Torres Samperio, Gonzalo Alberto 2766
Toth, Joe 353
Townsend, Elizabeth 953
Treviranus, Jutta 2303
Trevitt, Chris 961
Trivedi, Kiran 2768
Trompler, Christoph 714
Tsakalidis, Athanasios 311
Tsutsumi, Yutaka 647
Tunca, Burcu 2307
Tyler-Wood, Tandra 767, 772
Ullery, Joann 2309
Ullrich, Carsten 2313
Uskov, Vladimir 2770, 2772
Valaitis, Ruta 2317
Van Haverbeke, Laurent 2214
Van Petegem, Peter 2577
Van Valkenburg, Willem 1093
Vanderbist, Dirk 2321, 2329
Vanitchatchavan, Prachuab 2709
Vantaggiato, Antonio 2325
Vanthienen, Jan 2321, 2329
Vargas-Hernández, José G 2333
Vasilev, Vasil 2268, 2337
Vassileva, Tania 968, 2268
Vaz De Carvalho, Carlos 1142, 1859
Veen, Wim 1093
Vellom, Paul 2341
Velthouse, Betty 2246
Venkatachary, Ranga 2345
Ventura, Sebastian 2721
Vesper, James 41
Vieville, Nicolas 561
Vogt, Manfred 2218
Wade, Vincent 210
Wagoner, Diane 2774
Wakkary, Ron 976
Wallace, Alan 2571
Wallace, Renee 2514
Walloschke, Tanja 2076
Walshe, Ray 2349
Wang, Chien-Hsing 984
Wang, Chiuhua 1628
Wang, Hongxue 992
Wang, Hsiu-Fei 463, 1628

Wang, Lih-Ching Chen 2353
Wang, Ling 2356, 2360
Wang, Minjuan 2364
Wang, Sheng-Mei (Jenny) 999
Wang, Xuemei 2368
Warburton, Richard 567
Ward, Jessica 1562
Wasserstein, Janet 2372
Watanabe, Kenzi 2376
Watanabe, Toyohide 1006, 2380
Watson, Jason 1049
Weber, Dr. Peter J. 1013
Weber, Ian 593
Wedman, John 1419, 2384
Weitl, Franz 1018
Wenger, Etienne 1096
Whelan, Robert 1026
Whiteside, Amy 98
Whittington, Dave 1331
Wichert, Reiner 2386
Wickersham, Leah 2667
Wijekumar, Kay 1029, 2390, 2774
Willett, James D. 2393
Williams, Barry 2397
Williams, Darlene 1981
Williams, Vicki 2397
Willis, Dee Anna 2400
Wills, Sandra 2609
Wilson, Carol 1148
Winand, Udo 842, 850
Winslow, Joe 2404
Wishart, William 2178
Woelk, Darrell 1035
Wohlfahrt, Roland 1206
Wohlpart, Jim 2713
Wollowski, Michael 1043
Wood, Dan 1049
Wood, Michael 2776
Wortley, David 2408
Wright, Ken 891
Wright, Vivian 891
Wright, Jeff 1803
Wright-Smith, Linda 2410
Wroblewski, Krzysztof 2414
Wroblewski, Piotr 2414
Wu, Vincent 2418
Xexeo, Geraldo 824
Xu, Yuefei 2419
Yamada, Kouichi 2759
Yamamoto, Takanori 2618
Yang, Fei 2778
Ybarra, Carolyn 509
Yocom, Dr. D.J. 2549
Yong, Zhao 1655
Young, Jon I. 767, 772
Young, Robert (Bob) F. 47
Young, Stuart 669
Yu, Fu-Yun 2427, 2431
Yu, Jeongsu 2435
Yu, Ying 2439
Yuen, Patrivan 2442
Yuen, Steve 2442
Zadoff, Laura 2445
Zaharias, Panagiotis 1056
Zainal Abidin, Mohd Izani 2448
Zamani, Bibi Eshrat 2780
Zaparyniuk, Nicholas 1063
Zhang, Chenfeng 2452
Zhang, Sheri 2525, 2781
Zhou, Yi 2783
Ziemer, Norbert 1831
Zimmerman, Sara Olin 375
Zobel, Annett 2454
Zorfass, Judith 2785
Zorn, Nanette 2457

U.S. Department of Education
Office of Educational Research and Improvement (OERI)
National Library of Education (NLE)
Educational Resources Information Center (ERIC)

NOTICE

Reproduction Basis

☒ This document is covered by a signed "Reproduction Release (Blanket)" form (on file within the ERIC system), encompassing all or classes of documents from its source organization and, therefore, does not require a "Specific Document" Release form.

☐ This document is Federally-funded, or carries its own permission to reproduce, or is otherwise in the public domain and, therefore, may be reproduced by ERIC without a signed Reproduction Release form (either "Specific Document" or "Blanket").

EFF-089 (1/2003)